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REVISION OF THE CALLOPHRYINA OF THE WORLD WITH PHYLOGENETIC AND BIOGEOGRAPHIC ANALYSES (LEPIDOPTERA: LYCAENIDAE)

City University of New York PH.D. 1981

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REVISION OF THE CALLOPHRYINA OF THE WORLD WITH PHYLOGENETIC AND BIOGEOGRAPHIC ANALYSES (LEPIDOPTERA: LYCAENIDAE)

by

Kurt Johnson

A dissertation submitted to the Graduate Faculty in Biology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

1980

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Kurt Johnson

This manuscript has been read and accepted for the Executive Committee in Biology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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ACKNOWLEDGMENTS

Numerous people have contributed invaluably to this study. For aid in preliminary work on Callophryina genera Mitoura and Callophrys I have cited individuals in previous publications (Johnson, 1976a, 1978). For this general study of Callophryina I am indebted especially to Dr. Frederick H. Rindge, Curator of Entomology, American Museum of Natural History, and also to Drs. Randall T. Schuh, Norman I. Platnick, and Kumar Krishna of that same institution, along with Drs. David C. Miller and Joseph Grossfield of the City College, City University of New York, and Dr. Charles Mitter of Fordham University. Others who have aided are Eric and Janice Quinter (AMNH), Dr. Richard Vane-Wright (BMNH), the late Harry K. Clench (CMNH), Dr. Lee D. Miller (AME), Dr. John C. Downey (University of Northern Iowa), William D. Field (NMNH), Jon Sheppard (University of California, Berkeley), Julian P. Donahue (LACM), Rev. Roberto C. Eisele (Jujuy, Argentina), and Dr. Rob Robbins (Tufts University).

Considerable technical work has been aided by Bruce Casino, William Wells, Jeannie Horton, Rachel Spang, Elizabeth Phan, Eric Quinter, Iggi Fujardo, Cynthea Clevenger, Diane Kobilca, Joe Tully, Robert Rattley, Dr. Craig Johnson, Nancy Neiland, Pamela Stein, Karen Miller, and especially Stanley F. Alexander without whose aid completion of the work would have been impossible. Hospitality has been provided by Eric and Beth Johnson, Fr. David Kirk, William Wells, and William F. Spang at points very helpful to the study.

To all of these persons, credit for aiding the completion of this study is due, and I am extremely grateful to each of them.

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CONTENTS

I.	Title Page	
II.	Copyright Page	ii
III.	Approval Page	iii
IV.	Acknowledgements	iv
V.	Table of Contents	v
VI.	List of Tables	vii
VII.	List of Illustrations	viii
VIII.	Introduction	1
IX.	Materials and Methods	6
X.	Cladistic Analysis	15
XI.	Key to the Genera	54
XII.	Revision and Systematic Discussion	
	General Key	64
	Plesiocallophrys	81
	Monoplesiocallophrys	88
	Diplesiocallophrys	93
	Plesiocyanophrys	98
	Cissatsuma	107
	Cisincisalia	120

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Incisalia 124
Novosatsuma 142
Penaincisalia 161
Ginzia 183
Sandia 246
Mesocyanophrys 303
Paracyanophrys 351
Cyanophrys 369
Callophrys 476
Mitoura 527

XIII. Zoogeographic Discussion 595

XIV. Conclusions 634

XV. Appendix 1: Outgroup taxa dissected . . . 636

XVI. Appendix 2: Glossary 639

XVII. Appendix 3: Cladograms 643

XVIII. Appendix 4: Material Examined 694

XIX. Appendix 5: Photographs 725

XX. Appendix 6: Genitalia 741

XXI. Appendix 7: Genitalic Configurations . . . 785

XXII. Appendix 8: Palpi 789

XXIII. Appendix 9: Maps 806

XXIV. Bibliography 839

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LIST OF TABLES

		pages
	Reasons why the present study is unprecedented	1-2
	Evaluation of former classifications	2-3
	Abbreviations for collections	9
	Classification of Callophryina	19-22
	Key to the genera	54-63
	General key to selected species	64-76
	Key to species, seconday series Plesiocallophrys	77-80
	Diagnostic trait groupings, ferrea Group of Ginzia	194-197
	Diagnostic trait groupings, pluto Group of Ginzia	208-210
	Key to the species groups of Sandia	254
	Key to acaste Group of Mesocyanophrys	323-327
	Key to the species groups of Cyanophrys	374
1	Works concerning zoogeography of Lepidoptera	598-599
	Cladistic hierarchy in relation to geographic distributions	602-605
2	Endemism of Brown and Johnson	628-629

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LIST OF ILLUSTRATIONS

fig		page
1	Phylogenetic Relations	3
2	Cladogram of Callophryina	18
4	Geographic areas included by taxonomic groups	601
5	Schematic male genitalia	25
6	Schematic female genitalia	25
575	Cladogram of Callophryina with apparent sister groups	608
576	Three taxon statement	611
577	Endemism in central Asia	617
578	Croizat's "Tyrrhensis"	618
579	Five areas of North America	622
580	Apparent dispersal of Mitoura hesseli	623
581	Areas proposed as Quaternary refugia	625
582	Areas of endemic taxa in Callophryina	626
583	Other areas of general endemism for South America	627
584	Ten cladograms indicating pattern of congruence	631
550-574	Cladograms of Genera and Species Groups	643-658
7-117	Type and Representative Specimens	725-740
118-372c	Genitalic Structures	741-788
585-587	Characteristic Genitalic Structures	785-788
373-513	Palpal Structures	789-805
514-549	Distribution Maps	806-838

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INTRODUCTION

The family Lycaenidae includes several thousand butterfly species worldwide (Ehrlich, 1960, has estimated 3,500 [including the Riodinidae] but this is probably far too low). Within this assemblage, traditional taxonomy since Barnes and McDunnough (1917) has recognized three more familiar subdivisions (or subfamilies) of Lycaenidae--Lycaeninae ("copper" butterflies), Plebejinae ("blue" butterflies), and Theclinae ("hairstreak" butterflies)--along with five other subfamilies proposed by Eliot (1973) to include some lesser known groups.[1] The butterflies treated in this study belong to the Theclinae and within it form part of one "Tribe" (one of thirty-four "Tribes" [considering that category as also assumed in undivided subfamilies] sensu Eliot, 1973 [see below]). Eliot named this tribe "Eumaeini." Within this group, Eliot placed sixty-eight genera (see Appendix 1), of which only seven include the two hundred taxa on five continents considered in this study.

Prior to this study, classifications of the eumaeine genera included in this study (referred to here as the Callophryina sensu lato) have been derived from syntheses of many separate works on individual taxa or groups. Such classifications have utilized an assemblage of about eight genera, sometimes variously grouped under Callophrys as subgenera. The present study uses cladistic methods, and is unprecedented for the following reasons:

(1). It is the first generic level study of Lycaenidae on a worldwide basis.

(2). It is the first application of phylogenetic analysis, i.e., cladistic analysis, to any lycaenid group, for any region.

---

[1]Eliot replaces Plebejinae with Polyommatinae.

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(3). It is the first study of butterflies other than Shirozu and Shima (1979) to include a "cladistic" classification.

(4). It is the first revision of lycaenids to include a detailed synonymic treatment.

(5). It is the first analysis of lycaenid distributions by vicariance biogeographic methods (sensu Croizat, Nelson, Rosen and Platnick [see below]).

The phylogenetic methodology of the present study allows former classifications to be evaluated according to apparent monophyly (sensu Nelson, 1971). All of the prior works reveiwed below have consisted largely of paraphyletic or polyphyletic groups. In fact, only the monotypic genera proposed by earlier workers seem to have been monophyletic.

	Taxon	Standing	Present Phylogenetic Assessment
A.	(1). Early classifications[2]		
	Incisalia	Genus	Polyphyletic
	Mitoura	Genus	Polyphyletic
	Callophrys	Genus	Polyphyletic
	Satsuma	Genus	Polyphyletic
	Thecla	Genus	Polyphyletic

[2] Includes classifications of Leech, 1893-94; Godman and Salvin, 1887; Draudt, 1919; Barnes and McDunnough, 1917; Barnes and Benjamin, 1926; J. Comstock, 1927; McDunnough, 1938; Clench, 1944, 1946; Klots, 1951; Gillham, 1956; Brown, 1957; dos Passos, 1964.

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(2). Taxa proposed subsequent to the above[3]

Cyanophrys	Genus	Polyphyletic
Xamia	Genus	Monophyletic (monotypic)
Sandia	Genus	Monophyletic (monotypic)

B. Later classifications[4]

Callophrys, sensu lato	Genus	Polyphyletic
Callophrys, sensu stricto	Subgenus	Paraphyletic
Incisalia	Subgenus	Polyphyletic
Mitoura	Subgenus	Paraphyletic
Cyanophrys	Sugenus	Polyphyletic
Sandia	Subgenus	Monophyletic (monotypic)
Xamia	Subgenus	Monophyletic (monotypic)
Satsuma	Genus	Polyphyletic

The classification of Ziegler (1961), incorporated by dos Passos (1970) and Howe (1975), is the most recent prior to this study. The method of clustering taxa is by estimation of divergence by workers on particular groups. The Ziegler classification is suspect because Cyanophrys and Satsuma are excluded from consideration because of geographic assumptions. The dos Passos classification, although it includes Cyanophrys, is also dubious for similar reasons. Notwithstanding these inherent weaknesses, the following phylogenetic relations are the only ones implied in the above classifications (Fig. 1).

---

[3] Includes classifications of Clench and Ehrlich, 1960; Clench, 1961; dos Passos, 1970.

[4] Includes classification of Ziegler, 1961; dos Passos, 1970; Howe, 1975.

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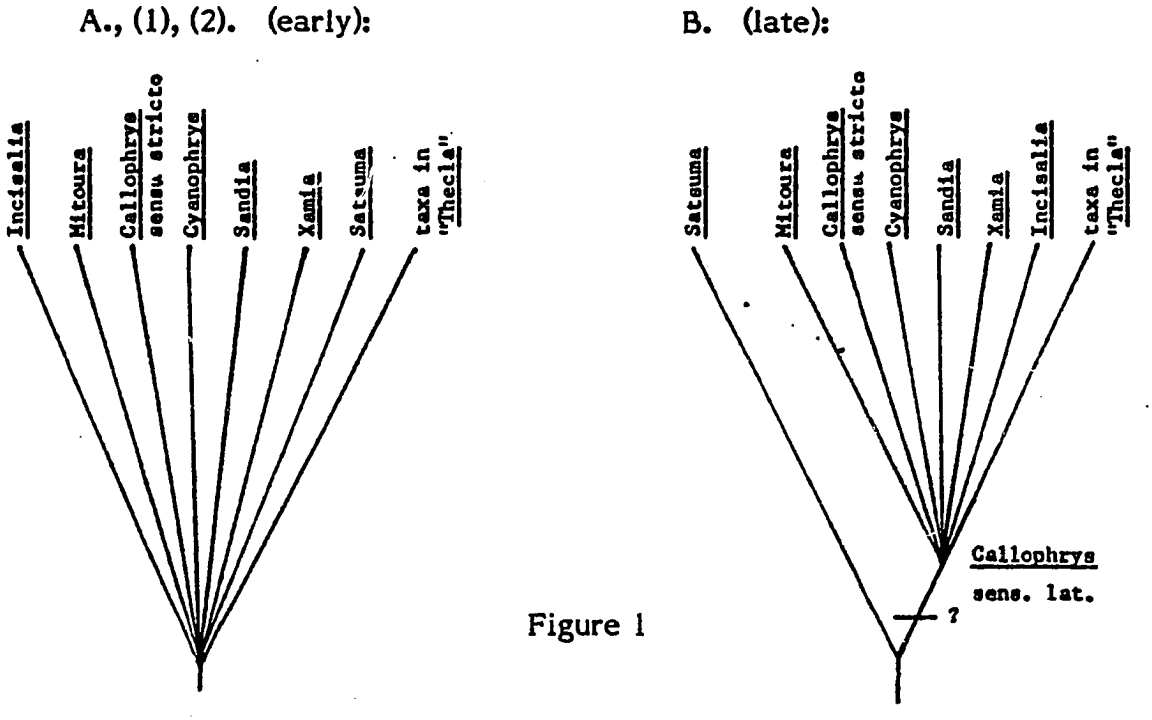


Figure 1

The present work incorporates the methods of "phylogenetic systematics" ("cladistics" sensu Hennig, 1950 (1966); Brundin, 1966, 1968, 1972; Nelson, 1970; Schlee, 1971; Cracraft, 1972, 1974; Platnick, 1977a, 1977b; Mickevich, 1978; Nelson, 1979; etc.) and "vicariance biogeography" (sensu Croizat, 1958, 1962; Croizat, Nelson and Rosen, 1974; Rosen, 1975, 1978, 1979; Platnick, 1976; Platnick and Nelson, 1978). Although it is not the purpose of this paper to review the precise theory and methodology of these approaches, the following general comments are useful.

Cladistic methodology involves the construction of branching diagrams (cladograms) representing successively nested sets of taxa grouped by shared derived characters (synapomorphies). Through discriminating derived (apomorphic) characters from primitive (plesiomorphic) characters, evidence concerning monophyly is achieved more precisely than in previous systematic methods. This is because measures of overall similarity or difference (see Cracraft 1974) are based on mixtures of primitive and derived characters. With cladistics, a purely phylogenetic and monophyletic hierarchy (or classification) results, indicative of

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hypothetical kinship relations. Hierarchical classifications allowing retrieval of cladograms are preferable to classifications produced by phenetic or evolutionary methods (see Cracraft, 1974) because the para- and polyphyletic groups resulting from the latter do not estimate purely phylogenetic relationships. Also para- and polyphyletic groups distort zoogeographical considerations, because non-phylogenetic groups are imaginary. Further, branching diagrams from the cladistic methodology can be used within the model of vicariance biogeography, particularly the method of "area cladogram analysis" proposed by Platnick and Nelson (1978) and Rosen (1979) which can indicate respective areas of hypothetical ancestral distributions.

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MATERIALS AND METHODS

Systematic Methodology:

Cladograms and Classifications. Fundamental cladograms (sensu Nelson, 1979) have been constructed for characters of the wings, head, male and female genitalia, legs and larval foodplant data. Polarity was decided through outgroup comparison (see Appendix 1 and Cladistic Analysis). A derivative cladogram (sensu Nelson, 1979) most parsimonious for all characters was constructed (Fig. 2), and is the basis for the classification. A cladistic classification (see Cracraft, 1974) is presented with no new categories created, and with the generic category arbitrarily applied to the fifth of the sequential splits in the cladogram.

Higher categories implied in the cladogram have been referred to as "Primary," "Secondary," "Tertiary," and "Quaternary Series." The hierarchical structure of the classification serves as the format of the revision, using the order inherent in the cladistic classification. Species groups are designated; the name of the species group and a list of its members precedes the descriptions of these taxa. The list allows retrieval of cladistic relations within the group as follows (species as x, y, and z):

x/y — z, etc.

(apomorph sister group) (plesiomorph sister group)

The use of a semicolon between taxa means cladistic relations are unknown; a question mark means polarity is uncertain. Generic and species group cladograms are presented in Appendix 3.

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Taxon Concept. Rosen (1979) has clarified an important problem relative to the cladistic method, the biological species concept (as a conceptual tool), and subspecies (as a methodological tool). Demonstrating that hybridization (reproductive compatibility) can be a shared plesiomorphy, and that use of subspecies requires a shift to phenetic considerations (measures of divergence) as the primary criteria for clustering taxa, he rejects both. I follow this and consider species as populations defined by an apomorphic character. I have, however, considered foodplants as possibly synapomorphic and have considered some morphological species limits in relation to the few discussions available concerning reproductive isolation (Bauer, [to Scott] pers. com. in Howe, 1975; Johnson, 1978). Generally, my initial guide for consideration of morphological species limits comes from my own work on Mitoura (Johnson, 1976a, 1976b, 1978).

Synonymies. Synonymic literature in Callophryina is vast. Synonymies presented here are complete to my knowledge, excepting some archaic or regional European and South American literature. Synonymies include all taxa ever treated as species; bibliographies of taxa described as subspecies are presented with the discussion of these taxa under "Remarks." Citations represent taxa specifically listed in publications and also those included by generic statements of authors; generic statements are considered by me as including all taxa described up to the date of a particular publication. Hence, some repetition of "in part" and non- "in part" citations results. Brackets are used around page numbers which are from works reproduced within other works. Consecutive page numbers are listed for serialized papers appearing on several sets of pages in one publication; each page cited indicates the page on which the paper is continued. Undocumented synonymies are noted as such. Synonymies implied by authors through lumping of higher categories but without listing the included species are

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also incorporated. In these cases the term "included x species" is used in brackets and considered as including those taxa described prior to the date of the publication. In regard to the publications of Seitz, I include his plate letters as "Fig. x" for consistency.

Diagnoses. Superficial characters, which aid in identification are mentioned first. Apomorphic characters follow (these being treated in detail for genera under "Cladistic Analysis"). Comments on primitive character states useful for superficial identification are also included.

Terminology. A glossary is included in Appendix 2; it includes descriptive terms for genitalia added to those proposed by Johnson (1976a). Names of colors cited with an initial capital letter are from Ridgway (1912) or Smithe (1975). Especially for iridescence, these are quite arbitrary; however, they are more useful than vague undefined terms. Venation is followed from Clench (1975). In tables, terms such as "small" or "wide" are defined immediately after their first usage, and often measurement ratios (not raw measurements) are given to afford strict definitions to these.

No particular group or taxon is "primitive" or "derived" in itself; rather character states are considered relatively primitive or derived. The terms "plesiomorph sister group," "apomorph sister group," "relatively apomorph" or "relatively plesiomorph" are sometimes used to describe cladistic relationships but should never be taken as statements about the organisms or taxa themselves.

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Collections. Specimens from the following collections have been examined and provided with identification labels. Just over 2,200 specimens were dissected for genitalia, legs, and/or palpi. Abbreviations indicated below are used in the paper.

AME, Allyn Museum of Entomology

AMNH, American Museum of Natural History

AIL, Argentine National Collection (Institute Miguel Lillo)

BC, Breyer Collection (Pelotas, Brazil, on loan NMNH)

BMNH, British Museum (Natural History)

CAS, California Academy of Science

CMNH, Carnegie Museum of Natural History

EC, Eisele Collection (Jujuy, Argentina)

LACM, Los Angeles County Museum of Natural History

MCZ, Museum of Comparative Zoology, Harvard University

MCP, MacPherson Collection (Salta, Argentina)

NMNH, National Museum of Natural History

UCB, University of California, Berkeley

Other private collections, noted individually.

The Material Examined is listed in Appendix 4.

Characters. Several studies have included commentary on the relative taxonomic value of characters in Lycaenidae. Eliot (1973) has provided the most recent survey of the family as a whole. Clench (1955; amended, 1965) considered various characters; Stempffer (1957, 1967) contributed voluminous data on many African taxa as did Sibatani (1946) concerning Indo-Australian taxa. Riley (1956)

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has analyzed particular genera and Shirozu and Yamimoto (1956) have contributed in reference to Lycaenidae-Riodinidae relations. Ehrlich (1958) and Ehrlich and Ehrlich (1967) provided an analysis of Rhopalocera including Lycaenidae, but without specific reference to character states. Kristensen (1976) has re-evaluated the Ehrlich data in a Hennigian framework, concluding that Lycaenidae is the sister group of Nymphalidae, and that this sister pair represents the most apomorphic pair in a branching diagram of the families of butterflies.

In regard to groups included in the present study, Clench (1944, 1946) commented on characters of the wing and male genitalia. Nicolay (1971a, 1971b, 1976, 1977, 1979) has done similarly for some other Neotropical genera. Ziegler (1961) presented a preliminary classification based on numerous listed characters but did not include commentary on the character states. Tilden (1963) and Shields 1965 (1966) discussed superficial characters in some particular genera or species groups. For taxa of lower categories, the legs and head have not been considered prior to this paper. Johnson (1976a, 1978) first considered the female genitalia, presenting a detailed analysis of male and female genitalia of one monophyletic group (Mitoura as defined by him) along with a glossary.[5]

Following is a list of published opinions on the relative usefulness of characters in Lycaenidae with comments based on the present study and particular character states used in the cladistic analysis. This study is the first to list characters as relatively primitive or derived within the Lycaenidae.

Characters of the Genitalia:

MALE (a). vinculum. Eliot (1973) considered this useful in Lycaenidae. I have not found it so for the taxa of this study. (b). labides (= uncus). Eliot (1973) stated these are useful in Polyommatinae, and Sibatani (1946)

---

[5]Due to some proofs not seen by the author (Johnson, 1976a), several discrepancies between some textual material and tables resulted; these have been corrected in this study, as noted specifically under particular taxa.

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used the character in Indo-Australian Theclinae. I have found this character helpful at the species level in Mitoura sensu lato. (c). falces (= brachia). According to Eliot (1973), falces are useful in some groups. They are used by Sibatani (1946) in Indo-Australian Theclinae but I have not found them useful during this study. (d). valvae (= claspers). Valvae are not useful according to Eliot (1973) though they are emphasized by Sibatani (1946) for Theclinae. Valvae have been found by me to be extremely useful and consistent (see Johnson 1976a, 1976b, 1978, and below). (e). aedeagus (= penis). Stressed as important by Eliot (1973) for intra-Lycaenidae relations, the aedeagus has been very useful relative to outgroups of taxa in this study (see Cladistic Analysis I). (f). cornuti of aedeagus. Not mentioned as useful by any authors except Johnson (1976a), this character has proved informative in the present study, especially for higher categories. (g). juxta. Found occasionally useful by Eliot (1973) and stressed by Clench (1955), the juxta is not present in Callophryina. (h). Supralimital characters (= abnormal features). Eliot (1973) mentioned the value of unique characters within particular taxonomic groups. Such have been very useful in the present study and include: (1). degree of sclerotization of the bilobed configuration (e.g., clear, spiny, etc.); (2). flaring of vinculum dorso-cephalad; (3). development of spur-like appendages of vinculum dorso-caudad; and (4). cephalad extensions of aedeagus.

FEMALE. Used only by Johnson (1976a), these are very important and numerous useful characters occur (see Cladistic Analysis).

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Characters of the Head:

(a). antennae. Jordan (1898) used these at the family level; Riley (1956) mentioned the flagellum as useful at the tribal and generic levels. Clench (1955) used segment/shaft ratios while Eliot (1973) emphasized length/breadth ratios of the segments. These have not been found useful by me. (b). eyes. Chapman (1912) and Clench (1944, 1946) emphasized color of the eye-lining for the compound eye. (c). frons. Chapman (1912) and Clench (1944, 1946) have mentioned the usefulness of the frons color in "Thecla" sensu lato. I have found this also. (d). palpi. Eliot (1973) rejected palpi as useless because of sexual differences. The present study indicates, however, that the patterns of sexual dimorphism are extremely useful in higher categories. (e). Proboscis. Eliot (1973) mentioned the development of sensory hairs on the proboscis as useful in Lycaenidae at the subfamily level. I have not examined this character in Callophryina.

Characters of the Legs:

(a). structural characters. Eliot (1973), Clench (1955, 1965), Shirozu and Yamamoto (1956) and to a lesser degree Stempffer (1957, 1967) have extensively used characters of the leg structure (shape, spination, spurs, ratios, etc.) for intra- Lycaenidae categories and between families. The only characters of the leg I have found useful are those cited below.
(b). secondary sexual characters. The importance of forelegs in sexing Lycaenidae (in this case males of Eumaeini lacking a tarsal claw and evidencing various reduction or fusing of the tarsal segments into a blunt or spiny end) have been emphasized by all the above authors. In the present group I have found some relative apomorphic characters in the legs but useful only at the species group level. These are characterized by

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lengthening of the tibia and tarsal segments relative to width (see Cladistic Analysis IB2ba).

Characters of the Wings:

(a). color and pattern. Characters of the wings have received perhaps inordinate attention in all the butterflies, including Lycaenidae. Schwanswitsch (1948) has reviewed lycaenid wing pattern in detail. Such characters, immediately accessible to the lepidopterist, have been considered primary by most workers, especially Clench. However, the cladogram considered most parsimonious for the entire array of characters studied indicates that many wing characters of color and pattern are generally primitive and occur throughout the cladogram in a mosaic pattern. The reliance of many lepidopterists on such primitive characters as primary criteria for clustering taxa has led to the extreme polyphyly characteristic of all former classifications. Eliot (1973) stated that color itself does not appear to be important to the systematics of Lycaenidae, but the cladistic analysis in this study indicates that the pigmental and structural color states are primitive and derived, respectively (see Tables 1, 2).
(b). venation. Wing venation was long used as a primary source of characters, but except for particular modern usages (Stempffer, 1967; Clench, 1955; Eliot's 1973 usage for some higher categories) has come to be considered less important. I have not found it useful. (c). ultraviolet (UV) reflectance. No one has used UV reflectance before on taxa of this group. The most useful characters evidently regard reflectance patterns on the upper surface of the wings of iridescent specimens. Degrees of UV reflectance appear variously on the wing relative to scale layer thicknesses (Crane, 1954) and such characters seem useful in Callophryina. Availabili-

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ty of relatively few photographic results and lack of thorough knowledge of the outgroups has limited my use of UV characters.

Secondary Sexual Characters:

(a). scent patch (= scent brand, androconium). These have been considered useful at the subfamilial level by most authors (e.g., Clench, Eliot, Sibatani, Stempffer); their loss is considered apomorphic in this study (see Cladistic Analysis, Sandia, Mitoura). (b). brush organs on the vinculum. Eliot (1973) divided Eumaeini into two subgroups relative to occurrence of these organs. They are present to some degree in all the groups of the present study and I have not found their nature or occurrence useful in the present analysis.

Early Stages:

Eggs, larvae and pupae are known for only a few of the taxa in the present study. Therefore characters derived from them are not included in the cladistic analysis.

Larval Foodplants:

Ziegler (1961) utilized exclusive larval foodplant assemblages as criteria for clustering taxa. I have considered some of these (e.g., assemblages on gymnosperms) as autapomorphies for some genera or species groups.

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CLADISTIC ANALYSIS

Introduction

Prior to this study sixty-eight genera of Lycaenidae (see Appendix 1) have been considered as the tribe Eumaeini (sensu Eliot, 1973) and defined by him with the clusters of characters listed below. Until now, no one has attempted a phylogenetic analysis (sensu Hennig) to estimate monophyletic groups within these diverse taxa. In this study, I have studied the wing characters, male and female genitalia, legs, palpi and various characters of the head in nearly all the Eumaeini groups (specifically listed in Appendix 1). Below, I present cladistic analysis for one monophyletic assemblage I refer to as the infratribe Callophryina. It includes taxa formerly placed in the genera Callophrys, Cyanophrys, Incisalia, Mitoura, Sandia, Satsuma (= Ahlbergia), Thecla and Xamia.

Eumaeini according to Eliot (1973)

Characters of Eumaeini:

Character states distinguishing the Tribe Eumaeini and the Eumaeus-section of Eumaeini from other Lycaenidae are these:

Theclinae versus other Lycaenidae families. Mid- and hind tibiae with small spurs. Antennal shaft without bristled fringe. Antennal club cylindrical, except in species with more than ten forewing veins. Proboscis smooth-sided with short sensory hairs in some taxa. Venation of forewings with usually ten or eleven veins, seventh vein terminating at costa or apex, except in some unique taxa. Hindwing with veins and anad usually terminating with one or more tails, and with

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recurvature of wing lobe between anal and outer margins. Secondary sexual characters prominent: male scent patch consolidated into one distinct area, sometimes with associated hairy scales.

Eumaeini versus other Theclinae tribes. Hindwing with obvious tail or extension of vein Cu_2, or hindwing tailless and forewing with ten or eleven veins. If forewing with ten or eleven veins, tail at vein 3A. Forewing with veins Sc and R_1 free. Males without hair brushes dorsad on forewing. Male genitalia lacking juxta. Eyes hairy. Male fore tarsus with stubby tip.

Eumaeus-section versus Trichonis-section. Male fore tarsus subcylindrical and spined throughout.

Description, Eumaeus-section (Lycaenidae, Eumaeini):

Tagma generally not hairy though latter may occur with increasing altitude or latitude. Tropical taxa with various structural coloration on tagma, relatively simple on thorax and abdomen, more complex on head as reviewed below. On head, forepart between compound eye (frons) variously colored pigmentally or structurally. Antennae club-ended, usually of fourteen to sixteen segments, often alternating light (sometimes white) and dark in color. Palpi with three segments profusely scaled and hairy, often variously colored. As with most Lycaenidae, fore tarsus of males lacking tarsal claw and/or tarsal segments variously fused into a blunt and spiny-endead terminus; females with full development of tarsal segments and terminal tarsal claws. Legs profusely hairy and scaled, often variously colored, pigmentally or structurally. Wings prolific in coloration and pattern, the general pattern having been analyzed by Schwanswitsch (1948). Wing pattern of group under study generally with unicolorous upper surface, pigmentally or structurally colored; under surface mostly characterized by hoary mottling

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confined to postmedian, mesial, and postbasal patterns or with unicolorous ground color with postmedian line, forewing, and variously complete mesial line or spots on the hindwing. Structural color rare on under surface. Species of the group under study, tailed or untailed; males with a scent patch distad in the dical area of the forewing, upper surface, lost in some taxa.

The general configurations of the male and female genitalia are illustrated in Figures 5 and 6, and labelled according to the general terminology of Lepidoptera (Tuxen, 1970) along with that adopted for these groups by Johnson (1976a) and expanded in this paper (Appendix 2).

Cladistic Analysis of Eumaeini Genera

The most parsimonius cladogram for taxa formerly placed in the genera Callophrys, Cyanophrys, Incisalia, Mitoura, Sandia, Satsuma, Thecla (specifically the culminicola group sensu Draudt, 1919) and Xamia is presented in Fig. 2. It defines Callophryina as a monophyletic group within Eumaeini genera and suggests sixteen terminal taxa recognized herein as genera, ten of which are named as new. Using a subset numbering system, the cladogram can be divided into nested sets defined by shared derived characters (synapomorphies) expressed by the following classification and supported by the character states described subsequently.

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((Fig. 2))

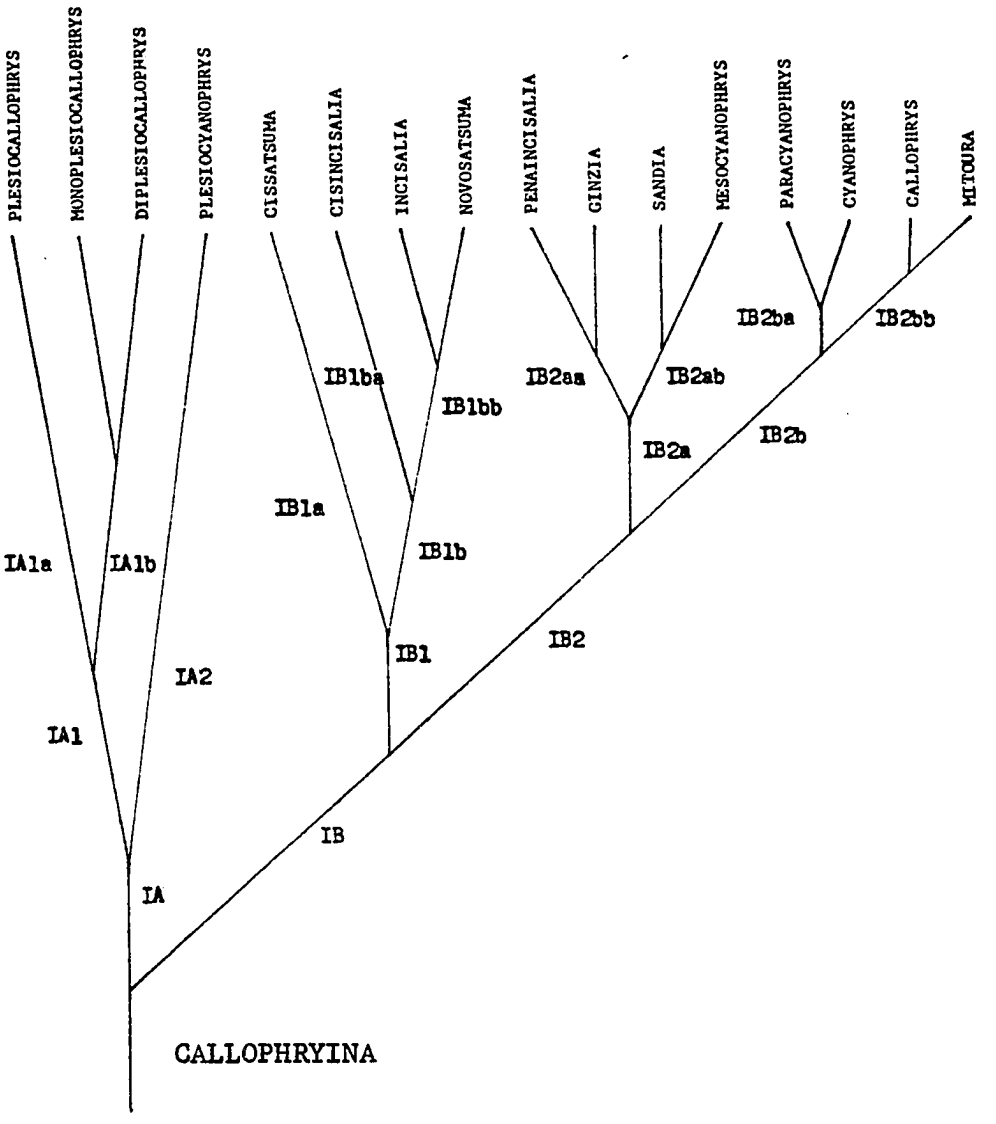


Fig.2

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Classification:

I. Callophryina

IA. Primary Series Plesiocallophrys (including Plesiocallophrys, Monoplesiocallophrys, Diplesiocallophrys, Plesiocyanophrys)

IA1. Secondary Series Plesiocallophrys (including Plesiocallophrys, Monoplesiocallophrys, Diplesiocallophrys)

IA1a. Tertiary Series Plesiocallophrys

Quaternary Series (unresolved)

Genus Plesiocallophrys (3 species)

IA1b. Tertiary Series Monoplesiocallophyrs (including Monoplesiocallophrys, Diplesiocallophrys)

Quaternary Series (unresolved)

Genus Monoplesiocallophrys (1 species)

Genus Diplesiocallophrys (3 species)

IA2. Secondary Series Plesiocyanophrys

Tertiary Series

Quaternary Series (unresolved trichotomy)

Genus Plesiocyanophrys (3 species)

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IB. Primary Series Cissatsuma (including Cissatsuma, Cisincisalia, Incisalia, Novosatsuma, Penaincisalia, Ginzia, Sandia, Mesocyanophrys, Paracyanophrys, Cyanophrys, Callophrys, Mitoura).

IB1. Secondary Series Cissatsuma (including Cissatsuma, Cisincisalia, Incisalia, Novosatsuma).

IB1a. Tertiary Series

Quaternary Series (unresolved tetratomy)

Genus Cissatsuma (4 species)

IB1b. Tertiary Series Cisincisalia (including Cisincisalia, Incisalia, Novosatsuma).

IB1ba. Quaternary Series (monotypic genus)

Genus Cisincisalia (1 species)

IB1bb. Quaternary Series Incisalia (including Incisalia, Novosatsuma).

Genus Incisalia (3 species)

Genus Novosatsuma (8 species)

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IB2. Secondary Series Penaincisalia (including Penaincisalia, Ginzia, Sandia, Mesocyanophrys, Paracyanophrys, Cyanophrys, Callophrys, Mitoura).

IB2a. Tertiary Series Penaincisalia (including Penaincisalia, Ginzia, Sandia, Mesocyanophrys).

IB2aa. Quaternary Series Penaincisalia (including Penaincisalia, Ginzia).

Genus Penaincisalia (5 species)

Genus Ginzia (22 species)

1. The chalybea Group (2 species)
2. The ferrea Group (3 species)
3. The pluto Group (6 species)
4. The frivaldskyi Group (3 species)
5. The circe Group (5 species)
6. The leechi Group (2 species)

IB2ab. Quaternary Series Sandia (including Sandia, Mesocyanophrys).

Genus Sandia (11 species)

1. The fusius Group (3 species)
2. The macfarlandi Group (3 species)
3. The augustinus Group (4 species)

Genus Mesocyanophrys (15) species)

1. The caramba Group (5 species)
2. The legionis Group (3 species)
3. The acaste Group (7 species)

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IB2b. Tertiary Series Paracyanophrys (including Paracyanophrys, Cyanophrys, Callophrys, Mitoura).

IB2ba. Quaternary Series Paracyanophrys (including Paracyanophrys, Cyanophrys).

Genus Paracyanophrys (6 species)

Genus Cyanophrys (40 species)

1. The longula Group (9 species)
2. The distractus Group (7 species)
3. The amyntor Group (7 species)
4. The iggii Group (2 species)
5. The circumcyanophrys Group (3 species)
6. The herodotus Group (5 species)
7. The miserabilis Group (7 species)

IB2bb. Quaternary Series Callophrys (including Callophrys, Mitoura).

Genus Callophrys (10 species)

Genus Mitoura (18 species)

1. The spinetorum Group (3 species)
2. The johnsoni Group (1 species)
3. The byrnei Group (4 species)
4. The dospassosi Group (4 species)
5. The loki Group (6 species)

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Discussion of Character States:

I. Callophryina as a monophyletic group.

Taxa of Eumaeini as clustered by Eliot (1973) are structurally very diverse. Lack of previous cladistic analysis in any of the groups necessitates study of as many representatives of eumaeine genera as possible. Study of all described taxa within these genera was impossible. Such study (as in Callophryina) indicates nested sets of apomorphies including quite various character states. Therefore, within some outgroup taxa studied, the particular polarity of character states (as more primitive or more derived) may be unclear. Hence, an overall comparison of Callophryina with other higher categories of Eumaeini has to be based on some general concept of primitive and derived character states for an entire morphotype of Eumaeini, e.g., the sum of inferred plesiomorphic and apomorphic character states of all taxa studied within the tribe.

In considering Callophryina as a monophyletic group there are a number of characters in common to the group which can be judged as uniquely derived and these qualify as synapomorphies for Callophryina as defined in this paper. These character states can be compared with those of outgroups assessed in this study as being more immediately related to Callophryina (e.g., possibly directly adjacent on relatively plesiomorph stems of a cladogram of all Eumaeini). Because of structural diversity in Eumaeini, synapomorphies of Callophryina can be less specifically related to character states of eumaeine groups evaluated as more distantly related. Character states of some eumaeine genera (listed in Appendix 1 but not treated in this discussion) indicate quite distant kinship to Callophryina and uncertain relation to other genera of the tribe. Because of such complexity, evaluations of these genera cannot be included in the present discussion except to omit them from close kinship to the Callophryina.

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In discussing character states below, I frequently provide general ratios of proportions for some morphological structures. This is for precision, and is not to be taken as raw measurement data. I list eumaeine genera other than Callophryina in quotes, indicating that I cannot be sure if any of these are monophyletic as presently defined.

Characters considered synapomorphic for Callophryina include the following:

(a). Aedeagus with distinct cephalad arc-shaped trough--trough generally two-sevenths to one-third shaft length, irrespective of length of aedeagus (Fig. 5).

Taxa of "Allosmaitia", "Calycopis", "Chalybs" (especially the janais group of Draudt, 1919), "Electostrymon", "Hypostrymon", "Lamprospilus", "Micandra", "Ministrymon", "Phaeostrymon", "Polyniphes", "Strymon", some "Thecla" (specifically the arria and palegon groups of Draudt, 1919), "Thereus", and "Tmolus" are judged by the entire scope of corroborating characters examined in Eumaeini as most closely akin to Callophryina. These share a cephalad trough circa 0.25 the entire expanse of the aedeagus. It is generally flat and in the same plane as the aedeagal shaft, not arc-shaped. "Chlorostrymon", "Callipsyphe", "Pseudothecla", "Satyrium", and "Strymonidia" share an aedeagus with cephalad trough much more than one-third entire length, circa 0.5. Similar to this configuration are troughs less smoothly curved and sometimes more within the plane of the aedeagal shaft (as in "Arawacus", "Cyanus", and very similar "Brangas", along with "Harkenclenus", "Magnastigma", "Nesiostrymon", "Oenomaus", and "Rekoa"). These are usually about 0.4 the length of the ductus shaft. In "Camena", "Dolymorpha", "Hypolycaena", "Iolus", and to some extent "Panthaides", a trough occurs which is deeply indented and angled, circa 0.6 length of the aedeagus. These are judged as more distantly related to Callophryina. "Erora", "Eumaeus", "Iophanus", "Panchala", "Philodudorix" and

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Fig. 5

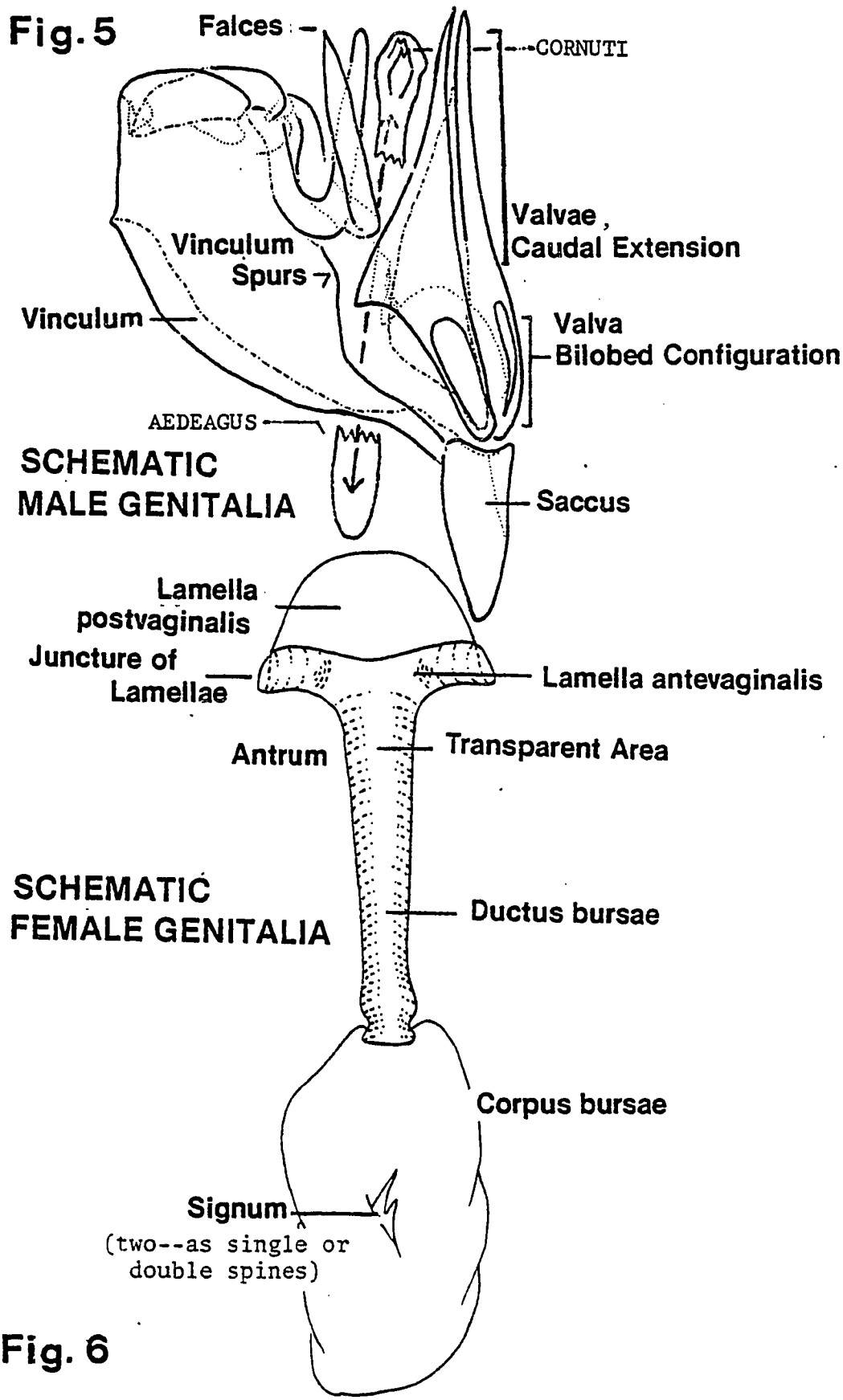


Fig. 6

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taxa of the Thecla arria Group of Draudt evidence a condition considered most plesiomorphic for the Eumaeini: celphalad trough hardly distinguishable from shaft of aedeagus, with latter reduced in entire length. In all the groups studied, elongation of the aedeagal shaft seems indicative of apomorphy.

(b). Lamellae variously expanded distad terminus of ductus bursae, with lobes of lamella postvaginalis entirely fused or with slight, clear, centrad juncture (Fig. 6). Expansion of lamellal lobes concomitant with increased narrowing of the ductus, exaggeration of this state indicating successive apomorphy (Figs. 186, 232, 310).

Except for some apparently extremely apomorphic character states within some taxa of other monophyletic assemblages of Eumaeini, taxa of the outgroups listed above under (a). evidence (in increasing magnitude of expression in the order of clusters for character states of the aedeagus trough) lamellae variously but decreasingly expanded caudad from the ductus terminus and usually in same plane or only slightly tapered from that of the ductus shaft. In these states, lobes (if present) are increasingly separated centrad by a gap with no fusion either to a simple centrad line or completely. Taxa in "Brangas", "Cyanus", "Rekoa", "Magnastigma" and "Nesiostrymon" show an extreme of this condition--slight tapering cephalad from the caudal end of the ductus (appearing almost antrum-like) but without distinct lamellal lobes. In "Brangas" occasional sclerotizations occur caudad along the ductal opening.

(c). Base of bilobed configuration completely fused to barely indented, unless oddly derived (Figs. 5, 240, 309).

"Allosmaitia", "Brangas", "Callipsyche", "Chlorostrymon", "Cyanus", "Harkenclenus", "Hypostrymon", "Oenomeus", "Phaeostrymon". "Pseudothecla", "Rekoa", "Satyrium", "Strymonidia", and "Virachola" have the base of valval bilobed configuration quite openly separated, with a centrad line often further

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dividing it. In "Arawacus", "Camena", "Eumaeus", "Hypolycaena", "Iolus", "Iophanus", and "Panthaides" the bilobed configuration is widely open at the base. The above states are judged successively primitive to that of Callophryina. Some taxa of "Ministrymon", "Strymon", "Tmolus", a cluster of taxa undescribed in Thecla, and some taxa of the palegon group of Draudt (1919) have a fused bilobed configuration. Dissection of further taxa in these genera, however, indicates transformation series suggesting independent derivation. This assessment is corroborated by the other character states in these taxa relative to Callophryina.

(d). Wing pattern, under surface, limited to uniform ground color and mesial arc of spots on hindwing (Fig. 7). This arc sometimes fused to a line, occasionally with correspondent parallel markings occurring distad as blotches or basad as blotches or slashes (Fig. 83). Some taxa with unique post-basal, mesial, and distad markings appearing hoary and mottled (Fig. 18). These latter, however, always without confinement of suffusion by encircling lines or margins.

Taxa generally corroborated as closest in kinship to Callophryina, "Tmolus", and the palegon group of "Thecla", have a striped under surface. "Allosmaitia", "Atlides", "Callipsyche", "Calycopis", "Calystryma", "Chlorostrymon", "Electrostrymon", "Hypostrymon", "Phaeostrymon", "Pseudothecla", "Strymon", "Strymonidia", and "Virachola" have stripes, patterns of dashes or lunules. "Panthiades", "Eumaeus", and some "Panchala" and "Magnastigma" have a thickly-lined transverse stripe, jagged anad. Some "Panchala ", "Chalybs" and the arria group of "Thecla" exhibit hoary or mottled suffusion always confined or limited by lunule-like edging.

It is anticipated that complete analysis of Eumaeini will indicate various nested apomorphies stemming from the basic morphotypes clustered and described above, with numerous apparent convergences. The general wing morphotype of Callophryina--green with slight maculation--is considered synapomorphic. It is

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thereafter derived to frequent hoary patterns which recur in a mosaic pattern throughout the group.

(e). Signa widely bifurcate spines; juncture of each signum to corpus bursae a discrete spine attached to bursae sac. No adjoining sclerotizations of sac surround the signa or extend from it (Figs. 186, 210, 260).

In all outgroups listed above, signa are spiny plates, patches, clusters, groups of spines or nodules, etc.; juncture of each signum to the corpus bursae is variously accompanied by sclerotization of the bursae sac (e.g., with "fan"-shape, mottling, flaring, dentritic patterns, or broad "wing"-shapes, etc.). These latter conditions are assessed as possibly synapomorphous of other monophyletic groups. None of such possibly group-defining characters appears to be apomorph to those of Callophryina, and, within each, particular patterns of derivation occur in various taxa (including loss of signa as in some Callophryina).

(f). Lateral shape of valvae "funneled" with distinct shoulder far caudad (circa last one-third of caudal length from dorsal articulation of valvae to its terminus, Figs. 141, 185).

This is perhaps the weakest character shared by all members of the Callophryina but not other Eumaeini.

In all outgroups listed above the valvae is variously tapered caudad its dorsal articulation to the vinculum.

The five character states reviewed above are shared by the stem taxa of Callophryina and provide a basic ground plan or morphotype for this monophyletic group. Apomorph conditions in Callophryina indicate that character states of other outgroups studied can be assessed as relatively plesiomorph to the Callophryina stem. Precise cladistic relations within other Eumaeini are, however, uncertain at this time.

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Internal consistency within the cladogram in Figure 2 determines a number of polarities which are useful in evaluating nested sets of synapomorphies within Callophryina, but not as easily evaluated in relation to the outgroups. This probably results because character source structures also undergo radical transformation in the outgroups. Therefore, a general plesiomorph assessment of same character states within Callophryina is useful for the ongoing discussion of relative apomorphy.

(a). Sexual dimorphism in the palpi: nested sets of apparently apomorphic conditions were useful in defining higher categories. The plesiomorphic condition of palpi in Callophryina is considered as the second and third segments being "short" (length circa four times width--Fig. 382); successive elongation and various ratios of segments relative to dimorphism is taken to be variously apomorphic (Figs. 384, 428). Outgroups in Eumaeini evidence similar patterns of apparent polarity.

(b). Frons: the fuscous frons is considered primitive within Callophryina. It becomes variously derived to a heavily spined and colored (green or brown) condition with other (usually white) coloration about the compound eye.

(c). Valvae: a tapered caudal extension in the valvae of male genitalia is considered the primitive condition in Callophryina (Fig. 123) and thereafter variously derived to non-tapered shapes (Figs. 266, 307). As with palpi, this polarity seems applicable within most of the outgroup taxa studied.

(d). Cornuti: wide and disclike conditions of the cornuti (aedeagus of male genitalia) are considered primitive for Callophryina (Figs. 129, 133) and considered variously derived in tapered or spined states (Figs. 246, 282). Outgroup taxa studied evidence similar reduction of the cornuti in states taken to be apomorphic.

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(e). Wing color: occurrence of structural color on the upper surfaces of the wings in Callophryina is considered apomorph relative to absence of same. Increasing extents of such coloration is judged as indicating increasing apomorphy (Figs. 8, 23, 42, 61). This polarity is corroborated by character states in stem versus derived groups of Callophryina.

(f). Saccus: a simple, broadly parabolic saccus is taken to be primitive in Callophryina (Figs. 147, 240) with extreme reduction (Figs. 156, 162) or elongation (Figs. 309, 325) considered apomorphic.

(g). Tails: the untailed condition is taken to be primitive (Fig. 7) with the tailed condition considered derived (Figs. 39, 103, 117).

IA. Primary Series Plesiocallophrys as the sister group of all other series of Callophryina:

Primary Series Plesiocallophrys contains taxa retaining numerous primitive character states relative to the rest of Callophryina. Few stem primitive characters are derived to any degree. Apomorph characters defining the group include the following. In the male genitalia, the "funneled" structure of the valvae in lateral view is lost (Fig. 120); in the female the centrad division of the lamella postvaginalis is fused completely (plesiomorph state has transparent centrad juncture as in (b). above) but further derivation of the lamellae is limited to moderate expansion of the lips distad without heavy sclerotization (Fig. 131). In the palpi, relative to entire length of second and third palpal segments, the second segment in both sexes is short (never exceeding 0.75 entire length or four times maximal width of second--Fig. 374); relative to ratios of third to second segments within a species, the third segment in each sex is about equal (Fig. 373),

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or the female slightly longer in particular derived taxa within the group (Fig. 378). The frons is green; this state is derived from an uncolored fuscous condition and this apomorphy occurs independently in other Callophryina.

Relations within Primary Series Plesiocallophrys:

IA2. Secondary Series Plesiocyanophrys as a monophyletic group:

Synapomorphic characters are as follows. They represent the character states of the series, after which the species are an unresolved trichotomy which cannot be further subdivided by relative apomorphy. Male genitalia: caudal extension of the valvae in known males distinctly "three-step" in structure (Fig. 129). Female genitalia: signa reduced to a single spine only slightly bifurcate centrad (Fig. 131)--shortness of the ductus (length usually three times width or less) being characteristic of the primitive morphotype. The primitive condition of the palpi is retained as are those of the characters of the wing. The derived character of the Primary Series, a green frons, is retained.

IA1. Secondary Series Plesiocallophrys as the sister group of Secondary Series Plesiocyanophrys (IA2):

This series (IA1) shares the synapomorphies of the Primary Series with IA2 but has none of the unique apomorphies of that series. Rather, its three genera share several synapomorphies defining them as a monophyletic group and the immediate sister of IA2. In male genitalia, though the primitive condition of variously tapered caudal extension of the valvae is retained, the cornuti are successively derived to a tapered configuration (Fig. 127). In the female, genitalia evidence the ductus derived to longer, narrower shapes with length up to twelve times width, and tips of lamellae become variously expansive distad (Fig. 119). Signa become variously less bifurcate. Taxa with relatively primitive

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palpal characters (Fig. 376) retain the characters of Primary Series Plesiocallophrys, while some derived taxa exhibit elongation of the second segment (up to six to seven times width in Diplesiocallophrys) with particular male/female segment ratios.

Relations within Secondary Series Plesiocallophrys:

IA1b. Tertiary Series Monoplesiocallophrys as a monophyletic group:

Several synapomorphies define this series as distinct from its sister group. Male genitalia exhibit valvae variously derived, including loss of tapering, and recurving in the caudal extension (Fig. 127). Cornuti are tapered. Female genitalia have ductal configurations elongate, length eight to twelve times width (Fig. 128). Distad expansion of lamella lips exceeds width of ductus. Centrad division of lamella postvaginalis becomes completely fused. Palpi evidence elongation of second segment in both sexes, with length equalling or exceeding six times width, but sexual dimorphism is as in the Primary Series (Fig. 376). In the wings, on the under surface, hindwing, mesial spots become obsolescent especially between veins Rs and M_3 (Fig. 10), and on the upper surface blue iridescence invades the forewing apices. These conditions are apomorph to the primitive condition (see (d). under Callophryina) of mesial band of spots, under surface, hindwing, and reduced iridescence above in tropical taxa.

Relations within Tertiary Series Monoplesiocallophrys:

Monoplesiocallophrys taxa as a monophyletic group:

The genus Monoplesiocallophrys is defined by the following autapomorphic characters. Female genitalia--ductus elongate, seven to eight times width (Fig. 124); sexual dimorphism of the palpi--second segment of both sexes elong-

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ate, length usually six times to slightly less width (Fig. 376); characters of the wing--crennation of the hindwing margin enclosing white cell interspaces is a shared derived character with the relatively apomorph genus Diplesiocallophrys; frons--the green frons is derived relative to outgroups, but shared by the two immediate sister genera.

Diplesiocallophrys taxa as a monophyletic group:

The genus Diplesiocallophrys exhibits the following autapomorphic characters. Female genitalia--ductus extremely long (length ten to twelve times width--Fig. 128); sexual dimorphism of the palpi--second segment, both sexes, elongate (seven to eight times width), sexual dimorphism evidencing ratio of third to second segment slightly more in female than in male (Fig. 378); characters of the wing and frons--see under sister group.

IA1a. Tertiary Series Plesiocallophrys as the sister group of Tertiary Series Monoplesiocallophrys (IA1b):

The relations in this series are unresolved; taxa are thus included in one genus Plesiocallophrys. In males, the primitive tapered state of the valval caudal extension and the broad disclike cornuti are retained in one species but derived to a tapered state in another (Figs. 118, 120). This latter species also evidences an autapomorph recurvature of the valvae caudal extension. In females, ductal length (circa six times width--Fig. 121) is the most relatively primitive among the three sister genera, but derived relative to outgroups (ductal length circa three to four times width--Figs. 130-132). The female of the species with most autapomorph male genitalia exhibits the primitive unfused state of the lamella postvaginalis (Figs. 120, 121), while that of the species with most relatively plesiomorph genitalic characters in the male exhibits the apomorph fusion of the

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lamella postvaginalis lobes (Figs. 118, 119). In the palpi, one species exhibits the primitive characters of a short second palpal segment in both sexes (Fig. 373), while that of another derived taxon is more elongate (Fig. 374). Dimorphism is as typical of the characters of the Primary Series. Wing characters show no derivation of the hindwing margin, above, to include crennation and white cell interspaces framed with a black marginal line. The green frons (except as noted) is derived (relative to outgroups) but shared with the immediate three sister genera.

IB. Monophyletic status of the Primary Series Cissatsuma:

The second Primary Series indicated by cladistic analysis of Callophryina includes a highly diversified group of taxa. Male genitalia retain primitive characters variously derived in the apomorph groups within the series. In female genitalia, distal extension of the lamellal lips becomes increased relative to the width of the ductus and heavy sclerotizations occur distad on the lips or ventrad on the lamella postvaginalis (Figs. 136, 140, 142, 150, 241, 306). These are considered derived relative to the simple and non-sclerotized conditions of the other Callophryina (Figs. 122, 130, etc.). In the palpi, relative to entire length of second and third palpal segments, the second segment in both sexes is short (never exceeding .75 entire length or four times maximal width of second); relative to ratios of third to second segments in sexes of a species, the ratio in males is far less than in females and never exceeds unity, generally equal to or less than one half unity, while in females this ratio is far higher, always exceeding .75 and equalling or exceeding unity. This condition indicates sexual dimorphism relative to elongation and these are considered apomorph to the short conditions characterizing the stem of the sister group (Figs. 382-513). Primitive characters of the wings are variously derived in the different groups of this Primary Series

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and include added maculation on the wing under surface of taxa green beneath (Figs. 101-103, 116-117), and derivation of mottled and hoary patterns on others (Figs. 14-44). The only leg characters indicating apomorphy occur in extremely derived taxa of this series.

IB1. Secondary Series Cissatsuma as the sister group of all remaining taxa of the Primary Series IB:

Cladistic analysis indicates that Primary Series IB can be divided by relative apomorphy into two Secondary Series. The apomorphic characters defining group IB1 as monophyletic and as the sister group of the remaining taxa of the Primary Series include the following. Male genitalia exhibit valvae on which the bilobed configuration becomes exaggeratedly shouldered and narrow or wide-rimmed, and the valval caudal extension becomes very thickly and evenly tapered to blunt ends (Figs. 135, 141, 147). This character, shared by stem taxa of Secondary Series Cissatsuma, is apparently plesiomorph relative to the various derivations to non-tapered configurations in the sister group Secondary Series Penaincisalia (Figs. 195, 231, 241). In female genitalia, the centrad division of the lamella postvaginalis becomes almost completely fused or occurs only as a notch, and the lamellae become variously more expansive distad, with angle of juncture of lamellae being up to 95° from terminal end of ductus (Figs. 133, 144). An antrum, however, is not developed. The ductus becomes elongate (exceeding always 1.25 times length and usually 1.5 times length of fully extended bursae) but remains wide (always at least half breadth of lamellae) except in a few highly derived taxa (Fig. 150); the signa become reduced, usually to a single spine (Fig. 140). All of these characters are considered apomorphic relative to those of Primary Series IA but are not shared by the taxa of Secondary Series IB2 of Primary Series IB. There is little sexual dimorphism in the palpi; the primitive character state of a

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short first segment in the palpi (usually less than half length of second segment) and short second segment (never exceeding .75 entire length second and third segments or four times maximal width of second) are retained in taxa exhibiting relatively primitive characters, but elongation of first and second segments occurs in derived taxa of each clade (Figs. 382-396). Patterns on the under surface of the hindwing are composed of highly mottled and hoary markings generally irrespective of postbasal, medial, submarginal, or marginal patterning. Along the margin of the basal disc the area costad usually has an exaggeratedly large white spot. These patterns (Figs. 14-44) are an evident derivation of the plesiomorph condition of Callophryina (simple arc of spots on the hindwing under surface) and hereafter occur in mosaic pattern throughout the infratribe.

Relations within the Secondary Series Cissatsuma:

IB1b. Tertiary Series Cisincisalia as a monophyletic group:

This series of three genera is considered relatively apomorph to the series represented by the genus Cissatsuma. The following synapomorphic characters are shared by members of IB1b. In male genitalia, the highly shouldered bilobed configuration represents less than three-eighths the length of the valvae; the caudal extension is therefore elongate (Figs. 141, 149) compared with the more plesiomorph states of Cissatsuma (Fig. 133). Female genitalia evidence a narrowing of the ductus in relation to the breadth of the lamellae (one-quarter or less lamellal breadth) and there are striations or convolutions ventrad on the lamella postvaginalis and/or sclerotizations on the lamella antevaginalis not necessarily limited distad (Figs. 140, 142, 144). These are considered apomorphic consistent with their appearance as derived states in various clades of Callophryina. In the palpi, the primitive characters are retained in taxa judged as evidencing plesiomorph character relative to the rest of the group (Fig. 388); the

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second palpal segment becomes elongate in derived states (Fig. 386), consistent with polarities elsewhere in Callophryina. The patterns of the under surface of the hindwing are formed from various combinations of black or brown markings edged widely distad with white in either repeated parallel lines or spots postbasal, postdiscal, submarginal, and marginal, giving a mottled or speckled appearance contrasting white and dark (Fig. 18). These characters, considered derived for the group relative to Primary Series Plesiocallophrys, occur in a different apomorph state in Cissatsuma and the Penaincisalia of South America.

Relations within the Tertiary Series Cisincisalia:

Ib1ba. Quaternary Series Cisincisalia and the genus Cisincisalia as the sister group of Quaternary Series Incisalia (IB1bb):

There is a single species of Cisincisalia, from Guatemala. The characters defining this taxon as representing the sister group of the remaining taxa of Tertiary Series Cisincisalia include the following. Female genitalia exhibit a wide and tubular ductus and lamellae distally flared at least halt the ductal width; the signa are reduced to a single spine vaguely bifurcate centrad (Fig. 140). These are considered autapomorphic of Cinsincisalia, within the characters shared with the other taxa of the Tertiary Series. Sexual dimorphism of the palpi is unknown due to lack of known males, but female retains primitive characters of the Primary and Secondary Series Cissatsuma; e.g., the second segment is short (length not exceeding four times width). The vague steel blue coloration above and mottled brown beneath, with the latter divided into postbasal and mesial patterns, are considered autapomorphic for Cisincisalia.

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IB1bb. Quaternary Series Incisalia as a monophyletic group:

This series contains the two relatively apomorph genera in the Tertiary Series which share the following synapomorphies. In the female genitalia, the caudal expanse of the lamella antevaginalis becomes reduced relative to that of the lamella postvaginalis (usually one-quarter or less) and limited to being simple distal lips at the caudal opening of the ductus, if present at all (Figs. 142, 144). This limitation of the lamella antevaginalis, occurring nowhere else in the Secondary Series Cissatsuma, is considered autapomorphic for the Quaternary Series Incisalia. There is no characteristic pattern in the sexual dimorphism of the palpi; in each genus some taxa exhibit the primitive state of the Secondary Series IA1 (Fig. 388), while other more derived taxa have the first and second segments elongated (Fig. 386). In apparent derivation, the patterns of the Tertiary Series in this Quaternary Series are not restricted simply to the basal disc; the line edging the basal disc distad is no more prominent than any other. One genus, Novosatsuma, includes a peculiar reversal of the sexual dimorphic patterns within its taxa, evidencing several taxa with males blue (Figs. 18, 20, 23) above. An interesting possible synapomorphy of the series is the autapomorphic usage in genus Incisalia of gymnosperms as the larval foodplant. The life histories of the Asian counterparts of Incisalia, Novosatsuma, are unknown.

Relations within Quaternary Series Incisalia:

Taxa of Incisalia as a monophyletic group:

Apomorphic characters distinguishing Incisalia are: male genitalia--the bilobed configuration is mid- to extremely wide rimmed and bulbously ovate, the caudal extension tapering thickly to a more abrupt taper caudad (Fig. 141); female genitalia--the lamellae are extremely flared, with distal expanse exceeding one

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and one-half times ductal width (breadth, thus three times ductal width) and usually more (Fig. 142). There is no transparent area cephalad the antrum as characteristic of Secondary Series Cissatsuma; sexual dimorphism of the palpi--the primitive condition of little dimorphism in the palpi is retained (primitive for the Secondary Series Cissatsuma, derived for the Primary Series Cissatsuma). Palpi of one species show the primitive condition of a second segment of reduced length (Fig. 388), while two other species are relatively derived in relation to this (Figs. 386-387); characters of the wing--the mottled and hoary markings are developed to an extent obscuring postbasal, mesial, submarginal, and marginal patterning.

Taxa of Novosatsuma as a monophyletic group:

The apomorphic characters shared by taxa of the genus Novosatsuma are as follows: female genitalia--breadth of the lamellae flared to five to six times ductal width, sclerotized folding of plates ventrad on either lamella and signa reduced to small broad-based single-pointed spines (Fig. 150); characters of the wing--structural color (iridescent blue) over entire wing upper surfaces of males (Figs. 18, 20, 23). Male genitalia and palpi are ambiguous. The occurrence of convolutions or plates ventrad on the lamella antevaginalis and reduction of the signa is indicated as autapomorphous in a number of other genera of the Callophryina evidencing extremely derived character states. The occurrence of structural color dorsad on the males is a remarkable character of this genus and considered as obviously apomorph.

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IB1a. Tertiary Series Cissatsuma as the sister group of Tertiary Series Cisincisalia (IB1b):

This group of species, not further subdivisible by apomorphic characters into separate genera, contains several species with the mottled and hoary wing patterns of the conserials but evidencing genitalia and palpi retaining most of the primitive character states of the Primary Series. Hence, few apomorphic characters are unique to Cissatsuma. In the male genitalia the relatively apomorph characters of the Secondary Series Cissatsuma are maintained as the primitive condition and not further derived (the rims are narrow) as in succeeding member genera (Figs. 133, 135, etc.). In the female genitalia the degree of apomorphy of characters listed in the Secondary Series Cissatsuma diagnosis is the least in Cissatsuma: expansion distad of the lamellae never exceeds the width of the ductus, and caudal length of the lamella postvaginalis never two times ductus width (Figs. 134, 136, etc.). In the palpi the primitive characters of the Primary Series Cissatsuma and the Secondary Series Cissatsuma are main tained in two species (Figs. 382-383), derived in two others (Figs. 384-385). On the wings, the most primitive combinations of mottled and hoary markings characterizing the apomorphy of the Secondary Series Cissatsuma are displayed, postbasal, medial, and sub- or marginal patterning still being visible (Figs. 14-17).

IB2. Monophyletic status of Secondary Series Penaincisalia:

This series contains two large and diverse sister groups sharing a number of synapomorphies. Male genitalia retain the relatively plesiomorphic characters of the 1B Primary Series or are variously derived in the different clades of the series. On female genitalia, except for some taxa in which the primitive condition is retained in an apparent mosaic pattern, a distinct antrum is present and considered a unique derivation (Figs. 205, 209, 211, 232, 241, 275, etc.).

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Cephalad the antrum is a transparent area distad, broken by a centrad sclerotized line, usually one-fifth to one-fourth the length of the ductus, also assessed as apomorphic (see Figs. above). The centrad area dividing the lamella postvaginalis into two quadraspheres is reduced to only a light line (Fig. 157, etc.), present as a notch caudad (Fig. 336, etc.), or completely lost (Fig. 310, etc.), in furtherance of the general transformation series of derivation in this character. In palpi (Figs. 397-513) the second segment in both sexes is elongate, exceeding (usually widely) four times maximal width (generalization of elongation in relation to entire length of second and third segments not possible because of variance of derivation of their ratios); second segment elongation is associated with elongation of the first segment, usually one-third to one-half length of former. Comparatively, the ratio of the third to second segments in sexes of a species finds the third segment of the males shorter (usually one-third or less the length of its second), the third segment of the females longer (at the very least one-half the length of its second and in some groups always much more or even equal). This state is assessed synapomorphous for the entire series. Wing patterns are diverse and legs evidence no apomorphy until IB2ba. The frons retains the primitive condition until series IB2ab. The cornuti retain the primitive condition initially and are derived later to tapered forms (Figs. 246, 282, etc.). Tails are similarly derived from tailless forms.

Relations within Secondary Series Penaincisalia:

IB2a. Tertiary Series Penaincisalia as a monophyletic group:

This series is the sister group of Tertiary Series IB2b. It contains four genera with apomorphic characters relatively plesiomorph in relation to the other members of Secondary Series IB2. The male genitalia retain primitive states in a mosaic pattern within the subgroups, but female genitalia share a strong synapo-

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morphy: the ductus (Figs. 186, 190, 194, 205, 215, 232, 244, etc.) is extremely narrow in relation to its length (length at least five times maximum width, usually much longer, except generality must include some derived groups this short) and usually not of uniform width, but variously flared or narrowed, except in some particularly derived taxa. Some taxa retain more primitive character states in which the above configuration is not modified to an obvious antrum with transparency cephalad (Figs. 172, 186), while in one sister group within the Tertiary Series such modification is gradually apparent (Figs. 232, 244). In the palpi, except for some highly derived taxa, the second segment is relatively shorter in the females than corresponding males, and the third segment relatively longer in females than corresponding males (Figs. 397-447). This is judged as a synapomorphous derivation from the ground plan of the Secondary Series. Characters of the wing evidence no unique apomorphies.

Relations within Tertiary Series Penaincisalia:

IB2aa. Quaternary Series Penaincisalia as a monophyletic group:

This series is defined by apparent synapomorphies containing two sister genera of highly disjunct distribution: China, and western montane South America. One species group of the Old World sister genus is superficially so similar to the South American taxa that in the text of the revision (Remarks, Penaincisalia) I discuss alternative cladograms concerning its placement. The stongest synapomorphy containing the entire series is in the male genitalia: the caudal extension of the valvae is short (barely exceeding or being quite shorter than the caudad extreme of the articulation of falces to vinculum) and there is no great variance between the breadth of the shouldered bilobed configuration and the breadth of the valvae at the base of the caudal extension (Figs. 156, 159, etc.). Shortening of the valvae is indicative of relative apomorphy in several

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outgroups, notably "Panchala" and the arria and badeta groups of "Thecla" (Seitz, 1909). Otherwise, in female genitalia of IB2aa, primitive characters are retained or variously derived in the subgroups of the series, making synapomorphy for the series itself unclear. Similarly, the relatively primitive state of the palpi as in Tertiary Series IB2a are variously derived in the subgroups as are the cornuti to various tapered forms with taxa of Penaincisalia and stem Ginzia showing no derivation. Derivation of dorsal structural coloration on the wings is considered synapomorphous for the series.

Relations within Quaternary Series Penaincisalia:

Penaincisalia taxa as monophyletic:

Due apparently to extreme montane isolation, taxa of this genus are extremely diverse in structure. They also resemble several other taxa in the "Thecla" grade group which have hoary and mottled under surface wing patterns. This has called attention to the apparent relation of the Penaincisalia to Callophryina, but also confuses Penaincisalia with the Thecla species listed as the "arria-group" by Draudt (1919). These latter are very different genitalically, with a short, troughless, linearly-shafted aedeagus. The apomorphic characters distinguishing Penaincisalia are these. In the male genitalia there is extreme caudal shortening of the valvae (caudal length less than entire articulation of the falces). The bilobed configuration is extremely indented cephalad, nearly dividing the bilateral lobes about one-third caudal extension of the configuration. This, though similar to the character state of "Allosmaitia" et al. (see I) is considered independently derived because of the strong synapomorphy of the aedeagus. Lateral view of the valvae, corresponding to caudal reduction, is blunt ended. The aedeagus is shortened, entire length less than entire expanse of genitalic structures, but still of obvious synapomorphy with Callophryina. Cornuti retain

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the primitive disclike character. Notedly, the saccus is extremely small (circa one-half caudal length of bilobed configuration) and the area of its attachment to vinculum extremely thin. This condition resembles Ginzia leechi and G. nicevillei. For discussion of alternate cladograms of these Ginzia see Remarks under that genus. Female genitalia retain the primitive condition of the Primary Series. These corroborate the monophyly of Penaincisalia vis-a-vis the Ginzia taxa mentioned above. Signa are reduced in some Penaincisalia taxa but knowledge of these taxa is too limited to infer polarity. Taxa of Penaincisalia exhibit very primitive palpi relative to general trends within Callophryina. However, the autapomorphic nature of some aspects of the palpi (e.g., extreme shortening of the third segment in males) make it difficult to state polarity generally for the genus. A future complete revision of this group (see Remarks) may clarify this problem. The complete upper surface structural coloration of males in some Penaincisalia taxa is autapomorphic.

Ginzia taxa as monophyletic:

Ginzia is the sister group of Penaincisalia. Within its broad species diversity is extreme structural modification. The apomorphic characters which define Ginzia as a genus are several. Relative to male genitalia of both Ginzia and Penaincisalia having a shorter and much less extremely tapered caudal extension of the valvae, Ginzia is characterized by this caudal extension being usually never more than one and one-half times the length of the bilobed configuration but always exceeding in length the caudad extreme of the articulation of falces to vinculum. In taxa representing the primitive state of this trend, there is no great variance between the breadth of the valvae at the base of the caudal extension (e.g. frivaldskyi group) while the successively derived species (e.g. pluto, circe and leechi groups) have this difference more and more exaggerated (see Figs.). Also there is an apparent transformation series from more wide and disclike

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cornuti (retained hitherto in Series IB2) from the former species group, to more narrow cornuti in the latter three groups.

In female genitalia, the general lack of apomorhic states, except in the most derived of its clades, contrast Ginzia to the distinctive characters developed in sister series IB2ab. All taxa of Ginzia evidence narrowing of the ductus (in relation to the ratio of ductal width and breadth of lamellae) characteristic of all clades of series IB2, but in Ginzia only a few taxa evidence a transparent area in the ductus and an antrum in most is not extremely noticeable, though there is often gradual flaring of the ductus to the lamellae (see Figs.). This mosaic pattern is taken to mean that apomorphic tendencies of the Tertiary Series are less developed in both genera of IB2aa than in their sister group. Signa are present in species representing relatively primitive character states (and most are never deeply bifurcate), but these are lost in the derived taxa of the leechi group. The strong synapomorphies of the male genitalia and palpi (notwithstanding dimorphic variations upon it) are considered corroborative of the generally mosaic explanation of diverse character states in the females. In the palpi of Ginzia (Figs. 401-421) there is apparent autapomorphic convergence toward only slight sexual dimorphism in the palpal ratios except a somewhat shorter second segment in the female (relative to corresponding males) in some taxa. Similarity of male and female palpi upon the ground plan of the elongation typical of the secondary Series IB2 seems to warrant this assessment. All taxa of Ginzia are characterized by the hoary and mottled undersides characteristic of Ginzia and Incisalia as they were formerly defined as grade groups (Figs. 29-44). This derived character occurs in a mosaic pattern of plesiomorphy following its initial appearance in both sexes. This has also been independently derived in Cisatsuma, and Novosatsuma (Figs. 14-24).

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IB2ab. Quaternary Series Sandia as the sister group of Quaternary Series Penaincisalia (IB2aa):

This series contains two genera whose taxa have been placed in various para- or polyphyletic groups (sensu Nelson) prior to this revision. Within Sandia (sensu this revision) are included taxa whose larvae utilize herbaceous angiosperms, and which have formerly been placed in Incisalia along with gymnosperm feeders. Cladistic analysis clearly indicates the affinity of the aforementioned forb-feeders with several other taxa for which Sandia takes priority as a generic name. Synapomorphies for Sandia also include three Neotropical species formerly placed in Cyanophrys (sensu Clench) or the grade group Thecla. The sister group of Sandia, Mesocyanophrys, contains a large group of tropical butterflies, apparently derived from the same ancestral stock. These and many Cyanophrys have been lumped as a large grade group prior to this revision because of primitive wing characters. The apomorphic characters defining this series includes the following. In the male genitalia, the caudal extension is extremely long (whether tapered or stepped), always well exceeding the caudal extreme of the falces articulation to the vinculum, and often the labides (Figs. 199, 229, etc.). The cornuti become successively derived in narrow and tapered configurations (Figs. 199, 243, etc.). In the female genitalia, the tendency of the Secondary and Tertiary Series to a pronounced antrum becomes prominent cephalad the lamellae (Figs. 209, 210, etc.). Cephalad the antrum transparency of the ductus becomes extreme, amounting to one-fifth to over one-fourth the entire ductal length. The centrad division of the lamella postvaginalis is lost in the furtherance of the general transformation series of this character (Fig. 236). Patterns of sexual dimorphism of the palpi are apparently variously derived in the subgroups. In the wings, both plesiomorphic patterns of Callophryina (undersurface of the wings is brightly green with patterns based on occurrences of

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variously medial white spots and/or associated parallel brown markings, and mottled and hoary patterns) reoccur in apparent mosaic pattern. The frons becomes colored green in tropical taxa.

Relations within Quaternary Series Sandia:

Sandia taxa as monophyletic:

Some introduction to this discussion has been given in the previous entry. The strong synapomorphies linking the three tropical Sandia with the herbaceous-feeding members formerly placed with Incisalia are these. In the female genitalia extreme distal widening and hemispherical shape of the lamellae is apparent (caudal expanse usually exceeding breadth of lamellae), the presence of an antrum extreme. There is extreme expansive transparency not only cephalad on the ductus, but centrad in the antrum (which evidences a clear indention cephalad). None of these characters appears in the Incisalia as defined in this paper. In Mesocyanophrys there is no transparency in the antrum itself, and modification (inferred by the general polarities of Callophryina as derived) of the ductus to extreme length versus width (see entry below) does not occur. In the male genitalia of all Sandia the ventral shape of the valvae is widely shouldered with caudal extension immediate tapering thinly caudad (Figs. 199, 208, 225, 229). This state does not appear in any other group. Wider, disclike cornuti are characteristic of taxa representing more plesiomorph characters; narrower cornuti occur in some representing more apomorphic states. The variance in the wing patterns of Nearctic and Neotropical Sandia is evaluated as a mosaic relative to primitive characters. The green frons and tails of the fusius group are considered an autapomorphy. All of the genera which have formerly included taxa now placed in Sandia have been either grade group "catch-alls" for the neotropical representatives or unique creations for Nearctic taxa not fitting any previously available

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Nearctic generic grouping. Since the four branches in Sandia [three Neotropical taxa with characters relatively primitive for the group, xami formerly of Xamia (with a sister species), macfarlandi of Sandia (sensu Clench and Erhlich, 1961), and the herbaceous angiosperm feeders formerly placed in Incisalia (sensu Ziegler, 1961, Clench, 1961, et al.)] vary greatly in the superficial primitive characters, the group has been easily confused.

Mesocyanophrys taxa as monophyletic:

Several items of consideration concerning Mesocyanophrys occur in the previous entry. Though superficially similar to the host of tropical callophryines with which taxa of this genus have been placed as Cyanophrys (sensu Clench), they are very different by reason of the apomorphic characters which define Tertiary Series Penaincisalia as opposed to Tertiary Series Paracyanophrys (described below). The Mesocyanophrys share synapomorphies not present in their sister genus Sandia. The ductus bursae of females becomes extremely elongate (length at least seven times width) with the antrum consequently less emphasized (Fig. 243). The clear centrad area of the antrum is not present (Fig. 236). Ultraviolet reflectance on the upper surface of the wings shows apparent absorption distad on the forewing. This is a different pattern than in the following series and might be taken as autapomorphic. Knowledge of outgroup UV reflectance is uncertain, however. In some taxa the white median line of the wing under surface is variously derived to a band; often postbasal markings have developed.

IB2b. Tertiary Series Paracyanophrys as the sister group of Tertiary Series Penaincisalia (IB2a):

Several synapomorphies encompass the taxa of this series and separate it from its sister group. The strongest are in the sexual dimorphism of the palpi

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(Figs. 448-549). In males the second palpal segment becomes elongate (at least six times maximal width, usually longer) while in females it is short (usually less than four times width). This contrasts with the states described in previous entries[generally characterized as the second segment being elongate in either sex (Secondary Series) and this condition being retained with unique modification of the particular dimorphic relations noted in the second and third segment ratios (Tertiary Series IB2a)]. Upon the ground plan of IB2b stated above, the ratio of the third to second palpal segments in males is 0.33 or less (i.e., much shorter); and in females 0.50 to unity (i.e., consistently much longer than on corresponding males). Based primarily on the above strong synapomorphy, modification of the lamellae in this series (generally characterizable as lips expanded distad to make angles of 70° to 135° between plane of ductus and juncture of lamellae and lack of transparency in the antrum) are taken to be autapomorphic for the series, not considered derived from the condition in Quaternary Series Sandia (IB2ab). Likewise, the particular structural coloration of the wing upper surfaces (with their apparent UV reflectance pattern--see below) might be assessed as independently derived in this series, although many outgroup comparisons are not possible at present.

Relations within Tertiary Series Paracyanophrys:

IB2ba. Monophyletic status of Quaternary Series Paracyanophrys:

This series contains two tropical genera of superficially similar callophryines. They share numerous synapomorphies indicating monophyly and distinction as the sister group of the genera Callophrys and Mitoura. These include: structural coloration dorsad on the wings, assessed as independently derived (see previous entry); female genitalia with sclerotized patches to plates on lamella antevaginalis (Figs. 241, 306); male genitalia with extreme flaring of the vinculum

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cephalad (Fig. 284); caudad area of arc of vinculum with elongate "spurs" proxad the valval caudal extension and often circumscribing latter (Figs. 308, 310); and UV reflectance pattern with apparent absorption centered about the scent patch, forewing, and base, hindwing. Conditions of the palpi are variously derived on the ground plan of the Tertiary Series and thus corroborative of independent derivation of the vincular and wing coloration characters in the series. Therefore, some apparently superficial similarities of occasional cephalad angling in the vinculum, or general outcropping of the vincular arc caudad, occur in some taxa of Quaternary Series Sandia.

Relations within Quaternary Series Paracyanophrys:

Taxa of Paracyanophrys as monophyletic:

Taxa of this genus, formerly lumped with other superficially similar Cyanophrys (sensu Clench) have the following characters assessed as autapomorphic for the genus: the frons is brown with correspondingly white eye-lining (although this character seems to occur as a latent primitive state in some members of the sister genus defined otherwise by synapomorphies not in common with Paracyanophrys); the ground plan of sclerotization deriving ventrad on the lamella antevaginalis is limited to patches, not complex plates (Fig. 241); the UV reflectance pattern dorsad on the wings is concentrated broadly on and basad the scent patch on the forewing and broadly basad on the hindwing. A unique apomorphy in some taxa is a bulbous-ended terminus of the valvae, male genitalia (Figs. 239, 242).

The valvae of the male genitalia retain the primitive tapered caudal extension not present in the sister genus (Figs. 242, 300). The primitive condition of disclike cornuti is retained in nearly all congeners but variously derived in the sister group.

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Taxa of Cyanophrys as monophyletic:

Taxa of this genus share numerous synapomorphies. They include: frons derived to green, corresponding eye-lining white; valvae of male genitalia with "three-step" caudal extension (Figs. 307, 309, etc.); saccus elongate, equalling or exceeding caudal length, bilobed configuration (Fig. 315); cornuti variously tapered or spined (Figs. 282, 309); ductus bursae of female genitalia extremely narrowed (width one-fourth or less breadth of lamellae--Figs. 309, 311), antrum consequently exaggerated; sclerotization developed centrad in transparent area of ductus (Figs. 260, 266); complex sclerotized plates ventrad on lamella antevaginalis (Figs. 306, 309); UV reflectance pattern on wing dorsum indicates absorption circumferenced about scent patch on forewing and restricted very basad on hindwing. Unique apomorphies occurring in some of the Cyanophrys include derivation of recurved caudal extension (Fig. 266) and elongation of terminal foreleg segments relative to width.

Quaternary Series Callophrys as the sister group of Quaternary Series Paracyanophrys (IB2ba):

Taxa of the sister genera of this series share the following derived characters: caudal extension of valvae, male genitalia, tapering abruptly at terminus (Fig. 341), or completely blunt ended (Fig. 333); sexual dimorphism in the palpi as in the Tertiary Series with second palpal segment in males long (at least six times maximal width, usually longer) while in females short (usually less than four times width), but differences between third segments of corresponding sexes successively less to entirely convergent (see Figs.). As in Ginzia (see previous entry) this state is considered independently derived.

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Taxa of this Quaternary Series retain a generally primitive configuration of the female genitalia (as in Penaincisalia of this Secondary Series) but become highly derived in some clades of each sister genus. (Occurrence of primitive characters in mosaic pattern within some groups need not be taken as an independent derivation or reversal.) More disclike cornuti occur in males of some taxa of this series (Fig. 499) but are derived in tapered and spined configurations in others (Fig. 508), and signa in the corpus bursae of females range from present to apomorphically absent (Figs. 342, 368). Similarly, within the series, taxa of one sister genus have the primitive uncolored frons persistent while those of the other have uniquely colored derivations.

Relations within Quaternary Series Callophrys:

Monophyly of taxa placed in Callophrys:

These butterflies are very similar phenetically, due to primitive characters persisting (including tailless brown wing dorsums and green coloration ventrad with simple median white spots on the hindwing). The variation between the Palaearctic and Nearctic components is so diverse that apparent synapomorphic characters seem to include only: juncture of bilobed configuration in male genitalia with caudal extension smoothly tapered (Fig. 325), not divided by a blunt corner between the two structures; frons derived either as bright green, brown with scattered green scaling, or bright chestnut brown (corresponding eye-linings white); signa in female corpus bursae reduced to single broad-based spine only vaguely bifurcate. A unique autapomorphy of the Palaearctic taxa is narrowing of the ductus to one-fourth to one-sixth breadth of lamellae, accompanied by sculpturing of the lamella postvaginalis (Figs. 322, 332).

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Monophyly of taxa placed in Mitoura:

Taxa of this genus display rather diverse autapomorphies, of which the following seem to be those which can be considered synapomorphous: pattern of median line, under surface, hindwing generally fused to line (variously arced or jagged) or broken dashes; limbal area, same surface brightly suffused grey, blue, and orangish around "Thecla-spot"; hindwings tailled; usage of gymnosperms and gymnosperm parasites.

There are two quite structurally diverse components of Mitoura, one with larva feeding variously on Cupressaceae and the other on Arceuthobium sp. (Loranthaceae). In another cladistic scheme these might be considered separate genera. Along with the foodplant synapomorphies (see Ehrlich and Raven, 1965) the following shared derived characters define these components: Cupressaceae utilizers--ductus on female genitalia reduced to one-fourth to one-sixth breadth of lamellae; signa on corpus bursae reduced to lost (Fig. 366), cornuti of male aedeagus narrowed and small (Fig. 365); Loranthaeceae utilizers--bilobed configuration of male genitalia fully sclerotized and spiny (Fig. 341); structural color present on wing dorsums (one exception). Loranthaeceae utilizers retain the more primitive states of the signa, ductus, and cornuti (Figs. 341, 342). Autopomorphies in some Cupressaceae utilizers include convolutions and sculpturing of lamellae postvaginalis (Fig. 358), presence of antrum (Fig. 350), sclerotizations distad at juncture of lamellae (Fig. 354), notches in saccus (Fig. 350), bifurcate cornuti (Fig. 363), elongated terminal segments of the palpi (Fig. 503), elongated aedeagus; postbasal markings or outstanding spots along margin, hindwing under surface (Fig. 117). Autapomorphies apparent in some Arceuthobium utilizers include notches in saccus (Fig. 347), bifurcate cornuti (Fig. 343), curvature of elongate aedeagus (Fig. 343), and postbasal markings or outstanding coloration or spot along margin, hindwing under surface.

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KEY TO THE GENERA[6]

Male

1. (a). Under surface pattern generalizable either as mottled and/or hoary (sometimes over-patterned with jagged lines) or as not mottled and/or hoary, rather as uniformly green, brown, or green and brown either immaculate or with markings occurring only anad or in limbal area or as a median line or arc of spots 2

   (b). Under surface pattern, hindwing, not generalizable as above, but mottled and hoary distinctly basad only, with emphatic jagged white median line centrad and suffused limbal area . . . . . Cisincisalia

2. (a). Under surface, hindwing, mottled and/or hoary, brown or blackish, sometimes over-patterned with brown to blackish jagged lines 3

   (b). Under surface, hindwing, not mottled and/or hoary, but uniformly green, brown, or green and brown, and immaculate, with small markings either anad or in the limbal area, or with median line or arc of spots 4

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[6]Because of structural diversity, this key cannot include the range of variation in all taxa of some genera; further, the most superficial of characters (wing color and pattern) are generally primitive in Callophryina and therefore, though useful in preliminary diagnosis, are not entirely consistent with the cladistic hierarchy of the infratribe as defined by shared derived characters.

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3. (a). Upper surface, both wings, entirely light brown (tawny, or yellow to buff brown, etc.) or with discal (forewing) and basal (hindwing) patches of light brown 5

(b). Upper surface, both wings, entirely dark dull brown, blackish, iridescent blue, lavender, orange, or flecked with iridescence . . 6

4. (a). Upper surface, both wings, bright or moderately bright iridescent blue, not dully sheened 7

(b). Upper surface, both wings, variously brown 8

5. (a). Under surface, hindwing, with hoary and mottled patterns not generally over-patterned with jagged lines, suffusion pattern generalizable as postbasal, mesial, submarginal and/or marginal in occurrence . . . . . Sandia (in part)

(b). Under surface, hindwing, with over-patterning of jagged lines obscuring general postbasal, mesial, submarginal and/or marginal patterning . . . . . Cisincisalia

6 (a). Upper surface, both wings, either entirely iridescent blue, lavender, or orange, or with broad patches of same 9

(b). Upper surface, with wings, flecked with iridescent blue, lavender, or orange . . . . . Cissatsuma, Novosatsuma, Ginzia[7]

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[7]Cladistic analysis indicates these genera are not close phylogenetic allies; even superficial characters of the female genitalia readily separate them. However, diversity in males of Ginzia, and maintenance of primitive characters in the male genitalia of some Novosatsuma make superficial dichotomous separation of these genera's males impossible in a key.

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7. (a). Under surface, hindwing, either immaculate green or with pattern of bold median white or yellowish line, entire to slightly broken, or with scant anal markings, usually brown or maroon, as the only wing maculation; never with suffusion along outer margin . . . . . Mesocyanophrys

(b). Under surface, hindwing, with median arc of spots variously complete, scattered, or junctured as vague wavy line of crescents; various spots occurring limbad or with suffusion along outer margin 10

8. (a). Under surface, hindwing, green, either immaculate or with arc of variously occurring whitish or yellowish spots sometimes fused to a line 11

(b). Under surface, hindwing, green or brown, median arc either as entire line, often jagged anad, or broken into dashes, but always thick and tricolorous (light centrad, dark distad and basad) with limbal area various colored and suffused usually orange and blue-gray 12

9. (a). South American . . . . . Penaincisalia

(b). Asian 13

10. (a). Under surface, hindwing, with median arc of spots comprising the only maculation except coloration of recurved lobe; no limbal markings or red-brown suffusion extending costad 14

(b). Under surface, hindwing, with median arc of spots with maculation on wing, and limbal markings present and/or red-brown suffusion costad along the outer margin 15

11. (a). Under surface, hindwing, with "Thecla-spot" . . . . . Sandia

(b). Under surface, hindwing, without "Thecla-spot" . . . . . Callophrys

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12. (a). Under surface, hindwing, limbal area with markings of generally bright blue-gray suffusion accented with bright orange surrounding the "Thecla-spot" . . . . . Mitoura

(b). Under surface, hindwing, limbal ara with markings generally obscured by ground color, suffusion or entirely lacking; suffusion, if present, generally yellowish to tawny with only slight orange about the "Thecla-spot". . . . . Sandia (in part)

13. (a). Upper surface, both wings, either fully iridescent blue or lavender, or with broad patches of same; hindwing with outer margin entire or vaguely crennated . . . . . Novosatsuma[8]

(b). Upper surface, both wings, fully iridescent blue; hindwing margins markedly uneven . . . . . Ginzia (in part)

14. (a). Upper surface, both wings, with iridescent blue unicolorous, without noticeable lighter silvery blue areas 16

(b). Upper surface, both wings, iridescent blue with basad and in discal area of the wings lighter silvery blue with darker blue costad . . . . . Plesiocyanophrys

15. (a). Under surface, hindwing, with median arc as vague wavy line of crescents; slight to moderate gray-brown suffusion along outer margin. . . . . Paracyanophrys[9]

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[8]Two taxa of Novosatsuma are not blue above and thus key out as 6.(b). (see footnote 7).

[9]The species rindgei and mykros are exceptions; both have spots in the arc and mykros also has postbasal markings. Both lack marginal suffusion. Female genitalia of Paracyanophrys are especially distinctive.

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(b). Under surface, hindwing, with median arc of spots complete to variously incomplete; anal area with markings or suffusion about the recurved lobe, limbal area with markings and/or suffusion about the "Thecla-spot" and/or with suffusion extending costad along the outer margin . . . . . Cyanophrys

16. (a). Upper surface, forewing, with unicolorous iridescence limited to area basad of cell M_3 and sometimes Cu_1, subapical area broadly fuscous to dark brown or black . . . Monoplesiocallophrys[10]

(b). Upper surface, forewing, with unicolorous iridescence extending into subapical area 17

17. (a). Upper surface, hindwing, with margin crennated and with black marginal line framing distinct white cellular interspaces . . . . . Diplesiocallophrys

(b). Upper surface, hindwing, margin not markedly crennated; no white cellular interspaces distinctly framed by black marginal line . . . . . Plesiocallophrys

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[10]One species in Cyanophrys, C. iggii, lacks iridescence in the apical area but can be recognized by the characters of 15.(b).

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Female

1. (a). Under surface, hindwing, pattern as either mottled and/or hoary, sometimes over-patterned with jagged lines, or not mottled and/or hoary, rather as uniformly green, brown, or green and brown either immaculate or with markings occurring only anad or in limbal area or as a median line or arc of spots . . 2

   (b). Under surface, hindwing, pattern not as above, but mottled and hoary distinctly basad only, with emphatic jagged white median line centrad and suffused limbal area . . . . . Cisincisalia

2. (a). Under surface, hindwing, mottled and/or hoary, brown or blackish, sometimes over-patterned with brown to blackish jagged lines 3

   (b). Under surface, hindwing, not mottled and/or hoary, but uniformly green, brown, or green and brown, and immaculate, with small markings either anad or in the limbal area, or with median line or arc of spots 4

3. (a). Upper surface, both wings, entirely light brown (tawny, or yellow to buff brown, etc.) or with discal (forewing) and basal (hindwing) patches of light brown 5

   (b). Upper surface, both wings, entirely dark dull brown, blackish, iridescent blue, lavender, orange, or flecked with iridescence . . 8

4. (a). Upper surface, both wings, light to moderate iridescent blue, blue-gray, or lavender basad on wing or into discal area 6

   (b). Upper surface, both wings, brown 7

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5. (a). Under surface, hindwing, with hoary and mottled patterns not generally over-patterned with jagged lines; suffusion pattern as postbasal, mesial, submarginal and/or marginal in occurrence . . . . . Sandia (in part)

(b). Under surface, hindwing, with over-patterning of jagged lines obscuring general postbasal, mesial, submarginal and/or marginal patterning . . . . . Incisalia

6 (a). Upper surface, hindwing, either immaculate green or with pattern of bold median white or yellowish line, entire to slightly broken, or with scant anal markings, usually brown or maroon, as the only wing maculation; never with suffusion along outer margin . . . . . Mesocyanophrys

(b). Under surface, hindwing, with median arc of spots variously complete, scattered, or junctured as vague wavy line of crescents; various spots occurring limbad or with suffusion along outer margin 9

7. (a). Under surface, hindwing, green, either immaculate or with arc of variously occurring whitish or yellowish spots sometimes fused to a line; limbal area not suffused 10

(b). Under surface, hindwing, green or brown, median arc either as entire line, often jagged anad, or broken into dashes, but always thick and tricolorous (light centrad, dark distad and basad) with limbal area various colored and suffused usually orange and blue-gray 11

8. (a). South American . . . . . Penaincisalia

(b). Asian 12

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9. (a). Under surface, hindwing, with median arc of spots comprising the only maculation except coloration of recurved lobe; no limbal markings or red-brown suffusion extending costad . . . 14

(b). Under surface, hindwing, with median arc of spots with maculation on wing, and limbal markings present and/or red-brown suffusion costad along the outer margin 17

10. (a). Under surface, hindwing, with "Thecla-spot" . . . . . Sandia

(b). Under surface, hindwing, without "Thecla-spot" . . . . Callophrys

11. (a). Limbal area with markings of generally bright blue-gray suffusion accented with bright orange about the "Thecla-spot" . . . . . Mitoura

(b). Limbal area with markings generally obscured by ground color or suffusion or entirely lacking; suffusion, if present, generally yellowish to tawny with only slight orange about the "Thecla-spot" . . . . . Sandia (in part)

12. (a). Genitalia with ductus bursae wide and tubular, with combined distal expanse of both lamellal lobes from ductus never to barely more than width of ductal shaft 13

(b). Genitalia with ductus bursae narrow, with width of ductus much less than combined distal expanse of both lamellal lobes from ductal shaft, most often width of ductus equal to or less than distal expanse of one lobe . . . . . Ginzia

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13. (a). Genitalia with lamellal lips barely expanded distad of the ductal shaft; distal expanse of each lip less than one-third to one-fourth ductal width . . . . . Cissatsuma[11]

(b). Genitalia with lamellal lips moderately expanded distad of ductal shaft, but shaft still appearing wide relative to entire configuration; distal expanse of each lip more than one-third ductal width but usually not one-half . . . . . Novosatsuma[11]

14. (a). Under surface, hindwings, with white spotting over green ground color appears as variously complete occurrence of spots in the median arc 15

(b). Under surface, hindwings, with white spotting over green ground color appears more randomly placed, not necessarly as tied to a various occurrence along the median arc, rather, variously displaced basad and distad . . . . . Plesiocyanophrys

15. (a). Genitalia with exceedingly long ductus bursae, length from 10 to 12 times width; distal expanse of lamellal lips exceeding ductal width . . . . . Diplesiocallophrys

(b). Genitalia with ductus shorter, length 6 to 8 times width; distad expanse of lamellal lips less than ductal width 17

16. (a). Genitalia with ductus length about 8 times width; lamella postvaginalis scalloped caudad to a rounded tip about one-half the breadth of the lamellal base . . . . . Monoplesiocyanophrys

(b). Genitalia with ductus about 6 times width; lamella broadly hemispherical, usually completely fused centrad . . . . . Plesiocyanophrys

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[11]Known females in these genera are so few that their dichotomous separation by wing characters cannot be stated reliably.

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17. (a). Genitalia with ductus bursae moderately wide, usually as wide as the distal expanse of one of the lamellal lips; central area of transparent patch caudad lamellae clear; antrum, if present, not obviously apparent due to ductal width . . . . Paracyanophrys[12]

(b). Genitalia with ductus bursae narrow, usually much less than two-thirds distal expanse of one lamellal lobe; antrum well developed and obvious; transparent patch caudad of antrum often sclerotized centrad; lamella antevaginalis often with obvious sclerotized plates . . . . . Cyanophrys[13]

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[12]Use of genitalic characters includes all Paracyanophrys, although wing character listed under males as 15.(a). is also useful except for two taxa.

[13]Use of the wing characters listed under males 15.(b). is also diagnostic for Cyanophrys.

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REVISION AND SYSTEMATIC DISCUSSION

GENERAL KEY TO SELECTED CALLOPHRYINA SPECIES PARTICULARLY SIMILAR IN SUPERFICIAL CHARACTERS

—including seventy-three species of eight genera particularly similar in wing color and maculation patterns formerly placed in polyphyletic Cyanophrys, sensu lato.[14]

Male

1. (a). Frons brown 2
   (b). Frons green 15
2. (a). Under surface, hindwing, terminal border gray-suffused red of various widths or broken 3
   (b). Under surface, hindwing, no gray-suffused red terminal border 4
3. (a). Under surface, hindwing, heavily mottled with bands of yellowish, greenish, and/or orangish in median, postmedian, and/or submarginal areas . . . . . Cyanophrys agricolor, C. banosensis
   (b). Under surface, hindwing, with simple green patterns of spots or blotching 6

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[14] "Cyanophrys sensu lato": taxa iridescent blue above, green beneath. Taxa in parentheses: no specimens of this sex are known but would be expected to key out as indicated; "anad" indicates "toward the anal margin."

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4. (a). Under surface, hindwing, with various patterns or coloration other than terminal gray-suffused red border 5

(b). Under surface, hindwing, immaculate green . . . . . Cyanophrys innocuus, C. alexanderorum

5. (a). Under surface, hindwing, "Thecla-spot" absent or appearing only as slight slash 7

(b). Under surface, hindwing, "Thecla-spot" emphatic or at least appearing as a spot 8

6. (a). Under surface, hindwing, uniform green; postdiscal arc of spots variously formed as complete, scattered, limited distinctly caudad or cephalad, or linked as slashes, crescents or occasional lines 9

(b). Under surface, hindwing, variegated green or brown, with post-discal markings, spots or lines, hardly visible 10

7. (a). Under surface, hindwings, terminal band broken but still obvious; obsolescent transverse postdiscal line with broken spots, slashes, or a complete line anad 14

(b). Under surface, hindwing, terminal band not obvious if present at all; obsolescent transverse postdiscal line with spots or slashes intermingled or interconnected . . . . . Paracyanophrys remus, P. remuborealis

8. (a). Under surface, hindwing, terminal gray-suffused reddish border very wide and tapered costad, surrounding or invading "Thecla-spot"; "Thecla-spot" large and black . . . . . Cyanophrys crethona, C. marianna

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(b). Under surface, hindwing, terminal gray-suffused reddish border thin or broken; "Thecla-spot" small, maroon colored with variably sized orange basad . . . . . Cyanophrys miserabilis, C. necopina, C. necopinoides

9. (a). Under surface, hindwing, spots of postdiscal arc of any color and occurring in each vein interspace 11

(b). Under surface, hindwing, postdiscal arc of spots incomplete with spots scattered or limited to distinct caudad or cephalad concentrations 13

10. (a). Under surface, hindwing, ground color green . . . . . Cyanophrys pseudolongula

(b). Under surface, hindwing, ground color brown . . . . . Cyanophrys alutus

11. (a). Under surface, hindwing, postdiscal arc of rounded spots, white 12

(b). Under surface, hindwing, postdiscal arc of rounded spots, black . . . . . Cyanophrys ruthae

12. (a). Upper surface of the wings deep iridescent dark blue . . . . . Paracyanophrys rindgei

(b). Upper surface of the wings bright light sapphire blue . . . . . Paracyanophrys sapphirus

13. (a). Under surface, hindwing, uniform green with scattered spots . . . . . Cyanophrys iggii, C. longuloides, C. paralonguloides

(b). Under surface, hindwing, green with spots fused so as to resemble slashes or crescents, especially in postbasal area . . . . . Paracyanophrys mikros

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14. (a). Under surface, hindwing, obsolescent transverse postdiscal line with broken spots or slashes . . . . . Cyanophrys longula

(b) Under surface, hindwing, obsolescent transverse postdiscal line in anal area connected as solid line from margin to vein Cu_1 or Cu_2 . . . . . Cyanophrys kirki

15. (a). Upper surface of wings blue 16

(b). Upper surface of wings brown . . . . . Sandia fucius, S. marialis, S. ampulla

16. (a). Upper surface blue either brightly iridescent from wing base at least to submargins or dully iridescent and restricted basad with broad fuscous apices and margins, especially on forewing 17

(b). Upper surface distinctly more gray than blue, submarginal fuscous invading discal cell as on female . . . . . Cyanophrys andromimikos

17. (a). Upper surface of the wings brightly iridescent blue from base at least to submargins 18

(b). Upper surface of the wings with blue not brightly iridescent, restricted basad; broad fuscous apices and margins, especially on forewing 19

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18. (a). Forewing and hindwing with wide fuscous marginal bands (1-2 mm.), not simply black marginal lines; recurved lobe red-brown highly contrasted with the fuscous bands . . . . . Cyanophrys amyntoides, C. amyntor, C. caramba, C. circumcyanophrys, C. clenchi, C. distractoides, C. distractus, C. durstorum, C. eiselei, C. (hiulcus), C. howei, C. misiones, C. platnicki, C. pseudoherodotus, C. quinterorum, Mesocyanophrys caramba, M. rachelae

(b). Forewing with only narrow black marginal line, not a definite band; hindwing without great contrast between fuscous marginal band and red-brown recurved lobe 22

19. (a). Under surface, hindwing, with complete or incomplete postdiscal arc of rounded spots 20

(b). Under surface, hindwing, with postdiscal line mottled slashes and/or spots or with postdiscal markings occurring only anad . . 17

20. (a). Under surface, hindwing, postdiscal arc of spots generally obvious and complete . . . . . Monoplesiocallophrys argentinensis, Plesiocallophrys pseudoargentinensis, P. roberti, P. (runa), Plesiocyanophrys goodsoni, P. (lamellalatus)

(b). Under surface, hindwing, postdiscal arc of spots either obsolescent, absent, or with spots anad only . . . . . Diplesiocallophrys maccourtorum, D. paranensis

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21. (a). Under surface, hindwing, with postdiscal line mottled slashes and/or spots; specimens usually under 15 mm. forewing length . . . . . Paracyanophrys amphoteros

(b). Under surface, hindwing, with postdiscal markings distinct spots or slashes concentrated anad; specimens usually over 16 mm. forewing length . . . . . Mesocyanophrys adelaidae

22. (a). Under surface, hindwing, immaculate, or at the most variegated green without noticeable markings . . . Mesocyanophrys legionis

(b). Under surface, hindwing, with various markings 23

23. (a). Under surface, hindwing, "Thecla-spot" present to any degree and emphatically different from other markings; "Thecla-spot" usually with centrad spot black, basad orange or reddish-edged with a darker slash 24

(b). Under surface, hindwing, no trace of "Thecla-spot" (either without spot, or this spot not different from others) 25

24. (a). Under surface, hindwing, postdiscal line of irregular white spots or slashes edged darkly basad, sometimes variously obsolescent . . . . . Cyanophrys chapadaensis, C. fragmentus, C. herodotus, C. priscilla, C. pseudocallophria, C. sicrana, C. sicranoides, Mesocyanophrys kyanos, M. paratetrameres, M. tetrameres,

(b). Under surface, hindwing, postdiscal line a broad white band, edged widely with suffused white . . . . . Mesocyanophrys bertha

25. (a). Under surface, hindwing, postdiscal markings a thin regular white line, or a variously irregular or complete line of thin white slashes or crescents 26

(b). Under surface, hindwing, postdiscal line an arc of round white spots, sometimes edged black basad. . . Cyanophrys paralonguloides

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26. (a). Under surface, hindwing, postdiscal line a very straight transverse bar, possibly mildly jagged anad; no brown in limbal area; tailed or not tailed 27

(b). Under surface, hindwing, postdiscal line variously complete, broken to entire, straight or curved; brown often in limbal area; not tailed 28

27. (a). Hindwing tailed . . . . . Mesocyanophrys tobias

(b). Hindwing not tailed . . . . . Mesocyanophrys pantobias

28. (a). Under surface, hindwing, with pronounced white postbasal spots or slashes 29

(b). Under surface, hindwing, without postbasal markings 30

29. (a). Postbasal markings emphatic, forming a "figure eight" configuration with cephalad markings of the postdiscal line; other white splotches often anad. . . . . Mesocyanophrys johnsonorum

(b). Postbasal markings small dots or slight slashes, not forming "figure eight" configuration with cephalad markings of postdiscal line; anal area free of any markings save those of postdiscal line . . . . . Mesocyanophrys abnormis, M. catharinensis

30. (a). Under surface, hindwing, postdiscal line complete and entire; forewing with white postmedian line, fading caudad . . . . Mesocyanophrys acaste, M. lycimna

(b). Under surface, hindwing, postdiscal line usually broken to present only cephalad; forewing without postmedian white markings. . . . . Mesocyanophrys acastoides

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Female

1. (a). Frons brown 2

(b). Frons green 14

2. (a). Under surface, hindwing, terminal border gray-suffused red of various widths or broken 3

(b). Under surface, hindwing, no gray-suffused red terminal border 4

3. (a). Under surface, hindwing, heavily mottled with bands of yellowish, greenish, and/or orangish in median, postmedian, and/or submarginal areas . . . . . .Cyanophrys agricolor, C. banosensis

(b). Under surface, hindwing, with simple green patterns of spots or blotching 6

4. (a). Under surface, hindwing, with various patterns or coloration other than terminal gray-suffused red border 5

(b). Under surface, hindwing, immaculate green . . . . . Cyanophrys innocuus, C. (alexanderorum)

5. (a). Under surface, hindwing, "Thecla-spot" absent or appearing only as slight slash 7

(b). Under surface, hindwing, "Thecla-spot" emphatic or at least appearing as a spot 8

6. (a). Under surface, hindwing, uniform green; postdiscal arc of spots variously formed as complete, scattered, limited distinctly caudad or cephalad, or linked as slashes, crescents or occasional lines 9

(b). Under surface, hindwing, variegated green or brown, with postdiscal markings, spots or lines, hardly visible 10

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7. (a). Under surface, hindwings, terminal band broken but still obvious; obsolescent transverse postdiscal line with broken spots, slashes, or a complete line anad 13

(b). Under surface, hindwing, terminal band not obvious if present at all; obsolescent transverse postdiscal line with spots or slashes intermingled or interconnected . . . . . Paracyanophrys remus, P. remuborealis

8. (a). Under surface, hindwing, terminal gray-suffused reddish border very wide and tapered costad, surrounding or invading "Thecla-spot"; "Thecla-spot" large and black . . . . . Cyanophrys crethona, C. marianna

(b). Under surface, hindwing, terminal gray-suffused reddish border thin or broken; "Thecla-spot" small, maroon colored with variably sized orange basad . . . . . Cyanophrys miserabilis, C. necopina, C. (necopinoides)

9. (a). Under surface, hindwing, spots of postdiscal arc of any color and occurring in each vein interspace 11

(b). Under surface, hindwing, postdiscal arc of spots incomplete with spots scattered or limited to distinct caudad or cephalad concentrations 12

10. (a). Under surface, hindwing, ground color green . . . . . Cyanophrys pseudolongula

(b). Under surface, hindwing, ground color brown . . . . . Cyanophrys alutus

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11. (a). Under surface, hindwing, postdiscal arc of rounded spots, white . . . . . Paracyanophrys rindgei, P. (sapphirus)

(b). Under surface, hindwing, postdiscal arc of rounded spots, black . . . . . Cyanophrys (ruthae)

12. (a). Under surface, hindwing, uniform green with scattered spots . . . . . Cyanophrys iggii, C. longuloides, C. paralonguloides

(b). Under surface, hindwing, green with spots fused so as to resemble slashes or crescents, especially in postbasal area . . . . . (Paracyanophrys mikros)

13. (a). Under surface, hindwing, transverse postdiscal line with broken spots or slashes . . . . . Cyanophrys longula

(b) Under surface, hindwing, transverse postdiscal line with anal area, margin to vein Cu_1 or Cu_2, connected as solid line . . . . . Cyanophrys kirki

14. (a). Under surface, hindwing, immaculate or sometimes mottled . . . . . Cyanophrys embolos, C. alexanderorum, Mesocyanophrys legionis

(b). Under surface, hindwing, with various markings 15

15. (a). Under surface, hindwing, postdiscal line of irregular white spots or slashes either entirely transversing the wing or limited strictly anad 16

(b). Under surface, hindwing, postdiscal line a generally regular transverse bar or thin line 17

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16. (a). Under surface, hindwing, postdiscal line of irregular white spots or slashes entirely transversing wing (however obsolescent in some areas) or distinctly confined anad 18

(b). Under surface, hindwing, white spotting of postdiscal arc reduced to scattered spots, expecially concentrated anad; reddish-brown spotting or slashing limited to general area of recurved lobe . . . . . Cyanophrys (adelaidae), C. (fragmentus), C. pseudoherodotus, C. quinterorum, Mesocyanophrys caramba, M. rachelae

17. (a). Under surface, hindwing, postdiscal line a very straight transverse bar, possibly mildly jagged anad; no brown in limbal area; tailed or not tailed 22

(b). Under surface, hindwing, postdiscal line variously complete, broken to entire, straight or curved; brown often in limbal area; not tailed 23

18. (a). Under surface, hindwing, postdiscal line of irregular white spots or slashes transversing wing (however obsolescent in some areas) 19

(b). Under surface, hindwing, postdiscal line distinctly confined anad; red-brown spots or blotches occurring distad postdiscal line often more emphatic than line itself 20

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19. (a). Under surface, hindwing, "Thecla-spot" apparent to any degree and emphatically different than other markings; "Thecla-spot" usually with centrad spot black, basad orange or reddish-edged with a darker slash . . . . . Cyanophrys andromimikos, C. chapadaensis, C. herodotus, C. hiulcus, C. misiones, C. priscilla, C. pseudocallophria, C. sicrana, C. sicranoides, Mesocyanophrys adelaidae, M. (kyanos), M. paratetrameres, M. tetrameres

(b). Under surface, hindwing, with "Thecla-spot" not apparent to any degree; postdiscal arc or rounded white spots edged only slightly dark basad, if at all 21

20. (a). Under surface, hindwing, white spotting reduced to scattered spots or slashes anad along postdiscal line or basad recurved lobe; emphatic red-brown spots or blotches distad above markings often extending cephalad . . . . . Cyanophrys amyntoides, C. amyntor, C. circumcyanophrys, C. clenchi, C. distractoides, C. distractus, C. durstorum, C. eiselei, C. howei, Sandia ampulla, S. fusius, S. marialis

(b). Under surface, hindwing, white spotting reduced to nearly absent, occasionally concentrated anad in area of postdiscal line or basad recurved lobe; occasional red-brown to maroon spots or blotches distad above markings always restricted anad . . . . . Mesocyanophrys (kyanos), M. (opaspangorum)

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21. (a). Under surface, hindwing, postdiscal arc of spots obvious and complete . . . . . Cyanophrys paralonguloides, Monoplesiocallophrys argentinensis, Plesiocallophrys pseudoargentinensis, P. roberti, P. runa, Plesiocyanophrys goodsoni, P. lamellatus

(b). Under surface, hindwing, postdiscal arc of spots either obsolescent or absent, or with spots occurring only anad . . . . . Diplesiocallophrys maccourtorum, D. paranensis

22. (a) Hindwing tailed . . . . . Mesocyanophrys tobias

(b). Hindwing not tailed . . . . . Mesocyanophrys pantobias

23. (a). Under surface, hindwing, with pronounced white post basal spots or slashes 24

(b). Under surface, hindwing, without postbasal markings 25

24. (a). Postbasal markings emphatic, forming "figure eight" configuration with cephalad markings of postdiscal line; other white splotches often anad . . . . . Mesocyanophrys johnsonorum

(b). Postbasal markings small dots or slight slashes, not forming "figure eight" configuration with cephalad markings of postdiscal line; anal area free of any markings save those of postdiscal line . . . . . Mesocyanophrys abnormis, M. catharinensis

25. (a). Under surface, hindwing, postdiscal line generally complete and entire; forewing with white postmedian line fading caudad . . . . . Mesocyanophrys acaste, M. lycimna

(b). Under surface, hindwing, postdiscal line usually broken to present only cephalad; forewing without postmedian white markings . . . . . Mesocyanophrys acastoides

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Primary Series Plesiocallophrys

(including Plesiocallophrys, Monoplesiocyanophrys,

Diplesiocalloprhys, Plesiocyanophrys)

(IA)

Secondary Series Plesiocallophrys

(including Plesiocallophrys, Monoplesiocallophrys, Diplesiocallophrys)

(IA1)

KEY TO SPECIES, SECONDARY SERIES

PLESIOCALLOPHRYS

Superficial Wing Characters:

Male

1. (a). Upper surface, forewing, dull blue iridescence in subapical area (distad discal cell in cell M_1, M_2, or even R) 2

   (b). Upper surface, forewing, subapical area broadly fuscous to dark brown or black, iridescence limited to area basad cell M_3, sometimes Cu_1 . . . . . Monoplesiocallophrys argentinensis

2. (a). Upper surface, hindwing, margin slightly to moderately crennated, marginal black line framing white in cell spaces . . . 3

   (b). Upper surface, hindwing, margin nearly entire, no distinct white cell spaces framed by black marginal line 4

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3. (a). Under surface, hindwing, mesial line white spots edged black basad, vivid and appearing broadly space across the wing but usually lacking in cells Rs and M_3 . . . . . Plesiocallophrys roberti

(b). Under surface, hindwing, mesial line of white spots edged black basad obsolescent to absent . . . Diplesiocallophrys maccourtorum

4. (a). Under surface, hindwing, mesial line white spots edged basad red-brown, appearing broadly spaced across the wing; specimens large, forewing length usually more than 15 mm. . . . . Plesiocallophrys pseudoargentinensis

(b). Under surface, hindwing, mesial line of white spots, edged black basad, present but minute; specimens small, forewing length usually less than 15 mm. . . . . Diplesiocallophrys paranensis

Female

1. (a). Under surface, hindwing, mesial line obsolescent or appearing as light scattered dashes . . . . . Diplesiocallophrys maccourtorum

(b). Under surface, hindwing, mesial line white spots variously edged basad with black or red-brown, sometimes absent between veins Rs and M_3 2

2. (a). Under surface, hindwing, mesial line complete 3

(b). Under surface, hindwing, mesial line lacking spots usually between veins Rs and M_3 4

3. (a). Under surface, hindwing, mesial line white edged basad red-brown, appearing broadly spaced across the wing . . . . . Plesiocallophrys pseudoargentinensis

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(b). Under surface, hindwing, mesial line white edged basad black, spots very vivid, appearing closely spaced to each other . . . . . Monoplesiocallophrys argentinensis

4. (a). Under surface, hindwing, mesial line with spots emphatic, except where lacking; Andes of western Argentina and southern Bolivia, and adjacent plains . . . . . Plesiocallophrys roberti

(b). Under surface, hindwing, mesial line with spots very small; southeastern Brazil . . . . . Diplesiocallophrys paranensis

Genitalia:

Male

1. (a). Both cornuti extremely tapered caudad, serrations only minor small points 2

(b). One or both cornuti broad and spatulate 3

2. (a). Relation of bilobed configuration and caudal extension one gradual sloping plane (no shouldering, recurvature, or corner) . . . . . Diplesiocallophrys maccourtorum

(b). Bilobed configuration distinctly shouldered, relation of it and caudal extension distinctly indented at their juncture; caudal extension slightly recurved . . . . . Plesiocallophrys roberti

3. (a). Cornuti similar 4

(b). Ventral cornutus moderately broad, spatulate; dorsal cornutus thinner and blunt-ended; both serrated with spines . . . . . Monoplesiocallophrys argentinensis

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4. (a). Both cornuti broad and spatulate, distinctly serrated with spines . . . . . Plesiocallophrys pseudoargentinensis

(b). Cornuti not broad and spatulate or tapered, both blunt-ended with tiny spines . . . . . Diplesiocallophrys paranensis

Female

1. (a). Ductus exceedingly long, length more than 12 times width, distal expanse of lamellal lips exceeding ductal width, signum widely bifurcate basad . . . . . Diplesiocallophrys maccourtorum

(b). Ductus shorter, from 6 to 10 times width, signum not bifurcate, or bifurcate only distad 2

2. (a). Ductus circa 10 times width, distad expanse lamellal lips about same as ductal width but with slight antrumal configuration; signum with long base, widely bifurcate distad . . . . . Diplesiocallophrys paranensis

(b). Ductus circa 6 to 8 times width, distad expanse of lamellal lips less than ductal width; signum nearly single spine, slightly bifurcate centrad 3

3. (a). Ductus circa 8 times width; lamella postvaginalis scalloped caudal to rounded tip about one-half breadth of base of lamellae . . . . . Monoplesiocallophrys argentinensis

(b). Ductus circa 6 times width; lamella broadly hemispherical, usually completely fused centrad . . . . . Plesiocallophrys pseudoargentinensis, P. roberti

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Tertiary Series Plesiocallophrys

(IA1a)

PLESIOCALLOPHRYS, NEW GENUS

DIAGNOSIS. Superficially similar to the immediate two sister genera, but lacking these latter genera's apomorph character of hindwing upperside having margin crennated and with a black marginal line framing distinct white cellular interspaces. Genitalia diagnostic: female of Plesiocallophrys with ductus length circa six times width (not eight to twelve times as in two immediate sister genera); male with cornuti of aedeagus broad and disclike (not variously tapered or blunt-ended as in taxa of the immediate sister genera). Distinct from outgroup Plesiocyanophrys, whose females have very short and wide ductal configurations (ductal length three to four times width) and males have three-step configuration of the valval caudal extension. Relative apomorph characters of Plesiocallophrys discussed under cladistic analysis (IA1a).

DESCRIPTION. Adult: Head with variously colored and spiny frons, and/or colored lining about compound eye. Legs of both sexes lacking any elongation relative to width (latter typical of apomorphy in Callophryina relative to outgroups). Palpi as typical of the Primary Series Plesiocallophrys. Wings short, length of forewing usually 15 mm. or less; males dull iridescent blue above, females duller gray-blue toward fuscous; wings below of both sexes green, markings various degrees of mesial white spots on hindwing; no tails. Male Genitalia: Primitive relative to Callophryina, caudal extension tapered. Saccus variously elongate, equalling one-half to two-thirds length of entire caudal extension; bilobed configuration usually parabolic, indented. Female Genitalia:

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Characteristic of the primitive Callophryina state; ductus wide, with width exceeding one-third to one-half breadth of lamellae, length six times width, versus three to four times width in Plesiocyanophrys outgroup, but far shorter than in Monoplesiocallophrys and Diplesiocallophrys sister groups (these eight to twelve times width). Signa primitive (variously bifurcate) but slightly derived toward nonfurcation in one taxon.

BIOLOGY. Early Stages: Unknown. Foodplants: Unknown.

TYPE SPECIES. Plesiocallophrys pseudoargentinensis, new species.

DISTRIBUTION. Spatial: Fig. 514. Two disjunct areas of central South America: southeastern Brazil and Paraguay, especially in montane areas, and westward in the Andes in northern Argentina and southern Bolivia. Temporal: Dates on specimens range from February to September.

ETYMOLOGY. The Greek name (considered feminine) indicates that the genus has relatively primitive characters (Plesio-) for Callophryina.

Plesiocallophrys pseudoargentinensis, new species

Figs. 7, 118, 119, 373

DIAGNOSIS. Most similar to Cyanophrys paralonguloides, both with males iridescent blue above except for thin dark marginal lines and an immaculate green underside save an emphatic median to post-discal arc of white spots across the hindwing. Other species having the latter under surface pattern, congeners P. roberti and runa, along with taxa of the sister genera of the Primary Series, all have restricted dull iridescence above with large fuscous apices and margins on the forewing. The superficially similar species pseudoargentinensis and

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Cyanophrys paralonguloides can be identified by the characters of their respective genera and by the genitalia of males and females as outlined under each species.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 373) as typical of the genus. Frons brownish, with green suffusion, becoming whitish ventrad. Upper Surface of the Wings: Ground color dull iridescent Dark Tyrian Blue, more obscured distad. Margins, both wings, and large area of forewing apex, fuscous. Scent patch distad in discal area, circa one-third length discal cell. Recurved lobe of hindwing Chestnut, black distad. Fringe deep brown, lighter distad. Under surface of the Wings: Ground color Oil Green to Yellowish Oil Green. Forewing immediately cephalad hindwing gray, nearly to margin. Hindwing, mesial row of small white spots, variously present or absent; edged slightly brown basad. Recurved lobe between outer and anal angles Mahogany Red to Chestnut. Fringe fuscous to black, lighter distad; whitish on hindwings. Length of Forewing: 15.0 mm. (holotype); $\bar{X}$ of 5 specimens (AMNH) 14.8 mm., range 14.5 mm. to 15.2 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 373) as typical of the genus. Frons as on male. Upper Surface of the Wings: Entire wings dull sheened gray except margins and submargin, hindwing, and apex and extreme costa, forewing. Margins, apices, costa, dark Raw Umber. Fringe fuscous to black basad; lighter distad. Under Surface of the Wings: As on males. Length of Forewing: 15.0 mm. (allotype); $\bar{X}$ of 5 specimens (AMNH) 14.9 mm., range 14.6 mm.--15.3 mm. Male Genitalia: Fig. 118. Valvae caudad saccus clear, mid-rimmed, parabolic and indented; valvae, lateral view round-tapered; valvae caudal extension thickly tapered. Saccus long, equal to at least two-thirds length vincular arc; cornuti wide, disclike. Female Genitalia: Fig. 119. Ductus long and extremely broad; length three to three and one-half times breadth of lamellae; breadth one-third to one-half of lamellal breadth. Lamellae

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expansive distad at least one-third their breadth; lamella postvaginalis hemispherical, slightly indented caudad. Signa long thin spines, vaguely bifurcate basad.

TYPES. Holotype male (Fig. 7), and allotype female, Santisima, Trinidad, Cordillera Province, Paraguay, May, leg. B. Podtiaguin; deposited AMNH. Paratypes. AMNH: same data as primary types (five males, five females two males, May; two females, May; one female, July; two females, one male, July-September; two males, August). BMNH: "G.T.B.", Baker Collection, BM 1927-360 [exact data meaning unknown], (three females). Paraguay, 1919, Hamilton Druce (two males).

DISTRIBUTION. Spatial: Fig. 514. Presently known from cordillera in Paraguay and Brazil in the montane areas. Temporal: Dates on specimens range from May to September.

REMARKS. Seventeen specimens were examined and thirteen genitalic dissections, males and females, were studied.

ETYMOLOGY: The name adds the Greek root pseudo to the familiar argentinensis, referring to the mistaken identification of this new species as the latter taxon prior to this study.

Plesiocallophrys roberti, new species

Figs. 8, 120, 121, 374

DIAGNOSIS. The immediate sister species of pseudoargentinensis. They share the characters summarized in the accompanying key, but differ as indicated there and as summarized below: roberti almost always lacks spots between veins Rs and M_3 on the hindwing underside, especially in the males.

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Males of roberti are darker blue, and females far more approaching blue than gray, regardless of wear. On pseudoargentinensis the spots on the hindwing under surface are emphatic, broadly spaced and edged basad red-brown. Genitalic differences are summarized in the accompanying key: males of roberti have derived valval configurations and cornuti; females exhibit an unfused lamella postvaginalis while the sister species has this structure completely fused.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 374) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color of both wings deep iridescent Dark Delft Blue over entire wing except margins, apical areas and submargins. Dull gray scent patch distad in discal area, small, about one-fourth length discal cell. Hindwing with blue nearly to margin, very seldom crennated, with black marginal color; latter a thin line; recurved lobe, hindwing, Chestnut; black distad, heavily fringed. Fringe, both wings, dark brown to black. Under Surface of the Wings: Ground color Rheineman's Green to Light Bice Green. Area of forewing immediately cephalad hindwing dark gray almost to margin, broadly blackish basad; rest of forewing immaculate green. Hindwing with mesial line of white spots edged slightly dark red-brown to blackish across wing but almost always lacking or obsolescent between veins Rs and M_3. Recurved lobe of hindwing dark Maroon, slightly suffused basad and with white slash anad. Fringe both wings gray, slightly framing some paler areas in cell interspaces. Length of Forewing: 14.5 mm. (holotype); $\bar{X}$ of 7 specimens (AMNH, EC) 14.2 mm., range 13.8 mm. to 14.5 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 374) as typical of the genus. Upper Surface of the Wings: Broad areas of forewing and hindwing margins, submargins, and apices dark fuscous to black. Rest of ground color iridescent Deep Slate Blue slightly overscaled with lighter blue. Forewing fringe blackish; hindwing same, but toward Chestnut in cell interspaces. Recurved lobe of hindwing deeply chestnut,

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fringed black distad. Under Surface of the Wings: As on males but more expression of obsolescent markings between veins Rs and M_3, hindwing. Length of Forewing: 14.0 mm. (allotype); $\bar{X}$ of 14 specimens (AMNH, EC), 13.8 mm., range, 13.2 mm. to 15.0 mm. Male Genitalia: Fig. 120. Valvae, caudad saccus, clear, mid-rimmed, shouldered, indented; valvae lateral view funneled slightly cephalad midway between dorsal articulation and terminus; valvae caudal extension nearly recurved to slightly recurved. Saccus long, equalling about one-half length of valvae. Cornuti narrow-tapered. Female Genitalia: Fig. 121. Similar to pseudoargentinensis, but with lamella postvaginalis only partly fused, distad extension of lamellae slightly less. Ductus length about seven times width. Signum of long spines, only slightly bifurcate basad.

TYPES. Holotype male (Fig. 8), vicinity of San Pedro, Jujuy Province, Argentina, 550 m., 2 May 1979. Allotype female, same data, 29 April, 1979, both leg. Rev. Roberto C. Eisele; deposited AMNH. Paratypes. AMNH: same data as primary type, 15 May 1979, (two females), 7 May 1979 (one female), 2 May 1979 (one female), 3 February 1979 (one female); 2 May 1979 (one male). Pichanal, Salta Province, Argentina, 28 May, 1972 (one male); 16 May, 1972 (one male), 12 May 1972 (one male), 4 June 1970 (one male); 7 June 1969 (one female), 17 May 1979 (one female); 15 May 1979 (one male).

DISTRIBUTION. Spatial: Fig. 514. Presently known from the montane region of northern Argentina, in Salta and Jujuy Provinces. One label indicates habitat as "swamp." Temporal: Dates on specimens range from early February through early June.

REMARKS. In all, twenty specimens were examined; the types and seven other specimens were dissected for genitalia, legs, and palpi.

ETYMOLOGY. This species is named for Roberto Eisele, Jr.

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Plesiocallophrys runa, new species

Figs. 9, 122, 375

DIAGNOSIS. Ductus of female genitalia nine times width, but not appearing thin because of constricted lamellae: circa two times ductal width. Most uniquely, the lamella antevaginalis has distad sclerotizations bevelled cephalad and the signa are reduced to a single long spine, bifurcate distad but with spines not curved.

DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, legs, and palpi (Fig. 375) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color of basad one-third of forewing and two-thirds of hindwing dull slightly shiny gray. Rest of wings fuscous; fringes same. Recurved lobe of hindwing dull Chestnut, heavily circumferenced black. Under Surface of the Wings: Ground color Mignonette Green. Wide area of forewing immediately cephalad of hindwing white-gray nearly to margin. Hindwing with nearly complete mesial line of white dots bordered faintly red-brown, slightly obsolescent costad. Recurved lobe between outer and anal margins deep Maroon with slight white slash basad. Fringes of both wings general fuscous, but Maroon anad on hindwing and on the vein-ends. Length of Forewing: 13.5 mm. (holotype). Male Genitalia: Unknown. Female Genitalia: Fig. 122. Ductus very long and wide, more than twice length of corpus bursa, and width equal to one-third breadth of lamellae. Lamellae distinctly "spade"-shaped; lamellae antevaginalis as only wide lips distad along the opening of the ductus. No antrum, lamellae simply as lips cephalad on ductus. Signa as single spines broadly bifurcate distad.

TYPES. Holotype female (Fig. 9), Catamarca Province, Argentina. Deposited BMNH.

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DISTRIBUTION. Spatial: Fig. 514. Known only from the type locality. Temporal: Unknown.

REMARKS. This single specimen in the BMNH warrants specific recognition due to its genitalic characters, several of which represent character states indicated as a highly derived relative to Callophryina.

ETYMOLOGY. The name means "javelin" or "dart" in Greek, referring to the unique configuration of the female genitalia.

Tertiary Series Monoplesiocallophrys
(including Monoplesiocallophrys, Diplesiocallophrys)
(IA1b)

MONOPLESIOCALLOPHRYS, NEW GENUS

Thecla Fabricius, 1807, p. 286. Clench, 1946, p. 185. Hayward, 1973, p. 152. (Nowhere in the literature is the only previously described species in this genus [argentinensis Clench, 1946] listed in any genus other than Thecla, though it has been assumed in common usage to belong in the taxon Cyanophrys Clench (1961) by virtue of Clench's description. The species in Cyanophrys have nowhere been listed by Clench.)

DIAGNOSIS. The single species in this genus is characterized by the following traits: The juncture of the caudal extension and bilobed configuration of the valvae is distinctly cornered; the ventral cornutus is wider than the dorsal. In the female genitalia the ductal length is moderate relative to taxa of the immediate sister genera, seven to eight times its width, and the lamella post-

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vaginalis is tapered caudad to a tip about one-half the basad lamellal breadth. The males have wings above with reduced blue iridescent on the forewing, the entire apical and subapical areas being fuscous to black, while taxa of the immediate two sister genera have blue invading at least the submargin. Beneath, both sexes have a complete mesial line on the hindwing, the spots edged vividly with black and appearing closely spaced, not variously obsolescent, edged in red-brown, or appearing broadly spaced across the wing.

DESCRIPTION. Adult: Head with green-suffused brown frons and white lining about the compound eye. Legs of both sexes lack any elongation evidencing apomorphy in Callophryina. Palpi derived from general condition of the Primary Series Plesiocallophrys to elongation of second segment. Wings with broad apical dark area, making blue iridescence of male above distinctly limited on forewing. Under sides bright green with full mesial band on hindwing of vivid white spots edged basad with black. No tail. Male Genitalia: Characterized by primitive tapered caudal extension with deep corner at juncture with bilobed configuration. Saccus very long, equalling two-thirds length of valvae. Cornuti derived relative to plesiomorph sister genus--dorsad cornuti narrowly blunt-ended, not spatulate. Female Genitalia: Derived to apparent intermediate condition relative to broad ductus of Plesiocallophrys and extreme narrow and long ductus of Diplesiocallophrys. The lamellae lips are expansive distad at least equal in distal extension to width of ductus. The lamella postvaginalis is tapered caudad to a caudal tip about one-half its breadth at base.

BIOLOGY. Early Stages: Unknown. Foodplants: Unknown.

TYPE SPECIES. Thecla argentinensis Clench.

DISTRIBUTION. Fig. 514. This genus must be considered to have a more reduced distribution than would be indicated by the common usage of the name

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argentinensis for superficially similar taxa of the two immediate sister genera. Consideration of the species diversity in these taxa limits the known range of Monoplesiocallophrys to the area of the type locality, Tucuman, Argentina (see Remarks below), and adjacent Catamarca. Temporal: Known dates of capture range from mid-May to mid-June.

REMARKS. It might seem unusual to so limit the constitution of this genus and its known distribution. However, considerations of the cladistic relations and the actual range of specimens assignable to argentinensis, once other taxa are recognized, prompts this limitation. There are other examples (e.g., Thecla caramba Clench) where an available name has been used for many similar populations and subsequent study indicates the type series of the early named taxon to be unique, while numerous other specimens actually represent different, heretofore undescribed taxa. Clench's type series is very homogenous in characters, and a female in the Breyer Collection (NMNH) from Catamarca is similar. There are several other specimens (in BMNH) I have incorporated from the uncurated Adams Bequest; these are argentinensis but have no data. It may be reasonable to conclude that all these taxa of the Primary Series Plesiocallophrys have seldom been collected. Hayward (1973) mentions argentinensis only from Tucuman, evidently referring to Clench's type series. In other Argentine lycaenids of this group under study, he mentions wider distributions. The largest series of any of the species in the primary series are from concerted collecting by the Rev. Roberto Eisele and from a similar local collection from Paraguay. It may be that argentinensis is a more southern Andean taxon, since it has not been collected by Eisele in Jujuy, nor is it in considerable Bolivian material available at several museums. I cannot consider Clench's type series conspecific (and therefore congeneric) with any other population I have studied in this group of superficially similar taxa. Clench himself recognized specimens

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of my Plesiocallophrys roberti and Diplesiocallophrys maccourtorum as new, and returned them to Eisele without describing them; they bear Clench's determination labels as Cyanophrys n. sp.

ETYMOLOGY. The name is Greek, from roots "mono" (one), "plesio" (ancient or oldest) added to the generic name Callophrys. It is considered feminine and refers to the genus being one component of the apomorph sister group of Plesiocallophrys.

Monoplesiocallophrys argentinensis, (Clench), new combination

Figs. 123, 124, 376

Thecla argentinensis Clench, 1946, p. 185. Hayward, 1973, p. 152.
species argentinensis: Comstock and Huntington, 1959, p. 76.

DIAGNOSIS. Somewhat similar to its congeners and some Plesiocyanophrys, but can be recognized by the dull black or brown (non-iridescent) apices of the forewings in the males, a character shared only to some degree with Plesiocallophrys pseudoargentinensis. The forewing apices of more distant sister species of Diplesiocallophrys are fully iridescent. Genitalia of all the species are distinctive as noted below and under each taxon.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 376) as typical of the genus. Upper Surface of the Wings: Ground color dull iridescent Delft Blue, becoming darker distad. Margins both wings blackish. Small (less than one-third length discal cell) scent patch distad in discal area. Forewing fringe black to brown, lighter distad. Hindwing black basad, white distad, black at vein termini; recurved lobe of hindwing with reduced coloration, Chestnut to

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blackish distad. Under Surface of the Wings: Ground color Oil Green to Spinach Green. Area of forewing immediately cephalad hindwing gray, darker basad, extending at least to vein Cu_2. Hindwing with median row of small white spots, edged deep red-brown to black basad. White dash emphatic distad of recurved lobe of the hindwing; lobe deep Raw Umber to black. Fringe of both wings dark brown to black, lighter distad; whitish on hindwings, vein-ends tipped black. Length of Forewing: $\bar{X}$ of four specimens (BMNH, AMNH), 13.7 mm., range 13.5 mm. to 14.2 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 376) as typical of the genus. Upper Surface of the Wings: Entire wings dull Payne's Gray except for margins and submargins, hindwing, and apex, extreme costa, margins, and submargins, forewing; these light Raw Umber. Juncture of Payne's Gray and Raw Umber, hindwing, moderately crennated. Fringe blackish-brown, lighter to gray distad. Under surface of the Wings: As on males, but lighter and more extensive coloration on the recurved lobe between the outer and anal margins of the hindwing. Length of Forewing: $\bar{X}$ of four specimens (BMNH, AMNH) 14.2 mm., range 13.8 mm. to 15.2 mm. Male Genitalia: See Fig. 123. Valvae caudad saccus clear, narrow-rimmed, parabolic, indented; valvae, lateral view, round-tapered; valvae, caudal extension very long, length exceeding caudad labides one-seventh length of entire valvae. Saccus extremely long, six-sevenths length of entire length of valvae. Base of vinculum not flared; vinculum slightly spurred. Cornuti narrow, disclike. Female Genitalia: Fig. 124. Ductus extremely long and wide, length five times width of lamellae, width one-third breadth of lamellae. Lamella postvaginalis three times caudal expanse of lamella antevaginalis. Lamella postvaginalis with definite centrad transparent line. Signa broad-based straight spines, moderately bifurcate basad.

TYPES. Holotype male, allotype female, and one male paratype in BMNH. Type Locality. Tucuman, Argentina.

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DISTRIBUTION. Spatial: Fig. 514. Presently known from northwestern Argentina along the edge of the Andes and out onto the adjacent plains and foothills in Tucuman Province. Temporal: Dates on known specimens range from mid-May to the second week of June.

REMARKS. In total, seven specimens were examined. The types and four other specimens were dissected for genitalia, legs, and palpi. I find it impossible to support that this and other congeners, or members of the genus Plesiocyanophrys, could be considered conspecific due to the similarity of wing characters. Future workers would be ill-advised to lump them based on these primitive characters, thereby creating a paraphyletic grade group.

DIPLESIOCALLOPHRYS, NEW GENUS

DIAGNOSIS. Male hindwing above margin crennated with white cell interspaces framed by black marginal line (shared with Monoplesiocallophrys but not Plesiocallophrys) and thence uniquely with obsolescent mesial markings on the hindwing underside, approaching immaculate. The genitalia of the females have an extra-ordinarily long ductus ten to twelve times its width.

DESCRIPTION. Adult: Head with variously colored and spiny frons, and colored lining about the compound eye. Legs of both sexes lacking any elongation relative to width (latter typifies apomorphy in Callophryina relative to outgroups). Palpi as typical of highly derived taxa in Callophryina second segment elongate; ratios of third to second in sexes of species slightly different --unique for immediate sister genera. Wings smallest in size of immediate four sister genera, forewing lengths in known specimens 11-13 mm. only. Wings above characterized by blue iridescence of males invading subapical area of

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forewing, and hindwing with crennated margin with black marginal line framing white cell interspaces. There is no tail. Male Genitalia: Characterized by narrow-tapered cornuti, a caudal extension and bilobed configuration junctured with little or no change in slope, and an extremely long saccus, exceeding two-thirds length of valvae. Female Genitalia: Remarkably long ductus, length exceeding ten to twelve times width. Signa widely bifurcate.

BIOLOGY. Early Stages. Unknown. Foodplants: Unknown.

TYPE SPECIES. Diplesiocallophrys maccourtorum, new species.

DISTRIBUTION. Spatial: Fig. 514. Disjunct: one species in the Andes of northwestern Argentina and the other in montane Parana State Brazil. Temporal: Flight periods of at least May through June are indicated.

ETYMOLOGY. The name indicates that this genus is a second component of the sister group Plesiocallophrys. The name is Greek, taken from "di" (two) and "plesio" (old, ancient) and added to the generic name Callophrys. It is considered feminine.

Diplesiocallophrys paranensis, new species

Figs. 10, 125, 126, 377

DIAGNOSIS. Can only be confused with its sister species maccourtorum found westward in montane northwestern Argentina, while paranensis is known only from southeastern Brazil. Differences between them have been summarized in the accompanying key. From superficially similar Monoplesiocallophrys and Plesiocallophrys species, paranensis can be distinguished by its obsolescent mesial line on the hindwing under surface, which appears only as faint spots.

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DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 377) as typical of the genus. Upper Surface of the Wings: Ground color dark iridescent Tyrian Blue. Wide areas of apex, margins and submargins, both wings fuscous to black. Scent patch distad in discal area. Hindwing with crennated margin, black marginal line framing white cell interspaces; recurved lobe between outer and anal margins dull Chestnut heavily fringed black distad. Fringe, both wings, black, white in cell interspace, hindwing. Under Surface of the Wings: Ground color bright Deep Turtle Green, lighter along submargin, hindwing. Forewing immaculate save broad area of gray immediately cephalad hindwing. Hindwing with mesial spots present only anad, very small, white, edged vividly black to Maroon. Recurved lobe of hindwing deep Maroon, only vaguely white basad and with Maroon extending along marginal fringe. Fringe, forewing, grayish black, hindwing pale, whitish in the cell interspaces, vein ends tipped black to Maroon, Maroon edging anad. Length of Forewing: 12 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 376) as typical of the genus. Upper Surface of the Wings: Extreme broad areas of apex, margins, and submargins (circa two-thirds wing surface) dull fuscous; rest of wing shiny dull Neutral Gray. No scent patch distad in discal area. Margins of both wings distinctly white-fringed. Recurved lobe of hindwing vaguely Chestnut. Under Surface of the Wings: As on males. Length of Forewing: 13 mm. (allotype). Male Genitalia: Fig. 125. Similar to maccourtorum but with wider rims and vague shouldering on bilobed configuration. Valvae, caudad saccus, clear, mid-rimmed, slightly shouldered cephalad, indented; valvae lateral view, funneled about one-half way between dorsal articulation and terminus; valvae, caudal extension, tapered. Saccus long, nearly two-thirds length of valvae. Cornuti narrow-tapered. Female Genitalia: Fig. 126. Similar to maccourtorum but ductal length about ten times width.

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TYPES. Holotype male, Caviuna, Parana State, Brazil, May, 1945, A. Maller. Allotype female, same data as holotype, June, 1945, A. Maller. Deposited AMNH.

DISTRIBUTION. Spatial: Fig. 514. Known only from the type locality. Temporal: Known only as May and June.

ETYMOLOGY. The name indicates the region of the type specimens, Parana State, Brazil.

Diplesiocallophrys maccourtorum, new species

Figs. 11, 127, 128, 378

DIAGNOSIS. Distinguishable from immediate conserials by characters treated in the accompanying keys; most similar to D. paranensis. D. maccourtorum is known only from the Andes, while paranensis occurs in southeastern Brazil.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 378) as typical of the genus. Frons green. Upper Surface of the Wing: Ground color dark Tyrian Blue, except for margins of both wings and apex of forewing; the latter are fuscous to black. Scent patch distad in discal area. Margin of hindwing crennated; black marginal line framing white cell interspaces. Recurved lobe black overscaled Chestnut, heavily fringed. Under Surface of the Wing: Ground color bright Deep Turtle Green; submargin of hindwing with lighter Clear Florite Green patches. Area of forewing immediately cephalad hindwing gray nearly to margin, blacker basad. Forewing and hindwing nearly immaculate or with barely visible mesial spots present only anad on hindwing. Recurved lobe Maroon, with white slash basad. Forewing fringe gray-brown; hindwing fringe

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gray with white in cell interspaces. Length of Forewing: 11 mm. (holotype); paratype male 12.5 mm. Female: Head, thorax, abdomen, legs and palpi Fig. 38) as typical of the genus. Frons green. Upper Surface of the Wings: Broad areas of apex, both wings, and margins deep fuscous; rest of wing shiny Neutral Gray. Margin of hindwing with brown to fuscous marginal line framing pale cell interspaces. Recurved lobe broadly Chestnut, black distad. Under Surface of the Wings: As on male but mesial line slightly more apparent, not as dots, but variously arranged dashes. Length of Forewing: 13 mm. (allotype). Male Genitalia: Fig. 127. Valvae, caudad saccus, clear, mid-rimmed, parabolic, indented; valvae lateral view funneled, about mid-way between dorsal articulation and terminus; valvae, caudal extension tapered. Saccus extremely long, equalling two-thirds or more length of valvae. Cornuti tapered. Female Genitalia: Fig. 128. Ductus extremely long, length twelve times or more width. Lamella postvaginalis widely eliptical; lamella antevaginalis diminutive, less than one-fifth expanse of former. Signa widely bifurcate spines.

TYPES. Holotype male (Fig. 11), Pichinal, Salta Province, Argentina, 29 May 1972, Roberto C. Eisele. Allotype female, same data, 28 May 1972. Deposited AMNH. Paratype. EC: San Pedro, Jujuy, Argentina, same data, 28 May 1972 (one male).

DISTRIBUTION. Spatial: Fig. 514. Presently known only from Salta and Jujuy provinces, Argentina. Temporal: Known only from late May.

REMARKS. This is a very distinct species, especially in the genitalia. Harry K. Clench identified this taxon as new for Eisele but did not describe it. There is a similar sister species eastward in southeastern Brazil (see Remarks under genus and sister genera). The types and paratype were dissected for genitalia, legs, and palpi.

ETYMOLOGY. This species is named for Mr. and Mrs. James E. McCourt.

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Secondary Series Plesiocyanophrys

(IA2)

Tertiary Series Plesiocyanophrys

(IA2a)

PLESIOCYANOPHRYS, NEW GENUS

Thecla Fabricius, 1807, p. 286. Clench, 1946, p. 185.

Thecla (in part): Schwanwitsch, 1948, p. 256. Franz and Schroeder, 1954, p. 85. Comstock and Garcia, 1960, p. 420. Comstock and Huntington, 1959, p. 175; 1961, p. 115. Lipes, 1961, p. 56. Zikan and Zikan, 1968, p. 56. Hayward, 1973, p. 152.

Callophrys Billberg, 1820, p. 80 (in part). F. Brown, 1978, p. 19. Scott, 1970 (1971), p. 101.

Cyanophrys Clench, 1961, p. 211; 1966, p. 7.

Cyanophrys (in part): Ehrlich, 1961, p. 211. Riley, 1975, p. 100. Beattie, 1976, p. 16.

Callophrys (Cyanophrys): Clench, 1961, p. 119. 1966, p. 70. dos Passos, 1970, p. 33. McGuire and Rickard, 1974, p. 406. Ross, 1976, p. 191 [109]. Scott, 1975, p. 297.

Callophrys (Cyanophrys) (in part): Gorelick, 1971, p. 3. Brown and Heineman, 1972, p. 233.

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DIAGNOSIS. Taxa of this genus superficially recognizable by several relatively primitive characters generally separating them from members of the sister genus Plesiocallophrys. Both genera with tailless members, males characterized by reduced blue on the upper surface of the forewing apex and both sexes characterized by a green underside with a simple mesial band of white spots and no "Thecla-spot" in the submargin of cell Cu_1, but members of Plesiocyanophrys have relatively unpointed apices of the forewing and hindwing, while members of Plesiocallophrys are characterized by a wing shape with definitely pointed apices.

DESCRIPTION. Adult: Head with green colored spiny development of the frons. Lining around the eye, white. Legs, both sexes, lacking any elongation indicative of apomorphy in Callophryina. Palpi as typical of the Primary Series Plesiocallophrys. Wings short, usually with forewing length 16 mm. or less. Males with greatly reduced iridescent blue above, large areas of forewing apex, and margins and submargins of both wings, fuscous. Blue above on some species silvery or dull, not deep. Females similar but with blue generally dull to sheenless. Wing under surface both sexes green with mesial lines of white lunules on hindwing. No tails. Male Genitalia: Males of only one species known. Valvae, caudal extension three-step; valvae, bilobed configuration mid-rimmed, parabolic and indented. Aedeagus with cornuti broad and disclike. Saccus not long as in Plesiocallophrys; parabolic, about equal in length to bilobed configuration. Female Genitalia: Very distinctive: ductus wide and short, length usually about two and one-half times terminal width. Lamellal lips variously expansive distad; ductus often flared caudad. Signa variously long, usually single spines.

BIOLOGY. Early Stages: Unknown. Foodplants: Unknown.

TYPE SPECIES. Cyanophrys goodsoni Clench.

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DISTRIBUTION. Spatial: Fig. 515. One species is distributed from Guatemala northward through Mexico into the southern United States. The South American congeners are found in the northern Andes, Colombia to Northern Ecuador, and in southwestern Brazil (Mato Grosso), respectively. Temporal: Flight periods from at least December through August are indicated.

REMARKS. I have made special efforts to locate the males of the several species known only from females. I have been unable to find any absolute matches from either data labels or possible wing pattern similarities. All known males of both Secondary Series Plesiocallophrys and Plesiocyanophrys are tailless. The only known male of Plesiocyanophrys is the northern species goodsoni and it has a very distinct limitation of the upper surface iridescence. However, I find no males in South America near the very obvious females with the distinct wide ductus and simple lamella that indicate a similar condition which might lend to their recognition. All of the males I have dissected from localities of or near females of the South American Plesiocyanophrys are tailed or tailless members of the Cyanophrys species groups, which I have demonstrated to be clinal in relation to loss of tail and all of which have tailed or tailless females accompanying them with the very obvious characters of highly derived Cyanophrys. There may be some reason for the lack of accompanying males in the species of Plesiocyanophrys in South America related to behavior or biology. In Secondary Series Plesiocallophrys, except for one case, the males have been readily apparent in numbers.

ETYMOLOGY. The name [Greek, "plesio" (oldest, ancient)] indicates that this is a group that retains the most relatively plesiomorph characters states among successive apomorphic characters in the Callophryina. It is considered feminine.

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Plesiocyanophrys goodsoni (Clench), new combination

Figs. 129, 130, 379

Thecla goodsoni Clench, 1946, p. 185.

species goodsoni: Comstock and Huntington, 1960, p. 119.

Callophrys (Cyanophrys) goodsoni: Clench, 1966, p. 70. dos Passos, 1964, p. 254. McGuire and Rickard, 1974, p. 406. Ross, 1976, p. 191 [109]. Scott, 1978, p. 297.

DIAGNOSIS. Recognizable in North and Central America by the reduction of blue on the upperside of the male to merely most of the hindwing and the discal areas of the forewing, broad areas of the apex and submargins being black-brown. Females more difficult to distinguish, generally recognizable by broad black-brown areas as on the males above with the rest of the wings being dull gray-blue. Both sexes with recurved lobe of the hindwing very pointed caudad, and a postmedian band on the green underside of the hindwing occurring as an arc of white spots. From immediate sister taxa in South America, goodsoni is recognized by its bright silvery blue contrasting to duller steel blue caudad of the discal cell on the forewing and the immediate costa margin of the hindwing, by the extremely wide ductus of the female genitalia (length = circa four times width), flaring to very simple hemispherical lamellae, and by the bulky wide-rimmed and short three-step configuration of the male valvae.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 379) as typical of the genus. Upper Surface of the Wings: Ground color dull silver-suffused Tyrian to Delft Blue, except for wide areas including at least one-third of margins, submargins, and apex of forewing margins of hindwing, which are deep Raw Umber to black; iridescent coloration lighter, distad toward deep

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Medici Blue. Scent patch distad in discal area, about one-third length discal cell. Margin of iridescence and black margin on hindwing slightly crennated. Recurved lobe of hindwing nearly black, positioned quite straight on wing, as on Nearctic Callophrys. Fringe black, lighter distad; on forewing, black basad, white distad, on hindwing with vein-tips blackened. Under Surface of the Wings: Ground color Spinach Green to Oil Green. Area of forewing immediately cephalad hindwing gray, darker basad. Hindwing with slight median arc of small white spots, edged basad with black or deep red-brown, variously expressed. Recurved lobe between outer and anal margins of hindwing black, edged with emphatic white slash basad. Fringe brownish black, paler distad, on forewing, whitish distad, on hindwing. Length of Forewing: $\bar{X}$ of 10 specimens (AMNH) 15.2 mm., range 14.6 mm. to 15.8 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 379) as typical of the genus. Upper Surface of the Wings: Markings similar to male but ground color fuscous lightly suffused, Neutral Gray, not iridescent blue-gray, and more limited basad. Remainder as in male, except recurved lobe of hindwings redder. Under Surface of the Wings: As in males, but recurved lobe of hindwing more red. Male Genitalia: Fig. 129. Valvae caudad of saccus, clear, mid-rimmed, parabolic to ovate and indented; in lateral view, round-tapered; caudal extension, three-step. Saccus parabolic; vincular spurs only slightly evident, curved; base of vinculum only slightly flared if at all. Cornuti as illustrated. Female Genitalia: Fig. 130. Ductus wide, exceeding in width one-half breadth of lamellae; short, length slightly over four times width. Lamella postvaginalis widely spherical, caudal length exceeding width of ductus; lamella antevaginalis hardly apparent, only as distal lips at terminal opening of ductus. Signa small, single, broad-based spines.

TYPES. Holotype male, allotype female and two paratype females in BMNH. Type Locality: Tegucigalpa, Honduras.

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DISTRIBUTION. Spatial: Fig. 515. From the extreme southern United States (south Texas and occasionally Arizona and New Mexico) southward to Guatemala and Honduras. Temporal: Dates on specimens range from June to August.

REMARKS. Until this revision, goodsoni has seemed a rather unique species, with reduced iridescent above. It was placed in Cyanophrys; the genitalia had not been studied; no one had made the connection between it and argentinensis. This study reveals it is part of a constellation of species in Central and South America, mostly hitherto undescribed, which exhibit primitive conditions of the male and female genitalia and palpal structures.

In total, seventy specimens were examined. The types and eight other specimens were dissected for genitalia, legs, and palpi.

Plesiocyanophrys brazilensis, new species

Figs. 12, 131, 380

DIAGNOSIS. Wing characters resembling those of species in the genus Plesiocyanophrys and Secondary Series Plesiocallophrys, but genitalia distinct among Plesiocyanophrys as follows: lamella postvaginalis expansive, nearly spherical in shape, with lamella antevaginalis merely completing the cephalad one-third of the sphere (this area is only slightly flared on lamellalatus and usually hemispherical with both lamellae of equal expanse on goodsoni); ductal length about three and one-half times its width (thus longer and narrower than lamellalatus and shorter and wider than goodsoni); signa unique, consisting of extremely pointed chevron-shaped single spines.

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DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, legs, and palpi (Fig. 380) as typical of the genus. Upper Surface of the Wings: Forewing with wide areas of costa, nearly one-half of apex slanting toward caudal markings dull Raw Umber; rest of wing dull Endive Blue basad to Payne's Gray distad. Darkening along the veins of both wings. Hindwing except for dull Raw Umber margins completely Endive Blue basad to Payne's Gray distad. Fringe dull Raw Umber, distinctly paler to white distad on the hindwing. Recurved lobe of hindwing no different from fringe coloration; border of marginal Raw Umber and Payne's Gray distinctly crennated in limbal area. Under Surface of the Wings: Ground color Spinach Green. Area of forewing immediately cephalad of hindwing gray, extending nearly to margin. Rest of wings almost completely immaculate except discal arc of rounded white spots in all the cell interspaces transversing the hindwing, with each of these spots slightly edged basad with red-brown. Recurved lobe of hindwing black distad, reddish brown basad but with a white blotch along its border with anal margin. Marginal parts of limbal area distinctly suffused red-brown in cellular interspaces; fringe distinctly brown on both wings, highlighted on hindwing by white marginal line in limbal area and fringe becoming white distad. Length of forewing: 15 mm. (holotype). Male Genitalia: Unknown. Female Genitalia: Fig. 131. Lamella postvaginalis expansive, nearly spherical in shape, with the lamella antevaginalis merely completing the cephalad one-third of the spherical shape of lamellae. Ductus length about three and one-half times its width; signa extremely pointed, chevron-shaped single spines.

TYPE. Holotype female (Fig. 12), Rio Pardo, Mato Grosso State, Brazil. Deposited AMNH.

DISTRIBUTION. Spatial: Fig. 515. Known only from the type locality. Temporal: Unknown.

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ETYMOLOGY. The name indicates the locality from which this species comes (west-central Brazil), indicating the uniqueness of this apparently southernmost species in the genus.

Plesiocyanophrys lamellalatus, new species

Figs. 13, 132, 381

DIAGNOSIS. Wing pattern resembling a number of non-congeners, especially sicrana, but genitalia, however, placing it clearly within Plesiocyanophrys; clearly distinguishable from any western South American congener by the extremely wide ductus, with width one-third length of ductus cephalad the antrum.

DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, legs, and palpi (Fig. 381) as typical of the genus. Upper Surface of the Wings: Apical and submarginal areas of forewings and margin of hindwings dull Raw Umber; rest of wing shiny Light Gull Gray with iridescent overcast. Recurved lobe slightly Chestnut. Under Surface of the Wings: Entirely Grape Green to Light Cress Green, except forewing light Gull Gray cephalad margin of hindwing. Hindwing with full postmedian band of white spots edged with red-brown basad. Spot at cell Cu_2 crescent-shaped and displaced basad out of line with rest. Recurved lobes of hindwing deep red-brown, black distad. Male Genitalia: Unknown. Female Genitalia: Fig. 132. Ductus wide with width one-third length of ductus cephalad the antrum. Antrum flaring widely to broad hemispherical lips of lamella postvaginalis; lamella antevaginalis straight-margined and extending about one-half length of lamella postvaginalis. Signa long spines vaguely bifurcate centrad.

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TYPES. Holotype female (Fig. 13), Casabe, Colombia, across Magdalena River from Barancabermoja, 6 December, 1956, Mrs. D. S. Bes; deposited AMNH. Paratypes, AMNH: same data as primary type, 21 December, 1956 (one female); Hacienda Garcia, Cauca Valley, Colombia, 29 January 1935, E. I. Huntington (one female); Colombia, Felipe Ovalle (one female). BMNH: La Chima, Rio de las Juntas, Bahaheye Province, Los Rios, Ecuador, June-July 1893, M. de Mathan (one female). AME: Casabe, Colombia, 15 December 1954, "M.M.B." (one female).

DISTRIBUTION. Spatial: Fig. 515. Currently known from a number of areas in northern South America--in the Andes mountains from Colombia, through Ecuador, and into northern Peru. Temporal: Specimens are known from December, January, June and July.

REMARKS. There is little doubt, even with the lack of male specimens, that the number of female specimens of this taxon represent a widely distributed hitherto undescribed species which is the South American sister species of goodsoni. The specimens in the type series, and the additional material listed in the Material Examined most often represent single specimens from separate localities. This may indicate their infrequency of capture and to some degree explain the lack of accompanying males; there may also be biological or behavioral reasons. I have meticulously looked for possible male counterparts without success, but the primitive characters of the female genitalia and palpi make the females unconfusable with any other group except Plesiocyanophrys.

In total, six specimens were examined. The type and five other specimens were dissected for genitalia, legs, and palpi.

ETYMOLOGY. The Latinized name refers to the very simple and primitive shape of the lamella postvaginalis on this species.

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Primary Series Cissatsuma

(including Cissatsuma, Cisincisalia, Incisalia, Novosatsuma, Penaincisalia, Ginzia, Sandia, Mesocyanophrys, Paracyanophrys, Cyanophrys, Callophrys, Mitoura)

(IB)

Secondary Series Cissatsuma

(including Cissatsuma, Cisincisalia, Incisalia, Novosatsuma)

(IB1)

Tertiary Series Cissatsuma

(IB1a)

CISSATSUMA, NEW GENUS

Satsuma Murray, 1874, p. 168 [nec. Satsuma Adams, 1868, p. 463] (in part). Murray, Ibid. loc. cit. Riley, 1939, p. 359. Sibatani, 1946, p. 64. Schwanwitsch, 1948, p. 256. Gillham, 1956, p. 149.

Callophrys Billberg, 1820, p. 80 (in part). Swinhoe, 1910-1911, p. 257. (Satsuma = Callophrys) (synonymy in error).

Ginzia Okano, 1941, p. 239 (in part). Okano, Ibid., loc. cit. Korschunov, 1972, p. 359

Ginsia (sic) (in part): Korschunov, 1972, p. 359

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Ahlbergia Bryk, 1946, p. 50 (in part). Bryk, Ibid., loc. cit. Kuroko, 1957, p. 98. Kim, 1961, p. 278. Shirozu and Hara, 1962, p. 94. Eliot, 1973, p. 440 (Ahlbergia = Ginzia = Satsuma).

Incisalia Scudder, 1872, p. 52 (in part). F. Brown, 1947, p. 21 (places all Satsuma sens. lat. with Incisalia in comment). Gillham, 1956, p. 149. (Satsuma = Incisalia) (synonymies in error).

DIAGNOSIS. Superficially, species of this genus resemble those taxa variously blue or brown above with mottled brown beneath known formerly as Ahlbergia Bryk, a polyphyletic grade group (sensu Nelson). Female genitalia of Cissatsuma have unmistakably primitive characters resembling no other Asian group: immediately recognizable by the wide ductus (usually exceeding in width one-half the breadth of the lamellae). The palpi of two of the species are obviously primitive (second segment short, male's length less than four times width, female's circa five times width), making them easily identifiable; palpi of other two known species more derived. Male genitalia characterized by a generally obvious shouldered bilobed structure complemented by a straight tapering caudal extension.

DESCRIPTION. Adult: Head with frons hairy but without distinct pigmental or structural color; white lining about the compound eye. Legs, both sexes, lacking any elongation relative to width (latter is evidence of apomorphy in Callophryina). Palpi typical of the primitive condition of Primary Series Cissatsuma but derived in two taxa. Wings comparatively large, forewing length often exceeding 15 mm; never with tails. Undersides hoary and mottled browns forming postbasal, medial, submarginal and/or marginal patterns. Upper surfaces of the wing without or with reduced blue area, primarily occurring postmedial on the hindwing. Male Genitalia: Generally characterized by

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shouldering of the bilobed configuration and a straight tapered caudal extension, giving appearance of distal and terminal points, but bilobed configuration generally narrow-rimmed, unique for the Secondary Series. Female Genitalia: Characterized by the obviously primitive wide ductal configuration, and diminutive expanse of the lamellae both distally and caudally.

BIOLOGY. Early Stages: Unknown. Foodplants: Unknown.

TYPE SPECIES. Cissatsuma albilinea Riley.

DISTRIBUTION. Spatial: Fig. 516. The species of Cissatsuma are found in western China, including eastern Tibet, in montane areas characterizing the region. Temporal: Apparently unknown.

ETYMOLOGY. The Latin prefix "cis" meaning "most primitive" or "ancestral" is added to a name formerly used for the eastern Palaearctic grade group: Satsuma. It indicates that Cissatsuma taxa have characters more primitive in relation to the other east Asian butterflies characterized by the hoary-brown and mottled undersides. The gender is feminine.

Cissatsuma tuba, new species

Figs. 14, 15, 133, 134, 382

DIAGNOSIS. Related to C. albilinea but can easily be distinguished from this congener by the underside of both sexes of tuba lacking any white lining about the basal disc of the hindwing and displaying not a lighter ochraceous distal area of the hindwing but instead one of brown patterns distinctly flecked with gray. Female of tuba with very distinctive lavender-blue across the discal and basal portions of the forewing, lighter lavender-blue across these same areas

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of the hindwing and a lighter, bluish-tinted patch in the distal cell spaces between veins Cu_2 and 2A, while females of albilinea when blue is present display it only on the hindwings. Male upperside of tuba superficially can be confused with less closely related species Ginza brabazonorum and G. casinorum, but these lack obvious markings distad the basal disc on the hindwing. C. tuba also distinguishable from upperside resemblance to Cissatsuma wellsorum, Ginzia fritzi, and G. tsekouensis by these all exhibiting deep brown patterns over lighter ground color on the hindwing underside devoid of heavy gray-overscaling. The genitalia of both sexes of tuba are markedly distinct (see below).

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 382) and frons as typical of the genus. Upper Surface of Wings: Entirely dull Prout's Brown; margins crennated, lightly fringed with brown. Scent scale costad distal end of discal cell. Under Surface of Wings: Forewing, bright Verona Brown with little evidence of spot distad in discal cell. Vague postmedian line of redder brown (near Chocolate) descending only to vein Cu_1. Apex of wing distad this line much lighter yellower brown; faint evidence of gray dusting between veins along the margin. Hindwing, postbasal disc rich brown (near Chestnut Brown), not mottled, but overlaid with scattered gray scaling. Edging of basal disc darker brown to black. Distad basal disc ground color lighter (near Snuff Brown) broken by submarginal crescent line and marginal darkening, but area entirely suffused with gray to ochre over-scaling. Submarginal crescent line Chestnut Brown deteriorating to blotches cephalad vein M_2. Margin widely darkened to more fuscous brown becoming narrower cephalad. Margin crennated; fringe entirely dark brown to black. Length of Forewing: 15 mm. (holotype). Female: Head, thorax, abdomen, legs, palpi (Fig. 382) and frons as typical of the genus. Upper Surface of Wings: Forewing Dark Raw Umber, appearing darker costad the distal end of the discal cell. Discal cell, entire basal area and areas distad

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these to median area bright Light Hyssop Violet tinted blue. Hindwing Raw Umber with faint Hyssop Violet in discal cell and caudad over entire area surrounding anal margin. Lighter violet patch, noticeably round, in cell Cu_2, and blue edging along the fringe of the margin from anal margin to vein Cu_2. Under Surface of Wings: As on male. Male Genitalia: Fig. 133. Vaguely similar to C. albilinea, but caudal extension of valvae much longer, exceeding uncus, whereas that of former barely exceeds caudal end of falces where they join the vinculum. Valvae caudad saccus mid-rimmed and shouldered, vaguely indented; valvae, lateral view, round, funneled; valvae, caudad extension, tapered, with vague shoulder quite cephalad; saccus, parabolic; cornuti as illustrated. Female Genitalia: Fig. 134. Only C. albilinea is similar, but the broad ductus of tubus is longer, seven times its width and appearing more so because of breadth of lamellae (more than one third length of ductus). The ductus bursae is small, only slightly larger than breadth of lamellae; the signa are widely bifurcate, whereas those of albilinea are a single spine.

TYPES. Holotype male (Fig. 14), and allotype female (Fig. 15), Tse Kou (= Tzeku), Yunnan Province, China, 1895, R. P. Dubernard, deposited BMNH. Paratype, BMNH: same data as primary types (one female).

DISTRIBUTION. Spatial: Fig. 516. Known only from type locality. Temporal: Unknown.

REMARKS. The male and female are associated on the basis of the identical labels and wing undersides.

ETYMOLOGY. "Tuba" (Latin) means pipe, referring to the characteristic shape of the ductus in the female of this species.

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Cissatsuma albilinea (Riley), new combination

Figs. 135, 136, 383

Satsuma albilinea Riley, 1939, p. 359.

[Ginzia]albilinea (included Satsuma species): Okano, 1941, p. 239.

[Ahlbergia]albilinea (included Satsuma species): Bryk, 1946, p. 50. Eliot, 1976, p. 440.

[Incisalia]albilinea (included Satsuma species, omitting albilinea): Gillham, 1956, p. 145, 149.

DIAGNOSIS. Similar in maculation to sister species tuba, and less so to sister taxa contexta and wellsorum, but distinguishable from them by white lining about the basal disc of the hindwing underside and by the broad area of lighter brown to ochraceous distad the white. There is also emphatic white edging distad the dark block at the distal end of the discal cell on the forewing underside. Male genitalia very different from the three congeners mentioned above, remarkably by the shortness of the caudal extension of the valvae of albilinea, which hardly surpasses the caudal end of the falces as they articulate between the vinculum and uncus. Same extension on the other species extends to or past the caudal end of the uncus lobes.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 383) and frons as typical of the genus. Upper Surface of the Wings: Ground color completely dark Raw Umber; male scent patch, usually lightened yellow distad in discal area of forewing. Hindwing margin only narrowly crennated; light ochraceous from broad areas of same beneath often visible in area of anal margin contrasted along recurved margin just caudad with red-brown in the

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fringe. Under Surface of the Wings: forewing ground color Snuff Brown to lighter Sayal Brown. Brown patch distad in discal cell darkened basad, edged with whie distad. Postmedian line regular from costa to vein M_3 or Cu_1 darkened basad, white to white-flecked distad. Margin darker brown, hardly crennated; fringe uniformly brown. Hindwing basal disc rich brown (near Chestnut) flecked over with darker scaling, postbasal markings hardly visible. Margin of disc moderately edged distad with white; distad disc ground color much lighter Sayal Brown or ochraceous, with brown markings of crescent line or submarginal markings reduced. Limbal area ochraceous, often intense, especially along anal margin. Fringe darker brown, tending toward red-brown along anal angle; margin only moderately crennated. Length of Forewing: $\bar{X}$ of 15 males (BMNH) 15.5 mm., range 14.5 mm. to 16.0 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 383) and frons as typical of the genus. Upper Surface of the Wings: Forewing completely dark Raw Umber, occasionally flecked with dull blue basad. Hindwing usually completely shiny Hyssop Violet basad, deep Raw Umber distad. Area around anal angle often lightened and contrasted with red brown of fringe in this area. Margin of wings only moderately crennated, hindwing; hardly crennated, forewing. Under Surface of the Wings: As on male. Male Genitalia: Fig. 135. Very distinctly within the group of sister species tuba, contexta, and wellsorum. Particularly, caudal extension of the valvae does not usually exceed caudal end of falces where they articulate between the vinculum and uncus. Caudad the saccus the valval lobes are thin rimmed, parabolic and indented, not broadly shouldered and wide-rimmed. The lateral shape of the valvae is round tapered, not funneled; saccus parabolic; cornuti as illustrated. Female Genitalia: Fig. 136. With the long thick tubular ductus characteristic of the sister taxa mentioned above, but ductus length six times its width, not seven times as in tuba and with breadth of lamellae much less (extension of lip of

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lamella antevaginalis from antrum less than width of ductus, not one and one-half times as in tuba). Other congeners with ductus more reduced. Signa as single spine, not bifurcate as in tuba and wellsorum.

TYPES. Types in the BMNH: holotype male; allotype female. Type Locality: Tatsienlu, west Szechwan Province, China, in the mountains of eastern Tibetan plateau, altitude 3-5000 m.

DISTRIBUTION. Spatial: Fig. 516. Generally distributed throughout southwest China and the eastern Tibetan region. Besides the type locality it is known from Weisi, Yunnan Province, north to the type locality in western Szechwan Province, and from there westward to the "Frontier of Tibet." A specimen from "Chauloo" may indicate Chayul in Tibet near Lhasa, since this name corresponds to no other name in China or Tibet more closely. There is also a specimen from Hong Kong (Yaregong, = roots of Yare, and Yarewonga) though this may only indicate locality of purchase. Temporal: None of the many specimens bears a date.

REMARKS. The largest collection of this species examined during this study is in the BMNH, forty specimens including the types. Numerous specimens confused with albilinea were dissected from a much larger series under that name, leaving three males and three females dissected bearing the wing patterns of the forty specimens mentioned above. Riley's original description of this species is unfortunate in that he compares it to the most similar species known at that time, Ginzia circe, from which it is quite distant phylogenetically. This makes the usage of the original description somewhat confusing, since Riley considered that albilinea might actually only be a form of circe.

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Cissatsuma wellsorum, new species

Figs. 16, 137, 138, 384

DIAGNOSIS. Similar to Novosatsuma magnasuffusa, and the male to C. tuba; superficially so close as to be inseparable from the former by wing patterns, whereas the genitalia place it in a different species group altogether. Male of magnasuffusa more "broadwinged" than those of wellsorum, appearing more like N. pratti and N. collosus in this regard (ratio of forewing length[base to apex] to wing length [distal ends of margin caudad vein 2A to vein R_4]1.36 in magnasuffusa $\bar{X}$ 1.63 for three males of wellsorum). Also, magnasuffusa has a third postbasal marking on the underside of the hindwing in the basal disc. Male genitalia of wellsorum resemble those of tuba and C. contexta, having an obviously tapered caudad extension of the valvae, and a shouldered configuration on the valvae caudad the saccus. Male genitalia of magnasuffusa resemble pratti and albilinea with obvious shouldered caudad extension of the valvae and wide-rimmed, oval configuration caudad the saccus. From tuba, wellsorum can be distinguished by the deep rich brown of the former in the discal area of the forewing and on the basal disc of the hindwing completely obscuring any post-basal markings, and the lush white overscaling distad the basal disc, while wellsorum has a much lighter ground color, with postbasal markings emphatic in the basal disc. Male genitalia of wellsorum have a caudal extension of the valvae distinctly tapered, are shouldered caudad the saccus and have a broadly parabolic saccus, while these characters in tuba are shouldered, oval, and thinly parabolic respectively. Female genitalia of wellsorum, while similar to tuba, have the ductus length less than four times the width of one lip of the lamella antevaginalis from the antrum distad while this ratio is six times on tuba.

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DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 384) and frons as typical of the genus. Upper Surface of the Wings: Uniformly deep Raw Umber throughout; male scent patch distad in the discal area. Faint line of blue along margin of hindwing from vein 3A to 2A, sometimes enlarged to a blue spot basad. Margins strongly crennated, fringe brown with light gray. Under Surface of the Wings: Forewing Snuff Brown overscaled with warmer Verona Brown, especially basad the wavy postmedian line running, deep brown to black basad, faintly white distad, from the costa to vein Cu_2. Emphatic brown marking at distad end of discal cell. Distad postmedian line, wing lighter, heavy brown flecking forming faint submarginal line followed by lighter, sometimes yellowed terminus, fringe slightly darker brown. Hindwing ground color Snuff Brown overscaled with warmer Verona Brown. Basal disc Warm Sepia with deep brown postbasal slashes lined basally with white forming parallel pattern with edge of basal disc which is deep brown to black basad and white distad. Area betwen these parallel patterns sometimes uniformly darker brown. Distad the basal disc wing lighter, with deep brown crescent line followed by lighter Snuff Brown submarginal area heavily scaled darker brown distad. Terminus thus dark brown, though not as dark as the postbasal, basal disc marginal, or crescent line markings. Margin with faint black line and brown fringe heavily tufted at the vein ends. Length of Forewing: 16 mm. (holotype); two paratypes 14 mm., 15 mm. (other paratypes not measured). Female: Head, thorax, abdomen, legs, palpi (Fig. 384) and frons as typical of the genus. Upper Surface of the Wings: Same as male, but without scent patch. Under Surface of the Wings: Same as male. Length of Forewing: 15 mm. (allotype). Male Genitalia: Fig. 137. Similar to tuba, but caudal extension of valvae strictly tapered, valvae caudad saccus shouldered but not oval in configuration; valvae lateral view funneled; saccus broadly parabolic; cornuti as figured. Female Genitalia: Fig. 138.

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Similar to tuba, but length of ductus only four times the width of one lip of the lamella antevaginalis distad the antrum. Corpus bursa larger than that of tuba, in relation to ratio of width of bursa to length of ductus.

TYPES. Holotype male (Fig. 16), Ta-Ho (= Tae-Ho river and river basin) border of Szechwan Province and Tsinghai Province, China, 1895, to Printemps from native collectors. Allotype female, Tien-Tseun (= Tienshui) just east of Tae-Ho river basin along Wei-Ho River, Kansu Province, China, native collectors to P. Dujean, 1904. Deposited in BMNH. Paratypes. BMNH: same data as holotype, (two males) Bahand, Yunnan (mission at Wui-si and Weisi, = Weisi), by Piere Ouvrad, January, 1917 (one male); Ta-tsien-lou (= Tatsienlu, = Kangting) west Szechwan Province, China, native collectors, 1910 (one male).

DISTRIBUTION. Spatial: Fig. 516. Known from the mountains of the eastern Tibetan Plateau from north Yunnan Province, north through western Szechwan Province to western Kansu Province and eastern Tainghai Province, China. Temporal: Known only from January, which may not indicate the date of capture, but only that of purchase.

REMARKS. The males and females are associated by the identical wing patterns and same general area of capture.

ETYMOLOGY. This species is named for Mr. and Mrs. William Wells.

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Cissatsuma contexta, new species

Figs. 17, 139, 385

DIAGNOSIS. Resembles Ginzia frivaldskyi but the male displays only the faintest blue above, with none along the margin of the hindwing, and beneath has a much broader submarginal band on the hindwing which is not flecked with gray and is connected through the lighter brown postmedian area to the basal disc by darkening along the veins. Genitalia of the male are easily distingishable from frivaldskyi as illustrated in the accompanying genitalic figures.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 385) and frons as typical of the genus. Upper Surface of the Wings: Dull Raw Umber slightly lighter in basal and discal areas; faint traces of light blue in cell of hindwing. Very outer margin of hindwing blackened with edge sharply serrated. Under Surface of the Wings: Forewing dull brown (Snuff Brown) overlaid with warmer brown (Verona Brown); spot obvious at distal end of discal cell and an entire wavy postmedian line darkened proximad and faintly white distad; no submarginal line is obvious, but there is gray scaling between the veins along the margin. The hindwing is Snuff Brown heavily mottled with darker brown in the basal disc and in the terminal area. This leaves a lighter band distad the basal disc, with the disc and darker terminal areas being connected by darkening along the veins, especially cephalad. There is very vague white edging distad the basal disc between veins Sc + R_1 and Rs. Length of Forewing: 12 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 139. Valvae caudad, saccus wide rimmed, nearly oval, not parabolic; valvae, lateral view, round-tapered, not funneled; valvae caudad extension, straight, not shouldered; saccus parabolic, not funnel or pointed; cornuti as illustrated. Female Genitalia: Unknown.

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TYPES. Holotype male (Fig. 17), Bahand, Yunnan Province, China, January, 1917, Pere Ouvrad. Deposited BMNH.

DISTRIBUTION. Spatial: Fig. 516. Known only from the type locality. Temporal: Known only from "January".

REMARKS. The date of capture may be inaccurate, or may refer to a date of purchase.

ETYMOLOGY. The Latin name means "interwoven" ("context") and refers to the dark vein connections between the basal disc and terminal markings on the hindwing underside which characterize the species.

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Tertiary Series Cisincisalia

(including Cisincisalia, Incisalia, Novosatsuma)

(Ib1b)

Quaternary Series Cisincisalia

(IB1ba)

CISINCISALIA, NEW GENUS

Callophrys (Mitoura)[Mitoura Scudder, 1872, p. 52]: Clench, 1980, in press.

DIAGNOSIS. The genus is easily recognizable as the upperside resembles Nearctic Arceuthobium--feeding Mitoura (e.g., spinetorum, etc.) and the underside is reminiscent of Nearctic Sandia (Incisalia [in part] prior to this revision), e.g., steel blue above and mottled brown beneath. The genitalia are unique, resembling Palaearctic Cissatsuma (Ahlbergia, Ginzia, or Satsuma prior to this revision), e.g., female with a wide tubular ductus and only briefly expanded lamellae distad.

DESCRIPTION. Adult: Head without distinct coloration of hairy frons. Lining of the compound eye white. Legs lacking any elongation relative to width indicative of apomorphy in Callophryina. Palpi typical (in females) of the primitive condition of Primary Series Cissatsuma and Secondary Series Cissatsuma: second segment short. Wings comparatively short, specimens not

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exceeding forewing length of 15 mm. Hindwing tailed. Upper surface of wings brown with bluish overcast, under surface brown with distinct mottling in post-basal and mesial areas of hindwing. Male Genitalia: Unknown. Female Genitalia: Characterized by primitive condition of wide tubular ductus, width exceeding one-half breadth of lamellae. Signa characterized by single long spine, vaguely bifurcate centrad.

BIOLOGY. Early Stages: Unknown. Foodplants: Unknown.

TYPE SPECIES. Callophrys (Mitoura) guatemalena Clench.

DISTRIBUTION. Spatial: Restricted to the Neotropical Realm and thus far known only from Guatemala. Temporal: The single specimen is from late July.

REMARKS. The species guatemalena Clench was placed by him in Callophrys (Mitoura). He (pers. comm.) considered it a "missing link" between Callophyrys (Mitoura) and Callophrys (Incisalia) in a phenetic concept. He placed it with Mitoura because of its similarity to Arceuthobium-feeding species like spinetorum Hewitson. The characters used for this lumping are primitive. Further, cladistic analysis of the groups listed immediately above indicates that Mitoura and Incisalia as subgenera of Callophrys create a broad polyphyletic group, whereas Mitoura itself is monophyletic as defined prior to this revision and Incisalia itself is broadly polyphyletic. Placing guatemalena with Mitoura makes it paraphyletic (sensu Nelson), and this was done also without reference to the genitalia which were not examined. The genitalia point out the distinct relationship of guatemalena to the primitive condition of species in Secondary Series Plesiocallophrys and Plesiocyanophrys in the Neotropics and to Palaearctic species formerly placed in Ahlbergia. The cladistic position of the genitalic characters indicates that guatemalena is representative of a unique Neotropical genus, apomorph to the Palaearctic genus Cissatsuma and plesio-

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morph to the conifer-feeding groups of species niphon Hübner, eryphon Boisduval, and lanoraieensis Sheppard (placed now in Incisalia Scudder, but formerly with several forb-feeding species of similar superficial phenotype) and their sister genus Novosatsuma in the eastern Palaearctic. The latter's species are of unknown foodplant usage.

The mottled and hoary wing patterns characteristic of all the groups formerly placed in Nearctic Incisalia and Palaearctic Ahlbergia are primitive. They also occur in a clade derived from Neotropical ancestors which have become the various species formerly placed in the genera Sandia, Xamia, and Incisalia (the forb-feeders, e.g., augustinus et al.). It is these latter phenes that led Clench to consider guatemalena as a missing link between the mottled and hoary brown phene and the characteristic Mitoura phene.

ETYMOLOGY. The Latin prefix "cis" meaning "primitive to" or "ancestral" is applied to Incisalia, indicating that Cisincisalia is the New World group relatively plesiomorph to the familiar Incisalia of North America. The gender is feminine.

Cisincisalia guatemalena (Clench), new combination

Fig. 140, 385

Callophrys (Mitoura) guatemalena Clench, 1980, in press.

DIAGNOSIS. Female easily recognized by the dull steel blue upper surface of the wings, wing shape and tails reminiscent of Arceuthobium- feeding Mitoura but with mottled markings on the under surface (especially the hind wings) resembling those characteristic of Incisalia sens. lat.

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DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, legs, palpi and frons as typical of the genus. Upper Surface of the Wings: Dull Raw Umber, slightly suggestive of steel blue overcast typical of the males of Neotropical representatives of Callophryina; margins of both wings and apices of forewing duller fuscous. Long tail at vein Cu_2, heavily fringed caudad; shorter tail at Cu_1, also heavily fringed caudad; heavy fringe along slight recurved lobe between anal and outer margins. Fringe Raw Umber, paler distad, pale to white distad in heavily fringed areas mentioned above. Under Surface of the Wings: Ground color variously brown. Forewing with darker brown slash centrad in discal cell; dark brown postmedian line, entire, from costa nearly to vein 2A, followed distad by lighter ground color, then six or seven submarginal brownish oval blotches costa to vein Cu_2; wide area of margin hoary darker brown, edged basad and distad deep brown to blackish. Hindwing various brown; lighter postbasal slash basad in cell $Sc + R_1$ and discal cell; wide, light postbasal line with four distinct "jags" from cell interspace $Sc + R_1$, along distal edge of discal cell, to anal margin; distad this in cell $Sc + R_1$ a median light slash entering caudad into cell Rs. Light brown postmedian line across entire wing from vein $Sc + R_1$ to anal margin just cephalad recurved lobe, continuous but jagged. Distad this line, wing of uniform ground color. Recurved lobe between anal and outer margins slightly darker brown, heavily fringed distad. Marginal area of cell Cu_1 with blackish crescent, open distad. Tails at Cu_1 and Cu_2 and recurved lobe heavily fringed caudad, dark basad; pale to whitish distad. Length of Forewing: 13.5 mm. (holotype). Male Genitalia: Unknown. Female Genitalia: Fig. 140. Ductus long and wide (width of ductus at least one-half breadth of lamellae) with lamellal lips extending quite distad of caudal edges of ductus, and variously convoluted. Signa single long spines, only vaguely bifurcate centrad.

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TYPE. Holotype, deposited CMNH. Type Locality: Balen, Municipio San Cristobal, Verapaz, Guatemala.

DISTRIBUTION. Spatial: Known only from the type locality. Temporal: Known only from 30 July.

REMARKS. This species was recently described by H. K. Clench. He placed the species in the genus Callophrys, subgenus Mitoura. According to the cladistic scheme of this paper and the priority of names accordingly, Callophrys and Mitoura are both terminal generic taxa and are immediate sister genera, but these are in a different secondary series than Cisincisalia in which guatemalena is here placed, and thus quite removed from actual close phylogenetic kinship. Mitoura and Callophrys are more closely related cladistically to six other genera than to Cisincisalia. Hence guatemalena should not be associated with either Mitoura or Callophrys, even as these have been defined prior to this paper.

I have examined the genitalia, legs, and palpi of the type specimen.

Quaternary Series Incisalia

(including Incisalia, Novosatsuma)

(IB1bb)

INCISALIA SCUDDER, status revised

Lycus Hübner, 1816, p. 74 (in part). Hübner, Ibid, loc. cit. J. Morris, 1860, p. 11

Licus (sic): Hübner, 1819-1823 [1823], fig. 203. Stuben, 1823, f. 203, 204.

Comstock and Huntington, 1958, p. 110.

Polyommatus Latrielle, 1805, p. 116. J. Morris, 1860, p. 11

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Strymon Hübner, 1816, p. 24. Butler, 1882, p. 470

Thecla Fabricius, 1807, p. 286. Boisduval, 1833, p. 105; 1852, p. 290. Fitch, 1858, p. 57. J. Morris, 1860, p. 11; 1862, p. 98. Reakirt, 1867, p. 146. Scudder, 1872, p. 52; 1876, p. 104. Caulfield, 1875, p. 89. W. Edwards, 1877, p. 4. Worthington, 1880, p. 40. Anon. 1881, p. 5; 1882, p. 3. French, 1882, p. 276. H. Edwards, 1884, p. 478; 1889, p. 57. Fern, 1884, p. 82. Fletcher, 1884, p. 16. Mead, 1884, p. 780. Packard, 1890, p. 767. Blatchley, 1891, p. 408. Smith, 1891, p. 12. Wolcott, 1893, p. 102. Davis, 1895, p. 46. Kirby, 1896, p. 99. Twogood, 1897, p. 31. Cary, 1901, p. 309. Beutenmuller, 1902, p. 32. Smith, Skinner, and Kearfoot, 1903, p. 7. Dyar, 1904, p. 786. Brimley and Sherman, 1903, p. 97. Davis, 1909, p. 6. Williams, 1909, p. 68. Newcomer, 1910, p. 312. Newcomb, 1912, p. 228. Winn, 1912, p. 15. J. Comstock, 1914, p. 35. Williams, 1914, p. 256. Davis, 1915, p. 25. Seitz, 1919, p. 760. Davenport and Dethier, 1938, p. 171.

Thecla (Incisalia) [Incisalia Scudder, 1872, p. 52]: Knobel, 1895, p. 25. W. Holland, 1931, p. 227.

Incisalia Scudder, 1872, p. 52. Dyar, 1904, p. 39. Cook, 1906, p. 182; 1907, p. 186, 234, 258, 405. Grinnell and Grinnell, 1907, p. 45. Skinner, 1907, p. 301. Barnes and McDunnough, 1917, p. 15. Barnes and Benjamin, 1926, p. 18. Blackmore, 1927, p. 10. J. Comstock, 1927, p. 167. Brodie, 1929, p. 4. Clark, 1929a, p. 115; 1932, p. 282. Klots, 1930, p. 161. Wright, 1930, p. 24. Fender, 1931, p. 185. L. Harris, 1931, p. 19; 1950, p. 14. Richards, 1932, p. 70. Remington, 1933, p. 102; 1953, p. 97. dos Passos and Grey, 1934, p. 278. Rogers, 1934, p. 184. Sheppard, 1934, p. 141. Garth, 1935b, p. 48; 1950, p. 32. Clark and Clark, 1937, p. 89; 1951, p. 82. T. Freeman, 1938, p. 246. Leussler, 1938, p. 277. McDunnough, 1938, p. 25. Proctor,

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1938, p. 126. Moore, 1939, p. 16. dos Passos, 1940, p. 167. Brooks, 1942, p. 35. Clench, 1943b, p. 249. Comstock and Huntington, 1943, p. 59. Kimball and Jones, 1943, p. 35. Blevins and Blevins, 1945, p. 123. Leighton, 1946, p. 60. Chermock and Chermock, 1948, p. 212. O. Chermock, 1954, p. 107. Chermock and Frenchin, 1949, p. 212. Merritt, 1950, p. 30. H. Freeman, 1951, p. 39. J. Jones, 1951, p. 20. Klots, 1951, p. 149. Hopfinger, 1953, p. 84. Martin, 1953, p. 77. Ziegler, 1953, p. 34. Voss, 1954, p. 97. Ferguson, 1955, p. 197. Martin and Truxel, 1955, p. 23. Bird, 1956, p. 107. DeFoliart, 1956, p. 98. F. Brown, 1957, p. 142. Clench, 1957, p. 58. Comstock and Huntington, 1958, p. 110. Mather and Mather, 1958, p. 82. Guppy, 1957, p. 170. McGugan, 1958, p. 24. Riotte, 1959, p. 12; 1962, p. 244. Hardy, 1960, p. 70. Moore, 1960, p. 18; 1972, p. 12. Puckering and Post, 1960, p. 26. J. Emmel, 1964, p. 369. dos Passos, 1964, p. 54. Kimball, 1965, p. 48. Shapiro, 1966, p. 33. Shields, 1966, p. 127; 1967, p. 83. Covell, 1967, p. 23. Hemming, 1967, p. 231. Johnson and Nixon, 1967, p. 520. Masters, 1968a, p. 26. Hooper, 1969, p. 8. Azevado, 1970, p. 7. Elrod, 1970, p. 13. Ferris, 1970, p. 4. Anon., 1972, p. 8. Johnson and Malick, 1972, p. 3. Kuehn and Masters, 1972, p. 5. Ehrlich and Ehrlich, 1973, p. 59. Johnson, 1972 (1973), p. 27. Shapiro and Shapiro, 1973, p. 92. Brower, 1974, p. 19. McCabe and Post, 1976, p. 97. Beattie, 1976, p. 30. Tilden and Huntzinger, 1977, p. 183. Wood, undated, p. 301. Miliotus, 1978, p. 4.

Incisalia Minot, ms. unpublished [Scudder, 1872, p. 52]. Seitz, 1919, p. 760.

Thecla = Incisalia = Strymon: Forbes, 1960, p. 129.

Thecla "Grupo (sic) irus" = Incisalia Minot (sic): Hoffman, 1940, p. 707.

Callophrys Billberg, 1820, p. 80. Clench, 1961, p. 204. Emmel and Emmel, 1962a, p. 33. Newcomer, 1962, p. 70. Huber, 1966a, p. 14; 1970, p. 10.

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Downey, 1966, p. 164. Nielson, 1966, p. 41. Rahn, 1966, p. 4. Nordin, 1967-1968, p. 60. Scott, Ellis, and Eff, 1968, p. 164. Catling and Walker, 1970, p. 3. Quinter, 1971, p. 4. Downey and Irwin, 1973, p. 21. L. Miller, 1975, p. 18. Scott, 1975, p. 17.

Callophrys (Incisalia): Ziegler, 1960, p. 21. Clench, 1961, p. 204. dos Passos, 1970, p. 30. Riotte, 1967, p. 135. Masters, 1969, p. 4; 1970 (1971a), p. 40; 1972 (1973), p. 179. Catling and Walker, 1970, p. 3. Ferris, 1971a, p. 35; 1971b, p. 25. Harris, 1972, p. 212. Shull and Badger, 1972, p. 22. Tidwell and Callaghan, 1972, p. 12. Gregory, 1975, p. 34. Johnson, 1975, p. 225. Howe, 1975, p. 289.

DIAGNOSIS. Species of this genus easily identifiable by being brown above and beneath, and with jagged mottled patterns of deep brown or red-brown over a lighter brown ground color generally obscuring any postbasal, mesial, submarginal or marginal patterns. Superficially confusable only with some species of Sandia Clench (sensu this revision), latter which have the same mottled patterns without the concentrically jagged lines and which are organized in postbasal, mesial, submarginal and marginal patterns. The species are all conifer feeders as larvae. The genitalia of both sexes are distinctive.

DESCRIPTION. Adult. Frons profusely hairy but scales of distinct pigmental or structural color. White lining about the compound eye. Legs indicating no apomorph extension of length relative to width. Palpi typically primitive for the Secondary Series Cissatsuma in one species, relativedly derived in two others. Wings about or sometimes exceeding 15 mm. except in one diminutive primitive species. Wing uppersides brown; wing underside with hindwing displaying jagged hoary and mottled patterns of deep brown or red brown over lighter brown. No tails. Male Genitalia: Characterized by a generally

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wide-rimmed and bulbously ovate bilobed configuration and a caudal extension tapering thickly caudad and again abruptly terminally tapered. Female Genitalia: Characterized by widely flared lamellae relative to width of ductus, though latter is relatively wide compared to Nearctic species which might be confused with it (e.g., forb-feeding Sandia, sensu this revision). No transparent areas caudad the antrum, the latter which is only slightly developed if not absent.

BIOLOGY. Early Stages: Described in detail for more familiar Nearctic species (see individual species treatments). Early instar larvae burrow in soft conifer needles, pupate in trash beneath the tree. Foodplants: Oligophagous on various conifers (see individual species treatments). Conifer usage is considered autapomorphic for Incisalia, and may be paralleled by similar usage in the sister taxon Novosatsuma with very similar Palaearctic phenes.

TYPE SPECIES. Licus niphon Hübner, designated by Scudder (1872).

DISTRIBUTION. Spatial: Figs. 517, 518. Boreal Nearctic, and adjoining areas of Pinaceae distribution in the montane west and in scarps and relict areas of the Nearctic Great Plains. Temporal: Known generally from late April through June.

REMARKS. As mentioned above, the three species included by this revision in Incisalia share conifer larval foodplant usage and apomorph genitalic and wing characters separating them from their sister groups in the Secondary Series Cissatsuma. Of primary interest to Nearctic lepidopterists, however, is that cladistic analysis indicates that these three species are not closely related phylogenetically to the several other species formerly placed with Incisalia. Rather, there are eight other genera more closely related to Incisalia phylogenetically than to these other species in the Nearctic. The lumping of these

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Nearctic species into a paraphyletic grade group Incisalia has been because of convergent wing characters derived from a base of primitive wing characters that occur throughout the plesiomorph groups in several clades. Derivation in Incisalia from a wide ductus configuration in the females (which never developed an extensive antrum or an obvious transparent area beneath it, and underwent successive derivation of wider lamellae) is apparent, along with correspondent indications of phylogenetic relations in the males. Quite differently, the obvious derivation of characters in species I now place in Sandia (e.g., augustinus et al.) indicates female configurations derived from Neotropical ancestral stock with a thin ductus, and an obvious antrum with large transparent area beneath (e.g., taxa fusius and marialis formerly placed in Cyanophrys). The wing patterns of these groups are resemblant as convergent autapomorphies. Also, the palpi of all the species I place in Sandia correspond with derivation from the plesiomorph pattern of sexual dimorphism apparent in the taxa fusius and marialis, while those of Incisalia correspond to Cissatsuma, with one species clearly exhibiting primitive conditions found only at more basic branching points in the cladogram of the Callophryina. Hence, Nearctic lepidopterists would be ill-advised to lump the taxa formerly placed in Nearctic Incisalia on phenetic grounds of relative superficial similarity of the wings unless it is their intent to create an obviously paraphyletic group, which can only obscure any worldwide phylogenetic or biogeographic considerations of the taxa.

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Incisalia niphon (Hübner)

Figs. 141, 142, 386

Licus (sic) niphon Hübner, 1819-1823 [1823], fig. 203. Stuben, 1823, f. 203, 204.

Thecla niphon: Boisduval, 1833, p. 105. Fitch, 1858, p. 57. J. Morris, 1862, p. 98. Reakirt, 1867, p. 146. Kirby, 1871, p. 399. Scudder, 1872, p. 52. Caulfield, 1875, p. 89. W. Edwards, 1877, p. 41. Worthington, 1880, p. 48. Anon., 1881, p. 5; 1882, p. 3. French, 1882, p. 276. Fern, 1884, p. 82. Fletcher, 1884, p. 16. H. Edwards, 1884, p. 478; 1889, p. 57. Packard, 1890, p. 767. Blatchley, 1891, p. 408. Smith, 1892, p. 12. Wolcott, 1893, p. 102. Davis, 1895, p. 46. Beutenmulluer, 1902, p. 32. Brimley and Sherman, 1903, p. 97. Davis, 1909, p. 6. Newcomb, 1912, p. 228. Winn, 1912, p. 15. J. Comstock, 1914, p. 35. Davis, 1915, p. 25. Seitz, 1919, p. 760. Davenport and Dethier, 1938, p. 171.

Thecla plautus Scudder, 1872, p. 52 (nec. plautus Fabricius).

Thecla nipha (sic): J. Morris, 1860, p. 12.

Polyommatus nipha (sic): J. Morris, 1860, p. 12.

Lycus nipha (sic): J. Morris, 1860, p. 12.

Thecla (Incisalia) niphon: Knobel, 1895, p. 25. W. Holland, 1931, p. 227.

Incisalia niphon: Scudder, 1872, p. 52. Dyar, 1902, p. 39. Cook, 1906, p. 182; 1907, p. 186, 234, 258, 405; 1909, p. 141. Skinner, 1907, p. 301. Barnes and McDunnough, 1917, p. 15. Barnes and Benjamin, 1926, p. 18. Forbes, 1928, p. 680. Brodie, 1929, p. 4. Clark, 1929a, p. 115; 1932, p. 282. L. Harris, 1931, p. 19; 1950, p. 14. Richards, 1932, p. 70. Remington, 1933, p. 102; 1953, p. 97. Rogers, 1934, p. 184. Sheppard, 1934, p. 143. Clark and Clark, 1937, p. 89; 1951, p. 82. T. Freeman, 1938, p. 246. McDunnough,

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1938, p. 25. Proctor, 1938, p. 186. Moore, 1939, p. 16. Brooks, 1942, p. 35. Clench, 1943a, p. 249. Comstock and Huntington, 1943, p. 59. Kimball and Jones, 1943, p. 35. Chermock and Chermock, 1948, p. 212. O. Chermock, 1954, p. 107. Merritt, 1950, p. 30. H. Freeman, 1951, p. 39. Klots, 1951, p. 149. Ziegler, 1953, p. 34. Voss, 1954, p. 97. Ferguson, 1955, p. 197. F. Brown, 1957, p. 142. Mather and Mather, 1958, p. 82. McGugan, 1958, p. 26. Riotte, 1959, p. 12; 1962, p. 244. Moore, 1960, p. 18; 1972, p. 12. dos Passos, 1964, p. 54. Kimball, 1965, p. 48. Shapiro, 1966, p. 33. Covell, 1967, p. 23. Shields, 1967, p. 83. Masters, 1968a, p. 26. Hooper, 1969, p. 8. Azevedo, 1970, p. 7. Elrod, 1970, p. 13. Johnson and Malick, 1972, p. 3. Kuehn and Masters, 1972, p. 5. Johnson, 1972 (1973), p. 27. Shapiro and Shapiro, 1973, p. 92. Miliotus, 1978, p. 4.

Callophrys niphon: Huber, 1966a, p. 14; 1970, p. 10. Downey, 1966, p. 164. Rahn, 1966, p. 4. Catling and Walker, 1970, p. 3. Quinter, 1971, p. 4. Downey and Irwin, 1973, p. 21.

Callophrys (Incisalia) niphon: Ziegler, 1960, p. 21. Clench, 1961, p. 204. dos Passos, 1964, 1970, p. 31. Riotte, 1967, p. 135; 1971, p. 18. Masters, 1969, p. 4; 1972 (1973), p. 179. Shull and Badger, 1972, p. 22. Harris, 1972, p. 212. Gregory, 1975, p. 34. Howe, 1975, p. 289.

species niphon: Comstock and Huntington, 1961, p. 196

DIAGNOSIS. Recognized by highly mottled browns, blacks, and whites beneath. Distinguishable from lanoraieensis by lack of "Thecla-spot" in cell distad between veins Cu_1 and Cu_2 and lacking postbasal markings continuous from costa to anal margin paralleling emphatic marginal edging of basal disc. Distinguished from eryphon by last mentioned trait above, and by the reduction of absence of markings in cell of the forewing underside.

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DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 386) and frons as typical of the genus. Upper Surface of the Wings: Ground color warm Prouts Brown often with Amber cast distad in discal cell. Hindwing often lighter limbally. Margin of hindwing deeply crennated; fringe deep Raw Umber occasionally scattered paler. Under Surface of the Wings: Ground color, forewing, light Cinnamon Brown; basal area and part of cell distad between veins Cu_2 and 2A often suffused darker. Deep red-brown (Smith's Bright Russet to Garnet Brown) with black slash centrad in discal cell connecting to costa, edged faintly white distad; deep brown to black slash distad in discal cell, edged distad with white. Postmedian line emphatic, costa to vein M_3, displaced distad between veins M_3 and Cu_2, again basad between veins Cu_2 and 2A. This line broadly brown to blackish-suffused basad, widely white distad. Distad postmedian line, brown to black-suffused chevrons between veins, costa to vein 2A. Margin widely brown to blackish-suffused basad, light russet centrad, black distad, broken into checkered fringe, white between the veins, black on the veins. Hindwing basal disc usually somewhat darker from rest of ground color. Postbasal markings irregular, usually reduced between Sc + R_1 and Rs, emphatic and distally displaced in discal cell: deep brown to black distad, widely white basad, absent to faint from cell to anal margin. Distad postbasal marking in discal cell, a second black to brown slash in cell of basal disc, deep brown to black but not as edged with white as former. Margin of basal disc irregular, deeply brown basad, black centrad, widely white distad. Distad margin of basal disc, ground color lighter Cinnamon Brown. Crescent line irregular, often continuously connected where it occurs. Distad crescent line deep submarginal russet, suffused gray between the veins, then lighter ground color distad to the margin; fringe brown basad, lighter distad. Length of Forewing: $\bar{X}$ of 15 specimens (AMNH) 15.2 mm., range 14.6 mm. to 15.8 mm. Female: Head,

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thorax, abdomen, legs, palpi (Fig. 386) and frons as typical of the genus. Upper Surface of the Wings: Similar to males, but with lighter areas of Amber or darker Chestnut in centrad patches, and limbally on the hindwing. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 15 specimens (AMNH) 15.5 mm., range 15.0 mm. to 16.0 mm. Male Genitalia: Fig. 141. Valvae, caudad saccus, clear, extremely wide-rimmed, shouldered; valvae, lateral view, funneled; valvae, caudal extension tapered; saccus reduced (length less than length of bilobed configuration of valvae); cornuti as illustrated. Female Genitalia: Fig. 142. Lamella postvaginalis of extreme breadth (breadth = two-thirds length of ductus cephalad lamella antevaginalis) and folded into two bilateral lobes, each with ventrad convolutions. Lamella antevaginalis extremely thin, present only as slight lip around ductus. Ductus narrowed centrad, flared at antrum and before corpus bursae. Transparent area between base of antrum and cephalad three-quarters of ductus length. Signum a single curved spine. For comparison with eryphon, see "Female Genitalia" under that taxon.

BIOLOGY. Early Stages: The egg was described by Fletcher (1884), the larva by Saunders (1868). Foodplants: The following foodplants have been reported in the literature: Pinus rigida, P. banksiana (Pinaceae), Clench, 1961; Howe, 1975.

TYPE. Location unknown, but original figure unambiguous. No neotype is designated. Type Locality: Florida.

DISTRIBUTION. Spatial: Fig. 517. From central southern United States north to Nova Scotia; westward across southern Canada and Great Lakes area of United States to southern Manitoba. Relict populations in Colorado "Front Range" of Rocky Mountains. Temporal: Univoltine. Flying from March through April in southern United States, late April into early June northward.

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REMARKS. Only one author (dos Passos, cited in pers. com. with Voss, 1954) has questioned the nonconspecificity of this species and its western sister species eryphon. My studies support their distinction as sister species.

In total, just over three hundred specimens were examined. Forty-two specimens were dissected for genitalia, legs, and palpi, from localities listed in Material Examined (Appendix).

Incisalia eryphon (Boisduval)

Figs. 143, 144, 387

Thecla eryphon Boisduval, 1852, p. 290; 1869, p. 14. J. Morris, 1860, p. 11. Scudder, 1876, p. 104 (to Incisalia, suggested). W. Edwards, 1877, p. 4. Anon., 1882, p. 3. H. Edwards, 1884, p. 478. Mead, 1884, p. 70. Smith, 1891, p. 12. Kirby, 1896, p. 99. Twogood, 1897, p. 31. Cary, 1901, p. 309. Skinner, Smith, and Kearfoot, 1903, p. 7. Dyar, 1904, p. 786. Williams, 1909, p. 68. Newcomer, 1910, p. 312. J. Comstock, 1914, p. 35. Williams, 1914, p. 265. Seitz, 1919, p. 760.

Thecla eriphon (sic): J. Morris, 1862, p. 100.

Lycus eryphon: J. Morris, 1860, p. 11.

Polyommatus eryphon: J. Morris, 1860, p. 11.

Strymon eryphon: Butler, 1882, p. 470.

Thecla (Incisalia) eryphon: W. Holland, 1931, p. 227.

Incisalia eryphon: Dyar, 1904, p. 39. Grinnell and Grinnell, p. 45. Barnes and McDunnough, 1917, p. 15. Barnes and Benjamin, 1926, p. 18. Blackmore, 1927, p. 10. J. Comstock, 1927, p. 167. Klots, 1930, p. 161. Wright, 1930, p. 24. Fender, 1931, p. 185. Sheppard, 1934, p. 142. Garth, 1935b, p. 28;

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1950, p. 32. Leussler, 1938, p. 277. McDunnough, 1938, p. 25. dos Passos, 1940, p. 167. Blevins and Blevins, 1945, p. 123. Leighton, 1946, p. 60. Chermock and Frenchin, 1949, p. 212. J. Jones, 1951, p. 20. Hopfinger, 1953, p. 84. Martin, 1953, p. 77. Martin and Truxel, 1955, p. 23. DeFoliart, 1956, p. 98. F. Brown, 1957, p. 142. Clench, 1957, p. 58. Guppy, 1958, p. 170. McGugan, 1958, p. 25. Hardy, 1960, p. 70. Moore, 1960, p. 18. Puckering and Post, 1960, p. 26. dos Passos, 1964, p. 55. J. Emmel, 1964, p. 369; 1972, p. 3. Shields, 1966, p. 127; 1967, p. 83. Johnson and Nixon, 1967, p. 520. Hooper, 1969, p. 8. Elrod, 1970, p. 13. Ferris, 1970, p. 4. Anon., 1972, p. 8. Ritterbush, 1972, p. 10. Leighton, 1972, p. 12. Johnson, 1972 (1973), p. 27. Ehrlich and Ehrlich, 1973, p. 59. McCabe and Post, 1976, p. 97. Tilden and Huntzinger, 1977, p. 183. Wood, undated, p. 301.

Callophrys eryphon: Emmel and Emmel, 1962, p. 33. Newcomer, 1962, p. 70. Nielson, 1966, p. 41. Nordin, 1967-1968, p. 60. Scott, Ellis, and Eff, 1968, p. 164. Scott, 1975, p. 17.

Callophrys (Incisalia) eryphon: Ziegler, 1960, p. 21. Clench, 1961, p. 204; 1963, p. 38. Masters, 1969, p. 4; 1970 (1971a), p. 40. Riotte, 1967, p. 135; 1971, p. 18. dos Passos, 1970, p. 31. Catling and Walker, 1970, p. 3. Ferris, 1971a, p. 35; 1971b, p. 25. Tidwell and Callaghan, 1972, p. 12. Johnson, 1975, p. 225. Gregory, 1975, p. 34. Howe, 1975, p. 289.

species eryphon: Comstock and Huntington, 1960, p. 58.

DIAGNOSIS. Distinguished from sister species niphon by eryphon's post-basal markings continuous from costa to anal margin, parallelling the marginal edging of the basal disc, and having emphatic markins usually apparent in the cell of forewing underside. Pattern otherwise jagged, obscuring wing area

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generalities. Recognizable from more similar sister species lanoraieensis by latter's diminutive size (usually with wing length under circa 13 mm.) and latter's distinctive "Thecla-spot" between veins Cu_1 and Cu_2 on the hindwing under surface.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 387) and frons as typical of the genus. Upper Surface of the Wings: Ground color dark Prouts Brown to lighter Amber; male scent patch distad in discal area. Hindwing often lighter limbally. Margin of hindwing deeply crennated; fringe dark basad, often paler to white distad. Under Surface of the Wings: Ground color light Ochraceous Salmon, forewings, and distad the basal area and in submargins of the hindwings. Forewing with darker Ochraceous Salmon basad, small spot distad in discal cell; regular postmedian line, costa to vein Cu_2, Hay's Russet basad, black centrad, white distad; submarginal Hay's Russet chevrons costa to vein Cu_2 or 2A followed distad by Hay's Russet blotching along entire forewing margin. Fringes checkered white between veins, russet to brown on the veins. Hindwing basal disc darker Ochraceous Salmon; postbasal markings forming line from costa to anal margin; ground color lighter basad, then darker brown distad toward margin of basal disc. Margin of basal disc deep Hay's Russet distad, lighter Ochraceous Salmon ground color distad to this. Crescent line jagged Hay's Russet framing lighter Ochraceous Salmon areas along the entire terminus. Black line along margin, fringe checkered white and deep brown. Length of Forewing: $\bar{X}$ of 15 specimens (AMNH), 15.5 mm., range 15.1 mm. to 16.0 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 387) and frons as typical of the genus. Upper Surface of the Wings: Similar to males, but with lighter areas centrad, both wings and limbally, hindwing. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 15 specimens (AMNH), 15.6 mm., range 15.0 mm. to 16.2 mm. Male Genitalia: Fig. 143. Valvae, caudad saccus, clear, wide-

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to mid-rimmed, unindented, shouldered with cephalad extension to unindented tip quite pointed; valvae, lateral view, funneled; valvae, caudal extension stair-step; caudal extension very short, barely exceeding caudal extension of the articulation of the falces; saccus widely parabolic, about same length as bilobed configuration of valvae; cornuti as illustrated. Female Genitalia: Fig. 144. Lamella postvaginalis wide (about one-half length of ductus cephalad lamella antevaginalis), but not widely bilobed like niphon, not convoluted ventrad. Antrum very exaggerated, flaring widely like a cup caudad one-ninth of ductus. Transparent area immediate cephalad antrum two-ninths to one-third length of ductus. Cephalad end of ductus flared outward. Signum as broad spine slightly bifurcate centrad.

BIOLOGY. Early Stages: Unknown. Foodplant: Ribes sp. Tietz, 1972 (doubtful); Pinus ponderosa Clench, 1961, Johnson and Nixon, 1967, Johnson, 1972 (1973), Ferris, 1971b; P. contorta Clench (loc. cit.); Pinus sp. F. Brown, 1957, Howe, 1975.

TYPE. Holotype male in the NMNH. Type Locality: California.

DISTRIBUTION. Spatial: Fig. 518. In montane areas of the United States and Canada: from western Nebraska and Black Hills of South Dakota westward to coastal and Sierra ranges; southward to eastern Arizona and central New Mexico; northward to southern British Columbia and southwestern Alberta. Eastward across southern Canada in scattered populations in Saskatchewan, Manitoba, Quebec, and Maine. Temporal: Univoltine, flying from early May into June on western Great Plains, late May into early July in western montane areas of the United States.

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REMARKS. My studies support the nonconspecificity of this species and niphon, and indicate that these two species are immediate sister taxa which together are the apomorph sister taxa of relatively plesiomorph lanoraieensis.

In total, just over five hundred specimens were examined. The type and eighty-two other specimens were dissected for genitalia, legs, and palpi, from the localities listed in Material Examined (Appendix).

Incisalia lanoraieensis Sheppard

Figs. 145, 146, 388

Incisalia lanoraieensis Sheppard, 1934, p. 141. dos Passos and Grey, 1934, p. 278. McDunnough, 1938, p. 25. Klots, 1951, p. 148. Martin and Truxel, 1955, p. 23. McGuggan, 1958, p. 24. dos Passos, 1964, p. 55. Brower, 1974, p. 19.

Thecla lanoraieensis: Forbes, 1960, p. 132

Callophrys lanoraieensis: Clench, 1961, p. 204. L. Miller, 1975, p. 18.

Callophrys (Incisalia) lanoraieensis: Ziegler, 1960, p. 21. dos Passos, 1970, p. 31. Masters, 1970 (1971a), p. 40. Gregory, 1975, p. 34. Howe, 1975, p. 289.

species lanoraieensis: Comstock and Huntington, 1961, p. 106.

DIAGNOSIS. Can be immediately recognized by its similarity to eryphon and niphon, but smaller in size (forewing length usually circa 13.5-14.0 mm., not circa 15.0 mm.) and with a "Thecla-spot" distad between veins Cu_1 and Cu_2, and long postbasal lines paralleling the markings of the edge of the basal disc. The species is most similar in wing pattern to eryphon, but generally lanoraieensis is found within the distribution area of niphon.

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DESCRIPTION. Male: Head, thorax, abdomen, legs and frons as typical of the genus; palpi primitive (Fig. 388). Upper Surface of the Wings: Ground color very dark Mummy to Prouts Brown throughout; male scent patch distad in the discal area of the forewing; limbal areas of hindwing often slightly lighter, toward Amber. Margin of hindwing moderately crennated, fringe dark basad and often on vein-ends, sometimes lighter distad. Under Surface of the Wings: Extremely mottled browns and whites. Forewing ground color Ochraceous Salmon to Fawn Color. Dark Auburn to darker brown blotches centrad and distad in the discal cell, edged white to Ochraceous Salmon. Postmedian line from costa to vein Cu_2 or even 2A, deep brown to black basad, white distad. Ground color distad postmedian line hardly lighter than rest of wing; deep Auburn to black submarginal spots between the veins except in cell Cu_2. Marginal black to deep brown line from costa to at least vein Cu_2, followed distad by light Fawn Color and pale fringe. Hindwing, heavily mottled: area of basal disc consequently less obvious. Ground color Fawn to Ochraceous Salmon; basal slash and postbasal lines sometimes extending to anal margin, Auburn to blackish distad, white basad. Margin of basal disc paralleling postbasal lines, deep Auburn to blackish basad, white distad. Ground color brown, often exaggerated between the veins. Distad margin of basal disc Fawn to Ochraceous Salmon, suffused with darker brown. Crescent line appearing as irregular emphatic blotches between the veins, followed distad by black markings between veins Rs and M_1, faintly between other veins and emphatically between veins Cu_2 and Cu_1, or sometimes 2A and Cu_2. Black line along the margin, fringe checked black and white. Length of Forewing: $\bar{X}$ of 6 specimens (AMNH) 13.9 mm., range 13.7 mm. to 14.5 mm. Female: Head, thorax, abdomen, legs and frons as typical of the genus; palpi primitive (Fig. 388). Upper Surface of the Wings: Similar to males; lacking scent patch distad in discal area, forewing. Wing with some slightly

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lighter areas of ground color centrad on both wings or limbally on hindwing. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 6 specimens (AMNH) 14.3 mm., range 14.0 mm. to 14.8 mm. Male Genitalia: Fig. 145. Valvae, caudad saccus, clear, mid-rimmed, parabolic and indented; valvae, lateral view, round-tapered; valvae, caudal extension, stair-step, maximum width somewhat less than one-third length. Saccus, long (exceeding length of bilobed configuration of valvae), broadly funneled; cornuti as illustrated. Female Genitalia: Fig. 146. Lamella postvaginalis broad (breadth equal to length of ductus caudad antrum) but not folded or convoluted ventrad. Antrum exaggerated (widely flared one-quarter length of ductus) and very transparent centrad. Limited transparent area caudad antrum. Lamella antevaginalis is diminutive, only as lips distad antrum. Signum a broad trifurcate spine with centrad spine three times length of other two.

BIOLOGY. Early stages: Unknown. Foodplant: Picea nigra (Pinaceae), Klots, 1951; Clench, 1961; Tietz, 1968; Howe, 1975.

TYPES. Holotype male, allotype female. Canadian National Collection, Ottawa. Type Locality: Lanoraie, Quebec Province, Canada (40 miles east of Montreal).

DISTRIBUTION. Spatial: Fig. 517. Scattered populations in spruce bogs; known from the States of Maine and New Hampshire (United States) and from Quebec and New Brunswick Provinces (Canada). Temporal: Univoltine, May into June.

REMARKS. This diminutive species was called to the attention of Nearctic lepidopterology by Sheppard in 1934. Since that time, populations encompassing a larger area of boreal eastern North America where Picea nigra grows have been discovered. Lepidopterists have generally thought it a

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derivative of insular evolution. The cladistic analysis indicates, however, that lanoraieensis is the primitive species of the genus and its populations apparently indicate relict patterns from a former larger distribution area on spruce. The species eryphon is the least derived of the Incisalia, indicating that niphon (the most derived) was a later addition to the eastern Nearctic boreal fauna after eryphon and lanoraieensis precursors were already in place. It may be that niphon evolved as an eastward manifestation of eryphon, as has been demonstrated as probable in relation to another conifer feeding group (Mitoura spp. on Cupressaceae) and its associated co-evolving plants (see Johnson, 1972, 1978; Van Haverbeke, 1968); in this case niphon populating eastward and northward would have come into sympatry with northern boreal populations of lanoraieensis and eryphon (now known also from the east) already in place.

In total, fifty specimens were examined; six specimens were dissected for genitalia, legs, and palpi, from the localities listed in Material Examined (Appendix).

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NOVOSATSUMA, NEW GENUS

Lycaena Fabricius, 1807, p. 285 (in part). de Niceville, 1891, p. 374.

Thecla Fabricius, 1807, p. 286 (in part). Pratt, 1892, p. 254. Kirby, 1896, p. 398.

Satsuma Murray, 1874, p. 168 [nec. Satsuma Adams, 1868, p. 463] (in part). Murray, 1874, p. 168. Seitz, 1919, p. 263. Okamoto, 1923, p. 68. Matsumura, 1929, p. 23. Doi, 1931, p. 46. Uchida, 1932, p. 316. Nakayama, 1932, p. 381. Seok and Takacuka, 1932, p. 316. Seok, 1933, p. 70; 1934, p. 763; 1935, p. 99; 1936, p. 64. Mori, Doi, and Cho, 1934, p. 44. Seok and Nishimoto, 1935, p. 97. Haku, 1936, p. 117. Esaki, 1939, p. 219. Sibatani, 1946, p. 64. Schwanwitsch, 1948, p. 256. Miyajima, undated, p. 175.

Callophrys Billberg, 1820, p. 80 (in part). Swinhoe, 1910-1911, p. 257 (Satsuma = Callophrys synonymy in error).

Ginzia Okano, 1941, p. 239 (in part). Okano, 1941, p. 239. Korschunov, 1972, p. 359.

Ginsia (sic) (in part): Korschunov, 1972, p. 359.

Ahlbergia Bryk, 1946, p. 50 (in part). Bryk, 1946, p. 50. Kuroko, 1957, p. 98. Kim, 1961, p. 278. Shirozu and Hara, 1962, p. 94.

Incisalia Scudder, 1872, p. 52 (in part). F. Brown, 1947, p. 21 (places all Satsuma sens. lat. with Incisalia in comment). Gillham, 1956, p. 149 (Satsuma = Incisalia) (synonymies in error).

DIAGNOSIS. This is a highly derived group of Palaearctic taxa which is the immediate sister group of Nearctic Incisalia and as such are more related to each other than to the other taxa in their regions with similar primitive wing

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patterns commonly recognized as mottled and hoary beneath. As a diverse and derived group, character states in Novosatsuma are various but several characters of the wing are superficially useful in recognizing them: all Palaearctic hairstreaks with the mottled and hoary underside (formerly thought characteristic of the polyphyletic genus Ahlbergia) with males iridescent blue above over most of the wing, even around the male scent patch, are of this genus. This is a unique character reversal from what had been considered the norm of Palaearctic members of the Ahlbergia phenotype, e.g., males brown above, females blue above. In Novosatsuma almost all the males are blue above, and the genus includes species with females blue above, brown above, or combinations. The only previously described species in this genus of eight species, pratti Leech, is only flecked blue above on males. For apomorphic characters distinguishing Novosatsuma see Cladistic Analysis, Novosatsuma.

DESCRIPTION. Adult: Head with frons hairy but lacking any scales of distinct coloration. Compound eye lining white. Legs without elongation relative to width, latter indicative of apomorphy in Callophryina. Palpi typical of primitive condition of Secondary Series Cissatsuma, but second segment elongated apomorphically in some taxa. Wings large, forewing expanse often exceeding 15 or 16 mm, untailed. Males in most species bright iridescent blue above over most of wing, even around male scent patch; females variously blue, brown, or combinations of above. Undersides with jagged patterns of hoary and mottled deep browns or red-browns in some species; hoary patterns of deep gray in others. Male Genitalia: Characterized by bulbously ovate and often wide-rimmed bilobed configuration, and thickly tapering caudal extension tapering again at the terminus. Female Genitalia: Ductus wide, but made more diminutive looking by expanse of lamellae, five to six times width of former. Ventral sclerotized invaginations often on lamellae; signum often reduced to small broad-based spine.

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BIOLOGY. Early Stages: Unknown. Foodplants: Unknown, but possibility of parallel usage of conifers as in morphologically similar sister group in Nearctic of great interest.

TYPE SPECIES. Novosatsuma monstrabilis, new species.

DISTRIBUTION. Spatial: Figs. 520, 521. The taxa of Novosatsuma are generally distributed across China (including central and eastern Tibet, Mongolia) into the Amur region of the Soviet Union and northwest Korea (Manchuria). They seem to be absent from the lowlands of southeastern China; most taxa are montane. Temporal: Known from May to July.

REMARKS. The number of new species of Palaearctic hairstreaks (or "elfins", in this case) formerly associated with the name Ahlbergia (Ginzia or Satsuma) which are described in this revision are undoubtedly a surprise to lepidopterology. The species of Novosatsuma illustrate a major point in this diversity--the character of blue males, instead of blue females, is so extreme as to be completely contrary to the previous assumptions about the phene of Ahlbergia in the Palaearctic. The assumption of brown males and blue females seems to have been so strong that two of the species of Novosatsuma were represented in the type series of species of Ahlbergia with brown males and blue females. Although the male scent patch (subsequently confirmed by dissection of genitalia and examination of the forelegs) was obvious, they were lumped with females of other species. The other new taxa in this group come from uncurated and undetermined material in the British Museum which before this study had not been examined, but yielded a diverse series of new taxa. The discovery of so radical a new group, its cladistic relation to Nearctic conifer-feeding Incisalia (sensu this revision), and its representing a clade primitive and more distantly related to the other "Ahlbergia" in the Palaearctic exhibiting hoary and mottled

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brown undersides, is of extreme interest. It may indicate the relative amount of time this group and allies have been in place in eastern Asia; the number of species in the montane regions exhibiting very different character states (e.g., collosa, larger than any previously known Ahlbergia sens. lat. and with male brown above, and monstrabilis, large but exotically bright silver blue above on the males) emphasizes this consideration. Formerly the Palaearctic elfins had been considered a group of a few species, hardly as diverse as Nearctic taxa. The situation is actually the reverse. The occurrence of a taxon of this clade in Guatemala suggests a former ancestral distribution (Holarctic and Central American) followed by subsequent vicariance.

ETYMOLOGY. The Latin prefix "Novo" meaning "most advanced," "newest," or "most recent" refers to the apomorph nature of this genus and is attached to the formerly used name for the polyphyletic grade group in the Palaearctic, Satsuma. The gender is considered feminine.

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SPECIES GROUPS (2)

1. The pratti Group

including collosa; magnasuffusa; plumbagina; pratti[15]

A. Cladogram and Characters, Fig. 552.

B. Distribution, Fig. 550.

Novosatsuma colossa, new species

Figs. 21, 147, 389

DIAGNOSIS. This species is related to N. pratti, but lacks any steel blue above, being completely light brown, and also lacks crennation of the hindwing margin. On the caudad vein M_3 underside, there is no white on the postmedian line of the forewing or caudad vein Rs on the hindwing as on pratti. The known specimen is also much larger than known examples of pratti.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 389) and frons as typical of the genus. Upper Surface of the Wings: Light Raw Umber throughout; scent scale at distal end of discal cell. Forewing margin moderately crennated, hindwing entire until vein M_3, thereafter moderately crennated. Under Surface of the Wings: Forewing warm Sayal Brown, yellowish distad

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[15]Because of the lack of knowledge of both sexes in most species, the hierarchy should be considered unresolved. However, a cladogram of available characters suggests the relationships shown in Figures 552, 553.

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brown postmedian line connecting costa and vein Cu_1, brownish toward Snuff Brown and Sepia basad. Prominent brown spot at distal end of discal cell. Margin very dark corresponding to hindwing color (see below), with slight white fringing between the veins. Hindwing entirely dark brown, darker than any Ridgway brown, approaching the Dusky Brown of Smithe (1975), dusted with black. Outstanding white marking across cell between veins Sc + R_1 and Rs, but no farther, and from the anal margin to vein 3A. Length of Forewing: Holotype, 16 mm. Hindwing expansive, 16 mm. from base of discal cell to distal end of vein Cu_1. Female: Unknown. Male Genitalia: Fig. 147. Resembling pratti but shape of valvae caudad saccus narrow-rimmed and oval, not mid- to wide-rimmed and shouldered. Caudal extension of valvae nearly straight, not shouldered as on pratti. Lateral view, valvae, somewhat chevron-tapered; saccus, funnel; cornuti as illustrated. Female Genitalia: Unknown.

TYPE. Holotype male (Fig. 21), Saio-Lou (= Siho, with suffix), Kansu Province, China, by native collectors, 1896; deposited in BMNH.

DISTRIBUTION. Spatial: Known only from the type locality. Temporal: Unknown.

REMARKS. The label on this specimen is the printed kind typical of the BMNH collection and which refers to "Tibet" or "collected by Tibetans" (translation from French, mine). Actually, these areas are now in west China. Saio-Lou is assumed as Siho; the frequent adding of "Lou" to town names is characteristic of these labels.

ETYMOLOGY. The Latin name (from "collos") refers to the size of this insect, the largest of these groups from Asia.

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Novosatsuma magnasuffusa, new species

Figs. 22, 148, 390

DIAGNOSIS. Wing patterns nearly identical with Cissatsuma wellsorum, but genitalia place magnasuffusa in another species group. Male genitalia of magnasuffusa resemble N. pratti, having obvious shouldered caudad extension of the valvae and wide-rimmed, oval configuration caudad the saccus, while wellsorum is like tuba and contexta, obviously tapered caudad extension of the valvae and a shouldered configuration caudad the saccus. Known specimen of magnasuffusa with ratio of wing length (base to apex) to wing width (distal ends of margin caudad vein 2A to vein R_4) 1.36, whereas same for three males of wellsorum is $\bar{X}$ 1.63, giving magnasuffusa the "broad-winged" appearance of pratti and collosa. Known specimen also has third postbasal marking in basal disc.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 390) as typical of the genus. Upper Surface of the Wings: Uniformly deep Raw Umber; male scent patch distad in the discal area. Faint line of blue along margin of hindwing from vein 3A to 2A. Margins strongly crennated; fringe brown with slight gray. Under Surface of the Wings: Forewing heavily overcast with warm Verona Brown over lighter ground color throughout. Wavy postmedian line running deep brown to black basad, faintly white distad, from costa to vein Cu_2. Light slash marking at distad end of discal cell. Marginal line on wings slightly darker brown, faintly edged basad between the veins with gray. Hindwing lighter Snuff Brown, overscaled with warmer Verona Brown. Basal disc Warm Sepia especially overscaled brown to black basad; margin of disc deep brown basad, faintly blackish centrad, whitish distad, especially white from anal margin to

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vein 2A. Two postbasal slashes broadly brown distad, white flecked basad, and a third faintly visible along vein 2A and noticeable by white flecking. Distad the basal disc wing lighter, with dark brown crescent line followed by lighter Snuff Brown heavily overscaled with gray or tawny, then strong brown along the terminus to the brown-fringed crennated margin. Length of Forewing: Holotype, 15 mm. Female: Unknown. Male Genitalia: Fig. 148. Similar to pratti and collosus. Valvae caudad saccus extremely wide-rimmed, shouldered; valvae, lateral view, funneled and with peculiar irregular shape between dorsal and ventral articulations of the valvae to the vinculum; valvae caudad extension distinctly shouldered; saccus, funnel; cornuti as illustrated. Female Genitalia: Unknown.

TYPES. Holotype male (Fig. 22), Chow-pin-sa, = two adjoining cities in Yunnan Province, China, Chao, and Pincha, "M and J" (meaning unknown, possibly "May and June"). Deposited BMNH. Paratypes: BMNH; same data as holotype (two males).

DISTRIBUTION. Spatial: Known only from the type locality. Temporal: Perhaps May and June, if part of label reading "M and J" indicates this.

REMARKS. The female of magnasuffusa is unknown but would likely prove very useful in separating it from tuba and wellsorum, both of which evidence the extremely long, bulbular ductus. From the male genitalia of magnasuffusa, placing it in the pratti-collossa group, one would expect the female genitalia of the former to resemble these latter species.

ETYMOLOGY. The name is a combination of Latin roots referring to "large" (magna) and "brown" (suffusa), indicating the broad-winged configuration typical of this species group and the general coloration.

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Novosatsuma plumbagina, new species

Figs. 19, 149, 391

Satsuma pratti: Leech, 1893-94: p. 355. South, 1902: p. 140 (misidentification).

DIAGNOSIS. This species superficially resembles N. pratti; the holotype of the new species was placed as a pratti cotype by Leech (see below). Above, plumbagina is much brighter silver-blue than pratti and, distinctively, the margin of this blue with the deep brown submarginal black of the hindwing is smooth and entire, not deeply jagged as in pratti. The underside of plumbagina displays patterns of deep charcoal (or graphite-like) black-brown, not the warm browns of pratti. The female genitalia are very different from pratti: the ductus is much shorter (breadth of lamellae nearly equalling length of ductus from base of antrum[pratti, same ratio nearly two times]), and the antrum widely flared meeting extremely wide lamella antevaginal lips, and with unique sclerotized plates ventrad on same.

DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, legs, palpi (Fig. 391) and frons as typical of the genus. Upper Surface of the Wings: Apical and submarginal area of forewing and slash at distal end of discal cell deep Raw Umber; discal and basal area, forewing, and all but terminal area of hindwing shiny Pale Medici Blue, terminal area of latter deep Raw Umber, meeting the hindwing blue in a broad smooth margin curved about the wing. Blue marginal line from anal margin to vein M_3 or M_2; margins deeply crennated, fringe black. Under Surface of the Wings: Ground color combinations of brownish black darker than any color in Ridgway. Ground color Smithe's Fuscous, with basal disc and forewing area basad postmedian line Dark Grayish Brown, the

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former heavily overcast with Dusky Brown. Forewing with wavy postmedian line from costa to vein Cu_2, Dusky Brown basad, black centrad, white distad; deep Dusky Brown spot distad in discal cell. Hindwing Dark Grayish Brown basal disc margined slightly with white and with obvious white markings from anal margin to vein 2A and between veins Sc + R_1 and Rs. Limbal area of hindwing heavily flecked with alternating Dusky Brown and pale gray. Fringe black. Length of Forewing: 16 mm. (holotype). Male Genitalia: Unknown. Female Genitalia: Fig. 149. Unique; ductus bursae nearly same length as breadth of lamellae. Antrum extremely flared outward to large lips of lamella antevaginalis. Ventral surface of lamella antevaginalis with two large sclerotized plates; signa small and bifurcate.

TYPE. Holotype female (Fig. 22), Chia-kou-ho (= Chia Ho, river basin), northern Hupeh and southern Shensi provinces, China, 1700 ft., A. E. Pratt collector, July, 1889. Other labels: cotype female, Leech; Leech Collection 1901-173. Satsuma pratti (see below in REMARKS). Deposited BMNH.

DISTRIBUTION. Spatial: Known only from the type locality. Temporal: July.

REMARKS. The holotype of this species was included by Leech in his "cotype" series of pratti. It is among those specimens noted by him as from the "Kuikiang" region that looked "different". There is a large region of gorges and lakes in northern Hupeh and southern Shensi provinces with many names based on the root Kiang (see REMARKS under pratti). All the pratti specimens of Leech are from this region, except those mentioned from Foochow (= Fouchau), southern Manchuria; the type of plumbagina is from about 400 km. northwest of the region mentioned above.

ETYMOLOGY. The species name (Latin, plumba) means "lead-like", referring to the dull charcoal black-brown colors characteristic of the underside of the wings.

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Novosatsuma pratti (Leech), new combination

Figs. 150, 151, 392

Satsuma pratti Leech, 1893-94, p. 354 (in part). Leech, Ibid., loc. cit. Seitz, 1909, p. 264, pl. 72, fig. f.

Satsuma taxon pratti: South 1902, p. 140 (misidentified in part).

[Callophrys]pratti (included Satsuma as synonym of Callophrys, in error): Swinhoe, 1910-11, p. 257.

Thecla pratti: Pratt, 1892, p. 254 (misidentifed in part).

[Ginzia]pratti (included Satsuma species): Okano, 1941, p. 239.

[Ahlbergia]pratti (included Satsuma species): Bryk, 1946, p. 50.

[Incisalia]pratti (included Satsuma species): Gillham, 1956, p. 145, 149.

DIAGNOSIS. This species is recognized by the dull steel blue upperside of the male and brighter gray-blue of the female contrasted beneath with rich brown mottling and large white markings on the hindwing from the anal margin to vein 2A and between veins Sc + R_1 to M_1, and to a lesser extent on the forewing postmedian band. Spots of white also occur in the basal disc, or along the margin of the disc as in no other congener.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 392) and frons as typical of the genus. Upper Surface of the Wings: Ground color Dusky Dull Bluish Green to darker only flecked with same. Male scent patch distad in the discal area. Margins heavily crennated, blackened, fringe black; slight bluish marginal band along the hindwing from anal angle to vein Cu_2. Under Surface of the Wings: Forewing Smithe's (1975) Burnt Umber, heavily flecked black basad, sometimes lighter toward Snuff Brown distad. Dark brown blotch distad in discal

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cell. Postmedian line from costa to vein Cu_1 or sometimes Cu_2, wavy, deep brown basad, widely white distad. Distad postmedian line, ground color lighter, brown to red-brown overscaling dusted with gray in the submarginal area. Margin darker, fringe brown to black mottled with gray. Hindwing basal disc Smithe's Fuscous to Ridgway's Bone Brown (but always brown in cast, not charcoal or gray), heavily mottled with overscaling and with its distal edge lined with white, emphatically between the anal margin and vein 2A and between veins $Sc + R_1$ to M_1 or sometimes to M_2. White often occurring within the disc. Distad basal disc ground color lighter but wing heavily mottled. Crescent line exaggerated, meeting marginal area with heavily mottled brown patterns. Marginal area flecked with gray, especially in the limbal area, edged distad with black; fringe black, slightly flecked with gray. Length of Forewing: $\bar{X}$ of 9 specimens (BMNH, AMNH), 15.5 mm., range 14.5 mm. to 16 mm. Female: Head, thorax, abdomen, legs, palpi and frons as typical of the genus. Upper Surface of the Wings: Apex and submarginal area of forewing, and submarginal area of hindwing dark Raw Umber. Remaining areas of wing, and adjoining in jagged pattern submarginal Raw Umber of hindwing, dull Pale Medici Blue variously overscaled with black. Under Surface of the Wings: Same as male. Length of Forewing: $\bar{X}$ of 6 specimens (BMNH, AMNH, NMNH), 16.0 mm., range 15.0 mm. to 16.5 mm. Male Genitalia: Fig. 150. Valvae caudad saccus mid-rimmed, shouldered, vaguely indented; valvae, lateral view, round, funneled; valvae, caudad extension, shouldered; saccus broadly parabolic; cornuti as illustrated. Female Genitalia: Fig. 151. Ductus moderately long (width of lamellae three-fourths length of ductus); lamella postvaginalis convoluted beneath in two to three folds; lamella antevaginalis narrow (circa one-half width of ductus), slightly flared cephalad from antrum; signa small, not bifurcate.

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TYPES. The "cotype" series of Leech is in the British Museum. Problems concerning it, however, had not been resolved with the publication of South (1902). Leech's description mentions a male and a female specifically, and four others from the same region, that look "different"; he also says that specimens were taken at another locality. All of these specimens would merit the status of syntypes. The last-mentioned specimens, which Leech mentions from Foochow (= Fuchau) have not been found; all others have. It is not known, however, if the Foochow specimens were given Leech labels and letter designations; if so, such were not found by South when he published his list of BMNH type material. The specimen chosen by South as the male "type"[in litt.] of pratti (but not specified as lectotype) is not the male of two specimens specifically mentioned by Leech (a male from Chang Yang, July 1888, labelled "b" later by BMNH staff); rather it is a male from Ichang, June 1888, by Mrs. Pratt that South placed in the type collection, along with a female from Chang Yang. The other four specimens Leech mentions were located in the BMNH, three from Chang Yang (males) and one from Chia-kou-ho (female). These all bear Leech cotype labels. The latter female, however, is not conspecific with the Chang Yang female specifically mentioned by Leech, and represents the taxon plumbagina (see discussion under that species). Hence, I have designated the one female specimen from Chang Yang (A. E. Pratt Collection, July 1888, Leech Collection, 1901-173, Satsuma pratti "b") as the lectotype since it is both a specimen mentioned specifically by Leech, chosen by South, and differentiates the species from plumbagina. This specimen has been marked with a lectotype label. The remaining specimens from Chang Yang and Ichang have been designated paralectotypes and are so labelled in the BMNH. Type Locality: Chang Yang, Yunnan Province, China.

DISTRIBUTION. Spatial: This species is widely distributed from eastern Chamdo on the eastern Tibetan plateau (Ta-tsien-lou; Frontier of Tibet; Yaan,

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Szechwan Province, China) northeastward across central China (Yunnan to Hupeh and Hunan Provinces) to (if Leech's unlocated specimens are accurately identified by him) southern Manchuria west of Korea. Temporal: All known specimens are from July.

REMARKS. Nearly all the specimens in the British Museum were dissected, as well as representates from the AMNH and NMNH, totaling fourteen specimens.

2. The monstrabila Group

including oppocoenosa; grossfieldi; -- cibdela; monstrabila[16]

A. Cladogram and Characters, Fig. 553.

B. Distribution. Fig. 521.

Novosatsuma oppocoenosa, new species

Figs. 24, 152, 393

DIAGNOSIS. This species is somewhat like grossfieldi, but can be recognized by the male being dull blue above, not purplish, and with structural iridescence limited to proxad cell Cu_1 and cell Cu_2 on the forewing and discal and anal areas of the hindwing. Beneath, the basal disc, hindwing, is deep brown on oppocoenosa flecked to blackish over lighter ground color and there is red-

[16]Because both sexes of most species are not known, the hierarchy must be considered unresolved, but a cladogram of available characters suggests the relationships shown in Figure 553.

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brown in the limbal area. The caudad extension of the valvae is much more pointed and tapered than any species in the monstrabila group.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 393) and frons as typical of the genus. Upper Surface of the Wings: Forewing dull Raw Umber except for dull Pale Medici Blue proxad in cells Cu_1 and Cu_2. Hindwing dull Raw Umber; dull Pale Medici Blue in discal and anal areas. Under Surface of Wings: Ground color, both wings, dull Verona Brown. Forewing marked with browner spots at distal end of discal cell, in an irregular, faint postmedian line bending noticeably distad at Cell M_3, caudad then to vein Cu_2. Evidence of any submarginal line limited to faint brown dusting between the veins. Hindwing, basal disc mottled contrastingly Mummy Brown over Verona Brown ground color, becoming extremely dark and black-flecked at inner margin of disc, and with postbasal connections to median outline of disc more obvious than those costal. Rest of wing uniform Verona Brown but with obvious reddish (Burnt Sienna to Argus Brown) patching in limbal area. Margin fringed and flecked with black. Length of Forewing: 15 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 152. Similar to grossfieldi but caudad extension of valvae radically more tapered and cornuti extremely different (as illustrated). Valvae caudad saccus wide-rimmed, oval, not indented; valvae, lateral view, round, slightly funneled; saccus, parabolic; cornuti as illustrated. Female Genitalia: Unknown.

TYPES. Holotype male (Fig. 24), "Ta-Ho", Tibet, 1895, by Printemps. Deposited BMNH.

DISTRIBUTION. Spatial: From the contiguous Tibetan plateau region, but known only from type locality. Temporal: Unknown.

ETYMOLOGY. The name combines the Latin root oppo, meaning "opposing", and coeno, meaning "muddy", referring to the contrasting deep brown over light brown markings of the hindwing underside.

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Novosatsuma grossfieldi, new species

Figs. 20, 153, 394

DIAGNOSIS. The male is recognized by the deep purplish coloring of the iridescence above and its limitation to the basal area on the forewing and to the proximal regions of the basal and discal areas on the hindwing. The female is unknown.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 394) and frons as typical of the genus. Upper Surface of the Wings: Nearly entire area of forewing Raw Umber. Only basal area and area immediately proxad scent scale shiny Plumbage Gray. Hindwing Raw Umber except Plumbage Gray in the proximal regions of the basal and discal areas. Margins heavily fringed and rounded by terminal Raw Umber area. Under Surface of the Wings: Forewing entirely Verona Brown; postmedian line absent except for slightly browner spot at area of vein R_2, submarginal line evidenced only slightly. Hindwing entirely Verona Brown, basal disc mottled somewhat darker. Distad basal disc immaculate Verona Brown except for very slightly darkened submarginal crescent line and darkening between the veins at the margin. Margin waxy and fringed brown. Length of Forewing: 15 mm. (holotype). Female: Unknown. Male Genitalia: Figs. 153. Valvae caudad saccus wide-rimmed, oval, indented; valvae, lateral view, round funneled; valvae, caudad extension extremely shouldered to slightly humped; saccus, parabolic, cornuti as illustrated. Female Genitalia: Unknown.

TYPES. Holotype male (Fig. 20), "Yatsu to Yalung R." (river), Szechwan Province, China, 30 April 1929, Kelley-Roosevelt Expedition; deposited BMNH.

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DISTRIBUTION. Spatial: Known only from the type locality. Temporal: Known only from April.

ETYMOLOGY. This species is named for Dr. Joseph Grossfield.

Novosatsuma cibdela, new species

Figs. 23, 154, 395

Satsuma chalybea: Leech, 1983-94, p. 355. South, 1902, p. 140 (in part) (misidentifications).

DIAGNOSIS. The male of this species is remarkably like the female of Ginzia chalybea, but can be readily identified by the presence of the forewing scent patch. Among the blue-maled members of Novosatsuma, cibdela most resembles monstrabila. It can be distinguished by the former's lack of any pale to white ground color on the wing undersurface and monstrabila's red-brown patches in the basi-terminal area of the hindwing. The female is unknown.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi and frons as typical of the genus. Upper Surface of the Wings: Apical and submarginal area of forewing deep Raw Umber; discal and basal area, forewing, and all but terminal area of hindwing shiny Pale Medici Blue, terminal area of latter deep Raw Umber between the veins, broken again by a blue and then deep Raw Umber marginal line. Under Surface of the Wings: Median area, both wings, Warm Sepia, forewing spots at end of discal cell, and forming irregular submarginal and postmedian lines of much darker brown, postmedian ground color beneath being lighter brown, flecked with gray. Hindwing with jagged postbasal line and irregular median line darker brown than Sepia ground color. Rest of wing distad

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median line much lighter brown heavily flecked with gray with chevroned submarginal line of brown, terminal areas darkened between the veins and darkened wavy outer margin with noticeable fringe. Length of Forewing: 14 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 154. Valvae caudad saccus wide-rimmed, oval, not indented; valvae, lateral view, round, funneled; valvae, caudad extension shouldered; saccus, funnel; cornuti as illustrated.

TYPE. Holotype male (Fig. 23), Chang Yang, Yunnan Province, China, May 1888, A. E. Pratt, collector; deposited BMNH.

DISTRIBUTION. Spatial: Known only from the type locality. Temporal: Known only from "May".

REMARKS. This specimen was in the syntype series of Satsuma chalybea Leech, identified as a female. A lectotype and paralectotypes of chalybea have been designated, and this specimen described as new.

ETYMOLOGY. The Latin name cibdela means "deceptive", referring to the near exact resemblance of the male to the female of chalybea.

Novosatsuma monstrabila, new species

Figs 18, 155, 396

DIAGNOSIS. The species can be recognized by the male's iridescent pale blue upperside encompassing the entire wings save the costal, apical and subterminal areas of the forewing and by the wide suffusion of pale to whitish ground color beneath, save basal disc of the hindwing and the deep red-brown of the basi-terminal areas of same. The latter distinguishes it easily from N. cibdela. Only the male is known.

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DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 396) and frons as typical of the genus. Upper Surface of the Wings: Apical and submarginal area of forewing light Raw Umber with scent scale; discal and basal area, forewing, and all but cephalad terminal and marginal area of hindwing shiny Pale Medici Blue. Marginal area of hindwings Raw Umber and then broadly white-fringed between the veins. Under Surface of the Wings: Forewing ground color Vinaceous Buff flecked with brown in discal and basal areas, Gray heavily flecked with white distad to margin. Light brown spot at end of cell, dark brown spots forming irregular submarginal and postmedian lines caudad to Cu_2. Hindwing basal disc deep mottled Warm Sepia with faint whitish postbasal spots and whitish spot at edge of disc between veins Sc + R_1 and Rs. The hindwing distad the basal disc is entirely gray heavily flecked with white except for submarginal crescent line of brown and a large Chocolate patch in the basi-terminal area from vein Cu_1 to the inner margin. There is no marginal line but these are heavily fringed with white alternating to brown at the veins. Length of Forewing: 16 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 155. Valvae caudad saccus wide-rimmed, oval, indented; valvae, lateral view, somewhat chevroned, funneled; valvae, caudad extension only slightly shouldered; saccus, funneled; cornuti as illustrated. Female Genitalia: Unknown.

TYPES. Holotype male (Fig. 18), Naoa Hills, Chindwin Province, China, April 1896, W. H. Evans, collector; deposited BMNH.

ETYMOLOGY. The Latin name monstrabila means "conspicuous", referring to the readily recognizable traits of this well-marked species.

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Secondary Series Penaincisalia

(including Penaincisalia, Ginzia, Sandia, Mesocyanophrys,

Paracyanophrys, Cyanophrys, Callophrys, Mitoura)

(IB2)

Tertiary Series Penaincisalia

(including Penaincisalia, Ginzia, Sandia, Mesocyanophrys)

(IB2a)

Quaternary Series Penaincisalia

(including Penaincisalia, Ginzia)

(IB2aa)

PENAINCISALIA, NEW GENUS

Thecla Fabricius, 1807, p. 286 (in part). Weymer, 1890, p. 123. Staudinger, 1894, p. 80. Druce, 1907, p. 579. Draudt, 1919, p. 760.

"Thecla": Lamas, 1977, p. 71.

[Incisalia] Scudder, 1871, p. 52. F. Brown, 1947, p. 21 (sp. culminicola Staudinger, et al., placed with Incisalia in comment).

DIAGNOSIS. Penaincisalia in the Neotropics superficially resembles several other taxa in the "Thecla" grade group which have under surface wing

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patterns somewhat resembling the hoary and mottled patterns of Penaincisalia. Such patterns usually call one's attention to the general relation of the Penaincisalia (in which the patterns immediately resemble what has commonly been called Incisalia in the Nearctic and Ginzia in the Palaearctic prior to this paper) to the Callophryina. But the pattern also confuses Penaincisalia with the Thecla species listed as the "arria-group" by Draudt (1919). These latter are not within the group presently under study (see Remarks for their affinities). The slight variance of these latter Thecla from a characteristic "Incisalia-like" pattern are one clue; dissections make them unmistakable. Penaincisalia representatives can be recognized by their bright iridescent uppersides on the males (lavender to pale blue or orange) and dull blue to brown females, but both with the characteristic checkered fringe above, and hoary and mottled brown and yellow patterns beneath.

DESCRIPTION. Adult: Head with frons profusely hairy but lacking any scales of distinct coloration. Compound eye with white lining. Legs without elongation relative to width (latter indicative of apomorphy in Callophryina). Palpi generally typical of primitive condition of Primary Series Cissatsuma, but with third segment on males extremely short and broadened centrad. Wing length short, generally 13.5 mm. to 15.0 mm. with structural color prominent on male upper surfaces of most species, present also (but usually as a sheen) on females. All species untailed. Wing under surfaces with mottled and hoary patterns, extensively suffused; brown-yellow combinations common, gray less so. Male Genitalia: Valvae uniquely shortened, being included completely by ring of vinculum. Bilobed configuration caudad saccus deeply indented, nearly dividing it into bilateral lobes at least one-third of the caudal expanse. Saccus very small, circa one-third caudal expanse of bilobed configuration; area of attachment to vinculum very thin. Aedeagus of same proportions as other

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Callophryina, but extremely reduced in length, less than length from tip of saccus to uncus. Female Genitalia: Various configurations, apparently reflecting extreme isolation of these populations but reflecting the generally primitive characters of Callophryina. Wide ductal configuration with variously expansive lamellae; lamellae postvaginalis often widely bilobed. Signa various, but typical of the worldwide group.

BIOLOGY. Early Stages: Unknown. Foodplants: Unknown.

TYPE SPECIES. Thecla alatus Druce.

DISTRIBUTION. Spatial: Fig. 519. Montane, found in isolated colonies in Colombia, Ecuador, Peru, and Bolivia. Temporal: Flight period of at least December through July is indicated.

REMARKS. The association of these taxa into one genus with a disjunct sister Palaearctic distribution was not indicated until the cladistic analysis of Callophryina and numerous outgroups was completed. Since it was not suspected at first, it has been impossible to reexamine the specimens of Neotropical areas in the BMNH with a mind to determine how many taxa are involved in present museum collections. This has, however, been done with specimens available in North America and five species seem to be indicated. Hence, this genus will warrant further study since it is newly recognized.

Penaincisalia presented a problem concerning alternative cladograms in relation to character states. In northwestern South America occurs a small group of species with iridescent uppersides on the males and undersides with hoary and mottled patterns. The genitalia are unique, relative to known members of Callophryina (though they have been treated as within the group by one author, Brown, 1947) representing supralimital characters of questionable plesiomorphy or apomorphy, and with highly dimorphic palpi. Do these belong in

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the monophyletic group treated in this study, and if so, are the only representatives known within other clades to resemble the characters of these South American taxa actually phylogenetically related? Because of the desirability of not introducing zoogeographical considerations into the decisions of most corroborated cladograms in this revision, so as not to inject a tautology into usage of these morphological data for independent zoogeographic considerations, the decision of cladistic relations must be decided on relative parsimony alone.

The only taxa with characters similar to those of the South American species in question are found in southwestern China and northern India (dispersal is indicated for the one species in north India, isolated just south of the Himalayan rim inhabited by a number of congeners). Do these characters represent phylogenetic relationship or are they convergent? If they are convergent, is there any evidence that the South American taxa belong in Callophryina at all, or can their characters be placed in a cladogram elsewhere?

Alternative cladograms are presented in Fig. 554. Option one (a). is that several similarities represent synapomorphy. In accordance with cladistic classification of this revision, these Asian and South American taxa would fall into the same genus. This would mean that these two widely disjunct groups of taxa represent elements of a former ancestral distribution area, but since their shared characters indicate relative plesiomorphy to a much larger group of Asian taxa with no other counterpart in the New World, the New World taxa would have to be a far flung survivor of a widely distributed ancestral group whose plesiomorph members are found on the periphery of an Asian group of wide diversity in taxa and zoogeography and again in a far flung area of the New World. This requires two relict populations, one in the Old World and one in the New World evolving to their own subsequent diversities in two widely disjunct areas. The characters seemingly shared by the groups are thus synapomorphs of

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relatively very plesiomorph structures and with subsequent independent apomorphy yielding the many unique differences between groups. The characters which can be considered synapomorphic in this case are reviewed in the figure. A second option is that the Asian group's characters can be considered highly derived conditions of the other Asian group. These characters are listed in the figure under (b) and would not relate the Asian and South American groups at all except by convergence, requiring only that the South American group be a far flung relict of the ancestral distribution area of the entire group of Asian relatives. This distribution occurs in another group (Ib1b) where the situations with character relations are far clearer. In none of these considerations are outright zoogeographical considerations introduced beyond the question of what requires most of nature, a question of parsimony. Zoogeographical consideration which might be introduced into the problem but would violate independent consideration of the general cladogram of Callophryina could include whether a pacific continent of the Cretaceous (Melville's "Pacifica", sensu Melville, 1979) might have been the harbinger of populations "rafting" eastward across the Pacific from east Asian distributions to western South America, thus allowing a simpler vicariant explanation of the disjunctions if the Himalayan and Andean "elfins" in question are congeneric sensu cladogram (a). This idea is not corroborated generally by current geological, geophysical, or substantial biological data (as discusssed in the later zoogeographical considerations in this paper), nor by other cladistic data in the present study.

There are two further considerations. One is presented in the cladogram (b) treatment of leechi group "elfins" as derived taxa of the larger Asian Ginzia group. The other is that the Andean "elfins" may not belong in Callophryina at all. If the leechi group is indeed derived from the larger Asian Ginzia group, this

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leaves the Andean species simply as a group plesiomorph to the larger Asian group. I accept this cladogram as most parsimonious because it does not

(1). require independent derivation of the characters of the Andean group from some group outside Callophryina.

(2). require a complicated geographic origin of the disjunction, merely a simpler disjunction between the entire Asian group and the western South American populations.

Hence the closest relations of similarity and difference in the genitalia of the two groups, those of the Andean species and the leechi group from north India and the southern Himalayas, are considered by me as convergent.

A further note on the superficial resemblance of Neotropical Paraincisalia to the species Draudt (1919) listed as his "arria-group" of "Thecla" (twelve species, many from the same montane areas as Penaincisalia) is useful. The arria-group taxa are all characterized by their supposed "Incisalia-like" patterns tending to have white edging circumferencing each mottled spot. Once this is recognized it is very helpful in separating them and also recognizing their own similarity to the markings of Asian Narathura Moore and Panchala Moore which co-occur in the ranges of many Asian Ginzia, Novosatsuma, and Cissatsuma. Dissection of species of the "arria-group" and outgroups related to the group under study in this work indicate the latter's affinity to Strymon and Ministrymon from which (assuming even these are monophyletic, which is doubtful) they may be a derived clade.

The centrally bifurcate nature of the branching diagram illustrating the cladistic structure indicated by the characters of Tertiary Series Penaincisalia can be rotated giving a different possible perspective on relative plesiomorphy in the group. If Sandia and Mesocyanophrys are considered relatively apomorph in the Tertiary Series Penaincisalia, it seems that several characters of Tertiary

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Series Paracyanophrys are derived a second time. Penaincisalia and Ginzia represent respective plesiomorph and apomorph derivations of character states typical of the grade associated with mottled and hoary under surface colorations and a gradual trend toward narrowing of the ductus bursae in females and away from primitive palpi in both sexes. Sandia and Mesocyanophrys exhibit character states relatively plesiomorph for what is eventually derived in themselves and successive clades to express a grade associated with green under surfaces of the wing with mesial white spots or lines, blue iridescent above, and very notable long ductus, long antrum (etc.) phenes. It should be appreciated that there are a constellation of relatively primitive characters for both grades (noticeable, frequently described characters) which become relatively apomorph for the hoary and mottled grade in Penaincisalia and Ginzia, and relative apomorph for the "blue above, green beneath" grade in Sandia, Mesocyanophrys, and the genera of Quartenary Series Paracyanophrys. Such an understanding lessens the significance of thinking that several of the "Cyanophrys"-like characters (a grade which becomes successively apomorph along at least three separate branches--Mesocyanophrys, Penacyanophrys, and Cyanophrys) become derived a "second time" in the succeeding Tertiary Series Paracyanophrys. Actually, there are numerous derivations of many primitive character states going on through all the branches. A more simplistic understanding of such characters might lead one to think that Mesocyanophrys and the primitive Sandia taxa fusius, ampulla, and marialis actually belong more akin to Tertiary Series Paracyanophrys than in Tertiary Series Penaincisalia, by simple parsimony involving the "problem" of several derived characters appearing again. Such a lumping of the grade phenes would destroy the monophyly of Tertiary Series Penaincisalia and make a paraphyletic, though phenetically very resemblant, group of Secondary Series Paracyanophrys.

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The characters seem not to indicate which of the two relative sister Quaternary groups in Paraincisalia (Quaternary Series Penaincisalia or Quaternary Series Sandia) express the most relative apomorphy.

ETYMOLOGY. The choice of Penaincisalia as the name for this group refers to the obvious resemblance of these taxa to the common usage of "Incisalia", their position as an immediate sister group of Ginzia but with representatives in the New World, and the parallel nature of the disjunct distributions. Pena-e (Latin), meaning "beside" or "near", is combined with Incisalia and is considered feminine.

SPECIES GROUPS

There is currently not enough information on characters, populations, and species in Penaincisalia to allow a cladogram for the group's presently included species. In the following revision, utilizing the specimens in United States collections (and types, but not other extensive material in the BMNH) the species are arranged arbitrarily.

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Penaincisalia alatus (Druce), new combination

Figs. 156, 157, 397

Thecla alatus Druce, 1907, p. 579; 1909, p. 434, pl 11, fig. 13. Draudt, 1919, p. 760, pl. 153, fig. g.

"Thecla" alatus: Lamas, 1977, p. 71.

[Incisalia]alatus: F. Brown, 1947, p. 21 (included categorically with taxa in Draudt's "culminicola" group in Incisalia).

species alatus: Comstock and Huntington, 1959, p. 65.

DIAGNOSIS. This species belongs to a group of species in South America which resemble the Nearctic "Incisalia" sens. lat. or Palaearctic "Ahlbergia" sens. lat. on the wing under surfaces. The very distinct mottled and hoary brown, gray, or yellowish patterns can be confused in South America only with the species that Seitz (1919) lists in his "arria-group" of "Thecla" (see REMARKS under Paraincisalia). From the other known Neotropical Paraincisalia, alatus can be recognized immediately by the yellowish cast of the under surface ground color, with mottled patterns of gray or brown. The upperside of the male is bright iridescent purple, dull blue on the females, and neither sex has the emphatic upperside chestnut coloration surrounding the recurved lobe of the hindwing as is characteristic of culminicola and anosma; the latter species is brown above on both sexes.

DESCRIPTION. Male. Head, thorax, abdomen, legs, palpi (Fig. 397) and frons as typical of the genus. Upper Surface of the Wing: Ground color bright iridescent Vinnaceous Purple to Dark Lavender. Narrow area of the margins, both wings, and apex, forewing dull Raw Umber suffused with yellow. Scent

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patch distad in discal area, small (less than one-fourth length of cell) and colored shiny white-gray. Fringe appearing wide, alternating white between the veins and dark Raw Umber suffused yellow on the veins. Under Surface of the Wing: Ground color Buckthorn Brown to Ochraceous Tawny, patterns formed by heavy mottling of brown to gray-brown suffusions over these. Forewing with broken postmedian line, costa to vein Cu_2. Ground color basad this line heavily suffused brown and gray. Distad this line, ground color generally immaculate, followed distad by submarginal brownish blotches in each cell interspace and then deep suffused gray and brown along the margin. Hindwing with ground color heavily suffused gray and brown, especially in the basal disc. Basal disc appearing as nearly of two halves, one basad and nearly black-suffused, the other distad and gray suffused, separated by lighter stripe of the ground color. The distal edge of the basal disc (median line) is very irregular, appearing crennated, edged blackish basad, yellow-white distad. Distad this line the entire ground color is uniformly suffused gray-brown. Submarginal brown blotches occur in each cell interspace in the submargin. The fringe of both wings is alternating yellow, blackish, and white, in a speckled pattern. A recurved lobe of the hindwing between the outer and anal margin is not apparent. Length of Forewing: Two specimens, 14 mm., 14.5 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 397) and frons as typical of the genus. Upper Surface of the Wings: Ground color dull brown heavily suffused with shiny iridescent Pale Medici Blue. No scent patch distad in discal area. Fringe, both wings, speckled, white in between veins, dull Raw Umber on the veins. Under Surface of the Wing: As on the males, but duller, and with brown and gray suffusions more profuse, obscuring clarity of the general markings. Length of the Forewing: Two specimens, 11.0 mm., 12.0 mm. Male Genitalia: Fig. 156. Characterized by extreme short caudal extension of valvae, emphatically indented configuration of the bilobed structure and

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reduction of the saccus. Valvae, caudad saccus, clear, narrow-rimmed, broadly parabolic, so emphatically indented as to evidence centrad sclerotized line between the bilobed clear areas. Valvae lateral view, irregular, with caudal extension obviouly reduced; valvae, caudal extension, extremely reduced, not exceeding in length the articulation of the falces to the vinculum; saccus, reduced as is caudo-distal connection to vinculum; aedeagus, reduced in length (not exceeding two times length saccus to caudal tip of uncus); cornuti, ventral disclike and slightly bifurcate, dorsal narrow-tapered. Female Genitalia: Fig. 157. Lamellae seemingly degenerate, lamella postvaginalis appearing only as two elliptical lobes split by centrad line. Lamella antevaginalis as vague lips about one-third the caudal length of the lamella postvaginalis. Ductus about one and one-half times caudal length of lamellae, flared cephalad emphatically at juncture with bursa. Signa single broad-based spines only slightly bifurcate distad.

TYPES. Holotype male, BMNH. Type Locality: Cajamarca Province, northern Peru. This is a montane area, the specimen label indicating circa 3,800 m.

DISTRIBUTION. Spatial: Fig. 519. I have examined specimens from northern Peru and southern Ecuador all from high montane areas (see Material Examined). More thorough study of this group may locate more specimens encompassing a larger distribution in the north Andes. Temporal: Dates on specimens range from May 31 to July 14.

REMARKS. The cornuti of the female genitalia of alatus are very similar to those of Ginzia frivaldskyi, a species from the plesiomorph sister branching immediate to the Paraincisalia. Both represent the primitive conditions of cornuti for the group worldwide Callophryina and reinforce the placement of these species with the Palaearctic representatives.

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In all, eighteen specimens from AMNH, BMNH, and NMNH were examined; eight were dissected for genitalia, legs, and palpi.

Penaincisalia oribata (Weymer), new combination, status revised

Figs. 25, 158, 398

Thecla oribata Weymer, 1890, p. 123, pl 4.

Thecla anosma Draudt: Draudt, 1919, p. 823 (synonymy in error).

DIAGNOSIS. This species is a sister species of alatus and is distributed farther south in the western Andes of South America. The species resembles alatus but the female is brown above, and distinctly gray-brown beneath, not yellowish as alatus. The mottled patterns beneath are more muddled and (as represented clearly in Weymer's original figure) the markings of both the distal edge of the basal disc (median line) and the submargins of the hindwing are punctuated with black dots. Weymer's figure also shows these dots on the post-median line of the forewing; the only specimen known to me has these dots deep brown, but not precisely black. Such distinct black dots do not occur on alatus; rather, highly suffused drab brown blotches occur. The genitalia are also different; those of oribata have the lamella postvaginalis present and separated into two lobes by a moderate centrad line; the ductus is sculptured and the signa reduced to simple sclerotizations on the bursa.

DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, legs, palpi (Fig. 398) and frons as typical of the genus. Upper Surface of the Wings: Upperside entirely Rood's Brown to more Cinnamon Brown basad. Fringe, both wings, dark except for whitish areas between the veins. Under Surface of the

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Wings: Ground color Wood Brown, suffused brown and gray; markings characterized by patterns forming heavily mottled concentrations of gray and brownish overscaling. Forewing mottled gray-brown; postmedian, from costa to vein Cu_2, as deep brown to blackish dots. Margin heavily suffused brown. Hindwing with basal disc suffused grayer than rest of wing; distal margin (median line) formed by irregularly placed black dots in the cellular interspaces, vaguely edged white distad; occasionally similar spot distad in the cell. Distad median line, ground color lighter, more tawny, followed distad by submarginal arc of black dots. Distad these, ground color briefly lighter before heavy brown and gray suffusion highlights margin; marginal suffusion somewhat broken, darker in cell interspace, lighter on the veins. Fringe alternating dark and pale, but not speckled. Recurved lobe of hindwing (apparent in Weymer's figure) not apparent in other known specimens. Length of Forewing. One specimen, 11.0 mm. Male Genitalia: Unknown. Female Genitalia: Fig. 158. Similar to alatus but lamellae postvaginalis more intact, not divided except by moderate centrad line. Ductus sculpture, constricting inward about half its length, then flaring toward bursae, emphatic flaring before juncture with bursae not as apparent as on alatus; signa limited to sclerotization on the bursa.

TYPES. It is obvious that the species was named from one female, but the deposition of this specimen was not mentioned, nor was it known to Comstock and Huntington (1962). I have found no further evidence of its location. Fortunately, there is a female from Carque, Bolivia, in the AMNH which matches the original description very closely, especially in relation to present knowledge of the congeners. I hereby designate it as neotype (Fig. 25) and have clearly labelled it as such. Type Locality: Weymer's specimen was from Tacora, "Bolivia" (sic), extreme northern Chile. Tacora is a volcano on the Border of Bolivia and Chile, though according to contemporary borders is quite obviously in

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Chile and to some extent Peru. The neotype is labelled Corque, Bolivia, from the high montane rim of the Andes west of Lake Poopo (south of Lake Titicaca) about one hundred seventy-five kilometers southeast of Weymer's type locality.

DISTRIBUTION. Spatial: Fig. 519. Thus far, this species is known only from two localities in extreme northern Chile and southwestern Bolivia. Temporal: Unknown.

REMARKS. Seitz (1939) in his "Corrections and Additions" to Thecla (p. 823) substitutes the name oribata for anosma, the latter the name which he used in his text on Thecla and described as new. Comstock and Huntington (1962) take this to mean that is was placed in synonymy, and they consider oribata to have priority over anosma. None of the statements included any discussion. Comparision of Seitz's figure of anosma (which is a male, and only the male is discussed by him) and Weymer's figure of oribata (which is female, and only the female is known), along with the disjunction of their localities (southern Bolivia and central Colombia) point to the erroneousness of such an evaluation. Seitz's description (see anosma, this paper) implies a unique insect; Weymer's figure quite closely resembles alatus more than any other congener. The specimen which has been made the neotype of oribata fits Weymer's figure very closely, and is definitely a sister species of alatus but not conspecific. Thus, the two taxa anosma and oribata represent distinct species and this error began with Seitz's commentary in his "Corrections".

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Penaincisalia culmincola (Staudinger), new combination

Figs. 26, 159, 160, 399

Thecla culminicola Staudinger, 1894, p. 80, pl. 2, fig. 6. Draudt, 1919, p. 760, pl. 153, fig. g.

Incisalia culminicola: F. Brown, 1947, p. 21 (culminicola et al. placed in Incisalia).

"Thecla" culminicola: Lamas, 1977, p. 71.

species culminicola: Comstock and Huntington, 1959, p. 198.

DIAGNOSIS. This species can be separated from its South American congeners by its iridescent lavender upperside and bright chestnut coloration in the limbal area surrounding the recurved lobe of the hindwing. The reader is referred to the diagnosis of alatus, and of the genus, for further remarks concerning similarity of these to non-congeners.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 399) and frons as typical of the genus. Upper Surface of the Wings: Ground color bright iridescent Vinnaceous Purple to Dark Lavender. Narrow area of the margins, both wings, and very wide area of forewing apices dull Raw Umber. Scent patch distad in discal area, colored whitish-gray, very small, less than one-fourth length of cell. Fringe broad, both wings; speckled white on mid-veins, dark on the veins. Limbal area of hindwing near recurved lobe of hindwing brightly colored Chestnut. Under Surface of the Wings: Ground color Brussels Brown to Hazel; patterns formed by heavy suffusion of markings of Mahogany Red. Forewing, ground color not highly suffused; postmedian line from costa to vein Cu_2 barely visible--Mahogany Red basad, slightly white distad toward costa.

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Distad postmedian line, ground color uniform, Mahogany Red blotches in the cellular interspaces along the margin. Hindwing, basal disc with uniform ground color heavily suffused Mahogany Red; appearing more reddish than rest of the wing. Post-basal area with slight lightened disc (median line) irregular--edged Mahogany Red basad, slightly white distad, more emphatic costad. Distad median line, ground color to submargin uniform Hazel. Submargin with blotches of Mahogany Red and other areas suffused slightly yellowish-gray. Fringe, both wings, dark reddish-brown. Length of Forewing: one male, 12 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 399) and frons as typical of the genus. Upper Surface of the Wings: Ground color light shiny Pale Medici Blue (Bolivian specimens, BMNH) (blue is mentioned in original description) but seemingly brown in northern Andean specimens (e.g. Ecuador series, AMNH) (see Remarks below for further comments). Narrow areas of margins, both wings, and wide area of apices, forewings, dull Raw Umber in bluish specimens, not as noticeable in brownish ones. No scent patch distad in discal cell. Fringe, both wings, speckled dark Raw Umber on the veins, pale between. Under Surface of the Wings: As on males. Length of Forewing: Two females, 11.0 mm., 10.5 mm. Male Genitalia: Fig. 159. Similar to alatus but with caudal extension even more reduced and slimmer. Valvae caudad saccus, clear, narrrow-rimmed, broadly parabolic, indented so emphatically as to be split apart cephalad one-third of their length. Valvae, lateral view, irregular, with caudal extension obviously shortened; valvae, caudal extension tapered, very reduced and slim (vaguely exceeding caudal articulation of falces with vinculum, if at all). Saccus reduced, also caudo-distal areas joining it to vinculum. Aedeagus shortened (less than two times length from saccus to caudal tip of labides); cornuti--ventral, disclike and bulbous; dorsal, tapered. Female Genitalia. Fig. 160. Similar to alatus but with

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lamellae more entire and ductus less constricted caudad. Signa more reduced, hardly bifurcate.

TYPE. This species was named by Staudinger from Huallantani, Bolivia, altitude 4,000--5,000 meters. The location of the type is unknown, and the very general original description gives no clue to whether a single specimen or series existed. Because of the usefulness of clarifying the relationships within this group, and because the description of culminicola is unambiguous, I hereby designate a male in the AMNH from Bolivia (labelled simply Bolivia, but the only such specimen available to me in the United States) as the neotype. The type locality of culminicola (Huallantani) is not known to me from any map. The specimen designated as the neotype is very similar to Seitz's figure, which agrees with the original description except that his specimen does not have emphatic Chestnut coloration in the limbal area of the hindwing, upper surface. This character, apparent in larger series available to me from Ecuador (AMNH), is not mentioned in the original description or by Seitz. There is, however, no difference in the genitalia, between these wing variants, or between populations of culminicola from Ecuador and Bolivia. Thus, the Bolivian specimen in the AMNH seems useful as a neotype. I have clearly labelled it as such (Fig. 26). Type locality: Bolivia (neotype).

DISTRIBUTION. Spatial: Fig. 519. Ecuador and Bolivia, always from the high mountains in the former (3,500 m.), and presumably in the latter (from Staudinger's description 4,000--4,500 m.). Seitz (1939) mentioned the species from Colombia (3,500--4,400 m.) and from Cuzco, Peru (circa 3,000--4000 m.). It seems to be generally distributed through the high Andes of western South America, south into Bolivia. Temporal: Dates on specimens include ranges of dates in May and December.

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REMARKS. The designation of a neotype for culminicola should help clarify the relationships in this rather confusing group characterized by highly resemblant wing patterns and variously disjunct distributions. The lack of differences between genitalia of culminicola males from Ecuador and Bolivia (though there are noticeable minor differences in the wing pattern, reflected in comparing Ecuadorean specimens with the original description, Seitz's figure, and the neotype) seems to indicate that it is possible by thorough morphological study to place the many scattered populations of South American Penaincisalia into species catagories without undue fear of distortion from the extremely isolated nature of the montane populations of this genus. I have been able to compare genitalia of males from Bolivia and Ecuador but I have not been able to do so with females because of lack of material.

Of interest in regard to the placement of South American species of Penaincisalia as conserial with some groups of Palaearctic taxa is the hindwing pattern on the undersurface of culminicola. It is similar to Palaearctic Ginzia frivaldskyi (a species representing relatively primitive characters on the immediate sister branch to Penaincisalia). This lends further credence to the association of these two widely disjunct groups as conserial.

In all, thirty-seven specimens of culminicola were examined; eight were dissected for genitalia, legs, and palpi, including the specimen designated neotype.

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Penaincisalia anosma (Draudt), new combination, status revised

Thecla anosma Draudt, 1919, p. 760, pl. 153, fig. h.

Thecla oribata Weymer: Draudt, 1919, p. 823 (synonymy in error).

DIAGNOSIS. This species can be recognized by the male's dark brown upper surface and lack of a scent patch distad in the discal cell. The underside is gray-brown with reddish brown markings postmedian on the forewing and medial and submarginal on the hindwing.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi and frons as typical of the genus. Upper Surface of the Wings from[original description]: completely dark brown, lacking a scent patch distad in discal cell. Fringes brown, not speckled; slight violet sheen to basad on the wings in oblique light. Hindwing with a prominent recurved lobe between the outer and anal margins (not apparent in figure, but apparent in one other known species of the genus). Under Surface of the Wings[from original description]: Monotonously grayish-brown strewn with red scales; with incoherent dark lunular spots. From original figure: ground color grayish brown; basal disc of hindwing suffused darker. Prominent postmedial line from costa to vein M_3 darker red-brown. Margin of forewing narrowly suffused red-brown. Hindwing, basal disc suffused darkly blackish-gray; distal edge (median line) dark to blackish. Distad median line, ground color normal; submarginal arc of irregular red-brown slashes; a lunule apparently displaced distad this line in cell M_3. Margin of hindwing[narrowly] suffused red-brown. Fringe, both wings, brown. Female: Unknown. Male Genitalia: I have not been able to examine the genitalia. Female Genitalia: Unknown.

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TYPES. Holotype male in the Fassl Collection, Naturhistorisches Museum, Basle, Switzerland. Type Locality. Bogota, Colombia, elevation 3,000 m.

DISTRIBUTION. Spatial: Fig. 519. Known only from the type locality. Temporal: Unknown.

REMARKS. This is the only species in the genus I have been unable to examine. There may be specimens in the BMNH but since the association of the South American species in this group with Paraincisalia was not made until after my work there, a thorough search for taxa in the group (especially in uncurated material) was not made. Such searches have yielded most of the detailed information on new groups of taxa in this study. However, study of material in Penaincisalia has been limited to types, and generally curated materials. Notwithstanding, there can be little doubt that this species is distinct. It is unfortunate that a search for further material has been impossible to date.

Penaincisalia bimediana, new species

Figs. 27, 28, 161, 162, 400

DIAGNOSIS. This species can be recognized by the under surface occurrence of a post-median and submarginal band of the forewing along with a median and submarginal band on the hindwing.

DESCRIPTION. Male. Head, thorax, abdomen, legs, palpi (Fig. 400) and frons as typical of the genus. Upper Surface of the Wings: Ground color Prout's Brown to Russet; reddish hue of overscaling very distinct making exact color uncertain. Wings suffused darker brown distad; fringe brown, both wings, especially bright reddish along outer margin of hindwing. This and adjoining area

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of wing anad about the recurved lobe, with a distinct red-brown border. Recurved lobe of the hindwing distinctly elongate. Under Surface of the Wings: Ground color of the forewing Buffy Brown, tinged yellowish, except for submarginal area suffused Morocco Red. Hindwing, ground color Mars Brown, suffused Russet on basal disc, Morroco Red in submargin. Forewing with very prominent postmedian line, costa to vein Cu_2--brown and nearly regular, red suffused basad and distad; basad this line, prominent brown slash distad in discal cell; distad postmedian line, arc of normal ground color followed immediately distad by prominent submarginal line of brown blotches suffused bright Morroco Red distad. Fringe bright Morroco Red. Hindwing basal disc broken by reddish median slash; distal edge of disc irregular, bordered with brownish line. Distad basal disc, ground color normal followed distad by arc of prominent submarginal brown blotches followed immediately distad with bright Morroco Red suffusion; these becoming emphatic along margin. Fringe, Morroco Red. Recurved lobe of hindwing prominent, colored darker brown. Female: Head, thorax, abdomen, legs, palpi (Fig. 400) and frons as typical of the genus. Upper Surface of the Wings: As on males but less Russet. Under Surface of the Wings: As on males. Male Genitalia: Fig. 161. Similar to all congeners, especially with reduced caudal extension of valvae and highly indented valvae caudad the saccus, reduced saccus and aedeagus, but general size of valvae in regard to vinculum very diminutive. Cornuti spatulate, but dorsal cornutus thinner, mildly bifurcate distad. Female Genitalia: Fig. 162. Ductus very broad, over one-half its caudal length gradually flaring to simple lamellae; latter as simply lips about caudal opening of ductal tube. Ductus joined cephalad with bursae by emphatically flared structure. Signa with tripod-shaped spines.

TYPE. Holotype female (Figs. 27, 28), Cuicocha, Imbabura Province, Ecuador, 3,800 m., May 31, 1939. Deposited AMNH.

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DISTRIBUTION. Spatial: Fig. 519. The species is known from Lake Cuicocha, the central peak characterizing the small Imbabura Province of Ecuador, and from a single male in the CMNH labelled only "Bolivia". Temporal: Known only from late May.

REMARKS. Its appearance in undetermined material in the United States indicates that more species may be found in this group. As mentioned, complete search of uncurated material in the BMNH was not done for this group, because of its late association with the general group under study. The known male was associated by similar wing pattern.

ETYMOLOGY. The name refers to the two obvious lines paralleling transversely across each wing surface making this species very noticeable. The roots are Latin, "bi" (two) and "media" (middle).

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GINZIA OKANO, status revised

Lycaena Fabricius, 1807, p. 286 (in part). Butler, 1866, p. 27. de Niceville, 1894, p. 353.

Thecla Fabricius, 1807, p. 286 (in part). Lederer, 1855, p. 100. Elwes, 1884, p. 887. Kirby, 1896, p. 398. Pratt, 1892, p. 254. Pryer, 1946, p. 16.

Satsuma Murray, 1874, p. 168 (nec. Satsuma Adams, 1868, p. 463). Elwes, 1881, p. 865. Eliot, 1973, p. 440.

Satsuma (in part): Leech, 1894, p. 353. South, 1902, p. 140. Seitz, 1910, p. 264. Okamoto, 1923, p. 68. Matsumura, 1929, p. 23. Doi, 1931, p. 46. Nakayama, 1932, p. 32. Uchida, 1932, p. 989. Seok and Takacuka, 1932, p. 316. Seok, 1933, p. 70; 1934, p. 763; 1935, p. 99; 1936, p. 64. Mori, Doi, and Cho, 1934, p. 27. Seok and Nishimoto, 1935, p. 97. Haku, 1936, p. 117. Esaki, 1939, p. 219. Seok, 1939, p. 216. Sibatani, 1946, p. 64. Schwanwitsch, 1948, p. 256. Miyajima, undated, p. 175.

Callophrys Billberg, 1820, p. 80. Swinhoe, 1910-1911, p. 257 (Callophrys = Satsuma, synonymy in error).

Ginzia Okano, 1941, p. 239 (in part). Okano, Ibid. loc. cit.

Ginsia (sic): Koschunov, 1972, p. 359.

Ahlbergia Bryk, 1946, p. 50 (in part). Bryk, Ibid. loc. cit. (replaced Ginzia unnecessarily). Kuroke, 1957, p. 98. Shirozu and Hara, 1962, p. 94.

Incisalia Scudder, 1872, p. 52 (in part). F. Brown, 1947, p. 21 (included worldwide phenetic group under Incisalia, in error). Gillham, 1956, p. 149 (Incisalia = Satsuma, in error).

Callophrys (Incisalia): Ziegler, 1960, p. 21 (placed Incisalia sens. lat., of authors, as subgenus).

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DIAGNOSIS. Ginzia taxa superficially resemble members of Palaearctic Cissatsuma and Novosatsuma since hoary and mottled undersides of all these taxa are a primitive character. Genitalia (especially females) are distinctive as follows: males of Ginzia with apomorph shortening of valval caudal extension, it usually never exceeding one and one-half times length of the bilobed configuration but always exceeding caudad extreme of articulation of falces to vinculum; breadth of caudal extension at juncture with bilobed configuration decreases in successively apomorph states; females with extremely obvious narrowing of ductus relative to breadth of lamellae characteristic of apomorphy in the Secondary Series Penaincisalia and not present in any superficially similar genera.

DESCRIPTION. Adult: Head with frons and eye-lining uncolored, save fuscous. Palpi as on conserials, but often with extremely shorted terminal segment. Legs of both sexes lacking any elongation relative to width (latter typical of apomorphy in Callophryina relative to outgroups). Wings above usually brown with some derivation in some taxa of iridescence in suffusion, patches, or even entire upper surfaces. Under surfaces of wing with hoary and mottled brown patterns, but none with concentrically jagged markings as in some Cissatsuma or Novosatsuma. Male Genitalia: Valvae characterized by caudal extension always exceeding one and one-half times caudal length of bilobed configuration but not caudal articulation of falces and by a narrowed breadth of caudal extension caudad the bilobed configuration; cornuti in apparent transformation series from more wide and disclike to an apomorph tapered state. Female Genitalia: Ductus variously narrowed caudad lamellae relative to breadth of latter, more extreme in the apomorph state; no transparent area caudad lamella, and antrum not apparent. Signa in apparent transformation series from somewhat bifurcate to reduced to lost in apomorph state.

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BIOLOGY. Early Stages: Only the life history of G. ferrea (G. frivaldskyi, misidentified, Shirozu and Hara, 1962, p. 94 see[synonymic discussion under frivaldskyi]). Only a few of the treatments are in English. The larvae feed on blossoms. Foodplants: Food plants are recorded for G. frivaldskyi only, but the work of Shirozu and Hara (loc. cit.) does not include the Latin names of these, making its commentary of little use.

TYPE SPECIES. Lycaena ferrea Butler, by original designation. That species was also designated as the type of Ahlbergia (by Bryk, original designation) and Satsuma (by Murray, original designation).

DISTRIBUTION. Spatial: Figs. 522, 523, 524, 525. Species of this genus occur from the rim of the Himalaya mountains (western Tibet east to Szechwan Province, China) eastward across southern China to Hong Kong. Only one species is known from India or the southern flanks of the Himalayas. Northward, species of Ginzia occur across China and Mongolia, and from Transbaikal in the Soviet Union eastward to the Kamchatka peninsula of Siberia, generally coinciding with the Amur River drainage. Distribution of taxa also includes the Korean Peninsula and the entire Japanese archipelago. Temporal: Dates of capture indicate flight periods variously from February through July.

REMARKS. Ahlbergia Bryk has, since Eliot's work (1973), been recognized as replacing both Satsuma Murray (by homonymy) and Ginzia Okano (by priority). However, the common usage of species associated with that genus has been polyphyletic (sensu Nelson). This study indicated that Ginzia has priority though it is curious that Hemming (1967) states this but Eliot restores Ahlbergia. Cladistic analysis limits the name Ginzia to the species here included, and other superficially similar taxa are found in four other genera in this study. Identification of Ginzia has formerly been limited to the recognization of hoary and

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mottled undersides and their occurrence in Asia. These wing characters are primitive characters relative to several other clades in worldwide Callophryina and convergent relative to various trends of derivation. Therefore, they are not useful diagnostically except for general phenetic placing of specimens into several possible groups.

A study of these groups by Gillham (1956) lumps all with Incisalia. I have treated the ideas and implications of this work in detail under the species which Gillham examined. Not only is his "genus" polyphyletic (sensu Nelson), but the critical disqualification of his work is his neglect of the types, his consideration of only a few taxa, and his failure to recognize that the taxa ferrea and frivaldskyi are not conspecific.

Concerning the latter, this study treats in detail the non-conspecificity of ferrea and frivaldskyi and the relation of this to synonymy. It also places these two species in the context of more immediate sister species discovered during the present investigation.

Most of the previous taxonomic errors in dealing with Palearctic "elfins" have resulted from an assumption that only a few species were involved, and consequent juggling of the relations among these. Workers have not comprehended the actual number of taxa represented, which, even counting species with obvious wing character difference, is prodigious. Most of these new species are from specimens which evidently have not been seen before. They come from the BMNH, and certainly must have been overlooked, even by Leech, since it is nearly impossible to imagine how the obviousness of some of them could have escaped any worker.

The following arrangement of species groups by apomorphic characters is accompanied by "Diagnostic Trait Groupings," useful in separating species of the species groups, along with other regional congeners which are superficially

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similar. These "Diagnostic Trait Groupings" are more useful than a simple key, because there is disparity between apparent wing patterns and genitalic configurations and a combination of characters is more useful than a dichotomous key. In groups with confusing wing patterns, groups require constellations of characters for easy recognition. In a key, the lack of one character in an aberrant specimen, or specimens from a hitherto unknown variant population can be easily misidentified. For Ginzia I provide trait groupings for the pluto Group, and for all the species in north China and the eastern Soviet Union, in particular reference to the Amur River Basin.

The generic cladogram and characters are presented in Figure 555.

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SPECIES GROUPS (6)

--as defined by nested sets of synapomorphies presented in Figure 555. Since diverse characters of the wing in Ginzia occur in a mosaic of patterns relatively primitive for Callophryina, a dichotomous key has not been possible. Rather, the text presents diagnostic trait groupings for clusters of taxa either phenetically or regionally allied. Since most taxa are new, appropriate specimens have also been figured.

1. The chalybea Group

including chalybea/casinorum

A. Cladogram and Characters (in Generic Cladogram, Fig. 555)

B. Distribution, Fig. 522.

Ginzia chalybea (Leech), new combination

Figs. 163, 401.

Satsuma chalybea Leech, 1893-94, p. 355.

Satsuma chalybea var. pluto: Leech, 1893-94, p. 355 (misidentified).

Satsuma taxon pluto: South, 1902, p. 140 (misidentified).

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DIAGNOSIS. This species can be recognized by the under surface pattern which resembles concentric arcs alternately gray to light drab, and has deep brown markings distad the postmedian lines on the forewing and hindwing. The female is quite distinctive on the upper surface, very bright gray-blue clearly framing a black-brown apex on the forewing and a smoothly edged terminal band on the hindwing.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 401) and frons as typical of the genus. Upper Surface of the Wings: Broadly dark Raw Umber except for suffusion of bluish scales basad. Small male scent patch distad in discal cell (less than one-fourth length of cell), usually colored yellowish. Hindwing deeply crennated, fringe black with some white; faint blue marginal line along the border, occasionally repeated along extreme margin of the forewing. Under Surface of the Wings: Ground color Warm Sepia, Olive Brown to Brownish Olive. Darker, more brown in hue basad postmedian line, forewing, and in basal disc, hindwing. Area basad postmedian line, forewing, slightly mottled brown or olivaceous brown; lighter marking distad in discal cell. Postmedian line reduced to dark blotchy brown line followed immediately distad by one more olivaceous, then one of lighter brown, again olivaceous and, in the submargin, a deep brown wavy line from costa to vein Cu_2. Margin distad to this olivaceous to deep brown; fringe weakly alternating deep brown, black, or white. Hindwing, basal disc dark Warm Sepia, two to four postbasal black lines paralleling each other in two rows of two across the cell; these followed distad margin of basal disc distinctly black basad and shaped as a crennated arc. Distad this margin a broad olivaceous band distad to crescent line, not a white line. Crescent line a deep brown arc of hemispherical markings followed immediately distad by a more narrow olivaceous band. This directly replaced by another crennated brown band joining the margin, cephalad the wing with complete

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terminal brown and broadening caudad to another brown, olivaceous, or brown band. Highly crennated margin heavily fringed, brown with some alternate white. Length of Forewing: male, BMNH, 15.0 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 401) and frons as typical of the genus. Upper Surface of the Wings: Apex and submargin, forewing, and broad terminal area of hindwing deep Raw Umber contrasting with bright Pale Medici Blue on rest of Wing. No scent patch distad in discal cell. Blue and Raw Umber on hindwing joining along a smooth, arced border, not a jagged one or one with brown hemispheres scattered through the blue. Distad this smooth border is a blue marginal line, continuous along the extreme margin of the forewing to about vein M_3. Hindwing especially crennated, fringe black with some alternate white. Under Surface of the Wings: As on male. Length of Forewing: 15.0 mm. (lectotype). Male Genitalia: Unknown; see remarks below. Female Genitalia: Fig. 163. Ductus long, length nine times width. Lamella postvaginalis extremely spatulate, almost as two wide hemispheres, adjoining ductus cephalad and meeting with a broad indention caudad. Margin of lamella postvaginalis minutely convoluted. Lamella antevaginalis very reduced, only present as rim of broad lamella postvaginalis and curved ventrad around the caudal tip of the ductus with caudal tenth of ductus protruding past the lips of the lamella antevaginalis. Corpus bursae small, length less than one-half length of ductus; signa large and thickly bifurcate.

BIOLOGY. Early Stages: Unknown. Foodplant: Unknown.

TYPES. Leech's original syntype series contained three specimens, two males and one female. These were found in the type collection and regular collection of the BMNH, with South having designated specimens labelled "a" and "c" as the male and female types, respectively, and assumed "b" as a syntype (South, 1902). Specimen "c" with Leech's labels (listed as a female by South) was

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found in the regular collection; it, however, is not a female and represents another species (see Remarks, below). Also, the abdomen of the male specimen "a" had been attached with glue and dissection reveals the association to be erroneous (see Remarks, below). Therefore, I have designated the female "b" as the lectotype. This was also figured by Seitz (1910, pl. 72, fig. g). I have designated the male specimen "a" as a paralectotype. Labels have been affixed clearly marking these as such. Type Locality. Chang-yang (= Changyang) in Hupeh Province, east central China, altitude circa 2,000 meters.

DISTRIBUTION. Spatial: Fig. 522. Specimens known from Changyang in Hupeh Province and Ta-Tsien-Lou (= Tatsienlu), west Szechwan Province, west China, considered by me as conspecific. Temporal: None of the specimens has a date.

REMARKS. The only male in Leech's type series was the only male of this species available for examination by me. Its abdomen was affixed with glue and represented the genitalia of the family Pieridae. Hence, the male genitalia of this long-described species still remains unknown. It is not known if the female genitalia of the lectotype precisely represent the configuration of normal chalybea. It might be argued that the peculiar form of the lamella antevaginalis on this specimen resulted from a bending down of that structure due to damage, thus explaining the unique protrusion of the ductus quite caudad the base of the lamella. Manipulation of the dissection to a position with the lamellae antevaginalis placed caudad the caudal end of the ductus did not satisfy me, however, that this configuration (typical of the group) was the natural one. Other females have not been available for dissection. Leech's syntype "c" is not a female, but a male and the holotype of cibdela, the male of which almost uncannily resembles the female of chalybea. Why Leech, and others, failed to recognize the male scent patch (very obvious on this specimen) or other then

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undescribed species with these blue males is not known. The genitalia and the forelegs of this specimen confirm the sex and the non-conspecific nature of this particular specimen.

Ginzia casinorum, new species

Figs. 29, 164, 402

DIAGNOSIS. Immediately distinguished from the other medium-sized brown-maled species by its hindwing appearing to be divided, with half having deep immaculate brown in the basal disc and half very light Snuff Brown devoid of any other markings distad. Extremely wide, shouldered margin of the valvae caudad the saccus is also very distinctive (see below and figures); female unknown.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 401) and frons as typical of the genus. Upper Surface of the Wings: Entirely warm Raw Umber, appearing slightly mottled with lighter shades. Scent patch at distal end of discal cell. Margin appearing heavily fringed and moderately crennated; slight gray scaling between veins 3A and Cu_2. Undersurface of the Wings: Entire ground color save basal disc, hindwing, and light postmedian line, forewing, light Snuff Brown. Forewing, postmedian line somewhat apparent, red-brown extending to vein Cu_2. Basad this line some evidence of red-brown scaling scattered across wing. Hindwing, basal disc uniformly dark Warm Sepia, vaguely mottled and with slight evidence of blackened postbasal line edged white distad, but only between anal margin and vein Cu_2. Distad postbasal line, scattered red-brown scaling sometimes apparent. Fringe of margin somewhat darkened. Length of Forewing: holotype, 13 mm., paratypes not measured. Female:

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Unknown. Male Genitalia: Fig. 164. Extremely wide-rimmed and shouldered valval shape caudad the saccus, widening distally. Caudal extension of valvae nearly straight; lateral shape round, slightly funneled cephalad; saccus pointed; cornuti as illustrated. Female Genitalia: Unknown.

TYPES. Holotype male (Fig. 29), Tsekou (= Tzeku), Szechwan Province, China, 1900, R. P. J. Dubernard. Paratypes (two males) same data as holotype, all deposited BMNH.

DISTRIBUTION. Spatial: Known only from the type locality. Temporal: Unknown.

ETYMOLOGY. This species is named for Mr. and Mrs. Bruce Casino.

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2. The ferrea Group

including ferrea/kimi--abromadogutta

A. Cladogram and characters, Fig. 556.

B. Distribution, Fig. 522.

Diagnostic Trait Groupings of Superficially Similar Ginzia from the ferrea group and congeners of northern China and southeastern Soviet Union.

Under surface of hindwings with basal disc red-brown (sometimes suffused with black), emphatic postbasal markings (or evidence of same beneath suffusion), submarginal pattern blotches of brown; entire hindwing underside often heavily suffused with gray. Length of forewing scent patch, male, over one-third length of discal cell, and colored yellowish. Male genitalia, area of bilobed configuration caudad saccus definitely ovate to shouldered in its own right and not nearly contiguously sloped into area of caudal extension, caudal extension only slightly shouldered, if at all; margins of cornuti generally rounded; female genitalia, no convolutions ventrad on lamella postvaginalis; signa reduced to small single broadly based spines. Range limited to Japan . . . . . ferrea

Under surface of hindwings similar to ferrea but duller brown, less suffused with gray and with little white edging the margin of the basal disc.

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Undersurface, forewing, basad postmedian line usually as dark as basal disc, hindwing. Forewing scent patch as on ferrea. Male genitalia with distad sloping of bilobed configuration caudad the saccus contiguous with caudal extexsion of the valvae, caudal extension tapered, terminal end of aedeagus not flared, caudal cornutus usually tapered to gradual point; female genitalia with breadth of lamellae nearly equalling length of ductus and with obvious convolutions ventrad on lamella postvaginalis, signa long, a broad spine bifurcated at the very end. Range, mainland Asia (Korea, Manchuria, and the Amur region of the Soviet Union) . . . . . kimi

Undersurface of hindwings, basal disc, gray-brown, mottled as to make any post-basal markings diminutive; submargin patterns distinct thin jagged black line arcing across the wing, framing within serrations areas of lighter ground color, not usually suffused with gray. This pattern, and checkering of margin black and white, form distinct impresssion of arcs of spots about the margin. Above, a marginal blue line creates the same effect. Length of forewing scent patch, male, small (one-fourth or less length of discal cell), colored black. Male genitalia, area of bilobed configuration caudad saccus definitely ovate to shouldered, caudal extension definitely shouldered, not tapered. Female genitalia, breadth of lamellae only slightly less than length of ductus, lamella postvaginalis convoluted ventrad and triangular in shape (caudal end tapered toward a point). Latter configuration and ductus narrowed in area intervening antrum and corpus bursae, creating unique shape, signum a small broad based spine. Range, northern China and southeastern Soviet Union. . . . . frivaldskyi

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Undersurface, both wings, dark chocolate brown. Male, with upper surface also shiny chocolate brown with steel-gray sheen and blue marginal line on hindwing running along highly crennated margin. Female above sheened to pale silver-gray with distinct blackened terminal markings between the veins, arcing about the wing. Basal disc of hindwing scarcely darker than rest of the wing, mottled and with vivid postbasal markings and another dark marking within cell basad margin of disc in the discal cell. Terminal markings of suffused blue-gray distad a serrated brown jagged line, arcing across the wing. Scent patch on male small (one-fourth or less length of discal cell), colored dark. Male genitalia with bilobed configuration caudad saccus ovate to shouldered, tapered toward point cephalad, not contiguous with slope of caudal extension; caudal with second row of teeth arced about its margin. Female genitalia similar to kimi but length of ductus one and one-half times breadth of lamellae, and only a vague single convolution ventrad on the lamella postvaginalis; signum one long nonbifurcate spine. Range, northern China and southeastern Soviet Union . . . . . abromadogutta

Hindwing margin so crennated as to form nearly tail-like shapes at the ends of veins 2A, Cu_2, and Cu_1, with pattern exaggerated by jagged extension of postbasal disc margin between veins Cu_1 and M_2, and a parallel jagged pattern in the submargin. Latter is heavily suffused with gray. Male scent patch circa one-third length of discal cell. Male genitalia with short valvae (do not exceed caudal end of falces where these articulate to vinculum); caudal extension extremely broad and then suddenly tapered to small points. Female genitalia with breadth of lamellae equal to or exceeding length of ductus, wide lamella antevaginalis lips, and deeply

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convoluted lamella postvaginalis ventrad; signa large, broad-based, widely bifurcate spines. Range, presently known only from Manchuria . . . tricaudata

Undersurface of the hindwing with basal disc deep brown, bordered black basad, white distad. Light crescent-shaped marking in discal cell. Terminus heavily darkened. Upperside of male heavily suffused light blue-gray except apex and submargins forewing and submarginal area hindwing. Male scent scale circa one-third length of discal cell. Male genitalia, bilobed configuration caudad saccus wide rimmed, indented, parabolic; caudal extension tapered to blunt tips. Range, presently known from northern China and the trans-Baikal Region, Soviet Union . . . . . aquilonaria

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Ginzia ferrea (Butler), status revised

Figs. 165, 166, 403

Lycaena ferrea Butler, 1866, p. 27. de Niceville, 1891, p. 374.

Satsuma ferrea: Murray, 1874, p. 168 (as type of Satsuma Murray, 1874).

Satsuma frivaldskyi = ferrea: Leech, 1894, p. 353.

Satsuma frivaldskyi (in part): Matsumura, 1929, p. 23.

Satsuma frivaldszkyi (sic) (in part): Seok, 1939, p. 216 (misspelling appears attributed to Seitz, 1909, but evidently in error).

Satsuma frivaldskyi ferrea (in part): Seitz, 1909, p. 264, pl. 72, fig. f. Okamoto, 1923, p. 68, Doi, 1931, p. 46. Uchida, 1932, p. 989. Nakayama, 1932, p. 381. Seok and Takacuka, 1932, p. 316. Seok, 1933, p. 70; 1934, p. 763; 1935, p. 99; 1936, p. 64. Mori, Doi, and Cho, 1934, p. 44, pl. 27, fig. 4. Seok and Nishimoto, 1935, p. 97. Haku, 1936, p. 117. Esaki, 1939, p. 219, pl. 103, fig. 398.

Satsuma ferrea (in part): Nakayama, 1932, p. 381. Mori, Doi, and Cho, 1934, p. 27. Seok, 1939, p. 216. Sibatani, 1946, p. 64. Miyajima, undated, p. 175.

[Ginzia] frivaldskyi ferrea (included Satsuma species): Okano, 1941.

[Ahlbergia] frivaldskyi (in part) (included Satsuma species): Bryk, 1946, p. 50.

Ahlbergia ferrea: Kim, 1961, p. 278. Shirozu and Hara, 1962, p. 94.

Incisalia frivaldskyi ferrea: Gillham, 1956, p. 149.

Callophrys (Incisalia) [frivaldskyi ferrea] (included all Incisalia species): Ziegler, 1960, p. 21.

Incisalia [frivaldskyi ferrea]: (included all Satsuma species): F. Brown, 1947, p. 21.

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Thecla frivaldskyi = Thecla coerulescens A. Bang-Haas = Lycaena ferrea: de Niceville, 1891, p. 374 (synonymies in error).

Ginsia (sic) ferrea (in part): Korschunov, 1972, p. 359.

Ginzia ferrea (in part): Korschunov, 1972, p. 359.

DIAGNOSIS. Endemic to Japan and there representing the only taxon of the genus. Can be distinguished from other species grouped in the character discussion above by the red-brown basal disc of the hindwing underside, the large male scent patch which is colored yellowish, the male genitalia evidencing a non-contiguous slope between the bilobed configuration and the caudal extension, and the female's lamellae breadth only being two thirds or less the length of the ductus.

DESCRIPTION. Male: Head, thorax, abdomen, palpi (Fig. 403) and frons as typical of the genus. Upper Surface of the Wings: Ground color dark Raw Umber overtoned distad with steely blue and suffused with light Medici Blue basad, especially on forewing. Male scent patch distad in discal area, over one-third length of cephalad vein of discal cell, colored yellowish. Wing margins checkered white between veins, black on veins; only slightly crennated. Under Surface of the Wings: Ground color yellow-brown (toward Raw Sienna) over-scaled with darker browns. Forewing, postmedian line costad to vein Cu_2, regular but displaced distad in cell M_3, red-brown basad, white distad. Brown marking distad in discal cell; rest of ground color heavily scaled, darker basad; marginal fringe checkered white and brown. Hindwing, basal disc, Carob Brown suffused with black and white flecks. Two postbasal markings, or at least evidence of same, black distad, white ventrad. Margin of disc deeply brown basad, black centrad, white distad. Distad margin of disc, ground color, lighter Raw Sienna, followed by brown blotches in submargin, sometimes crescent-

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shaped; distad these, ground color suffused very gray; margin red-brown, fringe alternating white and brown. Length of Forewing: $\bar{X}$ of twenty specimens (AMNH, BMNH), 13.5 mm., range 12.0 mm. to 14.5 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 403) and frons as typical of the genus. Upper Surface of the Wings: Entire wing, except apex and submargins (forewing) and submargins (hindwing) bright shiny light Medici Blue. No scent patch distad in discal cell. Marginal line of blue on hindwing from vein 2A to Cu_1 or M_3. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of twenty specimens (AMNH, BMNH), 14.0 mm., range 12.5 mm. to 15.0 mm. Male Genitalia: Fig. 165. Valvae caudad saccus, clear, narrow-rimmed, ovate to shouldered, not indented; valvae, lateral view, chevron to round-funneled; caudal extension of valvae tapered, only slightly shouldering, if at all; saccus pointed to slightly funneled; cornuti as illustrated. Female Genitalia: Fig. 166. Breadth of lamellae two-thirds or less the length of the ductus; lamella postvaginalis hemispherical in shape, not convoluted ventrad. Signa very reduced, small, single, broadly-based spines.

BIOLOGY. Early Stages: See below. Foodplant. Treated by Shirozu and Hara, 1962, but translation not available with latinized names.

TYPE. Holotype male, BMNH. Type Locality. Japan.

DISTRIBUTION. Spatial: Fig. 522. Japan, from Hokkaido south to Kyushu, in montane areas. Temporal: Dates on specimens examined range from March through early June.

REMARKS. The possible conspecificity of this species with frivaldskyi has been discussed in the literature since the time of Leech (1893-94) and de Niceville (1891). It has continued until the present (Seitz, 1910; Gillham, 1956; and in the popular guides published in Asia see[synonymy and bibliography]).

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Leech, who thought they were distinct species, had seen both sexes of the taxa and also the types, save perhaps frivaldskyi [of which he had seen at least Lederer's engraving (Leech, 1893-94)]. He had not, however, seen the genitalia. De Niceville considered them conspecific (1891). He also wanted to lump the then-current genus for these taxa (Satsuma) with Thecla which, even at that time, was known as a grade group of questionable value (Leech, 1893-94). Gillham, who dissected genitalia reputed to be these species, had seen none of the types, not all of the known taxa, and was ignorant of any taxa described after Leech or Seitz which the latter did not include. His lumping of the two taxa, along with his lumping of these species of the current genus (Satsuma) with Nearctic Incisalia Scudder cannot be considered credible on the evidence he presents. Having seen only a few of the taxa and none of the types of Satsuma, he knew nothing of the species limits for characters in the groups. Even his figure of the genitalia reputed to be frivaldskyi (from South Korea) cannot be confidently associated with that name; it seems to me to represent the species kimi described in this paper. The female genitalia presented by Gillham are too crudely drawn to clearly confirm this, but the male genitalia are representative of kimi, which is a sister species of ferrea, distinct mainly in genitalia and representing a mainland Asian distribution. From the present study I am confident that ferrea and frivaldskyi are distinct species and not immediate sister species. The more immediate sister species of frivalskyi are abromadogutta and tricaudata.

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Ginzia kimi, new species

Figs. 30, 167, 168, 404

Thecla frivaldskyi Lederer, 1855, p. 100. Elwes, 1884, p. 887. Pryer, 1946, p. 16 (all in part).

Thecla trivaldskyi (sic): Kirby, 1896, p. 398 (in part).

Thecla fridvalskyi (sic): Elwes, 1881, p. 865 (in part).

Satsuma frivaldskyi: de Niceville, 1891, p. 375. Seitz, 1910, p. 264, pl. 72, fig. f. Gillham, 1956, p. 149. Elwes, 1881, p. 865. Matsumura, 1929, p. 23 (all in part).

Satsuma frivaldszkyi (sic): Seok, 1939, p. 216 (misspelling appears attributed to Seitz (1909), but evidently in error).

Satsuma frivaldskyi ferrea: Seitz, 1910, p. 264, pl. 72, fig. f. Okamoto, 1923, p. 68. Doi, 1931, p. 46. Uchida, 1932, p. 989. Nakayama, 1932, p. 381. Seok and Takacuka, 1932, p. 316. Seok, 1933, p. 70; 1934, p. 763; 1935, p. 99; 1936, p. 64. Mori, Doi, and Cho, 1934, p. 44, pl. 27, fig. 4. Seok and Nishimoto, 1935, p. 97. Haku, 1936, p. 117. Esaki, 1939, p. 219, pl. 103, fig. 398 (all in part).

Satsuma ferrea: Murray, 1874, p. 168. Nakayama, 1932, p. 381. Mori, Doi, and Cho, 1934, p. 27. Seok, 1939, p. 216. Sibatani, 1946, p. 64. Miyajima, undated, p. 175 (all in part).

Satsuma ferrea frivaldskyi: Leech 1894, p. 353.

[Ginzia]frivaldskyi (included Satsuma species): Okano, p. 239 (in part).

Ginsia (sic) ferrea (in part): Korschunov, 1972, p. 359.

Ginzia ferrea : Korschunov, 1972, p. 359 (in part).

[Ahlbergia]frivaldskyi (included Satsuma species): Bryk, 1946, p. 50 (in part).

Incisalia frivaldskyi: Gillham, 1956, p. 149 (in part).

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Incisalia frivaldskyi ferrea: Gillham, 1956, p. 149 (in part).

Callophrys (Incisalia)[frivaldskyi](included all Incisalia species): Ziegler, 1960, p. 21 (and other authors).

Callophrys ferrea: Kawazoe and Wakabayachi, 1977, p. 118 (in part).

Incisalia[frivaldsky](included all Satsuma species): F. Brown, 1947, p. 21 (in part).

DIAGNOSIS. Similar to ferrea but occurring on the mainland of Asia. Separable from other taxa reviewed in the "Diagnostic Trait Groupings" by: underside of the hindwing duller brown, less suffused gray, with little white edging on the margin of the basal disc; male genitalia, bilobed configuration and caudal extension forming nearly continous slope to the caudal end of the valvae; female genitalia, breadth of lamellae nearly equalling length of the ductus, and lamellae postvaginalis deeply convoluted.

DESCRIPTION. Male. Head, thorax, abdomen, legs, palpi (Fig. 404) and frons as typical of the genus. Upper Surface of the Wings: Ground color dark Raw Umber overtoned distad with steel blue suffused with light Medici Blue basad, especially on the forewing. Male scent patch distad in discal area, over one-third length of cephalad vein of discal cell, colored yellowish. Wing margins checkered between veins, black on veins; wings only slightly crennated. Under Surface of the Wings: Ground color basad postmedian line, forewing, and in disc of hindwing Dresden Brown, heavily flecked with darker brown. Distad postmedian line, forewing, and basal disc, hindwing, ground color Fawn Color to Army Brown. Mottling of dark brown overscaling obscuring postbasal discs on hindwing, on forewing making heavy suffusion about a marking distad in discal cell; postmedian line brown to blackish basad, white distad. Marginal fringe faintly checkered white and dark brown. Hindwing, margin of basal disc only

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slightly edged with white distad, if at all; prominent white occuring only between veins $Sc_1 + R_1$ and Rs. Distad margin of basal disc, ground color Fawn Color to Army Brown replaced distad by brown blotches along the submargin and slight gray suffusion distad along the margin. Margin moderately crennated, fringe alternating white between veins, brown to black on veins. Length of Forewing: 13.0 mm. (holotype). Female: Head, thorax, abdomen, legs, palpi (Fig. 404) and frons as typical of the genus. Upper Surface of the Wings: Entire wing, except apex and submarginal areas of the forewings, and submarginal areas of the hindwing, bright shiny light Medici Blue. No scent patch distad in discal cell. Marginal line of blue on hindwing from vein 2A to Cu_1 or M_3. Under Surface of the Wings: As on male. Length of Forewing: 15.1 mm. (holotype). Male Genitalia: Fig. 167. Valvae caudad saccus clear, mid-rimmed and broadly parabolic to shouldered. One continuous tapered slope from margin of bilobed configuration to caudal tips of valvae. Valvae, lateral view, only slightly funneled. Caudal extension of valvae tapered, not shouldered; saccus funneled; cornuti as illustrated--caudal tip of aedeagus not flared, caudad cornutus tapered to a point. Female Genitalia: Fig 168. Breadth of lamellae nearly equalling length of ductus and with obvious convolutions ventrad on the lamella postvaginalis; signa long broad spines bifurcated at the tip.

TYPES. Holotype male (Fig. 30), South Korea, May 20, 1936, D. M. Seok. Allotype female, South Korea, May 2, 1936, D. M. Seok; deposited AMNH. Paratypes. NMNH: Korea, Schaus, no other data (two specimens). Seishin, Korea, Yanovsky (one specimen). BMNH: Pt. Sajan, = Najin (Port), North Korea, three specimens. The sexes of the paratypes are unknown because the specificity of this species was not expected at the time of examination, and complete data not noted.

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DISTRIBUTION. Spatial: Fig. 522. From data on specimens listed, and the literature, apparently distributed from Korea northward in the Amur River Basin of eastern Siberia in the Soviet Union, westward in the Amur tributaries and perhaps southwest in the mountains of northern China (a specimen with identical male genitalia, from Labran (= Labrang = Siaho), Kansu Province, northwest China). See Material Examined (Appendix). Temporal: Known specimen dates range from May into June.

REMARKS. The mainland Asia populations of this species definitely do not interbreed in nature with those of ferrea in Japan. Further, the difference in the genitalia indicate to me that the taxa cannot be considered conspecific within the present knowledge of species limits of characters in this genus. Hence, I consider kimi and ferrea as immediate sister species separated by a vicariance event. The specimens in the AMNH (2) and NMNH (4) and CMNH (2) were all dissected.

ETYMOLOGY. I am pleased to name this new species from Korea for David S. C. Kim.

Ginzia abromadogutta, new species

Figs. 31, 169, 170, 405

DIAGNOSIS. Distinguishable by the characters listed in the Diagnostic Trait Groupings for species from northern China and Siberia, Soviet Union: undersides of wings uniform chocolate brown in color, a third postbasal marking just basad the disc margin in the discal cell, male with deep chocolate brown upperside, shiny with a steel-gray sheen, and a vivid blue marginal band on the hindwing. Female al ›ve, brightly shiny blue-gray. Male genitalia similar to

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ferrea, with reduced saccus and area of valvae caudad saccus tapered to a point. Female genitalia more like kimi except ductus one and one-half times breadth of lamellae and with little convoluting ventrad on the lamella postvaginalis.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 405) and frons as typical of the genus. Upper Surface of the Wings: Ground color very dark (to Smithe's (1975) Fuscous) sheened with steel blue (caused by deep suffusion, not visible, namable color). Scent patch distad in discal area--one-quarter or less length of discal cell. Hindwing with marginal crennated blue line. Forewing fringe black-brown, margin hardly crennated; hindwing fringe black with some white in the mid-veins, margin heavily crennated. Under Surface of the Wings: Ground color uniformly Rood's Brown to Verona Brown, not noticeably lighter distad on forewing or in alternating patterns of hindwing. Basal disc slightly darker from heavy suffusion of darker brown scales; mottled markings--two typically postbasal and another in discal cell just basad margin of disc. Margin of disc black centrad, deep brown basad, white distad. Distad margin of disc ground colors scarcely lighter; crescent line forming jagged deep brown line, arcing about wing and framing midveins. Latter highly suffused with blue-gray scaling; black line along margin, fringe dark brown or black suffused with gray flecks and margin heavily crennated. Length of forewing: 14.0 mm. (holotype), paratype 11.0 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 405) and frons as typical of the genus. Upper Surface of the Wings: Apex and submargin of forewing, and submargin of hindwings deep Raw Umber. Rest of wing bright shiny Pale Medici Blue. Blue marginal line across hindwing and between veins 2A to M_1, blackish blotch-like markings. Under Surface of the Wings: As on the males. Length of Forewing: 13 mm. (allotype). Male Genitalia: Fig. 169. Similar to ferrea but with bilobed configuration caudad saccus tapered to a point and not indented. Lateral view of valvae, extremely

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broad, funneled. Caudal extension of valvae tapered; saccus reduced, broad parabolic; cornuti with second row spines on caudad cornutus, as illustrated. Female Genitalia: Fig. 170. Similar to kimi but with ductus much longer in relation to breadth of lamellae (one and one-half times) and only vaguely convoluted ventrad on the lamella postvaginalis.

TYPES. Holotype male (Fig. 31), Chine (= China), R. P. Armand David. Allotype female, Amorland (= Amur region); holotype BMNH, allotype AMNH. Paratype. BMNH: same data as holotype, but with notation "region du Nord, NW Islafrontiere" (one male) which is of uncertain meaning, though it may refer to the region around the mouth of the Amur River northwest of the upper Japanese island of Sakhalin. This is part of the Soviet Union, where the Amur curves widely along the border of Manchuria in China and the Soviet Union.

DISTRIBUTION. Spatial: Specimens with adequate data indicate the species occurs in the northeast Amur River basin area of China and the Soviet Union. Temporal: No dates are included in the data.

REMARKS. All of the known specimens were dissected.

ETYMOLOGY. The name is a combination of Latin words meaning "chocolate" ("abroma") and "dark-spotted" ("mado", "gutta"), refering to the ground color of the upper and under sides and the black spots arcing about the margin of the hindwing.

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3. The pluto Group

including krishnai/tsekouensis--hortoni/brabazonum--pluto; milleri.

A. Cladogram and Characters, Fig. 557.

B. Distribution, Fig. 523.

Diagnostic Trait Groupings for the pluto Group

Underside of hindwings brightly mottled brown with heavy white and blue-gray overscaling; no distinct white marking from anal margin to vein 3A and in cell between veins Sc + R_1 and R_2; upper surface of female blue basad (forewing only) or with some vague blue on hindwing; male genitalia, valvae caudad saccus wide-rimmed and distinctly shouldered; female genitalia lamella postvaginalis not convoluted ventrad, lamella antevaginalis square-angled and margin not entire; ductus widely indented caudad antrum; signum one large spine, vaguely bifurcate basad . . . . . pluto

Underside of hindwings brightly mottled brown with some white and blue-gray overscaling; distinct white markings at anal angle to Vein 3A and in cell between veins Sc + R_1 and R_2; upper surface of females bright blue basad on both wings; male genitalia, valvae caudad saccus thin-rimmed and parabolic, saccus very reduced; female genitalia, lamella postvaginalis not

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convoluted ventrad, lamella antevaginalis thin and gently rounded with margin entire; signum widely bifurcate . . . . . hortoni

Under surface of hindwings mottled dull brown with some vague white and blue-gray overscaling; distinct white marking from anal margin to vein 3A but none at cell between veins Sc + R_1 and R_2; male scent patch long and thin, colored brown to black; female upper surface completely bright blue except for marginal area, hindwing, and submarginal-apical areas, forewing; male genitalia, valvae caudad saccus cleft, wide-rimmed and broadly rounded; female genitalia, lamella postvaginalis convoluted ventrad, lamella antevaginalis rounded caudad, not square-angled, margin nearly entire, not deeply cleft; signum very small and widely bifurcate . . . . krishnai

Under surface of hindwings mottled dull brown with no appreciable, if any, white or blue overscaling; only faint touch of white, if any, along basal disc from anal margin to vein 3A. Male scent patch above elipsoid and yellow; females above devoid of blue except for vague flecking basad; male genitalia, valvae caudad saccus cleft but narrow rimmed caudad; female genitalia, lamella postvaginalis convoluted ventrad, lamella antevaginalis square-angled, deeply cleft caudad antrum; signum large single vaguely bifurcate basad . . . . . tsekouensis

Undersurface, hindwings, mottled dull brown; postbasal disc only slightly darker brown than rest of ground color; both wings giving general appearance of being rather devoid of markings other than postbasal disc and distinct bright red-brown across the limbal area; upper surface, females, vaguely blue basad on both wings; male genitalia, valvae caudad

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saccus cleft, but narrow-rimmed especially cephalad and tapering toward a "point" caudad the saccus; female genitalia lamella postvaginalis not convoluted ventrad and broadly spatulate, no recognizable lamella antevaginalis but only as narrow lip bordering caudad end of ductus; signum large, broad basad and then bifurcate far distad . . . . . brabazonorum

Entire wings of female light silvery blue, except margins and apices. Under surface, forewing, with spot distad in discal cell; postmedian area prodigiously lined. Undersurface of hindwing with basal disc, area distad disc, and limbal areas evenly dusted, former dull dark brown, second lighter, latter faintly red-brown. Female genitalia similar to pluto but ductus wider (male unknown) . . . . . milleri

Superficially similar, but of a different group:

With rich mottled brown underside overscaled with white and gray-blue; female with dark brown above and bright blue basad on forewing; however, female genitalia obviously not of this group but similar to caesius and frivaldskyi . . . . . fritzi

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Ginzia krishnai, new species

Figs. 32, 171, 172, 406

DIAGNOSIS. Distinguished from superficially similar species in the pluto Group by the characters listed in the "Diagnostic Trait Groupings" of the species group.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 406) and frons as typical of the genus. Upper Surface of the Wings: Dull dark Raw Umber, sometimes with faint blue suffusion on both wings; scent patch distad in discal area, long and thin in shape, black to brown in color. Wing margins moderately crennated, fringe brown with faint white between veins. Under Surface of the Wings: Basic ground color dull gray-brown (toward Cinnamon Drab) flecked over with warmer Verona Brown, forewing basad a postmedian red-brown line, edged distad with gray, running from costa to vein Cu_2, broken distad in cell M_3. Distad postmedian line, ground color drab brown. Hindwing, postbasal disc mottled darker Verona Brown flecked with black; two postbasal spots vaguely white distad; distinct white marking from anal margin to vein 3A. Distad margin of disc, ground color dull drab brown; faint submarginal crescent line heavily flecked with Verona Brown, sometimes toward red-brown along margin (but this not emphatic in relation to rest of wing); margin brown to black; fringe beneath, brown. Length of Forewing: 13 mm. (holotype); mean of three of the paratypes, 13.3 mm., range 13.0 mm. - 14.0 mm. Female: Head, thorax, abdomen, legs, palpi and frons as typical of the genus. Upper Surface of the Wings: Marginal areas of both wings and apical areas, forewing, dull Raw Umber; rest of wing bright Light Violet Plumbeous heavily crennated in pattern along terminus of hindwing, and repeated as thin marginal line. Margins of both wings crennated, fringe of both wings obviously white between

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veins. Under Surface of the Wings: As on male; single specimen with more gray over-scaling than males. Length of Forewing: 14 mm. (allotype). Male Genitalia: Fig. 171. Valvae caudad saccus clear, cleft, wide-rimmed, and broadly rounded, not indented; valvae lateral view, round, vaguely funneled; caudad extension of valvae only vaguely shouldered; saccus, wide-parabolic; cornuti as illustrated. Female Genitalia: Fig. 172. Lamella postvaginalis convoluted ventrad; lamella antevaginalis rounded caudad, not square-angled, with margin nearly entire, not cleft; signum very small, widely bifurcate spines.

TYPES. Holotype male (Fig. 32), Loutsechiang (= Lutien), Yunnan Province, China, no other data; allotype female, same data; deposited AMNH. Paratypes. AMNH: same data as holotype, four males. NMNH: same data as others, two females.

DISTRIBUTION. Spatial: Known only from eastern Yunnan Province, in panhandle between Szechwan and Kaichow provinces. Temporal: Unknown.

ETYMOLOGY. This species is named for Dr. Kumar Krishna.

Ginzia tsekouensis, new species

Figs. 33, 173, 174, 407

DIAGNOSIS. Distinguished from others of the pluto Group by the characters listed in the "Diagnostic Trait Groupings" given for the species group.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 407) and frons as typical of the genus. Upper Surface of the Wings: Warm Raw Umber, lighter basad. Scent patch distad in discal area, elipsoidal in shape, colored yellow-brown. Slight flecking of blue over ground color. Wing margins

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crennated, edged faintly with gray, fringe brown to gray. Under Surface of the Wings: Forewing warm Cinnamon Brown throughout; faint darker postmedian line from costa to vein Cu_2; marginal area lightly flecked gray. Hindwing, postbasal disc mottled dull Prouts Brown, mottling within disc emphatic as is marginal darkening. Distal edge of disc white; markings from anal margin to vein 3A extremely vague, if present at all. Distad disc, ground color dull, sometimes heavily flecked darker; submarginal crescent line emphatic, followed distad by dull ground color and brown at the margin, latter slightly flecked with gray. Margin brown to black; fringe black and brown. Length of Forewing: 13 mm. (holotype). Two paratypes, 13 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 407) and frons as typical of the genus. Upper Surface of the Wings: Completely dark Raw Umber with faint blue basad suffusion on both wings; both wings with fringe between veins, noticeably white. Under Surface of the Wings: As on male, but with less dark overscaling of the lighter ground color. Length of Forewing: 13 mm. (allotype). Male Genitalia: Fig. 173. Valvae, caudad saccus, clear, cleft, becoming narrow-rimmed caudad; lateral view of valvae, broad, tapered; caudal extension of valvae, shouldered; saccus, broadly parabolic; cornuti as illustrated. Female Genitalia: Fig. 174. Similar to krishnai, but lamella antevaginalis square-cornered with margin deeply cleft caudad antrum. Signa large single spines, only vaguely bifurcate basad.

TYPES. Holotype male (Fig. 33), Loutsechiang (= Lutien), Yunnan Province, China, no other data. Allotype female, Ta-sien-lu (= Kangting), Szechwan Province, China. Holotype deposited AMNH; allotype, BMNH. Paratypes. BMNH: Tse Kou (= Tzeku), Yunnan Province, China, 1902 (one male); same data, 1900 (one male); same data, 1895 (one female, one male). AMNH: same data as holotype (one male).

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DISTRIBUTION. Spatial: Fig. 523. The known specimens range from eastern Yunnan Province of China, in the panhandle between Szechwan and Kaichow provinces, westward to the eastern Tibetan plateau region of China. Tzeku is in extreme northwest Yunnan and connected by a trail northeastward to Kangting in western Szechwan Province. The altitude range for these areas is 1500 - 3000 meters. Temporal: Unknown.

ETYMOLOGY. This species is named for the area from which specimens were discovered.

Ginzia hortoni, new species

Figs. 34, 35, 175, 176, 408

DIAGNOSIS. This species is the immediate sister species of brabazonorum, and can be distinguished from it and other taxa in the pluto species group, by the characters listed previously in the introduction of the group.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 408) and frons as typical of the genus. Upper Surface of the Wings: very dark Raw Umber with very faint basad steel blue overcast. Scent patch distad in discal cell. Margins moderately crennated, fringe brown; slight blue marginal line from anal margin to vein 2A. Under Surface of the Wings: Basic ground color warm Verona Brown. Forewing with slightly darkened slash distad in discal cell, and a postmedian line, darker brown basad, white distad, running continuously from costa to vein Cu_2. Marginal area heavily scaled with light gray. Hindwing basal disc darkened toward Warm Sepia. Two faint postbasal spots blackened distad, whitish basad. Margin of disc darker brown to black basad, white-lined distad with prominent white at veins Sc + R_1 and Rs to the margin, and from

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the anal margin to vein 3A. Distad margin of basal disc much gray and white overscaling, especially in broad crescent -shaped area along anal margin beneath white marking to vein 3A. Postmedian, a brown crescent line heavily flecked with gray; distad this a gray terminus completely darker brown (like the disc) overscaled slightly gray. Margin brown to black; fringe brown. Length of Forewing: holotype, 12.5 mm. Paratypes not measured. Female: Head, thorax, abdomen, legs, palpi (Fig. 408) and frons as typical of the genus. Upper Surface of the Wings: Both wings, distad the medial area, dark Raw Umber; basad shiny light Medici Blue. Under Surface of the Wings: As on male. Length of Forewing: allotype, 11 mm. Paratype, not measured. Male Genitalia: Fig. 175. Valvae caudad saccus, clear, narrow-rimmed, parabolic, not indented; valvae, lateral view, broad tapered, with slight funnel, area just caudad articulation to saccus very narrow; valvae, caudad extension, shouldered; saccus reduced, pointed to slightly funneled; cornuti as illustrated. Female Genitalia: Fig. 176. Similar to congeners but lamalla antevaginalis narrower and gently curved distad from antrum; caudal lip entire, not broken by large indentation or by uneven sclerotization; signa widely bifurcate spines.

TYPES. Holotype male (Fig. 34), "Qua-Se, Yu-tong, Kitchang-Kou," Tibet, May-June 1892, native collectors; allotype female (Fig. 35), same data; deposited in BMNH. Paratypes. BMNH: Wa-ssu-Kow (= Weisheichou = Weishi), Yunnan Province, China[northwest of type locality, circa 100 Km, on same trail](one male). Ta-Tong-Kido (= Ta Tong, = Kiao, = Victoria, = bay of or shore of Victoria, i.e., Hong Kong) 1894 (one female). The type locality is actually mountainous western Yunnan Province, China, Kitchange-Kou (= Kienchwanchau = Kienchwan) Yu-tong (= Yungtung = Yunglung), the label indicating connections on a trail.

DISTRIBUTION. Spatial: Fig. 523. Given the occurrence of one specimen from Manchuria, mentioned below, and another from Hong Kong, the distribution

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may span the entire regions of China north into the Soviet Union. Temporal: May, June, and July.

REMARKS. One other specimen of this species includes: BMNH, "Pompejekka" (= Pomiyevka = Pompeyevka), "Little Chingan Mountains" (= Little Kinghan Mountains"), Manchuria, May 1910, one male. I have not included it in the paratypes because of its disjunct distribution. The genitalia and markings of this specimen are indistinguishable from the type series.

ETYMOLOGY. I am happy to name this species for Rev. Jeannie Horton.

Ginzia brabazonorum, new species

Figs. 36, 177, 178, 409

DIAGNOSIS. This species is the immediate sister species of the previously described taxon and can be distinguished from it and other species by the characters listed previously for the pluto Group.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 409) and frons as typical of the genus. Upper Surface of the Wings: Warm Raw Umber throughout, no noticeable difference in coloration of margin or fringe; wing margin crennated obviously only after vein M_2. Scent patch distad in discal area. Under Surface of the Wings: Ground color dull Snuff Brown. Forewing, noticeable darkening distad in discal cell, vague irregular postmedian line from costa to vein Cu_2. Hindwing, basal disc hardly lighter to only slightly lighter than ground color; post-basal markings as emphatic as margin of disc; disc margin edged faintly brown to black basad, flecked with occasional white but hardly noticeable distad; no white markings outstanding in pattern. Crescent line vague to absent. Limbal areas splashed with bright red-brown, margin

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darker, black to brown; fringe brown to black, flecked with gray. Length of Forewing: 13 mm. (holotype and paratype). Female: Head, thorax, abdomen, legs, palpi (Fig. 409) and frons as typical of the genus. Upper Surface of the Wings: As on male but with faint blue basad on both wings, and without scent patch. Under Surface of the Wings: As on male. Length of Forewing: allotype, 13 mm. Paratypes not measured. Male Genitalia: Fig. 177. Similar to tsekouensis and krishnai but narrow-rimmed caudad and tapering to a point, vaguely indented. Valvae, lateral view, funneled; valvae, caudal extension, slightly shouldered; saccus, pointed; cornuti as illustrated. Female Genitalia: Fig. 178. Distinct from the entire pluto group by large spatulate lamella postvaginalis and lamella antevaginalis reduced to vague lip surrounding caudal end of ductus. Signa wide basad, widely bifurcate distad.

TYPES. Holotype male (Fig. 36), Loutsechiang (= Lutien), Yunnan Province, China, no other data; deposited AMNH. Allotype female, "eastern frontier of Tibet" (translation from French, mine), native collectors for P. Dujean, 1905; deposited BMNH. Paratypes. BMNH: Same data as allotype (one male, one female).

DISTRIBUTION. Spatial: Fig. 523. Lutien is in eastern Yunnan Province, in the panhandle between Szechwan and Kaichow provinces. The "eastern frontier of Tibet" is considered to be that area indicated by all such labels in British Museum (unless they are those placed in error, with other more exact data), e.g., the mountains of the extreme eastern Tibetan plateau now included in China and including the areas Tzeku, Tasienlu, and others listed in Ginzia taxa. Temporal: Unknown.

ETYMOLOGY. I am happy to name this species for my friends Kevin and Maria Brabazon.

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Ginzia pluto (Leech), new status

Figs. 179, 180, 410

Satsuma chalybea var. pluto Leech, 1893, p. 355 (misidentified in part).

Satsuma chalybea var. pluto Leech, 1893, p. 355. Seitz, 1909, p. 264, pl. 72, fig. g. (misidentified).

Satsuma taxon pluto: South, 1902, 140 (misidentified in part).

[Ginzia]pluto (included Satsuma species): Okano, 1941, p. 239.

[Ahlbergia]pluto (included Satsuma species): Bryk, 1946, p. 50.

[Incisalia]pluto (included Satsuma species): Gillham, 1956, p. 145.

DIAGNOSIS. Can be recognized by the characters listed in the "Diagnostic Trait Groupings" for the pluto Group.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 410) and frons as typical of the genus. Upper Surface of the Wings: Raw Umber; scent patch distad in discal area; wing margins moderately crennated, slightly blue marginal line sometimes present on hindwing from anal margin to vein Cu_2. Fringe brown to blackish, sometimes whitened between the veins. Under Surface of the Wings: Basic ground color warm Verona Brown to Cinnamon Brown, richly flecked and mottled with white and gray-blue overscaling. Forewing rich Verona to Cinnamon Brown throughout, broken by slight evidence of darker spot distad in discal cell and by an irregular postmedian line--darker brown to black basad, gray to white distad, running from costa to vein Cu_2. Emphatic gray overscaling in terminal area forming submarginal brown crescent line--heavily grayed distad to deep brown margin; fringe brown, lined inwardly with gray. Hindwing, rich brown, post-basal spots emphasized by deep brown to black; margin of basal disc lined brown to black basad, vaguely white distad,

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if at all. No distinct white markings from anal margin to vein 3A or in cell between veins Sc + R_1 and R_2. Area distad basal disc lighter brown, followed distad by pronounced bright brown to black crescent line. Distad crescent line deep brown moderately to heavily overscaled white and gray-blue. Fringe brown, lined inwardly with black. Length of Forewing: mean of 14 males (BMNH), 14 mm., range 13.5 mm. - 15.5 mm. Female: head, thorax, abdomen, legs, palpi (Fig. 410) and frons as typical of the genus. Upper Surface of the Wings: Both wings, distad medial area, dark Raw Umber. Forewing shinly blue basad; hindwing completely brown or sometimes scattered blue basad. Occasional specimens completely brown with slight blue flecking on both wings. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 14 females (BMNH), 14 mm., range 13.5 mm. to 15.0 mm. Male Genitalia: Fig. 179. Valvae caudad saccus, clear, distinctly shouldered and wide-rimmed; valvae, lateral view, nearly round, only very slightly funneled; caudal extension of valvae slightly to moderately shouldered; saccus parabolic to broadly parabolic; cornuti as illustrated. Female Genitalia: Fig. 180. Lamella postvaginalis not convoluted ventrad; lamella antevaginalis square-angled with margin not entire, widely indented caudad antrum. Signum as one large spine, vaguely bifurcate basad.

TYPES. The syntype series is in the BMNH. The Leech (1894) syntype series includes [see also South (1902)]: two males from Chow-pin-sa (= Chao, and Pincha), two adjoining cities in Yunnan Province, China [Leech specimens lettered "a," "b"]; one male from Pu-tsu-fong (= possibly Pishichai) Yunnan Province, China [Leech specimen "c"]; and two males and two females from Wa-suu-kou Yunnan Province, China [Leech specimen letters "d" to "g"]. All of these specimens bearing Leech's catalogue numbers "a" to "g" have been located. South designates one male [Leech letter "d"] from Wa-suu-kow as a "type" and one female [Leech letter "f"] from Wa-suu-kou as a "type". In

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the type collection of the BMNH two such specimens were located but they bore no labels indicating who placed them there, or distinguishing them from the other Wa-suu-kou syntypes except by the association with Leech's letters. Further, the remaining male syntype in the collection at large is actually a male of another species (see G. hortoni). The type collection includes also a specimen which I infer is that figured by Seitz, 1909, as pluto. It does not bear any special label, nor is it listed as a syntype. It is not a Leech specimen and is not conspecific with Leech's syntypes. Therefore, I have designated the Leech specimen letter "d" as the lectotype of pluto and have affixed a label clearly marking it so. I have designated all the remaining syntypes, except the one lettered "e," as paralectotypes. I have made the specimen lettered "e" a paratype of G. hortoni. The specimen figured in Seitz and located in the type collection of the BMNH has become the holotype of Novosatsuma magnasuffusa. Type locality: Wa-suu-Kou, Yunnan Province, China.

DISTRIBUTION. Spatial: Fig. 523. There are specimens known from the eastern edge of the Tibet (Chamdo-Yunnan) northeastward to Mongolia and eastward to Yupeh Province in central China. Temporal: None of the many specimens bears a date.

REMARKS. This species is somewhat variable, although the range of characters above and always the genitalia will distinguish it. It and the species below define five very clear morphological groups and I find no evidence of a cline, even when some of these specimens represent the same locality. All the known specimens of the following four species were dissected along with pluto individuals from every locality known in collections. Five generally sympatric species are indicated. Variation in pluto usually involves the degree of blue above in the females, as noted in the description, and the degree of white and blue-gray overscaling on the underside of the wings. Of all the species in this group, pluto is by far the most emphatically marked with such overcasts.

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Ginzia milleri, new species

Figs. 37, 181, 411

DIAGNOSIS. The only species in the pluto group with the female completely blue except for the margins; male unknown.

DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, legs, palpi (Fig. 411) and frons as typical of the genus, except thorax and cephalad portion of abdomen heavily dusted with blue scales. Upper Surface of the Wings: Apical and submarginal area of forewing, and marginal area of hindwing, light Raw Umber. Rest of upperside light Medici Blue, broken with darkening along the veins. Hindwing margin only slightly crennated, nearly entire, lightly fringed. Undersurface of the Wings: Ground color, both wings, dull Snuff Brown. Forewing with vague spot, distal end of discal cell and obvious postmedian line broken radically into three lines, each edged distad with white: located quite proxad R_1 to M_2, very distad in cell M_3, and again proxad in cell Cu_1. No submarginal line is present. Hindwing with basal disc quite evenly dusted over with Mummy Brown scaling, occasionally appearing mottled. Distad basal disc lighter, as in ground color, but still dusted. Terminal markings scaled darker, sometimes forming brown crescent line, but with obvious gray scaling overcast. Faint traces of red-brown (near Chocolate) in the limbal region. Length of Forewing: holotype, 13 mm. Male Genitalia: Unknown. Female Genitalia: Fig. 181. Strongly resembling pluto, but with ductus somewhat wider and lamella antevaginalis broader. Signum singly pointed as one long spine, not bifurcate as in pluto.

TYPES. Holotype female (Fig. 37), Saio-Lou, Tibet, 1900; deposited BMNH. Paratype: CMNH, no data (one female).

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DISTRIBUTION. Spatial: Fig. 523. Known only from type locality and one specimen without data. Temporal: Unknown.

ETYMOLOGY. I am happy to name this species for Dr. David C. Miller.

4. The frivaldskyi Group

including aquilonaria/tricaudata (?) -- frivaldskyi

A. Cladogram and Characters, Fig. 558.

B. Distribution, Fig. 524.

-- diagnostic trait groupings given previously under Ginzia of northern China and southeastern Soviet Union.

Ginzia aquilonaria, new species

Figs. 38, 182, 412

DIAGNOSIS. Males bright gray-blue above and their hindwing under surface characterized by a deep brown basal disc, of black margin edged with white, a light crescent-shaped marking in the cell, and a very light postmedian band distad the basal disc followed distad by a dark brown terminus. The bilobed configuration, male genitalia, wide-rimmed and parabolic and the caudal extension tapered blunt ends; female unknown.

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DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 412) and frons as typical of the genus. Upper Surface of the Wings: Apex and submargin of forewing, and submargin of hindwing dark Raw Umber. Rest of the wing bright shiny Pale Medici Blue. Scent patch distad in disal area, circa one-third length of discal cell. Under Surface of the Wings: Ground color light Snuff Brown to Fawn Color with basal disc of hindwing and terminal area of hindwing much darker. Basal disc of hindwing dark Sepia; light crescent shaped marking in center of discal cell. Margin of basal disc deep brown basad, black centrad, white distad. Distad margin of basal disc, ground color much lighter, followed in terminus by dark sepia-like brown somewhat suffused with lighter coloration. Margin moderately crennated; fringe brown with some lighter suffusion. Forewing with small blackish spot in discal cell; postmedian line from costa to vein Cu_2 broken into two planes--one basad from costa to vein M_3, one distad from vein M_3 to vein Cu_2, these deep brown to black basad, white distad. Length of Forewing: 14 mm. (holotype). Male Genitalia: Fig. 182. Area of valvae caudad saccus, clear, wide-rimmed, parabolic and indented; valvae, lateral view funneled; caudal extension of valvae tapered, tips of valvae blunt ended; saccus reduced, funneled; cornuti as illustrated. Female Genitalia: Unknown.

TYPE. Holotype male (Fig. 38), Manchuria, no other data; deposited AMNH.

DISTRIBUTION. Spatial: Fig. 524. Known only from the type locality. Temporal: Unknown.

ETYMOLOGY. The Latin name "aquilonaria" means "of the north" referring to the region of the type locality in relation to the distributions of these groups in Asia.

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Ginzia tricaudata, new species

Figs. 39, 183, 184, 413

DIAGNOSIS. Recognized by the boldly crennated hindwings forming the ends of veins Cu_1, Cu_2, and 2A nearly into tails and the recurved anal area of the hindwing into a lobe. The wing margins are widely fringed with checkered black and white, and the undersurface of the wings is characterized by vivid hoary gray along the terminus of both wings contrasted heavily to vivid gray-brown in the basal disc of the hindwing and basad the postmedian line of the forewing.

DESCRIPTION. Male: Head, thorax, adbomen, legs, palpi (Fig. 413) and frons as typical of the genus. Upper Surface of the Wings: Wings entirely brownish-black, heavily covered with a sheen of Deep Green Blue Gray. Scent patch distad in discal cell. Wing margins both wings, crennated, extreme on hindwing; ends of veins 2A, Cu_2, and Cu_1 appearing nearly as tails, recurved anal area of wing nearly as an ovate lobe. Light blue spot in submargin between veins 2A and Cu_2. Fringe, both wings, widely checkered--black at vein ends, white between. Under Surface of the Wings: Ground color, forewing, basad post-median line and in basal disc of hindwing Snuff Brown to Saccardo's Umber, Sepia to Bister distad. Forewing with chevron-like slash distad in discal cell; postmedian line from costa to vein Cu_2--black basad, faintly white distad. Distad postmedian line, submargin very hoary, suffused heavily with gray; submargin between veins M_3 and Cu_2 with two brown chevrons. Fringe darker brown. Hindwing, basal disc Sepia to Bister basad and with two postbasal spots--white basad, black distad. Margin of basal disc black basad, white distad; portion of disc between veins Cu_1 and M_2 widely displaced distad; these and adjoining part of disc margin forming a pattern paralleling the tail-like projections of

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these veins. Distad basal disc, postmedian area uniform Snuff Brown followed by chevroned crescent line, deeper brown and suffused with gray; distad, a broad terminus of hoary coloration heavily suffused with gray forming a definite jagged outline along a strongly crennated margin. Fringe suffused gray, black at the vein ends. Length of Forewing: 12 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 413) and frons as typical of the genus. Upper Surface of the Wings: As on male but much lighter, toward Medici Blue. Wings somewhat less drastically crennated. No scent patch distad in discal cell. Under Surface of the Wings: As on male. Length of Forewing: 12.5 mm. (allotype). Male Genitalia. Fig. 183. Valvae very peculiar for the group: short and with caudal extension very broad, then suddenly tapering toward small points. Caudal extension not exceeding caudal tip of falces where they articulate with vinculum. Valvae caudad the saccus narrow-rimmed, parabolic with slight corner caudad; indented. Lateral view, valvae, funnel; saccus parabolic; cornuti as illustrated. Female Genitalia: Fig. 184. Ductus short, about same length as breadth of lamellae. Lamella postvaginalis deeply convoluted ventrad into one or two folds; lamella antevaginalis broad-lipped. Bursae length equal to length of ductus; signum large, widely bifurcate and broad based.

TYPES. Holotype male (Fig. 39), China, May 28, A. Avinoff. Allotype female, Tunkinsk, Weissgbg. (sic), southwest Irkutsk, July, Avinoff. Deposited holotype, AMNH; allotype, NMNH. Paratypes. NMNH: no data (one female). CMNH: data undiscernable (one female).

DISTRIBUTION. Spatial: Fig. 524. This species is apparently from the area west of the southern end of Lake Baikal in the Soviet Union. The Tunkinsk mountain region (Tunkinskye Gol'tsy') is here, just southwest of the city of Irkutsk. Other Avinoff specimens in the NMNH and CMNH are from this region, and since it is directly on the border of northern Mongolia, this may be the area

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of China indicated by the vague unreadable label on the particular CMNH specimen of Avinoff. Temporal: Apparently from at least late May into July.

REMARKS. The association of the male and females is by their identical undersurface patterns.

ETYMOLOGY. The Latin names "tri" and "caudata" mean "three-tailed" and refer to the tail-like shape of the heavily crennated margins of the hindwing between an anal marginal recurved lobe and vein M_3. Their shape is further exaggerated by the jagged gray terminal band which parallels them on the undersurface.

Ginzia frivaldskyi (Lederer), status revised

Figs. 185, 186, 414

Thecla frivaldskyi Lederer, 1855, p. 100. Elwes, 1884, p. 887. Pryer, 1946, p. 16.

Thecla trivaldskyi (sic): Kirby, 1896, p. 398.

Thecla fridvalskyi (sic): Elwes, 1881, p. 865.

Satsuma frivaldskyi: de Niceville, 1891, p. 375. Seitz, 1919, p. 264, pl. 72, fig. f. Gillham, 1956, p. 149. Elwes, 1881, p. 865 (in part).

Lycaena ferrea Butler, 1868: Leech, 1894, p. 353 (placed as synonym of frivaldskyi in error).

Satsuma frivaldskyi (in part): Matsumura, 1929, p. 23.

Satsuma frivaldszkyi (sic) (in part): Seok, 1966, p. 216 (misspelling appears attributed to Seitz [1909], but evidently in error).

Satsuma frivaldskyi ferrea (in part): Seitz, 1909, p. 264, pl. 72, fig. f. Okamoto, 1923, p. 68, Doi, 1931, p. 46. Uchida, 1932, p. 989. Nakayama, 1932, p. 381. Seok and Takacuka, 1932, p. 316. Seok, 1933, p. 70; 1934, p. 763;

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1935, p. 99; 1936, p. 64. Mori, Doi, and Cho, 1934, p. 44, pl. 27, fig. 4. Seok and Nishimoto, 1935, p. 97. Haku, 1936, p. 117. Esaki, 1939, p. 219, pl. 103, fig. 398.

Satsuma ferrea (in part): Murray, 1874, p. 168. Nakayama, 1932, p. 381. Mori, Doi, and Cho, 1934, pl. 27. Seok, 1939, p. 216. Sibatani, 1946, p. 64. Miyajima, undated, p. 175.

Satsuma ferrea frivaldskyi: Leech, 1894.

[Ginzia]frivaldskyi (included Satsuma species): Okano, 1941, p. 239.

Ginsia (sic) ferrea (in part): Korschunov, 1972, p. 359.

Ginzia ferrea (in part): Korschunov, 1972, p. 359.

[Ahlbergia]frivaldskyi (included Satsuma species): Bryk, 1946, p. 50.

Ahlbergia ferrea (in part): Kim, 1961, p. 278. Shirozu and Hara, 1962, p. 94.

Incisalia frivaldskyi: Gillham, 1956, p. 149.

Incisalia frivaldskyi ferrea: Gillham, 1956, p. 149.

Callophrys (Incisalia) frivaldskyi (included all Incisalia species): Ziegler, 1960, p. 21 (and other authors).

Callophrys ferrea (in part): Kawazoe and Wakabayachi, 1977, p. 118.

[Incisalia]frivaldskyi (included all Satsuma species): F. Brown, 1947, p. 21.

Thecla frivaldskyi = Thecla coerulescens A. Bang-Haas = Lycaena ferrea: de Niceville, 1891, p. 374 (synonymies in error).

DIAGNOSIS. Male, bluish-black above; female bright light blue. Male scent patch small, one-fourth or less length of discal cell, dark colored. Markings on both sides, hindwing, characterized by a combination of checkered wing fringe and marginal markings appearing as a marginal arc of spots across the wing. Male genitalia, caudal extension definitely shouldered as no other member of the group; female genitalia with lamella postvaginalis tapered toward

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point; ductus narrowed between antrum and corpus bursae, making very recognizable configuration.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 414) and frons as typical of the genus. Upper Surface of the Wings: Ground color dark Raw Umber overtoned distad with steel blue; basad suffused Light Medici Blue, especially on forewing. Male scent patch distad in discal area, only one-fourth or less length of discal cell; dark colored. Wing margins checkered white between veins, black on the veins; wings moderately crennated. Checkered wing fringe and blue marginal line on hindwing broken by black midveins giving appearance of arc of spots running across the wing. Under Surface of the Wings: Ground color, basal disc of hindwing, gray-brown (Mouse Gray, Light Mouse Gray, to Hair Brown) mottled, making any postbasal markings indistinct. Ground color distad basal disc, lighter, with distinct submarginal black line; latter jagged, arcing across the wing. Serrations of submarginal line forming disjunct areas of light ground color around the margin; these not usually suffused with gray. Submarginal line and margin, along with white mid-vein fringe and black on the veins give distinct appearance of spots being arced about the margin of the wing. Forewing, ground color same as hindwing, but lighter, increasingly so distad. Postmedian line from costa to Cu_1 or Cu_2, usually with reduced spots, sometimes irregular; displaced distad between veins M_3 and Cu_1. Margins slightly hoary or suffused with darker flecking, occasionally appearing as slight submarginal line; small dark gray-brown blotch distad in discal cell. Fringe alternating white between veins, black on veins. Length of Forewing: $\bar{X}$ of 15 specimens (BMNH), 13.2 mm., range 12.5 mm. to 14.5 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 414) and frons as typical of the genus. Upper Surface of the Wings: Bright Light Medici Blue except for deep Raw Umber, apex and submargins of forewing, and submargins, hindwing. No scent patch

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distad in discal area. Blue marginal line on hindwing, broken by dark veins, giving appearance of arc of spots across the wing. Fringe checkered white between the veins, dark on the veins. Under Surface of the Wings: As on male. Length of Forewing: $\bar{X}$ of 15 specimens (BMNH), 14.2 mm., range 13.0 mm. to 15.0 mm. Male Genitalia: Fig. 185. Valvae caudad saccus, clear, definitely ovate to shouldered, caudal extension definitely shouldered. Valvae, lateral view, funnel; saccus broadly funneled; cornuti as illustrated. Female Genitalia: Fig. 186. Breadth of lamellae only slightly less than length of ductus, lamella postvaginalis convoluted beneath and triangular shaped, with caudal end tapered toward a point. Ductus narrowed between antrum and corpus bursa; signa single small broad-based spines.

TYPES. The original description mentions fifteen specimens from mountains in the vicinity of Ust-Buchtarminsk (see below) from 2 June. From the literature available to me on Lederer's life (Krattz, 1870; Strecker, 1878; Rebel, 1901) it appears that his extensive notebook and acquisitions from the Zoologisch-Botanischen Vereins in Vienna are now at the Naturhistorische Museum in Vienna. Type series not definitely located or examined. Type Locality. In his original description, Lederer records that the type specimens are from mountains in the vicinity of Ust-Buchtarminsk (= East Bukhtarminskoye) a peninsula jutting into Lake Zaysan just west of the Mongolian border in extreme east Kazakhstan, Soviet Union.

DISTRIBUTION. This species occurs from the Amur river basin south into Manchuria and possibly Korea (specimens reported by Gillham from Korea may not represent this species), and westward across northern Mongolia (in the mountains) through the trans-Baikal area and Irkutskaya Oblast (Sayan Mountains) southwest at least as far as the Altai Mountains. Temporal: Dates on specimens range from March into mid-June.

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REMARKS. See remarks under ferrea concerning the history of controversy concerning that species possible conspecificity with frivaldskyi. Seitz 1909, pl. 72, fig. f is not frivaldskyi, but ferrea. In total 38 specimens of frivaldskyi (BMNH) were examined; 12 were dissected for genitalia, legs, and palpi.

5. The circe Group

including prodiga/caesius--fritzi--montivaga/circe

A. Cladogram and Characters, Fig. 559.

B. Distribution, Fig. 525.

Ginzia prodiga, new species

Figs. 40, 41, 187, 188, 415

DIAGNOSIS. Recognized by the bright upper surface blue encompassing the discal and basal areas of both wings in both sexes, not just regions basad. There is a ragged hindwing margin and the undersurface pattern is reminiscent of the Novosatsuma pratti group. It is distinguished from the Novosatsuma taxa by genitalia of both sexes (see Remarks under Ginzia) from the blue-maled group of Novosatsuma by the pratti-like undersurface and from other Ginzia by this latter character. Illustrations cited and described below.

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DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 415) and frons as typical of the genus. Upper Surface of the Wings: Base of wings Verona Brown; forewing area proxad scent patch, distad to submarginal area bright shiny blue (near Burn Blue); entire hindwing except marginal area, bright shiny blue. Margin of hindwing serrated. Under Surface of the Wings: Forewing Verona Brown, spots distad in discal cell; regular but wavy submarginal and postmedian lines, richer red brown (near Chocolate), postmedian area, more red-brown than rest of wing. Hindwing, basal disc mottled deep brown (Mummy Brown) over Verona Brown and edged darkly. Dark edging, basal disc, accented by white distad markings between veins Sc + R_1 and Rs, veins Cu_2 and the inner margin, and white markings proxad a single postbasal spot. Distad basal disc, wing ground color Verona Brown, heavily mottled Mummy Brown. Length of Forewing: 12 mm. (holotype). Female: Head, thorax, abdomen, legs, palpi (Fig. 415) and frons as typical of the genus. Upper Surface of the Wings: Base of wings Verona Brown with entire wings distad, except apical area of forewing and submarginal areas of both wings, bright shiny blue (near Burn Blue). Margin of hindwing serrated and heavily fringed. Under Surface of the Wings: As on male. Length of Forewing: 15 mm. (allotype). Male Genitalia: Fig. 187. Similar to circe but caudad extension of valvae much shorter and less shouldered. Valvae caudad saccus, clear, mid-rimmed, parabolic, unindented; valvae, lateral view, vaguely chevroned, funneled; valvae, caudad extension, tapered; saccus wide-parabolic; cornuti as illustrated. Female Genitalia: Fig. 188. Similar to circe but area joining lamellae more pointed distad and curving cephalad, not caudad. Signa very reduced and not bifurcate.

TYPES. Holotype male (Fig. 40), Bahand, Yunnan Province, China, January, 1917, Cuvrad. Allotype female (Fig. 41), same data; both deposited BMNH.

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DISTRIBUTION. Spatial: Fig. 525. Known only from the type locality. Temporal: Known only from "January."

REMARKS. The sexes of this species are associated by the similarity of the underside markings and their identical labels. The date indicated for capture may be inaccurate, or refer to a date of purchase.

ETYMOLOGY. The Latin name "prodiga" means "extravagant", referring to the prolific blue coloration of the upperside of both sexes.

Ginzia caesius, new species

Figs. 42, 189, 416

DIAGNOSIS. Easy to recognize: the females resemble chalybea above but pluto beneath, and has genitalia closest to circe. The male is unknown.

DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, legs, palpi (Fig. 416) and frons as typical of the genus. Upper Surface of the Wings: Apical and submarginal area of forewing dark Raw Umber; rest of forewing and entire hindwing, except chevron-shaped patches along the margin, bright shiny Medici Blue. Veins above blue. Hindwing, wide marginal blue line bordering nearly black or charcoal-gray outer margin. Margin delicately crennated and fringed brown and white. Under Surface of the Wings: Forewing proxad postmedian line warm Verona Brown with darker spot edged distad with white at the distal end of the discal cell. Postmedian line darker brown proxad, black centrad, white distad, broken into two planes--vein R_2 to M_3, then distad, vein M_3 to Cu_2. Distad this line ground color warm Snuff Brown with broad terminal gray over-scaling, first light, then darker towared brown-fringed margin. Hind-

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wing, basal disc warm Verona Brown with Sepia-colored postbasal and medial markings. Latter form darkened edge of basal disc and are bordered distally with a narrow black and then broader white band. Entire basal disc often flecked with gray. Distad basal disc, postmedian area lighter Snuff Brown overlaid with darker brown and gray. Postmedian area followed distad by broad terminal darkening and obvious gray overscaling along entire margin. Proxad terminal area, dark brown blotches from vein Sc + R_1 to vein M_2 then becoming red-brown (nearer Chocolate) across limbal area. Margin moderately crennated; fringe brown. Length of Forewing: 15 mm. (holotype); one paratype, 12 mm. Male Genitalia: Unknown. Female Genitalia: Fig 189. Somewhat resembling circe, but the lamella postvaginalis tapered more narrowly caudad and lamella antevaginalis with strongly hemispherical sclerotizations about its rim. Ductus short, less than two times maximum breadth of lamellae, obviously flaired cephalad; signa reduced to extremely small spines.

TYPES. Holotype female (Fig. 42), Eastern Frontier of Tibet, 1906, P. Dejean. Paratype. Tatsienlou (= Kangting), Szechwan Province, China, 1910 (female). Both deposited BMNH.

DISTRIBUTION. Spatial: Fig. 525. Presently known from extreme eastern Tibet to western Szechwan Province of China. Temporal: Unknown.

ETYMOLOGY. The Latin name "caesius", means "blue-gray", referring to the very obvious coloring of the wing uppersides.

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Ginzia fritzi, new species

Fig. 43, 190, 417

DIAGNOSIS. This species is unique in the group because it appears superficially very similar to species of the pluto group. The upperside of the female has extensive blue, especially basad on the wings, and the underside, quite at variance with the circe group pattern of basal and postbasal concentrations of color, is hoary and mottled like the species related to pluto. The genitalia of fritzi, however, are unmistakably of the circe group, with the unique character of broadened antrum and lamella antevaginalis. The species can be distinguished from members of the pluto group by the characters listed in the pluto group "Diagnostic Trait Groupings" (where it is included because of its superficial similarity) and from the circe group by those obvious characters.

DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, legs and palpi (Fig. 417) as typical of the genus. Upper Surface of the Wings: Margins and apices warm Verona Brown to Sepia, base of forewing and slight area, base of hindwing, bright iridescent violet-blue. Margins, both wings, crennated to serrated; recurved lobe, hindwing, brighter red-brown. Under Surface of the Wings: Basic ground color warm Verona Brown. Forewing with postmedian line, costa to vein Cu_2, displaced distad, in cell M_3, black to brown basad, blue-suffused distad. Forewing terminus broadly suffused bluish. Hindwing ground color similar to forewing but lighter distad basal disc. Pattern characterized by two postbasal slashes, brown distad, blue-suffused basad; irregular margin of basal disc, brown basad blue-suffused to white distad; submarginal very jagged arc across wing, brown centrad, suffused blue basad and distad; and terminus suffused bluish and ordered distad by jagged black to brown border and basad by brown accents to submarginal line. Margin extremely

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crennated, if not serrated, heavily fringed brown, randomly suffused lighter. Male Genitalia: Unknown. Female Genitalia: Fig. 190. Obviously of the circe group but bearing some marked differences. Lamella postvaginalis hemispherical with slight "knob" caudad; concentric ventral folds ventrad. A large antrum configuration separating two wide lips of the lamella antevaginalis. Ductus flared caudad at antrum and again cephalad. Signa single curved spines.

TYPES. Holotype female (Fig. 43), Ta-tsien-Lou, Szechwan Province, China, 1910. Deposited BMNH.

DISTRIBUTION. Spatial: Fig. 525. The locality is in extreme montane western Szechwan Province of China as it borders westward on Tibet. Temporal: Unknown.

REMARKS. I have already noted the unusual and unexpected nature of the diversity in the Asian elfins. The species which form several other genera of these hoary and mottled butterflies testify to the apparent length of time evolution has been affecting various lineages across the east Asian continent. My recognition of several sibling species in the diversely speciated genus Ginzia is in part based on my assumption that if consistent variation is apparent, especially apomorphic characters, there is no reason to lump superficially similar taxa into grade group species for the entire continent. The species fritzi reinforces this attitude. Superficially it resembles a pluto group taxon, but dissection reveals genitalia obviously of another group of species whose genitalia, especially in the females, resemble no others.

ETYMOLOGY. This species is named for William ("Fritz") Spang, Jr.

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Ginzia montivaga, new species

Figs. 44, 191, 192, 418

DIAGNOSIS. This species resembles G. circe but can be recognized by the warm yellow-brown undersurface coloration and the genitalia. Male genitalia distinctive: caudal extension of the valvae much longer (extension bilobed configuration four times width; circe, two and one-half times width) and with rims extremely wide and broadly ovate.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 418) and frons as typical of the genus. Upper Surface of the Wings: Entire surface dark Raw Umber. Scent patch distad in discal cell. Margin and fringe slightly darker than rest of wing; margin vaguely crennated. Under Surface of the Wings: Entire underside except postbasal disc yellow-brown (near Tawny Olive). Forewing with postmedian line costa to Cu_2 curving distad at vein M_3; ground color slightly darker basad this line. Hindwing, postbasal disc darker brown (Verona Brown). Two blackish postbasal slashes faintly edged white basad. Margin of postbasal disc faintly edged black basad, white distad. Postmedian band of yellow-brown ground color followed by Verona Brown crescent line fused into darker Verona Brown ground color of terminal area. Margin darker and fringed brown, white, and black. Length of Forewing: Holotype, 14 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 418) and frons as typical of the genus. Upper Surface fo the Wings: As on male but lacking scent patch; both wings bright Hyssop Violet basad. Under Surface of the Wings: As on male, but allotype specimen (not as rubbed) richer brown--ground color toward Mikado Brown, basal disc toward Russet; crescent line of hindwing distinctly darker than terminal area. Length of Forewing: Allotype, 14 mm. Male Genitalia: Fig. 191. Resembling circe but caudal extension of valvae much longer in relation to

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width. Bilobed configuration broadly ovate and wide-rimmed, indented. No spines obscuring transparent lobes. Valvae, lateral view, round, funneled; saccus parabolic; cornuti as illustrated, more and more obvious spines than on circe. Female Genitalia: Fig. 192. Similar to circe but ductus longer (two times width of lamellae; circe less than one and one-half times) and with much more extensive convolutions ventrad on the lamella postvaginalis; signa larger than on circe and more bifurcate.

TYPES. Holotype male (Fig. 44), "Camp I, 11,200' to Kopadi [Tibet] 10, 250', to Camp II, 9150', 11 April," Kelley-Roosevelt Expedition,1929. Allotype female, "Lakashili to Aowak," 15 March, Kelley-Roosevelt Expedition, 1929, both deposited BMNH.

DISTRIBUTION. Spatial: Fig. 525. These specimens are from the "Kunlan Shan" area of high mountains ringing the northern plateau of Tibet and bordering Chinese (East) Turkestan. This area is also known as "Kokoshili" or "Shili" eastward on the Tibetan Plateau and as the "Tagh" northward. The two specimens span this distribution. The extreme high altitudes marked on the specimen labels is noteworthy and corresponds with those indicated on maps for the localities. Temporal: The dates on the specimens range from 15 March to 11 April.

REMARKS. The localities of these two specimens are on two high mountain trails. That of the holotype evidently refers to Kopa (Kapa on some maps) (suffixes [as in "Kopadi"] are common on British Museum specimens, and may relate to earlier word usages). Kopa is just west of the trail including the localities on the allotype. These latter refer to "Shili," which is eastward on the plateau and refers to a region. "Aowak" evidently refers to Ayak, a lake northward (hence, the prefix "Laka" on the label). The expedition's labels refer also to Yunnan and Szechwan, but such labels are placed indiscriminately on

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BMNH material and can be misleading as in this case. Some specimens from the Kelley-Roosevelt expedition also include "Thibet" labels or those mentioned just above. Earlier trips into western Tibet were evidently offshoots of the particular Szechwan and Yunnan itineraries (see Pratt, 1892).

ETYMOLOGY. The Latin name stems from a Latin colloquial "montivaga", "mountain roamer," referring to the rather exotic distribution of this insect along the rim of the Himalayas north of the Gobi desert.

Ginzia circe (Leech)

Figs. 193, 194, 419

Satsuma circe Leech, 1893-94, p. 354. Seitz, 1910, p. 264, pl. 72, figs. f, g.
Satsuma taxon circe: South, 1902, p. 140.
[Ginzia]circe (included Satsuma species): Okano, 1941, p. 239.
[Ahlbergia]circe (included Satsuma species): Bryk, 1946, p. 50.
[Incisalia]circe (included Satsuma species): Gillham, 1956, p. 145.

DIAGNOSIS. This species can be easily distinguished from all the congeners except its sister species montivaga by the characteristic wing shape and the simplicity of the underside pattern. The wing margin is hardly crennated, if at all, and the recurved lobe of the hindwing margin basad vein 2A is broadly "tail-like," not curved dramatically inward as on other species. Beneath the pattern is simple and generally unmottled. Lighter brown to yellow-brown on the forewing and hindwing distad the basal disc, with the basal disc uniformly to only very slightly mottled brown and with its edge pushed far distad between veins M_2 and Cu_1. The remaining pattern appearing as a simple darker brown postmedian

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line on the forewing being repeated by a submarginal line of blotches on the hindwing, with light ground color distad these lines, followed by a line of marginal brown. The taxon kopadiensis, found far to the west in Tibet, is similar but distinctly warm yellow-brown beneath and with quite different genitalia (see discussion under kopadiensis). High altitude forms of circe become more hoary and darkly scaled beneath but do not change appreciably in pattern.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 419) and frons as typical of the genus. Upper Surface of the Wings: completely Raw Umber; male scent patch distad in discal area, small (no more than slightly longer than maximum width of discal cell), usually yellowish. Margin hardly crennated but heavily fringed. Recurved lobe of hindwing broadly tail-like, not curved emphatically inward. Under Surface of the Wings: Ground color Snuff Brown to Sayal Brown, always with a yellowish cast except in high altitude specimens. Disc of hindwing darker Verona Brown, cast yellowish. Very little mottling on any part of the wings, but both wings heavily overscaled with flecks of darker brown. Forewing with postmedian line quite entire, costa nearly to base of wing, often as blotches of deeper brown rather than a line, and occasionally obscured. No marking distad in discal cell. Hindwing with basal disc hardly mottled, darker than rest of wing with disc margin pushed distad dramatically between veins M_2 and Cu_1. Usually no distinct edging of disc. Distad disc, marginal ground color lighter and more yellowish (as on forewing), with crescent line reduced to line of browner blotches ringing the basal sida in an arc. Distad this arc, lighter ground color followed distad by brown along the margin. Faint deep brown to black marginal line framing brown, black, and yellowish fringe. Specimens from high altitudes (3000 - 4000 meters) more hoary, dark-flecked, and with patterns obscured. Length of Forewing: $\bar{X}$ of twelve specimens (BMNH) 14.0 mm., range 13.0 mm. to 15.5 mm. Female:

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Head, thorax, abdomen, legs, palpi (Fig. 419) and frons as typical of the genus. Upper Surface of the Wings: As on male but without scent patch distad in discal area and with faint to somewhat noticeable blue basad on both wings. Under Surface of the Wings: As on male. Length of the Forewing: $\bar{X}$ of twelve specimens (BMNH), 14.5 mm., range 13.0 mm. to 15.5 mm. Male Genitalia: Fig. 193. Caudal extension broadly curved and tapering, unique within the circe Group. Valvae caudad saccus, clear, narrow-rimmed, slightly cornered, vaguely indented; valvae, lateral view, round, funneled; saccus broadly parabolic; cornuti as illustrated. Female Genitalia: Fig. 194. Ductus broad at caudal end, tapering to narrow neck before antrum. Antrum very reduced, narrow neck broadening into broad lips of lamella antevaginalis. Lamella postvaginalis quite ovate, convoluted ventrally with two major folds. Signa large, widely bifurcate, almost horse-shoe shaped.

TYPES. Syntype series in BMNH: Leech specimens from Ta-chien-lu (= Tatsienlu), western Szechwan Province, China, labelled "a" through "k", none with dates, all listed by South (1902), all located by me. South designated specimen "a" as the "male type" and specimen "j" as the "female type." I have designated specimen "a" as the lectotype and clearly marked it so; I have designated the other specimens of this series "a" through "k" as paralectotypes, and labelled them as such. Type Locality. Tatsienlu, west Szechwan Province, China, altitude circa 3000 meters.

DISTRIBUTION. Spatial: Fig. 525. Widely distributed along the eastern edge of the Tibetan Plateau in the western mountains of Yunnan and Szechwan provinces of China. Tatsienlu is on a mountain trail in western Szechwan Province north of the western panhandle of Yunnan Province and connected on this trail to Tseku (another common BMNH locality). Temporal: There are specimens with labels from March to June.

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REMARKS. Thirty-four specimens of circe were examined; twelve specimens of these were dissected along with numerous others originally placed with circe in collections but now associated with other taxa.

6. The leechi Group

including nicevillei/leechi

A. Cladogram and Characters, Figs. 554, 555, and Generic Discussion.

B. Distribution, Fig. 525.

Ginzia nicevillei (Leech)

Figs. 195, 196, 420

Satsuma nicevillei Leech, 1893, p. 355.

[Ginzia]nicevillei (included Satsuma species): Okano, 1941, p. 239.

[Ahlbergia]nicevillei (included Satsuma species); Bryk, 1946, p. 50.

[Incisalia]nicevillei (included Satsuma species): Gillham, 1956, p. 145.

DIAGNOSIS. This species is easily recognized by the underside resembling circe but the upperside being bright gray-blue on both sexes. It is similar only to leechi but can be distinguished from it by characters noted in leechi diagnosis: under surface, hindwing, more contrasted on nicevillei with obvious postbasal markings.

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DESCRIPTION. Male. Head, thorax, abdomen, legs and palpi (Fig. 420) as typical of the genus. Upper Surface of the Wings: Entire wing above, except costa and submarginal area of forewing and submarginal and anal areas of the hindwing bright Pale Medici Blue, heavily scaled, making blue coloration appear very dense and lustrous. Obvious blue marginal line on hindwing, anal angle to vein Cu_2. Male scent patch extensive, nearly half length of discal cell and with extensive dark scaling surrounding it. Margin nearly entire; emphatically white and black. Under Surface of the Wings: Ground color Snuff Brown to Sayal Brown, sometimes with yellowish cast. Basal disc of hindwing darker, Verona Brown to Warm Sepia; area basad postmedian line forewing only scarcely darker than rest of wing; area above cephalad curvature of hindwing margin sometimes lighter. Forewing markings--postmedian line, costa to vein Cu_2 faint to nearly absent, appearing as slightly deeper brown blatches. Rest of wing nearly uniform brown. Hindwing markings--deep diagonal postbasal slash from costa proxad to area of cell basad origin of vein M_3, deep brown to black; margin of basal disc faintly flecked black; distad this, ground color much lighter (toward Cinnamon) followed terminally by a jagged line of blotches (representing the crescent line) from vein Rs to vein Cu_1 replaced in the limbal area by general redder-brown overcast forming distinct area of limbal Mikado Brown. Wing margin from vein Cu_2, cephalad to base of forewing with alternate black and white, veins and midveins respectively, white midveins being emphasized as crescents along the margin. Anal area basad red-brown, limbal coloration often suffused with gray. Length of Forewing: Three male specimens (BMNH), mean 14.5 mm., range 14.0 mm. to 15.0 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 420) and frons as typical of the genus. Upper Surface of the Wings: As on male, but with blue more extensive, submarginal brown more reduced and lacking male scent patch distad in discal area. Under Surface of the Wings: As on male.

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Length of Forewing: Two female specimens (BMNH), 15.0 mm., 15.5 mm. Male Genitalia: Fig. 195. Caudal extension of valvae tapered; valvae, caudad saccus, clear, mid-rimmed, oval, slightly indented; valvae, lateral view, funnel; saccus reduced and broadly parabolic, cornuti as illustrated. Female Genitalia: Fig. 196. Lamella postvaginalis hemispherical; lamella antevaginalis narrow; no obvious convolutions or sclerotizations. Ductus length six times width; signum very reduced, appearing as small pointed spine.

TYPES. Two syntypes in BMNH, both from Chang-yang (= Changyang), Hupeh Province, China, 6000 ft. (= circa 2000 m.) by native collectors, 1888; other labels--Leech collection, 1910 - 173; Satsuma nicevillei "a" and "b," one male and one female, respectively. I have designated the male (Satsuma nicevillei "a") as the lectotype, and the female (Satsuma nicevillei "b") as a paralectotype, consistent with South's (1902) designation of these as "male" and "female type," respectively, and have clearly labelled them as such.

DISTRIBUTION. Spatial: Fig. 525. Known specimens represent two quite disjunct areas; Hupeh Province in east central China and extreme western Yunnan Province (three specimens, Tzeku, BMNH), montane west China. Temporal: Unknown.

REMARKS. I am considering the east central and western Chinese populations, despite some wing pattern and genitalic differences to be conspecific, since the hiatis between these characters and those of leechi is quite distinctive. Four specimens of the six specimens in the BMNH were dissected.

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Ginzia leechi (Riley)

Figs. 197, 198, 421

Satsuma leechi Riley, 1893.

Callophrys leechi: Swinhoe, 1910-1911, p. 257.

[Ginzia]leechi (included Satsuma species): Okano, 1941, p. 239.

[Ahlbergia]leechi (included Satsuma species): Bryk, 1946, p. 50.

[Incisalia] leechi (included Satsuma species): Gillham, 1956, p. 145.

DIAGNOSIS. Similar to nicevillei: having male and female entirely blue above, except for costa and submargins, and with underside resembling circe, but basal disc, hindwing, is darker than nicevillei, nearly obscuring any postbasal markings and rest of hindwing is less contrasted. The male genitalia are very distinct, bearing the only recurved caudal extension of the valvae in the eastern Palaearctic taxa included in this study.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 421) and frons as typical of the genus. Upper Surface of the Wings: Forewing apex and submargins of hindwing very dark Raw Umber to Smithe's (1975) Dark Grayish Brown, highly contrasted to bright thickly scaled Pale Medici Blue over rest of wing. Male scent patch distad in discal area, extending about one-third to one-half the length of the cephalad vein of the cell, somewhat suffused with bluish scales. Under Surface of the Wings: Ground color Sayal Brown somewhat overscaled with darker brown. Length of Forewing: two specimens (BMNH), 13.0 mm, 13.5 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 421) and frons as typical of the genus. Upper Surface of the Wings: Similar to male but with blue more extensive and deep widths of brown submargin and apex of the forewing more reduced. No scent patch distad in discal cell. Hindwing with

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marked black dashes around margin and recurved lobe yellowish framing centrad black dot. Under Surface of the Wings: Same as male. Length of Forewing: Two specimens (BMNH), 14.0 mm., 15.0 mm. Male Genitalia: Fig. 197. Caudal extension of valvae uniquely recurved, like no other species in eastern Palaearctic; valvae, caudad, clear, mid-rimmed, parabolic to oval, and indented. Lateral shape of valvae, funneled; saccus funnel; cornuti as illustrated. Female Genitalia: Fig. 198. Similar to nicevillei but lamella postvaginalis more trapezoidal in shape, not hemispherical, and depressed concavely caudad. Length of ductus nine times width, not six times as in nicevillei and with slight narrowing cephalad to antrum; latter widely flared to lamella antevaginalis. Signum nearly absent; present only as slight chevron on corpus bursae, similar to some Nearctic Mitoura.

TYPES. The types are in the BMNH: One male and two females as syntypes from Jaintia Hills (= Khasia Hills) (Seitz, 1910), Assam Province, north India, 1901. I have designated the specimen labelled "male type" as the lectotype, and the other two specimens from the type locality as paralectotypes. Labels clearly indicating this have been affixed by staff of the BMNH. Type Locality. The Jaintia Hills are located just south of Bhutan in the Indian state of Assam surrounding the town of Shillong.

DISTRIBUTION. Spatial: Fig. 525. The only specimens known are labelled from the Jaintia Hills and from Shillong, Assam Province, north India. No specimens are represented in the extensive Bailey Collection in the American Museum of Natural History which has Lepidoptera specimens from these and many adjoining areas. This may indicate the species is very limited in range or that Bailey did not collect at the appropriate time of year. Temporal: There is no data known, save the year of capture.

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REMARKS. There are five specimens of leechi in the BMNH; the male type and one female syntype were dissected, the rest associated by data and wing characters.

Quaternary Series Sandia

(including Sandia, Mesocyanophrys)

(IB2ab)

SANDIA CLENCH, status revised

Polyommatus Latrielle, 1804, p. 185. Godart, 1823, p. 674. J. Morris, 1860, p. 11.

Polyommate (sic): Latrielle, 1819, p. 610.

Lycus Hübner, 1819-1823 [1823], p. 74. J. Morris, 1860, p. 11.

Thecla Fabricius, 1807, p. 286 (in part). Kirby, 1837, p. 298; 1900, p. 365. Boisduval, 1833, p. 105; 1852, p. 289; 1869, p. 14. Westwood, 1852, p. 486. Fitch, 1858, p. 57. J. Morris, 1860, p. 17; 1862, p. 97. Harrison, 1862, p. 279. Scudder, 1863, p. 165; 1868, p. 378; 1872, p. 52; 1876, p. 104; 1889, p. 835. Reakirt, 1866, p. 146. Grote and Robinson, 1867, p. 774. Caulfield, 1875, p. 89. W. Edwards, 1877, p. 41; 1881, p. 54; 1882, p. 9; 1884, p. 57. Strecker, 1878, p. 129. H. Edwards, 1880, p. 30; 1881, p. 32; 1884, p. 478. 1889, p. 72. Worthington, 1880, p. 48. Butler, 1882, p. 470. Anon., 1882, p. 3. French, 1882, p. 273; 1886, p. 273. Elwes, 1884, p. 887. Fern, 1884, p. 79. Fletcher, 1884, p. 16. Mead, 1884, p. 780. Aaron, 1885,

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p. 180. Fyle, 1887, p. 14. Godman and Salvin, 1887, p. 34; 1901, p. 717. Reakirt, 1887, p. 332. Skinner and Aaron, 1889, p. 146. Packard, 1890, p. 53. Blatchley, 1891, p. 408. Smith, 1891, p. 12. Beutenmuller, 1892, p. 69; 1902, p. 32;1909, p. 32. Barber, 1893, p. 16. Oslar, 1893, p. 226. Wolcott, 1893, p. 102. Danby, 1894, p. 33. Davis, 1895, p. 46; 1909, p. 6; 1915, p. 24. Heath, 1895, p. 311. Knobel, 1895, p. 24. Kirby, 1896, p. 99. Twogood, 1897, p. 31. Hanham, 1900, p. 365. Browning, 1901, p. 300. Cary, 1901, p. 309. Beutenmueller, 1902, p. 32. Smith, Skinner, and Kearfoot, 1903, p. 7. Dyar, 1904, p. 786. Grinnell, 1905, p. 136. Cook, 1905, p. 136. Smith and Smith, 1905, p. 7. Brimley and Sherman, 1903, p. 97. McElhose and Schwarz, 1907, p. 313. Skinner, 1907, p. 129. Davis, 1909, p. 6. Cockle, 1910, p. 204. Newcomer, 1910, p. 31. Williams, 1909, p. 68; 1910, p. 36; 1914, p. 264. Newcomb, 1912, p. 228. Winn, 1912, p. 15. W. Comstock, 1914, p. 34. Reed, 1916, p. 268. Engelhardt, 1918, p. 204. Draudt, 1919, p. 760. Moore, 1922, p. 102. W. Holland, 1931, p. 227. Cockerell, 1934, p. 51. Davenport and Dethier, 1938, p. 171. Hoffman, 1940, p. 707. Comstock and Huntington, 1943, p. 58. Clench, 1944, p. 245; 1946, p. 154. Forbes, 1960, p. 132.

Thecla (Incisalia) [Incisalia Scudder, 1872, p. 52] W. Holland, 1931, p. 226. Hoffman, 1940, p. 707.

Thecla (Incisalia) (in part): Knobel, 1895, p. 25. W. Holland, 1931, p. 227.

Incisalia Skinner, 1878, p. 129 (in part). H. Edwards, 1881, p. 54. Lintner, 1896, p. 254. Dyar, 1902, p. 39. Cook, 1905, p. 36; 1906, p. 181; 1907, p. 145. Cary, 1901, p. 451. Cook and Watson, 1907, p. 202; 1909, p. 181. Grinnell and Grinnell, 1907, p. 45. Skinner, 1907, p. 32. Coolidge, 1908a, p. 432. Davis, 1915, p. 24. Barnes and McDunnough, 1917, p. 14. Lindsey, 1917, p. 351. Britton, 1920, p. 156. Gibson, 1920, p. 27. Moore, 1922, p. 12.

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Watson and Comstock, 1920, p. 453. Barnes and Benjamin, 1926, p. 18. Blackmore, 1927, p. 10. J. Comstock, 1927, p. 167. Forbes, 1928, p. 679. Brodie, 1929, p. 4. Brower, 1930, p. 258. Gunder, 1930, p. 42. Klots, 1930, p. 161; 1951, p. 46. Wright, 1930, p. 24. Fender, 1931, p. 89; 1938, p. 180. Clark, 1929a, p. 115; 1932, p. 250; 1937, p. 7. Klots, 1930, p. 161; 1951, p. 149. Wright, 1930, p. 24. Fender, 1931, p. 185. L. Harris, 1931, p. 19; 1950, p. 14. Richards, 1932, p. 70. Comstock and Dammers, 1933, p. 77. Hutchins, 1933, p. 212. Remington, 1933, p. 102; 1953, p. 97. dos Passos and Grey, 1934, p. 278. Rogers, 1934, p. 184; 1943, p. 67. Sheppard, 1934, p. 141. Garth, 1935, p. 28; 1950, p. 32. Clark and Clark, 1937, p. 89; 1951, p. 84. Cross, 1937, p. 20. Field, 1938, p. 152. T. Freeman, 1938, p. 246. Leussler, 1938, p. 277. Leville, 1938, p. 17. McDunnough, 1938, p. 25. Proctor, 1938, p. 186. Moore, 1939, p. 16. dos Passos, 1940, p. 167; 1964, p. 54. Wagner, 1941, p. 200. Williams, 1941, p. 218. Brooks, 1942, p. 35. Frederick, 1942, p. 20. Clench, 1943, p. 249; 1957, p. 58. Comstock and Huntington, 1943, p. 59; 1958, p. 110. Kimball and Jones, 1943, p. 39. Blevins and Blevins, 1945, p. 123. Leighton, 1946, p. 60. Chermock and Chermock, 1948, p. 212. Chermock and Frenchin, 1949, p. 212. H. Freeman, 1950, p. 7; 1951, p. 39. L. Harris, 1950, p. 14; 1972, p. 14. Merritt, 1950, p. 30. Bowman, 1951, p. 131. Clark and Clark, 1951, p. 83. H. Freeman, 1951, p. 39. J. Jones, 1951, p. 20. Rawson and Ziegler, 1951, p. 79; 1953, p. 33. Darlington, 1952, p. 35. Ehrlich, 1952, p. 88. Hopfinger, 1952, p. 84; 1953, p. 83. Meiners, 1952, p. 76. F. Chermock, 1953, p. 102. O. Chermock, 1953, p. 107. Eff, 1953, p. 88. Hessel, 1953, p. 107. Martin, 1953, p. 69. Ziegler, 1953, p. 33. Lambremont, 1954, p. 144. Voss, 1954, p. 17. Ferguson, 1955, p. 196. Martin and Truxel, 1955, p. 23. Bird, 1956, p. 107. DeFoliart, 1956, p. 98. Weiners, 1956, p. 163.

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F. Brown, 1957, p. 140. Guppy, 1957, p. 169; 1959, p. 103; 1960, p. 101. Hardy, 1957, p. 40; 1960, p. 70. Mather and Mather, 1958, p. 82. McGugan, 1958, p. 24. Riotte, 1959, p. 12; 1971, p. 18. Remington and Maeki, 1960, p. 127. Judd, 1960, p. 246. Moore, 1960, p. 18; 1972, p. 10. Ehrlich and Ehrlich, 1962, p. 33. Newcomer, 1962, p. 70. Garth and Tilden, 1963, p. 37. Simmons, 1963, p. 107. Emmel, 1964, p. 369. Powell, 1964, p. 100; 1968, p. 47. F. Brown, 1964, p. 171; 1969, p. 95. Kimball, 1965, p. 48. Shapiro, 1966, p. 33; 1974, p. 21. Shields, 1966, p. 127. Covell, 1967, p. 23. Hemming, 1967, p. 231. Johnson and Nixon, 1967, p. 520. Masters, 1967a, p. 208; 1968a, p. 26; 1970, p. 13; 1971b, p. 13; 1972a, p. 175. Masters and Masters, 1969, p. 6. Hooper, 1969, p. 5. Azevedo, 1970, p. 4. Callaghan, 1970, p. 228. Catling and Walker, 1970, p. 3. Elrod, 1970, p. 13. Ferris, 1970, p. 4; 1971b, p. 35. Price, 1970, p. 12. Anon., 1972, p. 8. Aaron, 1972, p. 8. Johnson and Malick, 1972, p. 3. Kuehn and Masters, 1972, p. 5. Ritterbush, 1972, p. 10. Johnson, 1972 (1973), p. 28. Ehrlich and Ehrlich, 1973, p. 59. Emmel and Emmel, 1973, p. 60. Shapiro and Shapiro, 1973, p. 92. Shields and Emmel, 1973, p. 32. Brower, 1974, p. 19. R. Brown, 1974, p. 27. Beattie, 1976, p. 30. McCabe and Post, 1976, p. 97. Tilden and Huntzinger, 1977, p. 83. Miliotus, 1978, p. 4. Wood, undated, p. 301.

Thecla = Incisalia = Strymon (in part): Forbes, 1960, p. 129.

Thecla "Grupo irus" = Incisalia Minot (sic) (in part): Hoffman, 1940, p. 707.

Thecla (Mitoura)[Mitoura Scudder, 1872, p. 31.] (in part [referring to xami (Reakirt)]). W. Holland, 1931, p. 231. Hoffman, 1940, p. 710.

Mitoura (in part, referring to xami): Barnes and McDunnough, 1916, p. 105; 1917, p. 14. J. Comstock, 1924, p. 37. Barnes and Benjamin, 1926, p. 17. McDunnough, 1938, p. 25. Stallings and Turner, 1946, p. 49. H. Freeman,

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1950, p. 7; 1959, p. 90. Klots, 1951, p. 142. Martin and Truxel, 1955, p. 22. Clench, 1957, p. 58. dos Passos, 1964, p. 54.

Callophrys Billberg, 1820, p. 80 (in part). Emmel and Emmel, 1961, p. 203; 1962, p. 33. Newcomer, 1962, p. 70; 1973, p. 13. Small, 1962, p. 195. Garth and Tilden, 1963, p. 53. Kendall, 1964, p. 129. Lambremont, 1965, p. 50. Downey, 1966, p. 164. Nielson, 1966, p. 41. Rahn, 1966, p. 4. Huber, 1966, p. 14; 1967, p. 10; 1968, p. 7; 1970, p. 10. Nordin, 1967-68, p. 60. Scott, 1968 (1970), p. 92; 1975, p. 17. Scott, Ellis, and Eff, 1968, p. 164. Catling and Walker, 1970, p. 3. Kendall and Kendall, 1971, p. 38. Quinter, 1971, p. 4. Masters, 1972 (1973), p. 175. Downey and Irwin, 1973, p. 20. L. Miller, 1975, p. 18 Scott, 1975, p. 17.

Callophrys (Incisalia) (in part): Ziegler, 1960, p. 21. Clench, 1961, p. 202. Kendall and Freeman, 1963, p. 2. Riotte, 1967, p. 135. dos Passos, 1970, p. 31. Clench and Miller, 1968, p. 129. Masters, 1969, p. 4; 1970 (1971a), p. 40; 1972 (1973), p. 179. Catling and Walker, 1970, p. 8. Ferris, 1971a, p. 35; 1971b, p. 25. L. Harris, 1972, p. 208. S. Miller, 1972, p. 231. Shull and Badger, 1972, p. 18. Tidwell and Callaghan, 1972, p. 12. Gregory, 1975, p. 33. Johnson, 1975, p. 225. Howe, 1975, p. 288.

Callophrys (Sandia) Clench and Ehrlich, 1960, p. 139. Ziegler, 1960, p. 21. Clench, 1961, p. 205. Kendall and Freeman, 1963, p. 2. dos Passos, 1964, p. 59; 1970, p. 37. R. Holland, 1974, p. 177. Howe, 1975, p. 290.

Sandia: Remington and Maeki, 1960, p. 127.

Callophrys (Cyanophrys) [Cyanophrys Clench, 1961, p. 211] (in part, referring to fusius Godman and Salvin).

Callophrys (Xamia) [Xamia Clench, 1961, p. 205] (referring to xami Reakirt): Clench, ibid; Kendall and Freeman, 1963, p. 2. dos Passos, 1970, p. 32.

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Opler, 1966, p. 212. Gorelick, 1971, p. 3. McGuire and Rickard, 1974, no. 391 (unpaginated). Howe, 1975, p. 290. NEW SYNONYMY.

Xamia (referring to xami): Emmel, 1972, p. 3.

DIAGNOSIS. Due to apparent transformation series in this clade, superficial characters various; genitalia display a clear homogeny of readily discernible characters. Neotropical Sandia easily recognized by brown rather than iridescent blue upper wing surface; Nearctic taxa superficially resembling Ginzia, Novosatsuma, Cissatsuma and Incisalia, all with primitive hoary and mottled under surface character. Transformation of characters between Neotropical and Nearctic extremes occurs in brown to green under surfaces of macfarlandi species group, which display a median line on the hindwing. Genitalia readily recognizable as follows: male--all taxa characterized by exaggeratediy large and shouldered bilobed configuration with an immediately tapered caudal extension; females--all taxa characterized by widely hemispherical lamellae mounted on an emphatic antrum equalling or exceeding the caudal length of the lamellae; antrum usually with transparent patch centrad; caudad antrum a wide transparent area appearing on the ductus; caudad transparent area ductus usually at least one and one-half to two times breadth of lamellae, compared to much smaller length in superficially similar conserials.

DESCRIPTION. Adult: Head with frons green in Neotropical taxa, uncolored other than fuscous Nearctic. Palpi as clarified in cladistic analysis. Legs of both sexes lacking any elongation relative to width (latter typical of apomorphy in Callophryina relative to outgroups). Wings above brown; under surfaces--Neotropics, green with median line of spots on hindwing; Nearctic, hoary and mottled brown patterns; intermediate areas of Mexico, green to brown with variously expressed median line. Male Genitalia: valvae displaying

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characters noted in above diagnosis; cornuti ranging from a disclike plesiomorph state to a narrowed apomorph state. Female Genitalia: typified by characters noted in above diagnosis; ductus becoming sculptured in extremely apomorph state; signa single cone-like spines, variously bifurcate.

BIOLOGY. Early Stages: Known for most of the Nearctic species (see individual taxa below), but none of the purely Neotropical taxa. Taxa of the primitive groups (e.g., macfarlandi and xami) feed on herbaceous leafy material, whereas those of the derived groups (e.g., irus, henrici, polios, et al.) variously feed on flowers or burrow into fruits. Foodplants: These are known for the Nearctic taxa but not for the purely Neotropical species. All known foodplants are angiosperms, and are forbs (herbaceous) unless the fruits or flowers of woody plants.

TYPE SPECIES. Sandia macfarlandi Clench and Ehrlich, by original description.

DISTRIBUTION. Spatial: Figs. 526, 527, 528, 529, 530, 531. Numerous taxa in the Nearctic representing relatively apomorphic characters; taxa representing relatively plesiomorphic characters: two neotropical species north of the isthmus of Panama, one spanning isthmus to Venezuela, another an apparently relict population in southwestern United States and northern Mexico. Temporal: Flight periods of Nearctic taxa generally range from mid-April to at least mid-summer depending on voltinism. Neotropical taxa are known from as early as February.

REMARKS. The present classification of the taxa included in the genus Sandia may be offensive to those with a purely phenetic concept of these taxa. It is unfortunate that the name Sandia must be applied, according to taxonomic priority, for this clade of taxa. The clade includes three species which by former

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usage would still be in the grade group "Thecla" (or at best, by common phenetic usage Cyanophrys as it was defined by Clench, though he never listed the species he considered members of that taxon when he described it). It also includes those species formerly placed in the genera Sandia and Xamia, which were described as convenient for unique Nearctic species not thought to fit any known Nearctic genus, and the group of species long considered as Incisalia in the Nearctic but known to be angiosperm feeders, not gymnosperm feeders as some of their former congeners. The name Incisalia (type species niphon Hubner) is no longer available for these, since the former concept of Incisalia is now seen as polyphyletic (sensu Nelson).

Consideration of Sandia (sensu this revision) in relation to relative primitive and derived character states should recommend the strength of the present definition in relation to concepts of successive splitting events and derivation, as opposed to the phenetic evaluation of relationships based on particular wing patterns which are in all cases primitive (e.g., fusius as "Thecla" or Cyanophrys on the basis of the green undersurface) or convergent (e.g. irus, henrici, et al. as Incisalia based on hoary and mottled undersurfaces) which as primitive characters occur in numerous species scattered throughout the cladogram).

Generic Cladogram and Characters, Fig. 560.

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SPECIES GROUPS (3)

KEY TO THE SPECIES GROUPS OF SANDIA

1. (a). Wings, under surface, uniform green. Hindwing with scattered white spots in median line and/or red-brown blotches in anal area . . . . . fusius Group

   (b). Wings, under surface, brown to yellow-green. Hindwing with mottled or hoary patterns, or thick median line, either arced or jagged 2

2. (a). Under surface, hindwing, brown with mottled or hoary patterns . . . . . augustinus Group

   (b). Under surface, hindwing, yellow green with thick median line, either arced or jagged . . . . . macfarlandi Group

1. the fusius Group

including fusius/marialis--ampulla.

A. Cladogram and Characters, Fig. 561.

B. Distribution, Fig. 526.

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Sandia fusius (Godman and Salvin), new combination

Figs. 45, 199, 200, 422

Thecla fusius Godman and Salvin, 1887, p. 34, pl. 52, fig. 6, 7. Draudt, 1919, p. 762, pl. 153, fig. i. Hoffman, 1940, p. 707. Clench, 1944, p. 245; 1946, p. 154.

Thecla marialis: Clench, 1946, p. 154 (placed as synonym of fusius in error).

species fusius: Comstock and Huntington, 1960, p. 113.

Callophrys (Cyanophrys) fusius: Clench, 1961, p. 211.

DIAGNOSIS. Not reliably separated from ampulla and marialis by wing characters. Male genitalia, however, are quite distinct: like ampulla, fusius with wide-rimmed and obviously indented bilobed configuration, and extremely narrow caudal extension; ampulla with configuration distinctly ovate, while on fusius this is pentagonal. Caudal extension of ampulla is immediately tapered caudad the bilobed configuration while that of fusius has a bulbous second step. Cornuti of ampulla are extremely wide-tapered, those of fusius, narrow-tapered. Females of these three species so resemble those of numerous species sharing wing characters like the amyntor Group of Cyanophrys that separation is very difficult.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 422) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color Sudan Brown to Brussels Brown; base of forewing and anal area, hindwing, suffused toward bright Antique Brown. Scent patch distad in discal cell, brown to blackish. Recurved lobe of hindwing bright Antique Brown, extending along margin at least to vein Cu_2. Tail distad on vein Cu_2. Fringe grayish, darker basad. Under Surface of the Wings: Ground color Rheinemann's Green to Elm

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Green. Area of forewing immediately cephalad hindwing deep gray, blackened basad and along the border of green color. Hindwing usually with vague medial line, sometimes with parallel distad red-brown markings in cells Cu_1 or Cu_2. Recurved lobe of hindwing Maroon to black, usually suffused gray and lined basad with white. Length of Forewing: $\bar{X}$ of 4 specimens (AMNH, BMNH) 17.2 mm., range 17.0 mm. to 17.4 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 422) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color of entire wings dark Raw Umber, darker of forewing apex. Basal half of forewing and basal third of hindwing suffused bright Pale to Light Purplish Gray. Recurved lobe light Antique Brown edged distad with black. Tail at Cu_2 long, white-tipped. Distad end of vein Cu_1 slightly extended as tail. Fringe blackish, both wings, lighter distad, toward white along limbal margin of hindwing. Under Surface of the Wings (Fig. 45): As on male, but hindwing white mesial spots more emphatic and parallel patches of red-brown more extensive and often of zig-zag shape in the cell interspaces. Broad white edge basad the recurved lobe. Fringe gray to white, especially limbally. Length of the Forewing: Only surely identified female (see Remarks below), 16.5 mm. (BMNH). Male Genitalia: Fig. 199. Valvae, caudad saccus, clear, wide-rimmed extremely shouldered, broadly indented; valvae, lateral view, round-tapered; valvae, caudal extension extremely narrow from bilobed configuration entirely caudad, except for slight bulbous shape just caudad bilobed area; saccus extremely broad funnel, cephalad tip reduced; base of vinculum flared; slight triangular spurs on vinculum; cornuti narrow-tapered. Female Genitalia: Fig. 200. Shape of lamella postvaginalis rather square, lamella antevaginalis as hemispherical arc about one-half cephalad expanse of lamella postvaginalis. Antrum long, equalling length of caudal expanse of lamellae; two rectangular sclerotizations on lamella antevaginalis just distad caudal tip of antrum. Transparent area of

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ductus nearly dividing the antrum and ductus into equal lengths. Ductus club-ended. Signa broad-based spines, widely bifurcate, one spine about twice length of other.

TYPES. The type was listed by Comstock and Huntington (1960) as a specimen from the Chisey Valley, Guatemala. This is incorrrect, however, since examination of the Godman and Salvin material in the BMNH indicated that no designation of a type was ever made from their syntype series listed in the description as: Jalapa Mexico (Schaus specimen); Chisey Valley and Polochic Valleys, Guatemala (Godman and Salvin specimens); and Chiriqui and Line of Railway, Panama ("Arce" sic specimens) (specimen label actually "Race", not "Arce"). All of those must be considered syntypes. Dissection of these specimens indicates they represent two species, either one of which might be considered fusius; one is marialis Clench, which is considered distinct in this revision and which has unambiguous types. Therefore, I designate the Jalapa, Mexico specimen (all the other fusius specimens are in pairs from localities, and thus could lead to ambiguity) as the lectotype. It is a male, and I have requested the staff of the BMNH to clearly label this specimen as the lectotype; two males from Chiriqui, Panama are designated paralectotypes. All other specimens in the Godman and Salvin syntype series are marialis Clench. Type Locality. Jalapa, Veracruz, Mexico.

DISTRIBUTION. Spatial: Fig. 526. Presently known from the states of Veracruz and Puebla, Mexico and southward into Panama. It is not known if this distribution is continuous. Temporal: The only known date is April (Panama).

REMARKS. Clench (1946) placed marialis as a synonym of fusius. This was an error. He had not dissected the types of either species and was unaware of the differences which indicate sympatric species (see comments under marialis).

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I have made a clear statement about females of fusius, but not of marialis. I have, with fusius and the other sister species ampulla, specimens from the same place, date, and collector. It is only on such a basis I would associate the sexes because of the great superficial similarity between females of these Sandia taxa and those of the amyntor Group in Cyanophrys (see Cyanophrys amyntor et al. and the key to female characters already presented for Callophryina).

Fifteen specimens from the area listed in Material Examined (Appendix) were studied; eight specimens from localities in Material Examined were studied for genitalia, legs, and palpi.

Sandia marialis (Clench), new combination, status revised

Figs. 201, 423

Thecla marialis Clench, 1944, p. 230, 244; 1946, p. 154 (placed as synonym of fusius Godman and Salvin).

Thecla fusius: Clench, 1946, p. 154.

species marialis: Comstock and Huntington, 1961, p. 161.

DIAGNOSIS. This taxon, fusius, and ampulla are quite indistinguishable by wing characters. The genitalia are very distinct, indicating fusius and ampulla as immediate sister species, and marialis as the immediate sister species of the former two. From fusius and ampulla, marialis can be readily distinguished by the extremely wide-rimmed and shouldered bilobed configuration, not indented, of the male genitalia, and the wide and tapered caudal extension of same. Both fusius and ampulla share an oddly shaped bilobed configuration, obviously indented, and an extremely narrow caudal extension (see Male Genitalia below, and figures).

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DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 423) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color Sudan Brown to Brussels Brown, forewing slightly suffused brighter, toward Antique Brown, of forewings and anal area, hindwing. Scent patch distad in discal cell, usually brown to blackish. Recurved lobe of hindwing between outer and anal margins bright Antique Brown with this coloration extending along margin to at least vein Cu_2. Tail at Cu_2. Wing fringe grayish, darker basad. Under Surface of the Wings: Ground color Rheinemann's Green to Elm Green. Area of forewing immediately cephalad hindwing deep gray, blackened basad and along the border with the green. Hindwing usually with a vague medial line, sometimes with one or two white spots edged with red-brown usually at cell Cu_1 or Cu_2. Recurved lobe of hindwing Maroon to black usually suffused grayish and lined basad with white. Length of Forewing: $\bar{X}$ of three specimens (BMNH, CMNH, MCZ), 13.2 mm., range 13.0 mm. to 14.0 mm. Female: Unknown. Undoubtedly, females of marialis are in collections, but no specimens from the same place, date, and collector as the males have been found. Male Genitalia: Fig. 201. Valvae, caudad saccus, clear, wide-rimmed, parabolic, not indented; valvae, lateral view, funnel; valvae, caudal extension tapered to straight points; saccus broadly parabolic, long, equally one-half of valvae; base of vinculum not flared; spurs on vinculum triangular; cornuti, dorsal, narrow-tapered, ventral, wide and spined curving ventral. Female Genitalia: Unknown.

TYPES. Holotype male in the MCZ. Type Locality. Victoria, Veracruz, Mexico.

DISTRIBUTION. Spatial: Fig. 526. Known from Veracruz State, Mexico south through Guatemala and Honduras to northern Colombia and Venezuela. Temporal: The only date known is that of the holotype, 7 February.

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REMARKS. Clench's (1946) sinking of marialis to synonymy with fusius was in error. Dissection of the types of the species and many other specimens indicates two very distinct species. The species fusius, marialis, and ampulla are part of a large clade including the taxa Xamia and Sandia in Mexico and the Nearctic and the forb-feeding "Incisalia" characteristic of North America. In arrangement of generic status to include the synapomorphies of the fifth successive split in the cladogram deemed most parsimonious for the entire group Callophryina, they are included in one genus. I have examined thirteen specimens of marialis for genitalia, legs and palpi from the localities listed in Materials Examined (Appendix).

Sandia ampulla, new species

Figs. 46, 47, 202, 203, 424

DIAGNOSIS. Generally indistinguishable from fusius and marialis by wing characters. Male genitalia are very different from the latter, and though they resemble the former, are easily distinguishable. The species marialis has a wide-rimmed unindented bilobed configuration and a wide and tapered caudal extension of the valvae, while fusius and ampulla share a more narrow-rimmed obviously indented bilobed configuration and an extremely narrow caudal extension. On fusius, however, the bilobed configuration is pentagonal in shape with mid- to wide rims cephalad and distad, and narrow caudad. There is also a slight bulbous configuration preceding the caudal extension. On ampulla the bilobed configuration is obviously ovate, uniformly rimmed, more narrow than on fusius, and the caudal extension proceeds immediately narrrow, not from a bulbous second step. The cornuti of ampulla are wide-tapered extremely, those of fusius

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narrow-tapered. As noted in the key to Callophryina the females of the fucius Group resemble some non-congeners which are plesiomorph taxa in an immediate sister group. These include primary amyntor Group taxa of Cyanophrys.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 424) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color Sudan Brown to Brussels Brown, forewing suffused greenish basad on both wings, brighter Antique Brown anad on hindwing. Scent patch distad in discal cell, usually brown to black. Recurved lobe of hindwing light Antique Brown with coloration extending cephalad along anal margin about two-thirds the distance to the abdomen. Tail at Cu_2. Fringe blackish, both wings, except along recurved lobe. Under Surface of the Wings: Ground color Rheinemann's Green to Elm Green. Area of forewing immediately cephalad hindwing grayish distally even to the margin, blacker basad and along the margin with the green. Hindwing with various spots faintly making up a median line across the wing, lightly white, edged brown basad. Area of recurved lobe Maroon to black. Fringe of both wings grayish, darker basad. Length of Forewing: Holotype, 12 mm. Female: Head, thorax, abdomen, legs, and palpi as typical of the genus. Frons green. Upper Surface of the Wings: Ground color of entire wings deep Raw Umber, toward blackish on forewing apex. Basal half forewing, and basal third of hindwing moderately suffused Light Purplish Gray. Recurved lobe of hindwing only slightly lighter than rest of wing, edged distad with black. Tail at Cu_2 long, faint extension at terminus of Cu_1. Fringe blackish, both wings, edged white in limbal area and at distal end of tail. Under Surface of the Wings: As on male, but with hindwing median line much more emphatic, both as to obviousness of white and extent of red-brown edging. Limbal area with broad Mahogany Red patch between veins Cu_1 and Cu_2 edged broadly white basad and the again red-brown basad the black recurved lobe. Length of Forewing: Allotype, 14.0 mm.

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Male Genitalia: Fig. 202. Valvae, caudad saccus, clear, mid-rimmed, extremely shouldered, indented; valvae, lateral view, round-tapered, slight funnel caudad; valvae, caudal extension, with extremely narrow base caudad bilobed configuration, scarcely wider than caudal tips; base of vinculum not flared; spurs absent; cornuti--dorsal, wide-tapered, immediately narrowing to much smaller tip, ventral, disc-like. Female Genitalia: Fig. 203. Characterized by sclerotizations between antrum and lamella antevaginalis, and by latter's curvature cephalad. Antrum very apparent tapering to narrow ductus. Transparent area at juncture of antrum and ductus. Signa uniquely extremely long curved single spines.

TYPES. Holotype male (Fig. 46.), Cordoba, Rio Cazones, Veracruz State, Mexico, "I: 95" (January, 1895?). Allotype female (Fig. 47), Rio Cazones, Veracruz State, Mexico, July 9. Both deposited AMNH.

DISTRIBUTION. Spatial: Fig. 526. Known only from the type locality, along the Rio Cazones. Temporal: The only date of certainty is July 9, on the allotype.

REMARKS. The male and female are associated by very similar data and process of elimination in relation to dissections of specimens of the sister taxa fusius and marialis. It is therefore slightly possible that they do not represent the same species.

ETYMOLOGY. The name refers to the ovate-based configuration of the male genitalia which resemble very remarkably an oval-based vase Latin "ampulla" with a thin neck.

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2. The macfarlandi Group

including scaphia/xami--macfarlandi

A. Cladogram and Characters, Fig. 562.

B. Distribution, Fig. 527.

Sandia scaphia (Clench), new status

Figs. 48, 206, 207, 426

Callophrys (Sandia) xami scaphia Clench, 1980, in press.

DIAGNOSIS. The immediate sister species of xami, found in central and southern Chiapas, Mexico, and in montane Guatemala. Differs superficially from xami in the undersurface of the wings (especially hindwings) being golden brown, not yellow green, with the postbasal band on the hindwing being more gently rounded and far less jagged toward the anal margin; the characteristic deep "jags" of xami at veins Cu_1 and Cu_2 are limited to short points on the band in scaphia. Further, limbal area of scaphia is not marked conspicuously with a dark "Thecla-spot" and associated dark blotches submarginally highlighted by orange as on xami; rather, entire area is dully suffused uniform golden-brown sometimes overcast with white, obscuring most (if not all) prominent markings.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 426) as typical of the genus. Frons with scales greenish to fuscous; eye-lining white. Upper Surface of the Wings: Entirely Honey Yellow except for broad areas of

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margin and apex, forewings, and margins (except for limbal area), hindwings. These warm Raw Umber to fuscous. Veins, both wings, overscaled with black. Male scent patch distad in discal area, prominently blackish. Tail at veins Cu_1 and Cu_2; fringed tuft on recurved lobe of hindwing. This area with much thinner marginal fuscous, often highlighted by whitening of the wing fringe. Under Surface of the Wings: Ground color Cartridge Buff to Cream Buff, forewing, Pinkish Cinnamon to Cinnamon, hindwing. Forewing with dull postmedian line, costa nearly to vein 2A, light yellowish to white, edge entire, marked moderately basad with Sayal Brown. Hindwing, basal disc, Cinnamon to Sayal Brown, mottled fuscous basad. Edge of postbasal disc (median line) white to dull yellow, edge basad Sayal Brown; disc gently rounded but with slight pointed extensions at veins Cu_1 and Cu_2. Distad medial line, ground color lighter (toward Cartridge Buff or Pinkish Cinnamon) to submargin. Submargin entire wing, and limbal area, heavily suffused and mottled with brown, gray, blackish, and whitish scales obscuring most markings. Very slight black dots sometimes visible in cells M_3, Cu_1, and Cu_2. "Thecla-spot" hardly visible to somewhat visible, heavily suffused on all sides Sayal Brown. Recurved lobe darkly scaled toward blackish, heavily fringed white basad, black distad; rest of wing fringe brownish, paler distad. Length of Forewing: $\bar{X}$ of four specimens, Chiapas, Mexico, 14.6 mm., range 14.0 mm. to 16.0 mm. Guatemala specimen 11 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 426) as typical of the genus. Frons and eye-lining as on male. Upper Surface of the Wings: Ground color darker than male, Orange Cinnamon to Mikado Brown. No scent patch distad in discal cell. Rest as on males. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of four specimens, Chiapas, Mexico, 14.8 mm., range 14.2 mm. to 16.0 mm. Male Genitalia: Fig 206. Differing from xami by shorter valvae (terminal end usually not exceeding caudal articulation of falces to vinculum) and with a shouldered

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bilobed configuration, not a cornered one, a less funneled lateral valval shape, and narrower cornuti. Valvae, caudad saccus, clear, mid-rimmed, shouldered and indented; valvae, lateral view, round-tapered; valvae, caudal extension, tapered; saccus pointed; cornuti as illustrated. Female Genitalia: Fig. 207. Differing from xami by ductus much more diminutive, antrum so long as to nearly equal ductus length. Signa extremely long single spines, only minutely cleft centrad.

TYPES. Holotype male (Fig. 48), in AME. Type Locality. San Cristobal las Casas, Chiapas, Mexico.

DISTRIBUTION. Spatial: Fig. 527. Known from the central mountains of Chiapas, Mexico and from the Sierra Madre Mountains (Lake Atitlan) in Guatemala.

REMARKS. Other known specimens of this species are from Lagos de Montebello, Chiapas, Mexico and Lake Atitlan, Guatemala. This species is being described concurrently to this revision by Clench but assigned as a trinomen to species xami. The genitalia and general flight period of scaphia indicate clearly it is a distinct species. Also, Clench includes this species in the genus Callophrys, subgenus Xamia. This is a phenetic concept of Nearctic and some allied species in the Neotropics assigned to a regional idea of Callophryina. As noted under Cisincisalia, Callophrys as defined in this paper is the immediate sister genus of Mitoura, but these are more closely allied to two other genera than to Sandia, in which xami and scaphia are placed. Xamia falls into synonymy with Sandia, since genera in this paper are defined by the synapomorphies of the fifth branching point in the derivative cladogram accepted as most parsimonious for the worldwide group. Species formerly assigned to Sandia, Xamia, and Incisalia are among those derived from this fifth branching point. However, the type species of Incisalia is not among these. Thus, scaphia is placed with Sandia.

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Sandia xami (Reakirt)

Figs. 204, 205, 425

Thecla xami Reakirt, "1866" (1867), p. 332. Aaron, 1885, p. 180. Godman and Salvin, 1887, p. 48; 1901, p. 717. Kirby, 1897, p. 402. Draudt, 1919, p. 772, pl. 154, fig. g. Cockerell, 1934, p. 51. Comstock and Huntington, 1964, p. 188.

Thecla (Mitoura) xami: W. Holland, 1931, p. 231. Hoffman, 1940, p. 710.

Mitoura xami: Barnes and McDunnough, 1916, p. 105; 1917, p. 14. J. Comstock, 1924, p. 37. Barnes and Benjamin, 1926, p. 17. McDunnough, 1938, p. 25. Stallings and Turner, 1946, p. 49. H. Freeman, 1950, p. 7; 1959, p. 90. Klots, 1951, p. 142. Martin and Truxel, 1955, p. 22. Clench, 1957, p. 58. dos Passos, 1964, p. 54.

Callophrys (Mitoura): Clench and Ehrlich, 1960, p 138.

Callophrys Group II (subgenus Sandia): [with macfarlandi Clench and Ehrlich], Ziegler, 1960, p. 21.

Callophrys (Xamia) Clench, 1961, p. 205. Kendall and Freeman, 1963, p. 2. Opler, 1966, p. 212. dos Passos, 1970, p. 32. Gorelick, 1971, p. 3. McGuire and Rickard, 1974, no. 391 (unpaginated). Howe, 1975, p. 290.

Xamia xami: Emmel, 1972, p. 3.

Thecla blenina Hewitson, 1968, p. 29. Kirby, 1896, p. 393. Smith, Skinner, and Kearfoot, 1903, p. 7. Dyar, 1904, p. 38. Skinner, 1907, p. 285. Coolidge, 1910, p. 375. W. Comstock, 1911, p. 87. Engelhardt, 1918, p. 41. Cockerell, 1939, p. 51. Wood, undated, p. 302.

Thecla belenina (sic): Engelhardt, 1918, p. 41.

Thecla blenina = xami: Aaron, 1885, p. 180. Barnes and McDunnough, 1916, p. 105; 1917, p. 14. Draudt, 1919, p. 772. Barnes and Benjamin, 1926,

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p. 17. W. Holland, 1931, p. 231. McDunnough, 1938, p. 25. Hoffman, 1940, p. 710.

Thecla blenina = siva W. Edwards: Smith, 1891, p. 12. Danby, 1894, p. 33. Draudt, 1919, p. 772 (synonymy in error).

Thecla blenina var. muiri: W. Comstock, 1911, p. 87 (association in error).

species xami: Comstock and Huntington, 1964, p. 188.

DIAGNOSIS. This species and scaphia Clench are similar. They resemble pale Mitoura beneath, xami with greenish-yellow ground color, scaphia with dull mottled brown and a solid mesial band of white edged variously brown. The latter is distinctly jagged along the veins anad on xami, rounded and much less jagged on scaphia. On xami, the limbal area of the hindwing is slightly hoary with brown to yellowish suffusion, and a vague "Thecla"-spot. On scaphia, the area is heavily suffused brown with gray overscaling nearly obscuring the mesial line distad and completely obscuring the "Thecla"-spot. The upper sides of both species are pale yellow-brown, but not shiny; the scent patch is prominent on males, as is the tail on both sexes. Aside from the tail, the upperside looks like xeric forms of some of the other members of this genus formerly placed with Incisalia.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 425) as typical of the genus. Frons with some slight greenish scaling, but generally dark golden brown; eye lining white. Upper Surface of the Wings: Ground color Honey Yellow to Cinnamon Buff. Lighter fuscous along margins of both wings and apex of forewing. Scent patch prominent, usually yellow, distad in discal area. Tail at Cu_2, second tail often at Cu_1. Under Surface of the Wings: Ground color Mytho Green to Dark Olive Buff over base of Wood Brown.

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Forewing generally immaculate save faint postmedian band costa to vein Cu_2, brown to black basad, edged whitish distad. Hindwing ground color as above but sometimes variously suffused more greenish or yellowish. Prominent mesial line, variously wide and arched about the wing: black centrad, brown basad, white distad. Distinctly jagged distad along veins Cu_1 and Cu_2 forming very distinct pattern. Limbal area variously suffused yellow to brown; "Thecla"-spot present, often diminutive. Fringe, both wings, gray to yellowish. Length of Forewing: $\bar{X}$ of ten specimens (AMNH, BMNH), 13.6 mm., range 12.6 mm. to 14.2 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 425) as typical of the genus. Frons as on male. Upper Surface of the Wings: Similar to males but often darker, toward Cinnamon Buff. No scent patch in discal area. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of ten specimens (AMNH, BMNH), 14.0 mm., range 13.2 mm. to 15.0 mm. Male Genitalia: Fig. 204. Valvae, caudad saccus, clear, mid-rimmed, parabolic, indented; lateral view, slightly funneled; caudal extension cornered at juncture with bilobed configuration, then tapered to blunt ends. Saccus funnel; cornuti wide, disclike, as illustrated. Female Genitalia: Fig. 205. Lamella postvaginalis hemispherical, vaguely indented caudad; lamella antevaginalis very narrow, tapering cephalad in slight antrumal configuration. Ductus length about three times caudal expanse of lamellae of vague antrum; transparent area cephalad antrum about one-third ductal length. Signa single long spines, hardly curved.

BIOLOGY. Early Stages: The early stages have been described by Ziegler and Escalante (1964) in detail. Foodplant: Echeveria gibbiflora De Candolie and Sedum allantoides Rose (both Crassulaceae); Ziegler and Escalante, 1964; Howe, 1975.

TYPE. Originally in Academy of Natural Sciences, Philadelphia, now at CMNH, but not located by me. Photograph in AMNH. Type Locality. Vera Cruz, Veracruz State, Mexico.

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DISTRIBUTION. Spatial: Fig. 527. From Jalapa, Vera Cruz, Mexico and Mexico City, Federal District, Mexico northward into the southern United States in southern Texas and Arizona. Temporal: Multivoltine, April; June into July; October to December.

REMARKS. The taxon blenina Hewitson has long been considered conspecific with xami (McDunnough, 1938; Clench, 1961; dos Passos, 1964; and others, see synonymy). The type of blenina is in the BMNH. I have dissected the genitalia, and they obviously indicate conspecificity with xami; the genitalia of the xami type I have not examined, but from the description it appears unambiguous.

Sandia macfarlandi Clench and Ehrlich

Figs. 208, 209, 427

Callophrys (Sandia) macfarlandi Clench and Ehrlich, 1960, p. 139. Ziegler, 1960, p. 21. Clench, 1961, p. 205. Kendall and Freeman, 1963, p. 2. dos Passos, 1964, p. 59; 1970, p. 37. W. Holland, 1974, p. 177. Howe, 1975, p. 290.
Callophrys macfarlandi: McFarland, 1965, p. 231.
Sandia macfarlandi: Remington and Maeki, 1960, p. 127.

DIAGNOSIS. This species is unmistakable, so much so that early workers placed it in a separate genus, a name which now takes priority for the Nearctic-Neotropical group of which it is a part. The undersurface is most distinctive. There is no tail, and the wings have a yellow-green ground color deeply suffused with darker greens and yellow-brown. There is a wide mesial to postmedian band winding in an arc about the hindwing, edged thickly with green or sometimes

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brownish suffusion. Distad this line the limbal area is highly suffused green and yellow and small spots usually in the cell interspaces giving a "jewel"-like appearance. There is some structural coloration in the limbal suffusion, adding to its distinctness. The upperside looks like a pale yellowish to gray "Incisalia" sens. lat. with a broad distal fringe of gray or buff.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 427) as typical of the genus. Frons hairy, with definite green scales; eye-lining white. Upper Surface of the Wings: Ground color Tawny Olive to Clay Color, fringe much lighter, often white. Scent patch prominent distad in discal area, gray to yellowish. No tail on hindwing; slight recurved lobe between outer and anal angles, usually dark fuscous. Under Surface of the Wings: Ground color variously suffused bright Courge Green to Mineral Green. Forewing darker (Tawny Olive) basad postmedian line. Postmedian line, costa to vein Cu_2 white to yellow distad, black basad; margin black. Hindwing with wide mesial to postmedian arc across entire wing, suffused brown basad, black centrad, white distad; slightly "jagging" along veins distad in the limbal area. Limbal area highly suffused greenish or yellowish with submarginal spots often in cell interspaces surrounded with green to gold structural color. Fringe, both wings, gray to buff. Slight recurved lobe between outer and anal angles, colored black, heavily fringed. Length of Forewing: Mean of six specimens (AMNH) 15.2 mm., range 14.5 mm. to 16.0 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 427) as typical of the genus. Frons as on males. Upper Surface of the Wings: As on males, but sometimes darker, toward Ochraceous Tawny to Sudan Brown. No scent patch distad in discal area. Under Surface of the Wings: As on males. Length of Forewings: Mean of six specimens (AMNH) 16.0 mm., range 15.5 mm. to 16.5 mm. Male Genitalia: Fig 208. Similar to xami, valvae, caudad saccus, clear, mid-rimmed, parabolic, not indented; valvae, lateral view, funnel;

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valvae, caudal extension tapered from cornered junction with bilobed configuration. Saccus broadly pointed; cornuti moderately wide, disclike, as illustrated. Female Genitalia: Fig 209. Similar to xami, but lamellae wide, breadth nearly three times caudal expanse; lamella postvaginalis with centrad division. Antrum not emphatic; transparent areas immediately cephalad about one-fifth entire length of ductus. Ductus circa two times length of antrum. Signa long spines, widely bifurcate centrad, prongs uncurved.

BIOLOGY. Early Stages. Described by Stallings, Turner, and Ehrlich, 1962 (also notes, same authors, 1959); additional behavioral notes by McFarland, 1965. Foodplant. Nolina microcarpa S. Watson (Agavaceae) (Clench and Ehrlich, 1960; Clench, 1961; Stallings, Turner, and Ehrlich, 1962; McFarland, 1965; nomenclature corrected to Nolina texana Watson by R. Holland, 1974).

TYPES. Holotype male, and allotype female, AMNH. Type Locality. La Cueva Canyon, west slope of Sandia Mountains, 1200 m., Bernalillo Co., New Mexico.

DISTRIBUTION. Spatial: Fig. 527. Disjunctly distributed: Sandia, Sacramento, Manzano, and Magdalena mountains of New Mexico; Ladron Peak, New Mexico (for complete listing of New Mexico localities see R. Holland (1974)); Davis and Chisos Mountains, Texas; Chihuahua, Mexico. Restricted to areas of the foodplant, characteristic of local dry upland areas. Temporal: Multivoltine; early May; June.

REMARKS. The species macfarlandi and xami have long been noted as unique among Nearctic hairstreaks. In fact, both had genera erected for them (Sandia and Xamia, respectively; see Clench, 1961). The cladistic question "what are the sister species?" had not been asked previous to this revision. Superficially, there are no known taxa that resemble either species (save the immediate

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sister of xami which I and Harry Clench discovered concurrently during the present study). The genitalia provide the answer: both are plesiomorph to what becomes derived as the herbaceous angiosperm-feeders, e.g., augustinus, Westwood et al., formerly placed in Incisalia. Cladistic analysis indicates that the macfarlandi Group has the augustinus Group as its immediate apomorph sister group. They are the immediate apomorph group to the brown-above Neotropical fusius Group. The latter lack upper surface structural color, rather, being brown above, as in the entire Sandia genus. The fusius Group, macfarlandi Group, and augustinus Group include a transformation series relative to coloration of the frons.

3. The augustinus Group

including augustinus/henrici--irus; polios

A. Cladogram and Characters (in generic cladogram), Fig. 560.

B. Distributions, Fig. 528, Fig. 529, Fig. 530 and Fig. 531, respectively.

Sandia augustinus (Westwood), new combination

Figs. 210, 211, 428

Thecla augustinus Westwood, "1846-52" [1857], p. 486.

Polyommate auguste Latrielle, 1819, p. 599.

Polyommatus augustus: J. Morris, 1860, p. 17.

Lycus augustus: J. Morris, 1860, p. 17.

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Thecla augustus Kirby (nec Fabricius, 1793), 1837, p. 298, pl. 3, figs. 4, 5; 1900, p. 365. J. Morris, 1860, p. 17; 1862, p. 103. Harrison, 1862, p. 279, f. 108. Scudder, 1863, p. 165; 1868, p. 378. W. Edwards, 1877, p. 41. Anon., 1882, p. 3. French, 1882, p. 272. Fern, 1884, p. 79. Fyle, 1887, p. 147. Skinner and Aaron, 1889, p. 146. Smith, 1891, p. 12. Davis, 1895, p. 46; 1915, p. 24. Heath, 1895, p. 311. Browning, 1901, p. 300. Smith and Smith, 1905, p. 7. Brimley and Sherman, 1903, p. 97. Davis, 1909, p. 6. Newcomb, 1912, p. 228. Winn, 1912, p. 15. Williams, 1914, p. 264. Seitz, 1919, p. 760, pl. 153, fig. h. Davenport and Dethier, 1938, p. 170.

Thecla augusta Harrison, 1862, p. 279, f. 108.

species augustus: Comstock and Huntington, 1959, p. 84.

Thecla (Incisalia) augustus: Knobel, 1895, p. 24.

Incisalia augustus: Scudder, 1876, p. 104. Dyar, 1902, p. 39. Cook, 1905, p. 136; 1906, p. 184; 1907, p. 145, 293, 405. Davis, 1915, p. 24. Barnes and McDunnough, 1917, p. 14. Moore, 1922, p. 12; 1930, p. 214; 1939, p. 16. Forbes, 1928, p. 679. dos Passos and Grey, 1934, p. 191. Rogers, 1934, p. 184; 1943, p. 167. McDunnough, 1938, p. 25. Proctor, 1938, p. 136. Williams, 1941, p. 218. Brooks, 1942, p. 35. dos Passos, 1943, p. 1. Kimball and Jones, 1943, p. 34. Bowman, 1951, p. 131. Martin and Truxel, 1955, p. 23. Brower, 1974, p. 119. Krogerus, undated, p. 6.

Incisalia angusta (sic): Wood, undated, p. 301.

Incisalia angustus (sic): Cook, 1907, p. 230. Prescott and Rogers, 1926, p. 42.

Thecla augustinus: Kirby, 1896, p. 395. W. Comstock, 1914, p. 34. Forbes, 1960, p. 133.

Thecla (Incisalia) augustinus: W. Holland, 1931, p. 225.

Incisalia augustinus: Barnes and Benjamin, 1926, p. 18. Clark, 1929a, p. 115; 1937, p. 7. Klots, 1930, p. 161; 1951, p. 146. dos Passos, 1936, p. 98.

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Clark and Clark, 1937, p. 89; 1951, p. 83. F. Chermock, 1953, p. 104. Remington, 1953, p. 97. Ziegler, 1953, p. 34. Voss, 1954, p. 17. Ferguson, 1955, p. 196. Bird, 1956, p. 107. DeFoliart, 1956, p. 97. F. Brown, 1957, p. 139. Clench, 1957, p. 58. Mather and Mather, 1958, p. 82. Riotte, 1959, p. 12. Judd, 1960, p. 246. Moore, 1960, p. 17. Remington and Maeki, 1960, p. 127. dos Passos, 1964, p. 54. Shapiro, 1966, p. 32. Shields, 1966, p. 127. Covell, 1967, p. 23. Masters, 1968a, p. 26; 1971c, p. 13; "1972" (1973), p. 175. Powell, 1968, p. 47. Hooper, 1969, p. 5. Azevedo, 1970, p. 7. Brodie, "1970" (1971), p. 4. Elrod, 1970, p. 13. Price, 1970, p. 15. Anonymous, 1972, p. 8. Emmel, 1972, p. 3. Kuehn and Masters, 1972, p. 5. Emmel and Emmel, 1973, p. 60. Shapiro and Shapiro, 1973, p. 92. Tilden and Huntzinger, 1977, p. 183.

Callophrys augustinus: Clench, 1961, p. 203. Emmel and Emmel, 1962a, p. 33. Newcomer, 1962, p. 70. Small, 1962, p. 195. Huber, 1966a, p. 17. Quinter, 1971, p. 4. Masters, 1972b, p. 7. Scott, 1978, p. 17.

Callophrys (Incisalia) augustinus: Ziegler, 1960, p. 21. dos Passos, 1970, p. 31. Clench and Miller, 1968, p. 129. Masters, 1969, p. 4; "1972" (1973), p. 179. Catling and Walker, 1970, p. 3. Ferris, 1971a, p. 34; 1971b, p. 25. Riotte, 1971, p. 18. Harris, 1972, p. 211. Gregory, 1975, p. 33. Howe, 1975, p. 286.

Thecla iroides Boisduval, 1852, p. 289; 1869, p. 14. J. Morris, 1862, p. 100. W. Edwards, 1877, p. 41; 1882a, p. 9. H. Edwards, 1889, p. 32. Mead, 1884, p. 780. Smith, 1891, p. 12. Danby, 1894, p. 33. Twogood, 1897, p. 31. Grinnell, 1905, p. 136. Cook, 1905, p. 136. Smith and Smith, 1905, p. 7. Cockle, 1910, p. 204. Newcomer, 1910, p. 31. Williams, 1910, p. 36. W. Comstock, 1914, p. 34. Seitz, 1919, p. 760. Davenport and Dethier, 1938, p. 170.

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Thecla irioides (sic): H. Edwards, 1880, p. 130; 1889, p. 32.

Polyommatus iroides: J. Morris, 1860, p. 17.

Lycus iroides: Morris, 1860, p. 17.

Thecla (Incisalia) iroides: W. Holland, 1931, p. 226. Hoffman, 1940, p. 707.

Incisalia iroides: Dyar, 1902, p. 39; 1904, p. 786. Cary, 1906, p. 451. Cook, 1907, p. 145. Coolidge, 1908a, p. 430. McDunnough, 1914, p. 196; 1938, p. 25. Barnes and McDunnough, 1917, p. 4. Barnes and Benjamin, 1926, p. 18. Blackmore, 1927, p. 10. J. Comstock, 1927, p. 167. Gunder, 1930, p. 42. Wright, 1930, p. 24. Fender, 1931, p. 185. Comstock and Dammers, 1933, p. 77. Garth, 1935, p. 28. Blevins and Blevins, 1945, p.123. Leighton, 1946, p. 60. J. Jones, 1951, p. 20. Hopfinger, 1952, p. 84; 1953, p. 83. Martin, 1952, p. 76. Martin and Truxel, 955, p.23. Brown, 1957, p. 139 (placed as synonym of T. augustinus Westwood). Guppy, 1959, p. 103. Powell, 1964,p. 100; 1968, p. 47. Shields, 1967, p. 83. dos Passos, 1940, p. 167; 1943, p. 3. Ferris, 1970, p. 4. R. Holland, "1972" (1973), p. 157. Leighton, 1972, p. 12. Shields and Emmel, 1973, p. 119. Shapiro, 1974, p. 121. Wood, undated, p. 301.

Callophrys iroides: Garth and Tilden, 1963, p. 53, pl. 5.

Callophrys (Incisalia) iroides: Garth and Tilden, 1963, p. 37. Tidwell and Callaghan, 1972, p. 12. Ziegler, 1960, p. 21.

Incisalia augustinus iroides: F. Brown, 1957, p. 139. Clench, 1957, p. 58. dos Passos, 1964, p. 54. Shields, 1966, p. 127. Anonymous, 1972, p. 8. Emmel, 1972, p. 3. Emmel and Emmel, 1973, p. 60. Tilden and Huntzinger, 1977, p. 183.

Callophrys augustinus iroides: Emmel and Emmel, 1962a, p. 33 Newcomer, 1962, p. 70.

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Callophrys (Incisalia) augustinus iroides: dos Passos, 1970, p. 31. Clench and Miller, 1968, p. 129. Ferris, 1971a, p. 35; 1971b, p. 25.

species iroides: Comstock and Huntington, 1960, p. 238.

Thecla fotis Strecker, 1878, p. 129. W. Edwards, 1884, p. 56. Smith, 1981, p. 12. Smith and Smith, 1903, p. 7. Engelhardt, 1918, p. 204. Seitz, 1919, p. 760. NEW SYNONYMY.

Thecla (Incisalia) fotis: W. Holland, 1931, p. 227.

Incisalia fotis: Skinner, 1878, p. 129. Dyar, 1902, p. 39. Barnes and Benjamin, 1926, p. 18. McDunnough, 1938, p. 25. Martin, 1953, p. 69. dos Passos, 1964, p. 54. Shields, 1967, p. 83. Ferris, 1970, p. 4. Masters, 1970b, p. 13. Emmel and Emmel, 1973, p. 60. Newcomer, 1973, p. 13.

Callophrys fotis: Emmel and Emmel, 1961, p. 203. Newcomer, 1962, p. 70. Brown, 1969, p. 95. Callaghan, 1970, p. 228.

Callophrys (Incisalia) fotis: Ziegler, 1960, p. 21. dos Passos, 1970, p. 31. Tidwell and Callaghan, 1972, p. 12. Gregory, 1975, p. 33. Howe, 1975, p. 287.

species fotis: Comstock and Huntington, 1960, p.111.

Thecla mossii H. Edwards, 1881, p. 54. Seitz, 1919, p. 760. NEW SYNONYMY.

Thecla (Incisalia) mosssi (sic): W. Holland, 1931, p. 227.

Thecla (Incisalia) mossii = polios Cook and Watson: Skinner, 1907, p. 327 (synonymy in error).

Thecla irus var. mossii: W. Edwards, 1884, p. 56. Beutenmuller, 1892, p. 169 (placed with irus in error).

Thecla irus = arsace Boisduval = mossii: Smith, 1891, p. 12 (synonymy in error).

Thecla irus = mossi (sic): Anon., 1882, p. 3 (synonymy in error).

Incisalia mossii: H. Edwards, 1881, p. 54. Dyar, 1902, p. 39. Cook, 1906, p. 141. Cook and Watson, 1907, p. 204. Barnes and McDunnough, 1917, p. 15.

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Barnes and Benjamin, 1926, p. 18. Clark, 1932, p. 250. dos Passos, 1940, p. 167. Leighton, 1946, p. 60. J. Jones, 1951, p. 20. Hardy, 1957, p. 40. Guppy, 1960, p. 101. Leighton, 1972, p. 12.

Callophrys mossi (sic): Scott, 1975, p. 17.

subspecies irus mossi (sic): Comstock and Huntington, 1961, p. 173.

Callophrys (Incisalia) mossii: Zeigler, 1960, p. 21.

Incisalia doudoroffi dos Passos, 1940, p. 168. Martin and Truxel, 1955, p. 23. Garth and Tilden, 1963, p. 37, 47, pl. 1. NEW SYNONYMY.

Callophrys (Incisalia) doudoroffi: Ziegler, 1960, p. 21.

species doudoroffi: Comstock and Huntington, 1959, p. 210.

Callophrys mossi (sic) doudoroffi: L. Miller, 1975, p. 18.

Incisalia polios schryveri Cross, 1937, p. 20 (associated with polios in error).

Incisalia schryveri: dos Passos, 1940, p. 167. F. Brown, 1957, p. 141; 1964, p. 55. NEW SYNONYMY.

Incisalia schryveri mossi (sic): Clench, 1957, p. 58.

Incisalia mossii schryveri: McDunnough, 1938, p. 25. Eff., 1953, p. 88. Martin and Truxel, 1955, p. 23. DeFoliart, 1956, p. 97. Forbes, 1960, p. 133.

Incisalia fotis mossii: Clench, 1957, p. 58. Anonymous, 1972, p. 8.

Incisalia fotis doudoroffi: Clench, 1957, p. 59. K. Brown, 1965, p. 171.

Incisalia fotis schryveri: Clench, 1957, p. 58. Ferris, 1971a, p. 35; 1976, p. 76.

Callophrys (Incisalia) fotis: dos Passos, 1970, p. 31 (mossii, schryveri, doudoroffi as subspecies).

DIAGNOSIS. The species augustinus (sensu this revision) is easily recognized by its having no tail and having undersurface pattern characterized by a dark basal disc with lighter ground color distad. Extremes of variations on this pattern across North America include: (1). Dark basal disc with no distad

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edging, simply lighter distad to the margin, often with submarginal brick-red (traditional "augustinus" and bayensis subspecies of "fotis"); (2). This and a white margin on the basal disc, with various markings in the submargins (subspecies of "augustinus", e.g., helenae dos Passos, and some subspecies of "fotis", e.g., mossii, treated by some as a species); (3). Tendencies toward immaculate yellow-brown with basal suffusions of darker scales ("fotis" subspecies doudoroffi, sometimes considered a species, windi, and numerous unnamed populations placed with "augustinus" in California); (4). Highly suffused basal disc with lighter coloration distad, variously developed crennated white of light line along the margin, with postbasal or sometimes submarginal spots, all of these patterns being dominantly gray (Nevada) to yellow brown (Alberta). I have found all combinations of these characters continentally and most often as much variation in some local populations as across regional clines. The genitalia of both sexes show no pattern distinguishing more than one taxon. See Remarks, below, for complete treatment of facies for taxa included in the synonymy of augustinus. I include the general "augustinus" (A). extreme and "fotis" (B). extreme in my description below.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi and frons (Fig. 428) as typical of the genus.

(A.) Upper Surface of the Wings: Ground color dark Prouts to Mummy Brown, sometimes lighter, toward Amber in limbal area, hindwing; male scent patch distad in discal area. Margins nearly entire, no "tail-like" structure at terminus of vein Cu_2; anal angle wing margin between terminus of veins 3A and 2A hardly recurved. Margin usually with white fringe, black on the veins. Under Surface of the Wings: Ground color of forewing Army Brown basad, Natal Brown to Bone Brown distad; no dark spot distad in discal cell; postmedian line, costa to vein Cu_1 or Cu_2 often faint or as brownish blotches, pushed distad between veins

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M_3 and Cu_2. Distad postmedian line wing lighter Mikado Brown to Orange Cinnamon; fringe white between veins, black at vein ends. Hindwing, basal disc deep various browns, often mottled, usually darker anad, not edged with white; margin of disc deep brown to blackish. Distad basal disc wing lighter brown, usually less mottled. Crescent line reduced to blotches or dots between the veins. Submarginal areas distad these blotches usually intensely gray overscaled. No white line along the margin; margin dark, fringe pale intercellular, dark black on the veins.

(B.) Upper Surface of the Wings: Entire wing warm Prouts Brown often highlighted lighter Amber especially in limbal area, hindwing; scent patch distad in the discal area of the forewing. Margins of wings nearly entire, only slightly crennated on hindwing, if at all. Margin pale to white with fringe darkened on veins. Under Surface of the Wings: Ground color, forewing basad postmedian line, and in basal disc, hindwing, Saccardo Brown. Distad postmedian line, forewing, and margin of basal disc, hindwing, ground color lighter, first whitish then toward Snuff Brown. This area almost appearing as a band on the wings. Forewing postmedian line, costa to vein Cu_2, deep brown to black. Broad terminal band on hindwing sometimes distinctly red-brown toward Maroon, sometimes yellowish to gray-flecked in xeric populations. Distad this band margin blackened, offset by broad white marginal markings preceding in an arc about the wing. These are broken by black along the veins and with white and brown fringe at the terminal ends. These hindwing markings somewhat repeated by lighter ground color in the terminus of the forewing. Length of Forewing: Mean of twenty specimens (AMNH) 14.8 mm., range 14.5 mm. to 15.5 mm.

Female: Head, thorax, abdomen, legs, palpi (Fig. 428) and frons as typical of the genus. Upper Surface of the Wings: As on males but lighter areas more emphatic especially centrad, forewing, limbally, hindwing. No scent patch distad

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in discal area. Undersurface of the Wings: As on males. Length of Forewing: $\bar{X}$ of twenty specimens (AMNH), 15.0 mm., range 14.5 mm. to 15.5 mm. Male Genitalia: Fig. 210. Valvae, caudad saccus, clear, mid-rimmed, extremely shouldered, tapering to indented point cephalad. Valvae, lateral view, funnel; valvae, caudal extension tapered to straight points, uneven surface apparent; saccus reduced point, equalling expanse of clear areas of bilobed configuration; cornuti as illustrated. Female Genitalia: Fig. 211. Lamellae hemispherical to elliptical, lamella postvaginalis exceeding lamella antevaginalis by one-half length, latter quite transparent. Antrum and lamella antevaginalis hardly distinguishable from one another, distad areas of these heavily sclerotized. Ductus unevenly sculpture, appearing bumpy; transparent areas caudad on ductus extending caudad to antrum, somewhat distad along cephalad expanse of ductus. Cephalad end of ductus quite club-ended. Signa single spines, vaguely bifurcate distad. See Remarks for discussion of variation in augustinus genitalia.

BIOLOGY. Early Stages: The larvae were described by Cook (1904) and Grundell (1904). The larvae and chrysalis were described by Elrod (1906) and Scudder (1889, 1893). The chrysalis has been treated by Cook (1907) and the entire life history by Cook (1906). Foodplant. Polyphagous on Eriodyction californicum (M. and A.), Kalmia augustifolia Linn., Vaccinium augustifolium Ait., corymbosum L., and vacillans Terr. (all Ericaceae), Tietz, 1972; Sedum sp. (Crassulaceae) Clench, 1961; Cousania mexicana var. stansburiana (Torr.) Jeps. (Rosaceae) Emmel and Emmel, 1973.

TYPE. No type designated in description and none extant (Comstock and Huntington, 1975, p. 84). However, name unambiguous, especially as related to this revision's consideration of conspecificity of augustinus and fotis. No neotype designated. The types of taxa synonymous with augustinus (alphabetical order) are deposited as follows: doudoroffi (AMNH); fotis (Field Museum/AME)

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iriodes (NMNH); mossii (AMNH); schryveri (Denver Museum of Natural History). Type Locality: None specified, but infered as "America" vis-a-vis Kirby's designation of former name used, e.g., augustus (see synonymy). The type localities of those taxa sometime treated as species but now in synonymy with augustinus include: doudoroffi (Big Sur, Monterey Co., California, United States); fotis (Arizona, United States); iriodes (not specified); mossii (Esquimalt, Vancouver Island, British Columbia, Canada); schryveri (Chimney Gulch, Boulder Co., Colorado, United States).

DISTRIBUTION. Spatial: Fig. 528. From the central southern states of the United States north and east to Labrador and Newfoundland. Westward to the Northwest Territories of Canada, south to Vancouver Island. Southward in the Rocky Mountains from British Columbia and western Alberta to Arizona and New Mexico, westward to California, the entire Pacific coast and southward into northern Mexico. Temporal: Univoltine, emerging late Feruary to March, southern United States, early or mid-April central area, early or mid-April through May, northeastern United States.

REMARKS. Nearctic lepidopterists will immediately note that I have synonymized the familiar "species" fotis with augustinus. This synonymy broadens the facies description significantly and removes the confusion concerning how to recognize these conspecific taxa (see Clench, 1961, for two figures needed to identify fotis [because augustinus was within it]; see Howe, 1975, for description of various "subspecies" and mention that "another" species might be involved. Neither considered the "other" species to be augustinus, but another taxon altogether). The opinion of this investigation that augustinus and fotis are conspecific results from the examination of the extant types of all taxa ranked as species or subspecies within these two taxa, and the examination of female and male genitalia from eighty-four localities spanning the North American

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continent, the examination of wing characters from at least two hundred localities (see Material Examined), and the current biological and foodplant data in the literature. The following criteria should be adequate to demostrate this hypothesis of conspecificity which will be documented in detail in a separate paper:

1. There are no genitalic or wing characters that can be characterized which will allow distinguishing the species augustinus and fotis throughout North America.

2. The construction of any such set of characters, hypothetically, leaves two named populations doudoroffi and windi impossible to place in either species, requires transfer of the population named bayensis (under "fotis") to a different species, or requires division of the type series.

3. The following parallelisms of wing characters occur using characters hitherto thought to distinctly distinguish different species:

   a. "f. bayensis" is paralleled by "augustinus" in Michigan.

   b. "f. mossi" is paralleled by "a. helenae".

   c. the tendency of limbal darkening and formation of a whitish edge to a darker basal disc, accented by a white spot near the costa is general throughout numerous populations formerly placed in either species.

   d. "f. windi" and "f. doudoroffi" are approximately paralleled by xeric populations of "augustinus."

   e. "fotis"-like (e.g. California "fotis") specimens occur at random in New Jersey "augustinus."

4. Series from Stockton, Utah, and Lethbridge, Alberta, each with identical data as to place and date, exhibit gradations of the characters hitherto

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thought to represent the two species, or examples hitherto thought to represent either taxon. Their genitalia are so similar as to not indicate non-conspecificity.

5. If the taxa doudoroffi and windi are placed as subspecies within either species, it is impossible to place other California montane populations, as yet unnamed, in either subspecies or species.

6. There are intergradations that would not allow solving the problem by erecting a third, intermediate, or other, species along with fotis and augustinus (e.g., perhaps in California).

7. The taxon augustinus has been shown to be broadly polyphagous, including different plant families. The idea that fotis feeds on Sedum (Crassulaceae) exclusively is excepted by southern California populations on Cowania (Emmel, 1973) and by the problem that Sedum-feeding populations bayensis, windi, and doudoroffi would have to be transfered to the species augustinus in any character scheme based on genitalia (and also wing patterns considering Michigan augustinus) in the first case, and seem unresolvable in the latter two cases if two species fotis and augustinus are involved. Hence, it seems that hitherto considered fotis has included strains of augustinus feeding on Sedum. Emmel (1973) mentioned the altitudinal separation of fotis from augustinus in California and that the former was often found with Callophrys comstocki. This latter taxon is an altitudinal form of Callophrys sheridanii (Howe, with Shields, 1976, and this paper); sheridanii occurs throughout the lowland areas characterized by some populations of augustinus. The same habitat coincidence has been mentioned by Callaghan (1970) and seasonal coincidence by Cook (1907). Leighton (1946) mentions that mossii "flies with iroides," making one suspicious if two taxa were actually involved.

8. All of the populations hitherto considered fotis and considered to feed on Sedum generally share the characterization of northern latitudinal or

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altitudinal populations with the brown disc, white edging, white costal spot maculation, shared by a. helenae in Newfoundland and Nova Scotia, and with a distinct exception of the gray form of fotis (hitherto considered f. fotis in the southwest United States); this latter population shows intergrades to typical augustinus.

9. There is no relative apomorphy in the palpi of either sex which can be used to differentiate any local or regional populations, as has been demonstrated in some designations of new species in other genera.

10. Shields (1967) has mentioned a hybrid specimen of "I. iroides and fotis." It is not known whether this specimen represented a hybrid of known parental stock of different local populations or a specimen with intermediate characters. As mentioned above, the latter exist commonly both in some local populations and also across geographic areas in the facies of populations formerly placed as subspecies of either "augustinus" or "fotis."

11. If foodplant or other biological evidence of non-interbreeding is offered by subsequent researchers as evidence of the presence of two "biological" species, such evidence cannot be considered conclusive on the basis of one locality alone, but must be reconsidered then in the light of the possible relations continentally. Further, evidence of local or racial purity as related to possible other demonstrations of reproductive isolation or compatibility would still demonstrate only a shared plesiomorphy and thus not warrant species recognition unless same studies could demonstrate a unique apomorphic character for the population(s) considered distinct (see Rosen, 1979, p. 275).

This species has presently within it four subspecies designations along with the nominate one. These include iroides (Boisduval) which prior to dos Passos'

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1964 synonymic list was considered by many as not conspecific (F. Brown, 1957; J. Comstock, 1928).

I have examined the male and female genitalia of this complex from eighty-four localities across the Nearctic distribution. All of the following names are indicated as representing populations conspecific with augustinus as reviewed below. Variation in the genitalia of males across the distribution of augustinus is moderate, involving the degree of shouldering of the bilobed configuration, the width of the caudal extension of the valvae, and the breadth and length of the saccus. There is no particular configuration which can be used to place an individual specimen at a locality or region, with the exception of the configuration of New Mexican and Arizonan material. The somewhat unusual configuration in this latter region, however, loses its integrity northward into western Colorado and allopatry is not indicated; further, some extreme genitalia from the northwest United States, e.g., Washington, and southern Canada (Puget Sound area), parallel the southwestern United States configuration. Variation in the genitalia of females throughout the range of augustinus defines no particular populations with unique characters. The only exception is the New Mexican and Arizonan populations which interface with intermediate states of their unique characters (see below) in southwestern Colorado. Dos Passos (1943) has reviewed the wing patterns of the various "subspecies" and provided a key. He has also commented on the distributions of these populations which have been given names. Since the relation of these descriptions with the genitalic data is at some variance, reviewing infraspecific taxonomy in relation to new data will be done in a separate paper. The names which represent populations conspecific with augustinus are listed below, with brief comments.

helenae dos Passos (1943 Am. Mus. Novit. 1230:2) (TL Doyles Station, Newfoundland, Canada); named as subspecies of augustinus; status after present study, available as clinal subspecific name within augustinus.

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croesiodes Scudder (1876, Bull. Soc. Nat. Sci. 3:104) (TL "Eastern United States"); used as name for eastern United States form (e.g. race or subspecies, given context of original description) by Scudder (1889); status after present study, available as clinal subspecific name within augustinus.

iroides (Boisduval) (1852, Ann. Ent. Soc. France, 10:289) (TL not specified); named as species of Thecla, thence variously Callophrys or Incisalia; placed as conspecific with augustinus (by dos Passos, 1964). Status after present study, available as subspecific name within augustinus. Analysis of male and female genitalia throughout range of augustinus indicates no unique characters within distribution area usually considered as iroides (west coast and Rocky Mountain region of United States) and also iroides var. immaculata Cockle (1910, Can. Ent. 42:204).

annetteae dos Passos (1943, Am. Mus. Novit. 1230:3) (TL Silver City, New Mexico, United States); named as subspecies of iroides; status after present study, available as subspecific name under augustinus. This population displays the most variant genitalic configuration in the complex, females with small third lobe tending to develop on lamella postvaginalis and reduction of signum to a single spine, males with more extreme shouldering of bilobed configuration and narrow caudal extension; intermediate character states between this and Rocky Mountain iroides occur in northern Arizona and southwestern Colorado.

mossii (H. Edwards) (1881, Papilio, 1:54) (TL Esquimalt, Vancouver Island, British Columbia, Canada). Named as variation of irus, erroneously. Wing characters often noted as unique, actually parallel annetteae (from similar climatic area). No genitalic characters distinctive. This taxon has been a candidate for specific status among some recent workers (e.g., Stanford, 1976, 1977) with common usage suggesting evidence (unpublished) of biological distinction. Such would have to be considered within context of point 11 under Remarks, above.

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schryveri Cross (1937, Proc. Colo. Mus. Nat. Hist. 16:20) (TL Chimney Gulch, Boulder Co., Colorado, United States). Named as subspecies of polios, erroneously. No characters indicating uniqueness vis-a-vis continental augustinus. Recently often associated with mossii as noted above (see Stanford, 1976, 1977).

bayensis (R.M. Brown) (1969 J. Lepid. Soc. 23:95) (TL San Bruno Mt., San Mateo Co., California, United States). Named as subspecies of fotis; recently noted as endangered (see Miller, 1975). Facies parallel Michigan augustinus; no characters noting uniqueness, except local habitat.

doudoroffi dos Passos (1940, Can. Ent. 72:168) (TL Big Sur, Monterey Co., California, United States). Named as species, then placed (dos Passos, 1964, et al.) as subspecies of fotis. Morph parallels other local populations in California usually placed with augustinus. Problem of what species with which to associate doudoroffi (considering long recognition with fotis but morph paralleling as above) points out difficulty of two taxon concept in this complex of populations.

windi Clench (1943, Can. Ent. 75:185) (TL Placer Co., California, United States). Named from particular local morph following dos Passos' recognizing doudoroffi as species. Other local morphs in California similar, variously placed with augustinus. Morph, as with doudoroffi, parallels xeric augustinus. Two taxon concept for this complex of populations might necessitate splitting of type series into two species, as with doudoroffi.

It should be noted that my statement of augustinus and fotis as conspecific is primarily a morphological hypothesis highly corroborated by my own analysis of the available biological and other additional data in the literature. As a hypothesis it predicts that no apomorphic character will be discovered that will indicate these two former "species" are not conspecific on a continental level.

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Sandia henrici (Grote and Robinson), new combination

Figs. 214, 215, 430

Thecla henrici Grote and Robinson, 1867, p. 774. Scudder, 1868, p. 378; 1889, p. 835, pl. 6, 23, 65, 75, 85. French, 1882, p. 273; 1886, p. 273. Anon., 1882, p. 19. Butler, 1882, p. 470. W. Edwards, 1884, p. 51. Fern, 1884, p. 80. Kirby, 1837, p. 400. H. Edwards, 1889, p. 32. Packard, 1890, p. 53. Blatchley, 1891, p. 394. Smith, 1891, p. 12. Beutenmuller, 1892, p. 59. Dyar, 1902, p. 35; 1903, p. 7. Skinner, 1907, p. 129. Winn, 1912, p. 15. Davis, 1915, p. 25. Seitz, 1919, p. 760. Moore, 1922, p. 2. Davenport and Dethier, 1938, p. 171.

Thecla henricii (sic): W. Edwards, 1881, p. 150. Blatchley, 1891, p. 394.

Thecla (Incisalia) henrici: W. Holland, 1931, p. 226.

Incisalia henrici: Cook, 1905, p. 216; 1907, p. 181, 229, 258, 405; 1908, p. 37, 181. Cook and Watson, 1907, p. 204; 1909, p. 181. Barnes and McDunnough, 1917, p. 15. Lindsey, 1917, p. 351. Barnes and Benjamin, 1926, p. 18. Forbes, 1928, p. 679. Brower, 1930, p. 258. Hutchins, 1933, p. 147. Clark and Clark, 1937, p. 89; 1951, p. 84. Clark, 1938a, p. 180. Field, 1938, p. 152. Leussler, 1938, p. 277. Leville, 1938, p. 17. McDunnough, 1938, p. 25. Moore, 1939, p. 16; 1960, p. 18. Wagner, 1941, p. 200. Williams, 1941, p. 218. Clench, 1943, p. 182; 1957, p. 58. dos Passos, 1949, p. 180; 1964, p. 54. H. Freeman, 1950, p. 7; 1953, p. 92; 1959, p. 89. L. Harris, 1950, p. 14. F. Chermock, 1953, p. 102. Remington, 1953, p. 99. Ziegler, 1953, p. 34. Ferguson, 1955, p. 196. Martin and Truxel, 11956, p. 23. Meiners, 1956, p. 163. Mather and Mather, 1958, p. 82. Kimball, 1965, p. 48. Shapiro, 1966, p. 33. Covell, 1967, p. 23. Masters, 1967a, p. 208; 1968a, p. 26; "1972" (1973), p. 175; 1975, p. 58.

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Powell, 1968, p. 54. Masters and Masters, 1969, p. 6. O'Byrne, 1970, p. 16. Price, 1970, p. 15. Harris, 1972, p. 14. Kuehn and Masters, 1972, p. 5. Johnson, "1972" (1973), p. 28. Brower, 1974, p. 19. Miliotus, 1978, p. 4.

Callophrys henrici: Clench, 1961, p. 202. Huber, 1967, p. 10; 1969, p. 7. Kendall, 1964, p. 129. Lambremont, 1965, p. 50. Downey, 1966, p. 164. Kendall and Kendall, 1971, p. 38. Masters, "1972" (1973), p. 175. Downey and Irwin, 1973, p. 20.

Callophrys (Incisalia) henrici: Ziegler, 1960, p. 21. Clench, 1961, p. 202. Kendall and Freeman, 1963, p. 2. Clench and Miller, 1968, p. 127. Masters, 1969, p. 4; 1972 (1973), p. 179. dos Passos, 1970, p. 31. Catling and Walker, 1970, p. 3. Harris, 1972, p. 209. S. Miller, 1972, p. 231. Shull and Badger, 1972, p. 18. Gregory, 1975, p. 33. Howe, 1975, p. 288.

species henrici: Comstock and Huntington, 1960, p. 180.

DIAGNOSIS. This species lacks the male scent patch on the forewing upperside. It has the "tail" of irus but lacks a "Thecla-spot" or a hoary patch basad in the basal disc of the hindwing underside. Teh basal disc is very dark brown to blackish, darker than any other congener.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 430) and frons typical of the genus. Upper Surface of the Wings: Ground color uniformly Prouts Brown to Mummy Brown, occasionally lighter, limbal area, hindwing. No scent patch distad in the discal area, only scattered androconial scales along the veins of the cell. Forewing hardly crennated, hindwing moderately crennated with extreme to a broad "tail" at vein Cu_2. Fringe is pale to white between veins, dark to black on the veins. Undersurface of the Wings: Ground color of the forewing basad postmedian line Mummy Brown to darker postmedian line, costa to vein Cu_2, deep brown to black basad, white distad, entire and hardly

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wavy; distad in discal cell, a large dark brown patch. Distad postmedian line, ground color lighter Tawny Brown to Buckthorn Brown; submarginal blotches from costa to base of wing, often emphatic between veins M_1 and M_2 and in cell Cu_2. Basad area of cell Cu_2, ground color often lighter than rest of wing basad postmedian line. Hindwing, basal disc very dark Mummy Brown to blackish; no hoary overscaling basad. Distad margin of basal disc, ground color lighter Dresden Brown, with submarginal area of deep brown blotches immediately distad. Distad blotches, broad area suffused toward dark Plumbago Gray distad to wing margin; area heavily overscaled with white. Margin black, fringe pale to white between veins, black on veins. Length of Forewing: $\bar{X}$ of twelve specimens (AMNH) 16.0 mm., range 15.2 mm. to 16.5 mm. Female. Head, thorax, abdomen, legs, palpi (Fig. 430) and frons as typical of the genus. Upper Surface of the Wings: Similar to males but often with large areas of centrad forewing and limbal area, hindwing, lighter, toward Amber. No scent patch distad in discal area. Undersurface of the Wings: As on males. Length of Forewing: $\bar{X}$ of twelve specimens (AMNH) 16.2 mm., range 15.5 mm. to 16.5 mm. Male Genitalia: Fig. 214. Valvae, caudad saccus, clear, narrow-rimmed, parabolic, not indented; slight wide corner at juncture of bilobed configuration and caudal extension; valvae, lateral view, round-tapered; valvae, caudal extension, tapering to broad straight points with rather blunt ends; saccus long, parabolic; cornuti disc-like. Female Genitalia: Fig. 215. Lamella postvaginalis with uneven edge, hemispherical shape; lamella antevaginalis only as slight lips distad the opening of the ductus. Antrum equalling about one-third length of ductus; transparent area directly cephalad one-seventh rest of length of ductus. Ductus about six-sevenths of lamellae cephalad transparent area, slightly flared cephalad. Signa as broad spines moderately bifurcate centrad.

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BIOLOGY. Early Stages: The life history, egg, larvae, and chrysalis have been described by H. Edwards (1881), Fernald (1884), French (1886), and Cook (1907). Foodplant: Carex sp. (Cyperacae), Polygonum hydropiper L., lapathifolium L. (Polygonaceae), Populus sp., Salix sp. (Salicaceae), Typha sp., and T. latifolia L. (Typhaceae), Tietz, 1972. Current common usage, (see Remarks) Vaccinium sp. (Ericaceae), Prunus (Rosaceae), Cercis (Fabaceae).

TYPES. In AMNH, lectotype male designated by dos Passos, 1943. Type Locality: Philadelphia, Pennsylvania, fixed by dos Passos, 1943.

DISTRIBUTION. Spatial: Fig. 530. From central Florida in the United States west to Texas and northward to Ohio, Ontario (Canada), and Quebec (Canada) in the area west of the Appalachian Mountains. In the Appalachian Mountain region only from and eastward to Nova Scotia (Canada). Westward in this northern area to Minnesota and Manitoba.

REMARKS. There is disparity between historically recorded larval foodplants and those considered by current common usage as valid. In regard to the later, more reliable records, there are several interesting larval fooplant usages in relation to regional distributions: generally in the eastern United States Vaccinium sp. and Prunus sp. have been recorded (Ericaceae and Rosaceae, respectively). These records should be judged in relation to some more current data, summarized briefly as follows: (1). Michigan: foodplant Viburnum flowers (pers. com. M.C. Nielsen to Eric Quinter, 1979). (2). Atlantic coastal plain (New Jersey, at least): foodplant Ilex opaca flowers (American Holly)--records of Vaccinium and Prunus possibly erroneous, due to observed perching on those plants--invariably in close proximity to Ilex, upon which oviposition has also been observed by Dale Schweitzer. Quinter has personally observed perching and

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activity on and around Ilex opaca in New Jersey pine barrens but cannot confirm oviposition or larval usage.

However, in local areas of West Virginia and Pennsylvania (e.g., Philadelphia), and in the entire Nebraska and Kansas distributions, Cercis (Fabaceae) is the foodplant (sources, common usage, Eric Quinter, Dale Schweitzer pers. com.). I have dissected males and females from all of these populations and I find nothing to indicate that more than one taxon is involved.

This species has a peculiar history of debate concerning its possible conspecificity with several other taxa. Early authors did not note that henrici lacked a centralized scent patch on the male. After this character, and that of the presence of a tail, became important in descriptions of the species, debate on its validity subsided. I have found that the genitalia of henrici make it the most easily recognizable of the herbaceous angiosperm-feeding Sandia.

Sandia irus (Godart), new combination

Figs. 216, 217, 431

Polyommatus irus Godart, 1823, p. 674. J. Morris, 1860, p. 11.

Polyommate Irus: Latrielle, 1819, p. 610.

Lycus irus: J. Morris, 1860, p. 11.

Thecla irus: Kirby, 1837, p. 399. J. Morris, 1862, p. 97. W. Edwards, 1877, p. 41; 1884, p. 57. Worthington, 1880, p. 48. French, 1882, p. 273. Boisduval, 1883, p. 101. Elwes, 1884, p. 887. H. Edwards, 1889, p. 72. Skinner and Aaron, 1889, p. 146. Blatchley, 1891, p. 408. Barber, 1893, p. 16. Oslar, 1893, p. 226. Danby, 1894, p. 33. Davis, 1895, p. 46. Knobel, 1895, p. 25. Hanham, 1900, p. 365. Browning, 1901, p. 300. Beutenmuller,

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1902, p. 32. Brimley and Sherman, 1903, p. 97. McElhose and Schwarz, 1907, p. 313. Skinner, 1907, p. 129. Davis, 1909, p. 6. Newcomb, 1912, p. 228. Winn, 1912, p. 15. Reed, 1916, p. 268. Seitz, 1919, p. 760, pl. 153, fig. h. Oberthur, 1920, pl. DV. Davenport and Dethier, 1938, p. 171. Comstock and Huntington, 1943, p. 58. Forbes, 1960, p. 132.

Thecla iris (sic): J. Morris, 1862, p. 97.

Thecla (Incisalia) irus: W. Holland, 1931, p. 226.

Incisalia irus: Lintner, 1896, p. 254. Dyar, 1902, p. 39. Cook, 1905, p. 216; 1906, p. 181; 1907, p. 181, 258, 405; 1908, p. 37. Cook and Watson, 1907, p. 204; 1909, p. 181. Barnes and McDunnough, 1917, p. 14. Anon., 1920, p. 156. Gibson, 1920, p. 27. Forbes, 1928, p. 679. dos Passos and Grey, 1934, p. 278. Rogers, 1934, p. 184. Clark and Clark, 1937, p. 89. Field, 1938, p. 152. McDunnough, 1938, p. 25. Moore, 1939, p. 16; 1960, p. 18. Williams, 1941, p. 218. Kimball and Jones, 1943, p. 39. H. Freeman, 1950, p. 7; 1951, p. 39. Harris, 1950, p. 14; 1972, p. 14. Clark and Clark, 1951, p. 84. Klots, 1951, p. 148. Darlington, 1952, p. 35. Hessel, 1953, p. 107. Ziegler, 1953, p. 34. Lambremont, 1954, p. 144. Martin and Truxel, 1955, p. 23. Riotte, 1959, p. 12. Remington, and Macki, 1960, p. 127. Simmons, 1963, p. 107. dos Passos, 1964, p. 54. Shapiro, 1966, p. 33. Covell, 1967, p. 23. Powell, 1968, p. 51. Elrod, 1970, p. 13. Price, 1970, p. 12. Brower, 1974, p. 19. Shapiro and Shapiro, 1973, p. 92.

Callophrys irus: Small, 1962, p. 195. Lambremont, 1965, p. 50. Downey, 1966, p. 164. Nordin, 1967-68 (sic), p. 60. Downey and Irwin, 1973, p. 20.

Callophrys (Incisalia) irus: Ziegler, 1960, p. 21. Clench, 1961, p. 202. dos Passos, 1970, p. 31. Catling and Walker, 1970, p. 3. Harris, 1972, p. 208. Shull and Badger, 1972, p. 18. Gregory, 1975, p. 33. Howe, 1975, p. 288.

species irus: Comstock and Huntington, 1960, p. 238.

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Thecla arsace Boisduval and Leconte, 1833, p. 103. J. Morris, 1860, p. 97. W. Edwards, 1884, p. 57. Dyar, 1902, p. 39 (placed as synonym of Polyommatus irus Godart). Barnes and Benjamin, 1926, p. 18. McDunnough, 1938, p. 25. dos Passos, 1964, p. 54; 1970, p. 31. Comstock and Huntington, 1959, p. 79.

Polyommatus arsace: J. Morris, 1860, p. 11.

Lycus arsace: J. Morris, 1860, p. 11.

species arsace: Comstock and Huntington, 1959, p. 79.

Thecla irus = mossi (sic) H. Edwards: Anon., 1882, p. 3 (synonymy in error).

Thecla irus var. mossii: W. Edwards, 1884, p. 56. Beutenmuller, 1892, p. 169 (placed with irus in error).

Thecla irus mossii: Skinner, Smith, and Kearfoot, 1903, p. 7 (placed with irus in error).

Thecla irus = mossii = henrici Grote and Robinson: Smith, 1891, p. 12 (synonymies in error).

subspecies irus mossi (sic): Comstock and Huntington, 1961, p. 173 (placed with irus in error).

Thecla irus = henrici: Scudder, 1889, p. 104. Davis, 1915, p. 25 (synonymy in error).

Thecla irus = fotis Strecker: Anon., 1882, p. 19 (synonymy in error).

Thecla irus = henrici: Scudder, 1889, p. 835, pl. 6, 23, 65, 75, 85. Davis, 1915, p. 25 (synonymy in error).

Thecla irus = henrici: Scudder, 1876, p. 104; 1889 (2), p. 835; (3), p. 6, 23, 65, 85. Davis, 1915, p. 25 (synonymy in error).

Thecla hadros Cook and Watson, 1909, p. 181. Seitz, 1919, p. 760.

Thecla (Incisalia) hadros: W. Holland, 1931, p. 226.

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Incisalia hadros: Barnes and McDunnough, 1917, p. 15. Barnes and Benjamin, 1926, p. 18. McDunnough, 1938, p. 25. dos Passos, 1949, p. 180; 1964, p. 54. H. Freeman, 1950, p. 7; 1953, p. 92. Klots, 1951, p. 148 (placed as synonym of P. irus Godart). Martin and Truxel, 1955, p. 27.

Callophrys (Incisalia) hadros: Kendall and Freeman, 1963, p. 2.

species hadros: Comstock and Huntington, 1960, p. 176.

Incisalia irus hadros: Klots, 1951, p. 148.

Callophrys (Incisalia) irus hadros: Ziegler, 1960, p. 21. Clench, 1961, p. 202. dos Passos, 1970, p. 31. Howe, 1975, p. 288.

DIAGNOSIS. This species can be distinguished from its congeners by the deep Bone Brown, Maroon to blackish basal disc of the hindwing undersurface which contrasts with the heavily Tawny to Ochre to Bister coloration of the rest of this wing. There is also a "Thecla-spot" in the limbal area, often surrounded by orange. The male scent patch is extremely elongated at the distal end of the discal area of the forewing.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 431) and frons as typical of the genus. Upper Surface of the Wings: Ground color uniformly Mummy Brown, suffused lighter toward Cinnamon Brown. Male scent patch, distad in forewing discal area, elongated. Forewing margin only slightly crennated, fringe pale between veins, dark on veins. Hindwing, moderately crennated; emphatic broad "tail" at terminus of vein Cu_2. Undersurface of the Wings: Ground color basad postmedian line of forewing Fawn Color, heavily suffused toward Natal Brown. Paralleled on hindwing by basal disc heavily overscaled toward deep Bone Brown, Maroon, or blackish. Forewing with deep brown blotch in the discal cell; postmedian line, costa to vein Cu_2, slightly wavy but entire. Ground color distad postmedian line lighter, darkening again along

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margin; fringe pale between veins, dark on veins. Margin, hindwing basal disc, extremely wavy, displaced distad from vein M_3 to vein Cu_2, heavily brown to black basad, white distad, emphatically white from anal margin to vein 2A and between veins Sc + R_1, and Rs. Distad margin, basal disc, ground color bright Mikado Brown; crescent line reduced to Natal Brown blotches of lines; distad these, wing darker toward crennated margin, with tail-like projection at terminus of vein Cu_2. Margin Bone Brown, Maroon, to blackish; fringe pale to white between veins, dark on veins. Length of Forewings: $\bar{X}$ of ten specimens (AMNH) 15.6 mm., range 14.5 mm. to 16.0 mm. (no Texas specimens; latter to circa 17.0 mm.). Female: Head, thorax, abdomen, legs, palpi (Fig. 431) and frons as typical of the genus. Upper Surface of the Wings: Similar to males but large suffused or completely lighter Amber to Sudan Brown areas centrad on forewing and in limbal area, hindwing. No scent patch distad in discal area. Undersurface of the Wings: As on males. Length of the Forewings: $\bar{X}$ of ten specimens (AMNH) 15.7 mm., range 14.8 mm. to 16.5 mm. (no Texas specimens; latter to circa 17.5 mm.). Male Genitalia: Fig. 216. Valvae, caudad saccus, clear, narrow-rimmed, parabolic, and indented; valvae, lateral view, round-tapered, with cephalad articulation extremely and broadly curved; valvae caudal extension, extremely narrow and tapered (length nearly seven times maximum width; extension caudad bilobed configuration about two times length of latter); saccus broadly funneled; cornuti as illustrated. Female Genitalia. Fig. 217. Lamella postvaginalis breadth about six-sevenths length of ductus, not widely folded and without convolutions centrad. Lamella antevaginalis thin, only one-fifth as wide as lamella postvaginalis, and slightly recurved cephalad from plane of antrum. Antrum flared out caudad one-third of ductus, very transparent centrad; transparent areas cephalad antrum about one-fifth remaining length of

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ductus. Ductus only slightly flared cephalad. Signum single very long spine, with very minute bifurcation centrad.

BIOLOGY. Early Stages: Detailed life history data has been given by Cook (1906). The larvae were described by Felt (1905) and J. Comstock (1904), the larvae and chrysalis by Beutenmuller (1893), W. Edwards (1873), Middleton (1880), J. Morris (1862), Boisduval and LeConte (1833; figured), Maynard (1886) and Scudder (1893); Holland (1905) described and figured the chrysalis. Food-plants: Tietz (1972) lists Baptisia tinctoria L., Cercis canadensis L. (both Fabaceae), Cyrilla racemiflora L. (Cyrillaceae), Ilex sp. (Aquifoliaceae), Leucothoe racemosa L. (Ericaceae), Lupinus perennis L. (Fabaceae), Prunus sp., Prunus domestica L., P. ilicifolia Nutt, ex H. and A. (Rosaceae), Vaccinium corymbosum L. (Ericaceae), and V. myrtillus L. as reported in the literature; Clench (1961) lists various Fabaceae, specifically, Lupinus perennis and Baptisia tinctoria; these latter are mentioned by Howe (1975).

TYPES. The type of irus is unknown but its description seems unambiguous. The type of arsace is likewise unknown, but its description is similarly unambiguous. The type of hadros was destroyed (Comstock and Huntington, 1960) but description and allopatric range make it unambiguous. No neotypes are designated. Type Localities: "America", inferred from description of irus and listed in Comstock and Huntington, 1960, p. 238; arsace is "Virginia and Georgia", hadros Houston, Texas.

DISTRIBUTION. Spatial: Fig. 531. From the Great Lakes and adjacent plains area of the United States eastward to the New England coast and southward to South Carolina, Georgia and Arkansas. Also in central and eastern Texas as "subspecies" hadros. Flight Period: Univoltine, emerging April to May eastward, flying to early June.

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REMARKS. This species has within it two presently recognized subspecies, i. hadros Cook and Watson and the nominate (dos Passos, 1964; Clench, 1961). The former was considered a separate species previous to Clench's work. I have examined male and female genitalia from 17 localities spanning the distribution of irus from northern New York through Georgia and Arkansas to Texas, the latter characterized as the distribution of hadros. I find no differences indicating hadros, irus or their intervening populations are not conspecific. Therefore I list the following name as conspecific with irus and available as a subspecific name along with the nominate: hadros Cook and Watson, representing the distribution of irus in Texas.

The male genitalia across the range of irus differ variously in the degree of narrowness in the caudal extension, degree of parabolic shape in the bilobed configuration, and shape of the saccus, but to no degree confusing them with any other species or suggesting other distinct taxa. The populations called hadros have a narrower caudal extension and a more bulbous parabolic bilobed configuration.

The female genitalia over the range of irus vary in degree of caudal expanse of the lamella postvaginalis. Specimens from Texas have a more expansive and lobate lamella postvaginalis.

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Sandia polios (Cook and Watson), new combination

Figs. 212, 213, 429

Incisalia polios Cook and Watson, 1907, p. 202. Cook, 1907, p. 235, 405; 1908, p. 37. Barnes and McDunnough, 1917, p. 15. Watson and Comstock, 1920, p. 453. Moore, 1922, p. 12; 1939, p. 16; 1960, p. 18. Barnes and Benjamin, 1926, p. 18. Blackmore, 1927, p. 10. Forbes, 1928, p. 680. Brodie, 1929, p 4. Clark,1932, p 250. dos Passos and Grey, 1934, p. 191. Rogers, 1934, p. 184. Cross, 1937, p. 20. McDunnough, 1938, p. 25. Proctor, 1938, p. 186. Williams, 1941, p. 218. Brooks, 1942, p. 35. Frederick, 1942, p 20. Clench, 1943, p. 249. Kimball and Jones, 1943, p. 34. Rawson and Ziegler, 1950, p. 79; 1953, p. 33. Bowman, 1951, p. 131. Clark and Clark, 1951, p. 83. J. Jones, 1951, p. 20. Klots, 1951, p. 147. Ehrlich, 1952, p. 88. Hopfinger, 1953, p. 84. Remington, 1953, p. 97. Ziegler, 1953, p. 33. Voss, 1954, p. 97. Ferguson, 1955, p. 196. Martin and Truxel, 1955, p. 23. DeFoliart, 1956, p. 98. F. Brown, 1957, p. 140. Riotte, 1959, p. 12. Remington and Maeki, 1960, p. 127. dos Passos, 1964, p. 54. Shapiro, 1966, p. 32. Covell, 1967, p. 23. Masters, 1968, p. 26; 1971b, p. 13; 1972 (1973), p. 175. Masters and Masters, 1969, p. 9. Hooper, 1969, p. 5. Ferris, 1970, p. 4. Anon., 1972, p. 8. Kuehn and Masters, 1972, p. 5. Ritterbush, 1972, p. 10. Brower, 1974, p. 19. McCabe and Post, 1976, p. 97.

Thecla polios: Davenport and Dethier, 1938, p. 171. Forbes, 1960, p. 132.

Thecla (Incisalia) polios: Skinner, 1907, p. 327. W. Holland, 1931, p. 227.

Callophrys polios: Downey, 1966, p. 166. Nordin, 1966, p. 60. Huber, 1967, p. 10; 1968, p. 7. Scott, "1968" (1970), p. 192; 1975, p. 17. Catling and Walker, p. 3. Riotte, 1971, p. 18. Masters, 1972b, p. 7. Downey and Irwin, 1973, p. 20. Miliotis, 1978, p. 4.

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Callophrys (Incisalia) polios: Ziegler, 1960, p. 21. Clench, 1961, p. 201. Masters, 1969, p. 4; 1972 (1973), p. 179. dos Passos, 1970, p. 31. Ferris, 1971, p. 35; 1973, p. 115; 1976, p. 68. Shull and Badger, 1972, p. 18. Gregory, 1975, p. 33. Howe, 1975, p. 288.

Incisalia polios schryveri Cross, 1937, p. 20. Comstock and Huntington,, p. 115 (association with polios in error).

Incisalia schryveri: dos Passos, 1940, p. 167. F. Brown, 1957, p. 141.

Incisalia polios = mossii W. Edwards: Skinner, 1907, p. 327 (synonymy in error).

Incisalia mossii schryveri: McDunnough, 1938, p. 25. Eff, 1953, p. 88. Martin and Truxel, 1955, p. 23. DeFoliart, 1956, p. 97. Forbes, 1960, p. 133.

Incisalia schryveri mossi (sic): Clench, 1957, p. 58.

Incisalia polios = schryveri: by virtue of above synonymy; synonymies in error.

species polios: Comstock and Huntington, 1962, p. 117.

DIAGNOSIS. This species can be distinguished by its relatively simple markings. On the under surface, hindwing, the basal disc is rather uniformly dark brown to Maroon, with mottling especially noticeable basad faint postbasal slashes. Very distinctly, the basad disc is followed distad by a very hoary terminal area, suffused gray and gray-blue and encompassing nearly half the wing from costa to anal angle. This latter hoary gray, extending so emphatically immediately distad the disc from costa to anal margin, serves to clearly distinguish the species from most specimens of congeners, along with the lack of distinct crennation of the hindwing margin or an emphatic recurved lobe.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 429) and frons as typical of the genus. Upper Surface of the Wings: Ground color deep Bone Brown, Mummy Brown to Prouts Brown. Scent patch distad in discal area. Occasional lighter brown (toward Amber) centrad on forewing or limbally on

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hindwing. No tail; margin faintly checkered. Margin of hindwing hardly crennated, recurved lobe hardly noticeable. Under Surface of the Wings: Forewing and hindwing with areas basad postmedian line and in basal disc, respectively, deep Bone Brown to Maroon tinted. Forewing, postmedian line, costa to vein Cu_2, white distad, black basad, often broken or irregular. Hindwing, with deeply Bone Brown to Maroon-tinted basal disc, bordered distad by some white, especially anad and often broken and irregular. Immediately distad basal disc limbal area and nearly entire one-half of wing in terminus highly suffused with gray or gray-blue, with only faint submarginal blotches showing through. Margin faintly checkered, hardly crennated. Length of Forewing: $\bar{X}$ of 10 specimens (AMNH) 14.6 mm., range 14.0 mm. to 15.5 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 429) and frons as typical of the genus. Upper Surface of the Wings: Similar to males but without scent patch distad in discal area and with larger and more expansive lighter areas of ground color. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 10 specimens (AMNH) 14.8 mm., range 14.0 mm. to 16.0 mm. Male Genitalia: Fig. 212. Valvae, caudad saccus, clear, mid-rimmed, shouldered caudad, parabolic cephalad, not indented; cephalad tip tapering to point; clear areas of bilobed configuration extending far caudad, nearly one-half entire length of valvae; valvae, lateral view, funnel; extremely wide caudad; valvae, caudal extension, recurved; saccus, broadly parabolic; cornuti, disc-like. Female Genitalia: Fig. 213. Shape of lamellae rather square, lamella antevaginalis about one-fourth expanse of lamella postvaginalis. Antrum wide, appearing as "goblet" mounted on ductus. Transparent area just cephalad antrum extends one-fourth rest of length of ductus. Ductus flared cephalad, transparent areas extending distad along much of the ductus. Signa as wide spines, widely bifurcate distad.

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BIOLOGY. Early stages. Cook, 1908, described the egg. The remaining life history, though known perhaps to some lepidopterists, has evidently not been published. Foodplant. Bearberry Arctostaphylos uva-ursi (Ericaceae), Clench, 1961.

TYPES. Holotype male. In NMNH. Type Locality. Lakewood, New Jersey.

DISTRIBUTION. Spatial: Fig. 529. From New Mexico in the Rocky Mountains of the United States northwestward to southeastern Alaska and the southern Northwest Territories of Canada. Eastward from the Rocky Mountains across northern states and southern Canada to Nova Scotia and Virginia. Temporal: Univoltine over entire range. Emerging mid-April through June in eastern United States; May through June in Rocky Mountains and north and west Canada.

REMARKS. There is presently one subspecies described within polios, other than the nominate, p. obscurus Ferris and Fisher (1973 J. Lepid. Soc. 27(2): 112-118). It represents the central Rocky Mountain distribution of polios from northern New Mexico through Colorado to southeastern Wyoming. The name davisi (polios ab. davisi Watson and Comstock, 1920, Bull. Amer. Mus. Nat. Hist. 42:453), though available as a subspecific name according to recent revisions of the Code of Zoological Nomenclature, has not, to my knowledge, been defined in such a way by any author.

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MESOCYANOPHRYS, NEW GENUS

Polyommate (sic) Polyommatus Latrielle, 1804, p. 185. Latrielle, 1819, p. 602.

Thecla (in part): Cramer, 1782, p. 259. Prittwitz, 1865, p. 318. Hewitson, 1867, p. 33; 1869, p. 34; 1877, p. 205. Burmeister, 1879, p. 24. Godman and Salvin, 1887, p. 33. Kirby, 1871, p. 399; 1896, p. 399. Berg, 1882, p. 169. Weeks, 1905, p. 19. Jones, 1912, p. 897. Draudt, 1919, p. 762. Kohler, 1923, p. 31; 1928, p. 4. Anon., 1926, p. 462. W. Holland, 1931, p. 228. Huntington, 1932, p. 210; 1933, p. 3. Bates, 1935, p. 190. Hoffman, 1940, p. 707. Biezanko and Piton, 1941, p. 11. Schweizer and Webster-Kay, 1941, p. 19. Clench, 1944, p. 231; 1946, p. 284. Schwanwitsch, 1948, p. 256. Franz and Schroeder, 1954, p. 85. Comstock and Garcia, 1960, p. 420. Comstock and Huntington, 1959, p. 175; 1961, p. 115. Lipes, 1961, p. 56. dos Passos, 1964, p. 55. Zikan and Zikan, 1968, p. 56. Hayward, 1973, p. 152.

Tecla (sic): Kohler, 1923, p. 31.

Callophrys Billberg, 1820, p. 80 (in part). Field, 1939, p. 347. Brown, 1968, p. 19. Scott, 1970 (1971), p. 249.

Callophrys (Mitoura) Scudder, 1871, p. 52 (in part). Kendall and Freeman, 1969, p. 3.

Callophrys (Cyanophrys) Clench, 1961, p. 211 (in part); 1963, p. 248. Gorelick, 1971, p. 3. Brown and Heineman, 1972, p. 233. McGuire and Richard, 1974, p. 48. Scott, 1975, p. 297. Ross, 1976, p. 190 [108].

Cyanophrys (in part): Ehrlich, 1961, p. 211. Clench, 1966, p. 7. Riley, 1975, p. 100. Beattie, 1976, p. 16.

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DIAGNOSIS. There are no general superficial characters that can be used to include all the species of this genus. However, two groups of wing characters usefully diagnose the groups within Mesocyanophrys: (1). Males dull iridescent blue above, with tails, and with white markings on the undersurface forming usually one, but sometimes more than one, white transverse line or bar are Mesocyanophrys; (2). Males or females with an immaculate underside but black or brown dots in a submarginal arc about the hindwing, are of this genus. Readily apparent apomorphic characters defining Mesocyanophrys are as follows: male genitalia with cornuti distended into tapered shape with spiny ends; female genitalia with ductus extremely long and narrow, width of ductus usually one-fifth to one-sixth or less breadth of lamellae, length usually exceeding seven times width; consequently antrum length is diminutive, always less than the length of the caudal extension of the lamellae.

DESCRIPTION. Adult: Legs not evidencing any elongation relative to width (latter indicates apomorphy in Callophryina). Frons variously spiny and colored green; eyelining white. Wings above iridescent blue on males, variously bordered with fuscous to black; female, duller brown with sheen of blue or purplish structural color especially basad on the wings. Under surfaces of wings, green, both sexes, patterns characterized by at least one transverse medial wing band on the hindwing, usually white or yellowish, complete to wide, or variously discontinuous, or lacking completely, often with supplementary red-brown patterns distad, or occasional more white markings. Hindwing with or without tail, depending on species. Palpi with second segment of females shorter than on corresponding males. Successive derivation leads to convergent palpi in some apomorph taxa. Male Genitalia: Generally characterized by males with long caudal extension, gradually tapered; with bilobed configuration variously parabolic in different general shapes (tapered, rectangular, etc.). Base of the

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vinculum not greatly flared, if at all; vincular spurs present as rounded areas, if at all. Aedeagus as typical of entire Callophryina, cornuti tapered in apomorph taxa. Female Genitalia: Generally characterized by variously hemispherical or rectangular lamellae, lamella antevaginalis, various, half to equalling entire caudal expanse of lamella postvaginalis. Antrum characteristically diminutive if present at all, complemented by extremely long ductus. Juncture of lamellae and ductus usually tapered without obvious antrum. Signa bifurcate spines.

BIOLOGY. Early Stages. Unknown. Foodplants. Unknown.

TYPE SPECIES. Thecla lycimna Hewitson.

DISTRIBUTION. Spatial: Mesocyanophrys is exclusively Neotropical South American, being distributed north of central Argentina no farther than Amazon River in the east and to Ecuador in the western Andes. Temporal: Dates of capture indicate flight periods of at least December to early June.

REMARKS. Mesocyanophrys includes a relatively large group of South American "blue above - green beneath" "Thecla-like" species which are the immediately apomorph sister clade to Sandia. Sandia, as defined in this study, includes in its plesiomorph groups a few "Thecla-like" species which are brown above and green beneath and give rise to what was traditionally defined by primitive characters as genera or subgenera Sandia, and Xamia and taxa formerly placed in Incisalia along with some gymnosperm-feeding taxa included by similar primitive characters. The Mesocyanophrys include a number of familiar South American "Thecla" and some newly recognized sister taxa which have developed a diverse clade of variously apomorph species, but represent a different group than some similar looking species included by me in the genera Paracyanophrys and Cyanophrys. These latter are successively more apomorph. Mesocyanophrys and Sandia have as their immediate sister genera Paraincisalia

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and Ginzia, which are Palaearctic-Neotropical and Palaearctic in distribution, respectively. These four genera are the plesiomorph sister group to a series including the superficially similar Paracyanophrys and Cyanophrys. Cyanophrys is the most apomorph group among these taxa which on the males are all iridescent blue above and green beneath.

ETYMOLOGY. "Meso-" refers to middle, indicating the characters of the species of this genus representing an intermediate position in relative apomorphy among the superficially similar tropical hairstreaks that have long been placed together in Thecla or Cyanophrys.

SPECIES GROUPS (3)

-- as defined by characters accompanying Fig. 563.

1. The caramba Group

including adelaidae; tetrameres/paratetrameres; rachelae/caramba

A. Cladogram and Characters, Fig. 563.

B. Distribution, Figs. 532, 533.

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Mesocyanophrys adelaidae, new species

Figs. 49, 218, 432

DIAGNOSIS. This species resembles others, but paratetrameres most closely. Known specimens of adelaidae are nearly immaculate on the undersurface, hindwing, however; marking present faintly only anad. The male genitalia are very distinct, with an extremely wide-rimmed, parabolic bilobed configuration in no way rectangular in shape or narrow-rimmed as on tetrameres and paratetrameres and with a long caudal extension leaving the bilobed configuration to appear relatively diminutive, not pronounced as on the former two taxa.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 432) as typical of the genus. Frons green. Upper Surface of the Wings: Bright iridescent Smalt Blue, brighter basad. Distad marginal band of dark Raw Umber, both wings, slightly wider at apeices. Scent patch distad in discal area, same brilliant blue as wing. Fringes dark Raw Umber, both wings; tail on hindwing at Cu_2. Under Surface of the Wings: Ground color, both wings, dull Deep Grape Green. Area of forewing immediately cephalad hindwing smokey gray suffused blackish, especially basad. Hindwing with vague white submarginal spots, in cells Cu_2, Cu_1, and M_3 strongly edged basad with rusty brown; another cephalad in cell M_1. Distad these white spots, cells Cu_2 to M_3, are a parallel line of rusty blotches along the margin, emphatic in cell M_3, diminutive in cell Cu_1 and connected to the coloration of the recurved lobe of the hindwing in cell Cu_2. Recurved lobe of the hindwing between outer and anal margins deep rusty brown, black basad; evidence of extension of the veins slightly at vein Cu_1. Fringe forewing, dull Raw Umber, rusty-brown distad, hindwing, dull Raw Umber basad, whitish distad. Length of Forewing: holotype, 16.0 mm.; one paratype, 15.0 mm.

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Female: Unknown. Male Genitalia: See Fig. 218. Valvae, caudad saccus, clear, wide-rimmed, widely parabolic, indented; valvae, lateral view, round-tapered; valvae, caudal extension, tapered; saccus, reduced (barely longer than width of vinculum immediately caudad); cornuti wide-tapered. Female Genitalia: Unknown.

TYPES. Holotype male (Fig. 49), Itabuna, Bahia State, Brazil, January, 1967, V. Becker; deposited AME. Paratypes. BMNH: Petropolis, Rio de Janeiro; Bahia, Brazil; (two males).

DISTRIBUTION. Spatial: Fig. 532. This species is known from southern Brazil and Paraguay. Temporal: Known from September to January.

REMARKS. All the known specimens were dissected for genitalia, legs, and palpi.

ETYMOLOGY. This species is named for Adelaide Vernon.

Mesocyanophrys tetrameres, new species

Figs. 50, 219, 433

DIAGNOSIS. The wing characteristics of this species resemble numerous congeners, especially rachelae, but its male genitalia can be easily recognized by the nearly rectangular configuration of the bilobed area of the valvae caudad the saccus, and an extremely tapered caudal extension; the saccus is very reduced (barely longer than that area of the vinculum caudad the base of the valvae) and the cornuti are uniquely shaped (see below).

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 433) as typical of the genus. Frons green. Upper Surface of the Wings: Entire upperside

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except extreme margins, hindwing, and slight band apex and margin, forewing, iridescent Alizarine Blue. Margin blackened, with white edging along the hindwing and with recurved lobe betwen anal and outer margin Chestnut Brown. No tail at end of vein Cu_2. Under Surface of the Wings: Entire wing Cress Green to Forest Green, except area of forewing just cephalad hindwing, deep gray, especially darker basad. Margin of forewing edged with red-brown, costal margin blackish. Hindwing with incomplete postmedian band of white spots, edged deep red-brown basad, in cells 2A, Cu_1, and Rs. Spot in cell Cu_2 located distad these, and in line with two submarginal brown spots in cells Cu_2 (small) and Cu_1 (large). Margin deep red-brown edged with white, becoming suffused with red-brown near recurved lobe between outer and anal margin. Margin deep red-brown, black distad. Length of forewing: 16.5 mm. (holotype). Female: Unknown. Male Genitalia: See Fig. 219. Valvae caudad saccus broadly indented as to be nearly flat; then nearly rectangularly shaped caudad to beginning of caudal extension. Caudal extension of the valvae extremely long and tapered; saccus very reduced, parabolic, length hardly exceeding width of vinculum just caudad. Valvae lateral shape nearly irregular but with slight funnel shape; cephalad cornutus broadly bifurcate at end; caudal cornutus spatulate. Female Genitalia: Unknown.

TYPE. Holotype male (Fig. 50), Sabara-Bellow Horizonta, Rio dal Velhao, Minas Gerais State, Brazil. A.G.N. Chalmers. Deposited BMNH.

DISTRIBUTION. Spatial: Fig. 532. Known only from the type locality. Temporal: Unknown.

REMARKS. The knowledge of the cladistic hierarchy of a group allows particular genitalic configurations (or other structures noted as synapomorphic characters) to be recognized as representing new taxa. When a sister group pair is found, like this species and its sister paratetrameres not only can the

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specificity of the two taxa themselves be seen as apparent within the cladistic structure, but their position in the relative hierarchy of related taxa further corroborates their actual "existence".

ETYMOLOGY. The Greek name "tetrameres" refers to the very rectangular appearance of the bilobed configuration that characterizes this species.

Mesocyanophrys paratetrameres, new species

Figs. 51, 220, 434

DIAGNOSIS. This species is the immediate sister species of tetrameres. Both share the distinctly rectangular shape of the bilobed configuration of male valvae, but on paratetrameres this configuration represents about one half of the entire length of the valvae, while on tetrameres it is only one third or less and much more reduced in expanse distad. Superficially, the male wing characters of paratetrameres resemble all the species in the amyntor Group of Cyanophrys. The female is unknown.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 434) as typical of the genus. Frons green. Upper Surface of the Wings: Deep iridescent Dull Violaceous Blue; thin areas of margins, both wings, blackish. Scent patch distad in discal cell blue as rest of wing. Hindwing with long, white tipped tail at vein Cu_2, slight point on vein at Cu_1. Recurved lobe hindwing, Chestnut, fringed widely black distad. Margin black, fringe white between veins. Under Surface of the Wings: Ground color bright Chromium Green with emphatic black marginal borders, both wings. Area of forewing immediately cephalad hindwing broadly gray-brown not quite to margin. Hindwing with mesial band of wandering red-

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brown spots, edged distad with white, especially anad; first, second and third spots from costa forming distad "jag"; similar displacement in cell Cu_2. Distad this mesial arc, red-brown spots in cell Cu_1 and Cu_2. Area cephalad deeply black recurved lobe, richly maroon, suffused gray and bluish in cell Cu_2. Fringe black, pale distad. Length of Forewing: 15.8 mm. (holotype), other specimens 16.0 mm., 16.2 mm. Female: Unknown. Male Genitalia. Fig. 220. Similar to tetrameres but with caudal expanse of bilobed configuration nearly one half length of entire valvae. Valvae, caudad saccus, clear, mid-rimmed, extremely elongate, parabolic, indented; valvae, lateral view, round-tapered but with expanse of round area nearly equal to that of tapering; valvae, caudal extension, tapered; saccus, reduced, barely longer than expanse of vinculum immediately caudad; vinculum ony slightly flared, spurs rounded; cornuti, narrow-tapered. Female Genitalia: Unknown.

TYPE. Holotype male (Fig. 51), Santissima Trinidad, Cordillera Province, Paraguay, May, T. Podtiaguin. Deposited AMNH. Paratypes, BMNH: no data (two males); AIL: Iguazu, Argentina (one male); Curitaba, Brazil (one male), Castro, Brazil (one male).

DISTRIBUTION. Fig. 532. Known from the type locality and other specimens from northern Argentina and southeastern Brazil. Temporal: Known only from May.

REMARKS. The holotype and the BMNH paratypes were dissected for genitalia, legs, and palpi.

ETYMOLOGY. The Greek name "para" added to "tetrameres" indicates that this species is the immediate sister species of tetrameres.

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Mesocyanophrys rachelae, new species

Fig. 52, 221, 222, 435

DIAGNOSIS. Recognized by the deep green underside, on the hindwing of which very bright white spots not or only faintly edged red-brown seem to occur at random along the median line. In this regard the species has been confused with caramba Clench on which such white spots occur but only toward the anal margin. The genitalia of the species are very distinct (see below).

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 435) as typical of the genus. Frons green. Upper Surface of the Wings: Entire wing except dark Raw Umber border of forewing and border along extreme margin of hindwing, dull iridescent Alizarine Blue. Raw Umber border, forewing, clearly wide (circa 2 mm.), not simply marginal darkening. Scent patch distad in discal area, blue; recurved lobe of hindwing faintly Chestnut but not extensive. No tail. Under Surface of the Wings: Ground color Deep Dull Yellowish Green. Area of forewing immediately cephalad hindwing dull grayish tan, blackened along margin with the green. Wings nearly immaculate except for very bright and distinct white spots, very slightly or not at all bordered with red-brown occurring submarginally at cells 2A, (displaced distad), Cu_2, Cu_1, M_2, and Rs. Paralleling these distally and limbally, faint traces of red blotches in cells Cu_2 and Cu_1, usually hardly distinguishable. Recurved lobe of hindwing between anal and outer margins, deep Maroon suffused distad and basad and with white slash basad along vein 3A. Sometimes a small spot, faintly separated from the spot prominent in cell 2A, occurs between the obvious white spots of cells 2A and Cu_2. Fringe of forewing dull red-brown, hindwing emphatic red-brown, darkened and extending basad on the hindwing veins; this red-brown marginal fringe paralleling (with green break between) brown suffusion extending distad from

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coloration of recurved lobe. Length of Forewing: $\bar{X}$ of three specimens (BMNH) 16.5 mm., range 16.0 to 17.0 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 435) as typical of the genus. Frons green. Upper Surface of the Wings: Wide areas of costa, apex and submargins of forewing, margin and submargins of hindwing, warm Prouts Blue. Rest of wing Lavender Gray distad to Endive Blue basad. Juncture of blue coloration and brown on hindwing slightly crennated. Recurved lobe of hindwing between outer and anal margins only slightly extended, lightly Chestnut. Fringe, forewing, Prouts Brown, hindwing same, but much lighter distad. No tail. Under Surface of the Wings: As on male, but white spots usually not as many and most often being emphatic at cell 2A and M_1 only. No noticeable red-brown edging on such spots, making them very bright white over the ground color. Coloration of recurved lobe of hindwing darker, toward black suffused, and edged basad with distinct white slash. Fringes of both wings light red-brown. Length of Forewing: $\bar{X}$ of three specimens (BMNH) 16.5 mm., range 16.0 to 17.0 mm.

TYPES. Holotype male (Fig. 52), La Chima, Rio de las Juntas, Bolivar Province, Ecuador, June-July 1893, M. de Mathan; allotype female same data. Deposited in BMNH. Paratypes. BMNH: same data as primary types (four males, three females).

REMARKS. This is a very distinct species, thus far represented only by substantial series in the BMNH which were lumped (with a question mark) with Clench's name caramba. The types and two of the paratypes were dissected for genitalia, legs, and palpi.

ETYMOLOGY. This species is named for Rachel Spang.

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Mesocyanophrys caramba (Clench), new combination

Figs. 53, 223, 224, 436

Thecla caramba, Clench, 1946, p. 255.

species caramba: Comstock and Huntington, 1959, p. 175.

DIAGNOSIS. Wing patterns superficially resembling those of the amyntor group, but usually distinguished by caramba's lacking a tail on the hindwing. M. caramba also resembles species with scattered white spots in the postmedian band of the hindwing undersurface like Mesocyanophrys rachelae; surest way to identify caramba is by dissection: male genitalia very distinctive with bilobed configuration parabolic and indented tapering to an extremely long caudal extension with bulbous ends. The female (Fig. 53) has similarly unique genitalia, characterized by almost rectangular shaped lamella postvaginalis, sclerotization distad the antrum at the base of the lamella antevaginalis and a relatively short ductus, length circa one and a quarter times caudad expanse of lamellae.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 436) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color bright iridescent Alizarine Blue. Scent patch distad in disal area of forewing same bright blue as wing. Only narrowest areas of margins, both wings, and apex, forewing fuscous to black. Recurved lobe of hindwing between outer and anal margins bright Chestnut, black distad and heavily fringed. Fringe both wings, fuscous to black, lighter distad, toward white, limbal area, hindwing. No tail at vein Cu_2. Under Surface of the Wings: Ground color Oriental Green to Winter Green. Area of forewing immediately cephalad hindwing deep gray nearly to margin. Hindwing with mesial line of white spots, bordered red-brown distad, emphatic, but lacking in cells Rs and M_2. Anad, recurved lobe deep

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Maroon, black distad; extending costa from it, three to four red-brown blotches or slashes parallel the white mesial spots. Length of Forewing: 16.5 mm. (holotype). Female: Head, thorax abdomen, legs and palpi (Fig. 436) as typical of the genus. Frons green. Upper Surface of the Wings: Broad areas of forewing and hindwing bright sheened Light Purplish Gray to Purplish Gray bordered by fuscous margins and submargins and apices of both wings. No scent patch distad in discal area. Recurved lobe between outer and anal margins bright Chestnut, bordered distad deep black, heavily fringed fuscous. Tail at terminus vein Cu_2. Fringe, both wings, fuscous, lighter distad. Under Surface of the Wings: Fig. 53. Similar to males but with red-brown submarginal markings, anad, more reduced. Length of Forewing: 15.8 mm. Male Genitalia: Fig. 223. Valvae, caudad saccus, mid-rimmed, parabolic, and indented; valvae, lateral view, round tapered, taper much longer than "round" area; valvae, caudal extension extremely long, exceeding terminal end of falces, bulbous ended. Saccus short, equal to width of vinculum directly caudad. Base of vinculum flared; spurs rounded; cornuti disclike. Female Genitalia: Fig. 224. Lamella postvaginalis near rectangular; caudal expanse approaching three quarters length of ductus. Antrum moderately prominent with sclerotizations just distad at base of lamella antevaginalis. Signum broadly bifurcate spines.

BIOLOGY. Early Stages: Unknown. Foodplant: Unknown.

TYPES. Holotype male, in AMNH. Type Locality: Massarauduba-Blumenau, Santa Catarina State, Brazil.

DISTRIBUTION. Spatial: Fig. 532. Known only from type locality. Temporal: Unknown.

REMARKS. Curators and specialists of several collections have identified specimens as caramba, but none of these matches the type specimen. Thus,

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Clench's single holotype is still the only known male. In the AMNH I located a specimen whose unique female genitalia and data indicate it is probably the female of caramba; it is described and figured in this paper. "Cyanophrys" sens. lat. are only seldom collected even with intense collecting by tropical workers; large collections where present have been built up over many years. Unique specimens seem to occur and not be seen again. Often collections have a series of a new taxon. Further collections in other years at the same place turn up new taxa, but only occasionally those found unique a few years before. Areas with much long term collecting, like Pelotas, Brazil, by Biezanko, eventually yield series of numerous species in an area. See Ross, 1976, for comments on low density of Cyanophrys sens. lat. The taxon caramba seems indicative of this same phenomenon. All known specimens were dissected for genitalia, legs, and palpi.

2. The legionis Group

including legionis--opaspangorum / kyanos

A. Cladogram and Characters, Fig. 564.

B. Distributions, Fig. 532.

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Mesocyanophrys legionis (Clench), new combination, status revised

Figs. 54, 225, 226, 437

Thecla legionis Clench, 1944, p. 231, 240.

species legionis: Comstock and Huntington, 1961, p. 108.

Thecla acaste: Clench, 1946, p. 188 (placed legionis as synonym of acaste Prittwitz).

Thecla acaste legionis: Clench, 1946, p. 188

DIAGNOSIS. Of species in this group there are very noticeable differences in the coloration of the under surfaces of the wings. In legionis the under surface is immaculate green with the only noticeable markings a vague arc of lighter green occurring as light blotches distad in the cell interspaces along the margin. On kyanos and opaspangorum the hindwing under surface has mesial and occasional postmedian white or red-brown blotches anad.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 437) as typical of the genus. Frons green. Upper Surface of the Wings: Entirely bright iridescent Diva Blue, with only a thin Wings: Fig. 54. Both wings entirely Rheinemanns Green. Area of forewing immediately cephalad margin of hindwing brownish gray. Hindwing immaculate except for very noticeable arc of lighter green blotches in the cell interspaces along the margin. Length of Forewing: male (AMNH), 16.5 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 437) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color dark dull Violaceous Gray broad areas of costa, apex, margins, and submargins of forewing, and outer margin of hindwing dull Raw Umber. Costa and area cephalad on hindwing distinctly lighter than general ground color.

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Recurved lobe of hindwing between outer and anal margins suffused red-brown. Fringe of forewing brown to blackish basad, grayish distad; on hindwing nearly white with darkening on the vein-ends. Under Surface of the Wings: As on male. Length of Forewing: 12.5 mm. (holotype). Male Genitalia: See Fig. 225. Valvae, caudad saccus, clear, bevel-rimmed, wide, indented; valvae, lateral view, round-tapered, slight funnel centrad. Valvae, caudal extension tapered, extreme in length (three times length of bilobed configuration); saccus short, (same length as bilobed configuration), parabolic; base of vinculum not flared; vinculum with triangular spurs; cornuti, narrow-tapered. Female Genitalia: See Fig. 226. Lamella postvaginalis hemispherical, indented slightly caudad; lamella antevaginalis one-quarter expanse of lamella postvaginalis, appearing only as smooth curved lips distad the opening of the ductus. Antrum wide and long, length two-thirds to one time caudal expanse of lamella antrum. Ductus straight, length after transparent area three to four times that of antrum. Signa broad bifurcate curved spines, first hardly noticeable, second large and appearing hooklike.

TYPE. Holotype female in MCZ. Type Locality: Blumenau, Santa Catarina State, Brazil.

DISTRIBUTION. Spatial: Fig. 532. Presently known from only montane southeastern Brazil Brazil in Bahia, Minas Gerais, Espirito Santos, Rio de Janeiro, and Santa Catarina states. Temporal: Dates on specimens range from February to May.

REMARKS. This taxon was described as a species by Clench in 1944 and made a subspecies of acaste by Clench in 1946. At that time only the holotype female was available for study. The present investigation has discovered the male of this taxon associated by wing pattern and vicinity of distribution. Study of the genitalia of the females of legionis and acaste indicate they are not conspecific. Study of these in relation to other acaste Group taxa indicate that

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legionis is not only not conspecific with any other taxon in the group but that it is one species in a clade of three immediate sister taxa, all exhibiting very similar wing patterns but very different genitalia and called here the "legionis species Group". Study of the male genitalia of legionis, and all the above-mentioned congeners corroborates this evaluation. The name legionis is, therefore, returned to species rank. Five females and four males were dissected for genitalia, legs, and palpi.

Data on the other known specimens of legionis include those summarized in the Material Examined.

Mesocyanophrys opaspangorum, new species

Figs. 55, 227, 438

DIAGNOSIS. Separable from kyanos by a simple genitalic character: cornuti of aedeagus wide-tapered, not extremely narrow-tapered as in kyanos. Other genitalic differences as below.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 438) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color dark iridescent Cyanine Blue. Scent patch distad in discal area. Only extreme outer margins of both wings black. Recurved lobe of hindwing, very reduced, only vaguely Chestnut, heavily fringed. Fringe dark fuscous, lighter distad. No tail. Under Surface of the Wings: Ground color deep Winter Green. Area of forewing immediately cephalad hindwing deep gray nearly to margin. Hindwing nearly immaculate except for white spots one extremely costad, and also anad cell Cu_1; broad bright red-brown basad recurved lobe and a large "Thecla-spot". Recurved lobe of hindwing small, deep red-brown suffused basad as above and

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with white slash in cell just basad. Fringe, both wings, fuscous to red-brown, pale distad in cellular interspaces. Length of Forewing: 17 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 227. Similar to legionis but with wide bulbous juncture between caudal extension and bilobed configuration. Latter more parabolic, narrow-rimmed, not wide-rimmed and beveled as in kyanos. Valvae, lateral view, round-tapered. Saccus broadly parabolic, diminutive. Vinculum slightly flared, not spurred. Cornuti wide-tapered as illustrated. Female Gentalia: Unknown.

TYPE. Holotype male (Fig. 55), Santa Catarina State, Brazil, H. Wornicke; deposited BMNH.

DISTRIBUTION. Spatial: Fig. 532. Known only from type locality. Temporal: Unknown.

REMARKS. This is the other species indicated by the scattered specimens with various genitalic configurations making up the legionis group. It has been impossible to place this specimen with any of the other taxa, as made clear in the remarks under other legionis group taxa. The lack of material in this and other groups in South America is unfortunate, superficially, but given the sporadic and low density occurrences of all the "Cyanophrys," a remarkable amount of material is actually available in the major accessible world collections.

ETYMOLOGY. This species is named for William F. Spang, Sr., name meaning "Father of the Spangs."

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Mesocyanophrys kyanos, new species

Figs. 56, 228, 439

DIAGNOSIS. This species is similar to opaspangorum but the genitalia distinguish it, most markedly by the thinly tapered cornuti and wide, bevel-rimmed bilobed configuration on the male.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 439) as typical of the genus; frons green. Upper Surface of the Wing: Ground color deep iridescent Indigo Blue but shining much lighter. Only the slightest edges of the wings black. Recurved lobe of hindwing vaguely evident, Chestnut, heavily fringed basad black. Fringe, both wings black. Tail at vein Cu_2. Under Surface of the Wing: Ground color bright Rheinemanns to Winter Green. Area of forewing immediately cephalad hindwing dark gray nearly to margin. Hindwing nearly immaculate, but with mesial and anad markings faintly present--small white spots from cell Cu_1 anad and bright red-brown basad recurved lobe, and a "Thecla-spot". Recurved lobe of hindwing reduced, bright red-brown circumferenced black. Black along margin, especially to tail. Fringe black. Length of Forewing: 14.5 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 228. Valvae, caudad saccus, clear, bevel-rimmed, parabolic, indented; valvae, lateral view, round, funnel; valvae, caudal extension, tapered; saccus parabolic; base of vinculum flared, only basad evidence of vinculum spurs; cornuti narrow-tapered. Female Genitalia: Unknown.

TYPE. Holotype male (Fig. 56), Borhumi, south Sao Paulo State, Brazil, deposited BMNH.

DISTRIBUTION. Spatial: Fig. 532. Known only from the type locality. Temporal: Unknown.

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REMARKS. Given the small number of specimens from which this species group is defined (other than with legionis) one might desire to lump all the taxa into one or two species. However, knowledge of the cladistic relations of this and other related groups allows consideration of the genitalic configurations as representing specific taxa. Also the fact that the specimens come from widely divergent areas in the humid tropics of southern Brazil further indicates the probability of several taxa being involved. If the genitalia were not so catagorically different in facies, making it impossible to decide what to relate with what, one might prefer lumping these taxa. This, however, is further harmful to any valid zoogeographical considerations, since lumping would obscure the relative value of apomorphy in the characters. Hence, I treat the unique specimens in this group as representing distinct, but little known species, as is typical of numerous well known "Cyanophrys" sens. lat. like Jones' bertha, and the crethona sister species noted by several authors but not named until this paper.

ETYMOLOGY. The Greek name kyano refers to the "indigo" coloration of the dark iridescent upper surface.

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3. The acaste Group

including tobias--johnsonorum / pantobias--acastoides--catharinensis /abnormis --acaste /lycimna; bertha.

A. Cladogram and Characters, Fig. 565.

B. Distribution, Fig. 533.

KEY TO ACASTE SPECIES GROUP

SUPERFICIAL WING CHARACTERS

1. (a). Wings not tailed 2

   (b). Wings tailed . . . . . tobias

2. (a). Under surface of the hindwing with transverse bar not bordered widely by additional white 3

   (b). Under surface of hindwing, transverse bar extremely wide, complemented by emphatic white extending distad and/or basad and with variously expressed white postmedian bar, forewing . . . . . bertha

3. (a). Under surface of hindwing with complete transverse white bar or arc, either entire or slightly wavy, but not broadly broken; with or without occasional red-brown distad or basad this or dark blotches along the margin 4

   (b). Under surface of hindwing with transverse white bar incomplete anad, completely missing on one-third to one-half of wing anad, or broken and irregular 7

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4. (a). Postbasal area with no white markings supplementing white transverse bar 5

(b). Postbasal area with one to two white markings supplementing white transverse bar 6

5. (a). Specimen of larger size (forewing length exceeding circa 15 mm.) plus apices of wings and recurved lobe not obviously pointed . . . . . acaste or lycimna (use Genitalic Key)

(b). Specimen of small size (forewing length less than or about 15 mm.) plus apices of wings and recurved lobe of hindwing obviously pointed . . . . . pantobias (use Genitalic Key)

6. (a). Southeastern Brazil . . . . . catharinensis

(b). Andes, and areas immediately adjacent . . . . . abnormis

7. (a). Postbasal area with no white markings supplementing white transverse bar . . . . . acastoides

(b). Postbasal area with emphatic white slashes forming "figure-8" shape with costad area of highly irregular white median line . . . . . johnsonorum

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KEY TO ACASTE SPECIES GROUP (excepting bertha)

GENITALIC CHARACTERS

Male

1. (a). Caudal extension tapered 2
   (b). Caudal extension "three-step" 3
2. (a). Bilobed configuration narrow-rimmed, ratio of caudal extension to bilobed configuration less than one-third entire length of valvae 4
   (b). Bilobed configuration mid- to wide-rimmed 5
3. (a). Three-step configuration obvious, relative caudal lengths of bilobed configuration, second step, and final tapered length about the same . . . . . acaste
   (b). Three-step configuration only slightly apparent; second step (after bilobed configuration) relatively short with terminally tapered last step equalling about or more than one-half of entire valval length . . . . . pantobias
4. (a). Bilobed configuration and tapered caudal extension in same gradually sloped plane, e.g., no distinct cornering (see genitalic terms) between former and latter . . . . . tobias or acastoides (see Wing Characters or Female Genitalia)
   (b). Bilobed configuration and tapered caudal extension separated by marked cornering, former making up one-third or less entire length of valvae 6

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5. (a). Ratio of caudal extension to bilobed configuration more than two to one terminal end, slope between bilobed configuration and caudal extension concave, caudal extension often bulbous . . . . . lycimna

(b). Ratio of caudal extension to bilobed configuration only slightly more than one; slope between bilobed configuration and caudal extension nearly a straight taper; caudal extension not bulbous . . . . . johnsonorum

6. (a). Bilobed configuration one-third or less entire length of valvae, juncture with caudal extension not in same plane . . . catharinensis

(b). Bilobed configuration over one-third (circa two-fifths) entire length of valvae, juncture with caudal extension in gradual sloping plane . . . . . abnormis

Female

1. (a). Caudal length of lamella antevaginalis nearly equal to that of lamella postvaginalis . . . . . pantobias

(b). Caudal length of lamella antevaginalis only about one-fourth that of lamella postvaginalis or less 2

2. (a). Terminal shape of lamella postvaginalis with distinctly pointed centrad tip . . . . . catharinensis

(b). Terminal shape of lamella postvaginalis flat or gently rounded; not pointed tip 3

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3. (a). Antrum long, nearly one-half length of centrad area of lamella postvaginalis, not gradual taper from ductus to lamella antevaginalis . . . . . lycimna

(b). Antrum barely present, only as gradual taper from ductus to lamella antevaginalis 4

4. (a). Lamella antevaginalis diminutive, appearing only as rim of caudad opening of ductus, with or without distad sclerotization, but not present as distinct lips 5

(b). Lamella antevaginalis present as lips about one-fourth caudal expanse of lamella postvaginalis . . . . . acaste

5. (a). Ductus short, length cephalad beginning of transparent area not exceeding twice width of lamellae 6

(b). Ductus long, length cephalad beginning of transparent area exceeding two and one-half times width of lamellae 7

6. (a). Lamella postvaginalis hemirectangular with centrad sculptured area . . . . . abnormis

(b). Lamella postvaginalis hemispherical . . . . . acastoides

7. (a). Ductus length two and one-half times lamellal breadth . . . tobias

(b). Ductus length exceeding three times lamellal breadth . . johnsonorum

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Mesocyanophrys tobias, new species

Figs. 57, 229, 230, 440

Thecla acastoides: Clench, 1946, p. 181. Hayward, 1973, p. 152 (all misidentified).

DIAGNOSIS. Recognizable as the only one of the species with a white transverse bar or line on the hindwing undersurface which also has tails. The genitalia are likewise distinctive as outlined in the discussion of male genitalia in the diagnosis of the immediate sister species pantobias.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 440) as typical of the genus. Frons green. Upper Surface of the Wings: Entire wings iridescent Endive Blue to Dutch Blue. Only extreme margins of both wings dull Raw Umber. Margin of hindwing with ends of veins and midveins forming distinct crennations. Tail at vein Cu_2 thin, about equalling in length the recurved lobe of hindwing; recurved lobe bent anad, colored lightly Chestnut, black distad. Scent patch distad in discal cell, colored blue; fringe of both wings dull Raw Umber, suffused white around recurved lobe. Under Surface of the Wings: Ground color bright Light Oriental Green to Oriental Green. Area of forewing immediately cephalad hindwing, dull gray extending to margin. Hindwing with very distinct submedian line of white dashes traversing wing, somewhat displaced distad at the cell, edged basad with prominent red-brown. Prominent arc of red brown blotches (caudad) or slashes (cephalad) paralleling the white transverse line to vein M_2, sometimes to vein M_1. Green ground color slightly lighter distad this arc. Brown rings limbal area of margin cephalad recurved lobe of hindwing. This lobe deep Maroon to black anad, suffused red-

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brown, extending distad. Fringe very prominent, brown on veins, whitish between veins; tail tipped white. Length of Forewing: 14.5 mm. (holotype). $\bar{X}$ of 7 specimens (AMNH), 15.3 mm., range, 15.0 mm. to 16.0 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 440) as typical of the genus. Frons green. Upper Surface of the Wings: Entire wing except basad third of forewing, and basad half of hindwing, warm Prouts Brown. Basal areas vaguely irridescent Endive Blue to Dutch Blue, darker basad. Recurved lobe of hindwing very light Chestnut, nearly same color as margins. Fringe lighter brown. Tailless. Under Surface of the Wings: As on males. Length of Forewing: 15 mm. (allotype). Male Genitalia: Fig. 229. Valvae, caudad saccus, clear, narrow-rimmed, parabolic, indented; valvae, lateral view, round-tapered, very slight funnel centrad; valvae, caudal extension, very slightly recurved; saccus, extremely reduced, less than one-half length of bilobed configuration; base of vinculum flared; wide parabolic spurs on vinculum; cornuti, dorsal narrow-tapered, ventral disclike. Female Genitalia: Fig. 230. Lamella postvaginalis and lamella antevaginalis of very different caudal length, with latter diminutive. Antrum length exceeding that of lamellae; ductus long, exceeding four times length of antrum. Transparent area just cephalad antrum; signa broad-based widely bifurcate spines.

TYPES. Holotype male (Fig. 57), allotype female, Cordoba, Argentina; deposited in AMNH. Paratypes. AMNH: "Mexico" (data erroneous), (one male). NMNH: Buenos Aires, Argentina Breyer, (one male). MCZ: Montevideo, Uraguay, Biezanko (two males). BMNH: Belgrano, Argentina (two males); La Plata, Parque Pereira Iraola, January 13, 1970, Vardy and Arguindoguy (one male).

DISTRIBUTION. Spatial: Fig. 533. Distributed in Argentina along the eastern slope of the Andes from Catamarca and La Rioja provinces, south to San

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Juan Province, and eastward across the plains through Cordoba Province and the Rio Plata delta to extreme southern Brazil. Temporal: Known only from January. Most specimens have no data.

REMARKS. The name tobias replaces the familiar usage acastoides Berg for this species characterized by the white transverse wing bar on the under surface of the hindwing and wide tails. A review of the original description of acastoides indicates that no tail is referred to, other than the recurved lobe of the hindwing between the outer and anal margins. Further, Clench's name portoena is a synonym of acastoides. The latter species, sensu this revision, refers to the untailled species found from the western Argentine Andes north into central Bolivia and characterized by the transverse wing bar being missing anad on the wing. Genitalic dissections indicate that tobias has an untailled sister species eastward in southern Brazil and surrounding regions, which is described immediately following this taxon. All the types were dissected for genitalia, legs, and palpi.

ETYMOLOGY. I am pleased to name this species for Dr. Randall T. Schuh.

Mesocyanophrys pantobias, new species

Figs. 58, 231, 232, 441

Thecla acaste Prittwitz, 1865, p. 315 (in part, and of authors); Thecla lycimna Hewitson, 1868, p. 33 (in part, and of authors). (This species has undoubtedly been identified as acaste and as lycimna, but limitation of much South American literature to lists makes it impossible to render a synonymy.)

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DIAGNOSIS. With some reliability, males of pantobias recognizable by their small size (forewing length usually less than 15 mm.), very pointed caudal shape of the hindwings, and lack of any brown markings along the hindwing margin and limbal area beneath. Actually, pantobias most resembles its immediate sister species tobias (formerly erroneously associated with acastoides) but from which it can be immediately separated by the latter's having a tail. Females are not reliably recognizable except by the genitalia (as outlined below and under each species): both species are characterized by the lamella antevaginalis nearly equalling the lamella postvaginalis in caudal expanse.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 441) as typical of the genus. Frons green. Upper Surface of the Wings: Hindwing shape distinctly pointed caudad, exaggerating appearance of recurved lobe. Wings entirely bright iridescent Elton Blue to Deep Dull Violaceous Blue. Margins thickly black, wider at apices, forewing. Recurved lobe thin, Chestnut centrad, black fringed distad, with light white marking anad. Male scent patch distad in discal cell, very narrow, blue scaled as rest of wing. Under Surface of the Wing: Ground color Lettuce Green but more yellowish in cast. Area of forewing immediately cephalad hindwing grayish brown distad to margin, blackish basad. Hindwing with nearly straight transverse white line of small rectangular markings, costa to area anad recurved lobe; these bordered basad with gray-brown. Light brown "Thecla-spot" in cell Cu_1. Recurved lobe blackish to Maroon, black distad, Maroon extending caudad in cell Cu_2; fringe (both wings) gray brown, slightly white distad on hindwings. Length of Forewing: 15.0 mm. (holotype). $\bar{X}$ of paratypes 14.8 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 441) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color pale Payne's Gray to Violaceous Gray basad on both wings, more expansive on hindwing. Rest of wings dull fuscous to Raw Umber. No scent

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patch distad in discal area. Fringes, both wings, dull fuscous. Recurved lobe Chestnut, fringed black distad. No tail. Under Surface of the Wings: As on males. Length of Forewing: 12.5 mm. (allotype). Male Genitalia. Fig. 231. Characterized by slight three-step configuration unlike any immediate sister species. Valvae, caudad saccus, clear, wide-rimmed to mid-rimmed, widely parabolic, indented; valvae, lateral view, round-tapered; round area caudad much less expansive than area tapered; valvae, caudal extension, slight three-step, tapered immediately about one half of length; saccus parabolic. Base of vinculum slightly flared; spurs rounded to pointed. Cornuti narrow-tapered. Female Genitalia: Fig. 232. Lamellae of nearly equal caudal expanse; distad expanse of lamella antevaginalis relative to antrum very obvious, equalling circa one-third distad extension from center of antrum (see Remarks).

TYPES. Holotype male (Fig. 58), Puerto Acquirre, Misiones Province, Argentina, Hayward. Deposited AMNH. Allotype, female, Paraná, Brazil, deposited BMNH. Paratypes. NMNH: Parana, Brazil (two males).

DISTRIBUTION. Spatial: Fig. 533. Presently known from the montane areas of northern Argentina, Misiones Province and montane Parana State, Brazil. Temporal: Known from February to April.

REMARKS. Initially in the study, the existence of this species was not suspected. I considered these small acaste-like specimens dwarfs and did not dissect them. However, as I examined large volumes of material from northern Argentina, Paraguay and southern Brazil trying to resolve the identities of names available and of specimens from various populations, it became apparent that actual relationships are very different than those implied by former taxonomic work on this group. For instance, acastoides does not have a tail; the names portoena Clench and acastoides are synonymous; acaste is not a synonym of lycimna; acastoides is a sister of catharinensis, not the latter of acaste;

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abnormis is a species in its own right; and finally, small tailed tobias, which subsumed the long known tailed "acastoides" has a sister species, namely pantobias. Thus, the "dwarfs" are not dwarfs at all, but a tailless sister species of tailed tobias. All the types were dissected for genitalia, legs, and palpi.

ETYMOLOGY. The names implies that this species is the immediate sister species of tobias, new species.

Mesocyanophrys johnsonorum, new species

Figs. 59, 233, 234, 442

DIAGNOSIS. Easily identified by the under surface of the hindwing: long crescent-shaped postbasal markings parallel the slashes costad in the mesial line, forming "Figure-8" shape. Rest of mesial line is obsolescent to absent, except anad.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi as typical of the genus. Frons green. Upper Surface of the Wings: Ground color bright Violaceous Blue with broad areas of forewing costa (2-3mm.) dark fuscous to black. Otherwise, margins of forewing and hindwing thinly fuscous to black. Scent patch distad in discal area. Recurved lobe vaguely Chestnut, bordered with black. Fringe, both wings, fuscous. Under Surface of the Wings: Ground color Rheinemanns Green. Area of forewing immmediately cephalad hindwing broadly brown to gray, darker basad. Forewing with lightly white speckled postmedian line. Hindwing with "Figure-8"-shaped pattern formed by crescent-shaped white slashes in postbasal area paralleling costad slashes of mesial line. Wing otherwise immaculate except for occasional white markings anad, and a brown arc variously occurring distad along the submargin. Length of Forewing:

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15.0 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi as typical of the genus. Frons green. upper Surface of the Wings: Nearly entire forewing fuscous to warm Raw Umber; extreme base of wing dull Violaceous Gray. Hindwing with more expansive Violaceous Gray (outer third anad and upper half costad), rest of wing fuscous to dull Raw Umber. Under Surface of the Wings: As on males, but more white anad. Length of Forewing: 15.0 mm. (allotype). Male Genitalia: Fig. 233. Differing markedly from congeners with extremely flared vincular base and short, broad saccus. Valvae, caudad saccus, clear, mid-rimmed broadly parabolic; valvae, caudal extension, tapered, joined with slight corner to bilobed configuration; valvae, lateral view, round-tapered. Female Genitalia: Fig. 234. Ductus very long, exceeding three times breadth of lamellae. Lamella antevaginalis diminutive; lamella postvaginalis rather hemi-eliptical; signa widely bifurcate spines, one quite broader than the other.

TYPES. Holotype male and allotype female, San Pedro, Jujuy, Argentina, 17 July, 1978, Roberto C. Eisele. Paratypes: AIL: Tucuman, San Pedro de Colaleo (sic), Argentina, March, A. Teran (one male), January, 1920, no other data (one female); Tucuman, Villa Nougues, Argentina, 21 January, 1921 (one male); Obra Grande, Oran, Salta, Argentina, 10 January to 1 March, 1967, R. Golbach (one male).

DISTRIBUTION. Spatial: Fig. 533. Known only from Argentina, in the western provinces of Tucuman and Salta along the Andes. Temporal: Known from January to July.

REMARKS. The well-marked species is further testimony to the species diversity of Mesocyanophrys, especially westward along the Andes of western Argentina.

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ETYMOLOGY. I am pleased to name this species for Eric and Beth Johnson.

Mesocyanophrys acastoides (Berg), new combination

Figs. 108, 235, 236, 443

Thecla acastoides Berg, 1882, p. 169. Hayward, 1973, p. 152.

species acastoides: Comstock and Huntington, 1959, p. 60.

Thecla herodotus: Draudt, 1919, p. 762 (acastoides placed as race of herodotus in error).

Thecla herodotus acastoides: Schewizer and Webster-Kay, 1941, p. 19 (association with herodotus in error).

Thecla acaste Burmeister, (nec. acaste Prittwitz): Draudt, 1919, p. 172 (placed as synonym of acastoides in error).

Thecla portoena Clench, 1944, p. 231. Clench, 1946, p. 188 NEW SYNONYMY.

species portoena: Comstock and Huntington, 1962, p. 177.

Thecla deidamia: Weeks, 1905, p. 19. (misidentified). Clench, 1944, p. 242 (Weeks specimens made types of portoena, new species).

DIAGNOSIS. Recognized by the lack of a tail and by the white transverse hindwing bar on the under surface being limited to the upper half of the wing and then anad on most specimens (Fig. 108) or occasionally continuing anad as a broken line (extreme southern end of range in western Argentina).

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 443) as typical of the genus. Frons green. Upper Surface of the Wings: Bright iridescent Deep Dull Violaceous Blue to Violaceous Blue, becoming darker toward

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the margin. Moderately broad (circa one-sixth expanse of wing) areas of apex, margins, sub-margins, and costa, and outer margin of hindwings, dull Raw Umber; marginal dull Raw Umber, hindwings, extending basad along the veins. Scent patch distad in discal area, elongate and brownish. Recurved lobe of hindwing between outer and anal margins deep Chestnut, blackened distad. Fringe of forewing blackish, lighter distad; hindwing fringe blackish, nearly white between the veins. Under Surface of the Wings: Ground color Oriental Green to Light Oriental Green. Area of forewing immediately cephalad hindwing grayish-brown, darker basad; some specimens with whitish suffusion distad. Hindwing, median band variously covering circa one-half to entire wing, variously edged basad with reddish-brown suffusion. Specimens from northern part of range (e.g., Bolivia) with line obsolescent or absent after veins M_3 or Cu_1, those farther south (e.g., western Argentina) with band nearly complete. Distad median band, parallel series of small red spots in cells M_3 or 2A or occasionally costad. Recurved lobe of hindwing deep Mahogany Red with coloration displaced distad into cell Cu_2. Fringes on both wings dark basad, lighter distad; white between veins, hindwing. Length of Forewing: type series, Bolivia, range 12.0 mm to 13.5 mm. $\bar{X}$ of 8 specimens from western Argentina, (BMNH, AMNH [Eisele]), 13.8 mm., range 13.5 mm. to 14.5 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 443) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color dull Payne's Gray to Violaceous Gray, large areas of submargins and margins, both wings, and apex, forewing dark Raw Umber. Recurved lobe of hindwing. No tail. Fringe fuscous, lighter distad. Under Surface of the Wings: As on male. Length of Forewing: $\bar{X}$ of 5 specimens (BMNH, AMNH [Eisele]), 13.9 mm., range 13.0 mm. to 14.5 mm. Male Genitalia: Fig. 235. Valvae, caudad saccus, clear, narrow-rimmed, parabolic, indented; valvae, lateral view, round-tapered, slight funnel cephalad; valvae, caudal

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extension, tapered; saccus, reduced, cephalad extension equal to width of vinculum immediately caudad; cornuti, dorsal narrow-tapered, ventral, spiked. Female Genitalia: Fig. 236. Lamella postvaginalis quite hemi-rectangular, centrad area pointed; lamella antevaginalis with sclerotized lips but expanse barely noticable, more as caudal opening of antrum. Antrum as flared area of ductus length. Signa deeply bifurcate spines, one very reduced, other highly curved.

TYPES. Location of Berg's type is unknown. Clench's portoena deposited MCZ. Type Localities: acastoides, Argentina; portoena, Cussiluni, Bolivia.

DISTRIBUTION. Spatial: Fig. 533. Presently known from central Bolivia, in the mountains, southward along the Andes and adjacent foothills to San Juan Province, Argentina. Temporal: Known only from April and May. Numerous specimens lack data.

REMARKS. The complicated synonymy of the name acastoides results from the incorrect assumption prior to this revision that the taxon acastoides applied to species characterized by an acaste-like under surface of the wings, but with a prominent tail at vein Cu_2 on the hindwing. This idea seems to have originated from Clench's (1944, 1946) impressions of the original uses of the names. Since Clench's work, the name acastoides has seemed one of the easiest to apply to southern South America specimens having a white line on the under surface of the hindwing and a prominent tail. However, Dr. Pedro Wygodzinsky (American Museum of Natural History) and I have examined the original description and find that the only "tail" referred to is the extended anal lobe between the outer and anal margins of the hindwing, which on western Argentine specimens is pronounced. The other character typical of these specimens is the mottling or reduction costad of the white line on the hindwing under surface. It is this mottling which evidently led earlier authors to place acastoides with

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herodotus, though it is unknown whether they considered acastoides to have a tail or not. In 1944, Clench named the species portoena from Bolivia, characterized by the incomplete line on the hindwing underside, and known only from males. Examination of these and other specimens, associated with females, from Bolivia through western Argentina indicate a cline, both in wing and genitalic characters. Thus, Clench's portoena, lacking a tail but with a pronounced lobe on the hindwing and mottled under surface line, falls into synonymy with acastoides. For reference, I have figured the under surface of a male in the extra group of photographs following those of the Cyanophrys sens. lat. (Fig. 108). In all, nine males and six females were dissected for genitalia, legs, and palpi.

Mesocyanophrys catharinensis (Clench), new combination, status revised

Figs. 237, 238, 444

Thecla acaste catharinensis Clench, 1944, p. 231, 242; 1946, p.

Thecla acaste: Draudt, 1919, p. 763 (in part).

subspecies acaste catharinensis: Comstock and Huntington, 1959, p. 179.

Thecla lycimna Hewitson, 1868, p. 33. Clench, 1946, p. 188 (places acaste catharinensis as synonym of lycimna, in error).

Thecla acaste f. lycimna: Clench, Ibid., loc. cit.

DIAGNOSIS. Resembles abnormis or a large acaste or lycimna but specimens usually have one to two white postbasal markings on the under surface, hindwing. However, only reliably distinguishable by the male or female genitalia, as noted in the accompanying keys.

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DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 444) as typical of the genus. Frons green. Upper Surface of the Wings: Both wings dull iridescent Deep Dull Violaceous Blue to Violaceous Blue, darker toward margin. Margin thinly black, wider at apices. Scent patch distad in discal area same blue as ground color. Recurved lobe of hindwing bright chestnut, fringed black distad. No tail. Under Surface of the Wings: Ground color Light Oriental Green to Oriental Green. Forewing area immediately cephalad hindwing gray, nearly to margin. Hindwing with prominent white transverse mesial bar, slightly variegated and arc-shaped, often bordered red-brown basad. Occasional dark blotches distad along the submargin. Recurved lobe deeply black distad, bright Chestnut basad. Length of Forewing: $\bar{X}$ of ten males (AMNH, CMNH, MCZ, BMNH), 15.2 mm., range 14.0 to 15.8 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 444) as typical of the genus. Frons green. Upper Surface of the Wings: Wide areas of margins and apices, both wings, dark Raw Umber. Rest of ground color dull Payne's Gray to Violaceous Gray. Recurved lobe of hindwing chestnut, black distad. No tail. Under Surface of the Wings: As on male. Length of Forewing: $\bar{X}$ of six females (MCZ, AMNH, BMNH), 15.0 mm., ranges 14.2 to 16.0 mm. Male Genitalia. Fig. 237. Similar to acastoides and abnormis, bilobed configuration very broad and round cephalad in comparison to extreme tapering of caudal extension in other species group taxa. Valvae, caudad, saccus, clear, narrow-rimmed, widely parabolic, indented; valvae, lateral view, round-tapered; valvae, caudal extension, tapered; saccus parabolic; base of vinculum only slightly flared, spurs curved; cornuti narrow-tapered. Female Genitalia. Fig. 238. Lamella postvaginalis eliptical and centrad area distinctly pointed; Lamella antevaginalis as only slightly sclerotized lips distad caudal opening of ductus. Antrum long, nearly one half length of centrad area of lamella postvaginalis. Transparent area immediately cephalad, this part of ductus

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narrowed. Transparent area length about equal to length of antrum, rest of ductus about three to four times length of these. Signa deeply bifurcate thin spines, one about one-half length of other.

TYPES. Holotype male, allotype female, and one paratype in the MCZ. Type Locality: Blumenau, Santa Catarina State, Brazil.

DISTRIBUTION. Spatial: Fig. 533. Known currently from southeastern Brazil only, Santa Catarina, Parana, and Rio Grande del Sol. Temporal: Dates on specimens range from February to May.

REMARKS. Clench named catharinensis as a subspecies of acaste from quite distinctive specimens from Santa Catarina, Brazil. Examination of the male and female genitalia of these and many other specimens and taxa from the region indicate that catharinensis is a distinct species which is the immediate sister species of abnormis and thus the sister taxon of acastoides. The two taxa abnormis and acastoides are found from western Argentina north to Central Bolivia, respectively, while catharinensis is found eastward, in southern Brazil. Five males and six females have been identified as catharinensis by dissection of genitalia, legs, and palpi.

Mesocyanophrys abnormis (Clench), new status

Figs. 109, 239, 240, 445.

Thecla acaste abnormis Clench, 1946, p. 189.

DIAGNOSIS. This species is easily recognized by its large size and resemblance to acaste or lycimna except that the mesial line is of widely jagged and irregular white slashes, as on catharinensis, but only sometimes

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complemented by the emphatic white postabasal markings of the latter species. M. abnormis is Andean while catharinensis occurs in southeastern Brazil.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 445) as typical of the genus. Frons green. Upper Surface of the Wings: Bright deep Violaceous to Tyrian Blue. Thin areas (1 mm. to 2 mm. costad) of both wings black to fuscous along margins. Scent patch distad in discal area. Recurved lobe of hindwing brightly Chestnut, darker distad. Fringe, both wings, fuscous. Under Surface of the Wings: Deep Rheinemanns Green to Winter Green. Area of forewing just cephalad hindwing, dull gray to brownish nearly to margin. Forewing with widely spaced postmedian line of white slashes. Hindwing with mesial line of dashes variously jagged and broadly spaced to occasionally connected. White postbasal markings variously emphatic. Recurved lobe black to Maroon. Fringe fuscous, lighter distad especially about recurved lobe. Length of Forewing: $\bar{X}$ of four specimens, AMNH, 15.6 mm., range 15.0 mm. to 16.0 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 445) as typical of the genus. Frons green. Upper Surface of the Wings: Dull Violaceous Gray except for postmedian to marginal areas of both wings which are fuscous to black. Recurved lobe of hindwing dull Maroon to Chestnut. Fringe, both wings, fuscous. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of four specimens in AMNH 16.0 mm., range 15.5 mm. to 16.5 mm. Male Genitalia: Fig. 239. Differing both from acaste and lycimna as follows: caudal extension tapered as on lycimna (three-step on acaste) but much shorter, not exceeding caudal end of labides; clear areas of bilobed configuration roundly parabolic, not long and irregular as on lycimna; rims of bilobed area markedly thinner than on lycimna. Saccus parabolic, vinculum flared cephalad, cornuti somewhat tapered, spiny along margins. Female Genitalia: Fig. 240. Marked by widely hemi-rectangular lamella postvaginalis with slight convoluted division centrad; lamella

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antevaginalis diminutive to lacking, slight sclerotizations distad. Antrum nearly same as general taper to lamellae; ductus beneath antrum less than one and one half breadth of lamellae. Signa bifurcate spines, one large, the other obsolescent.

TYPES. Holotype male, allotype female, BMNH. Type Locality: La Rioja, Argentina.

REMARKS. Clench named this taxon as a form of acaste. As noted in comments general to this generic treatment, dissection of the types indicated it cannot be considered conspecific with acaste but, rather, is more akin to catherinensis (discussed in detail under Remarks, lycimna). The relations of the taxa in this genus are further summarized in the species group cladogram (Fig. 565). For reference, and to note the similarity of maculation in the acaste Group, I have figured the under surface of a male in Fig. 109 in the additional photographs following Cyanophrys sens. lat.

Mesocyanophrys acaste (Prittwitz), new combination

Figs. 241, 242, 446

Thecla acaste Prittwitz, 1865, p. 318. Draudt, 1919, p. 763, pl. 154, fig. a. Kirby, 1896, p. 399. Kohler, 1923, p. 31. Clench, 1944, p. 229; 1946, pp. 155, 188, 189. Zikan and Zikan, 1968, p. 55. Hayward, 1973, p. 152.

Thecla lycimna Hewitson, 1868, p. 33; 1877, p. 203, pl. 80, figs. 663, 664, 665. Draudt, 1919, p. 763 (placed as synonym of acaste). Hayward, 1973, p. 152.

Thecla acaste f. lycimna: Clench, 1946, p. 188 (placed as synonym of acaste catharinensis).

Tecla (sic) acaste: Kohler, 1923, p. 31.

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species acaste: Comstock and Huntington, 1959, p. 59.

species lycimna: Comstock and Huntington, 1961, p. 117 (as synonym of acaste in error).

DIAGNOSIS. Tailless acaste, acastoides, catharinensis, lycimna, and abnormis all resemble each other in characters of the wing. All are separable by genitalia, as indicated in the accompanying key.

DESCRIPTION. Male. Head, thorax, abdomen, legs and palpi (Fig. 446) as typical of the genus. Frons green. Upper Surface of the Wings: (using topotypical specimens associated with genitalia not of lycimna Hewitson) brilliant irridescent Deep Dull Violaceous Blue to Endive. Blue with only thick black marginal borders on both wings. Scent patch distad in discal cell colored blue as rest of ground color. Recurved lobe of the hindwing bright Chestnut. Fringe brownish black basad, grayish distad, on hindwing blackened along the vein-ends. Under Surface of the Wings: Ground color entirely Light Oriental to Oriental Green. Area of forewing immediately cephalad margin of hindwing brownish to gray. Hindwing with transverse median line more or less entire, bright to vague or mildly broken, paralleled distad by short line very vague reddish spots, at least in cells Cu_1 and Cu_2. Coloration of recurved lobe blackish, slightly suffused reddish-brown. Length of Forewing: $\bar{X}$ of 12 specimens (AMNH), 15.3 mm., range 14.5 mm. to 15.8 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 446) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color Violaceous Gray to Payne's Gray. Wide area of costa, apex, margins and submargins of forewing, and narrower areas of hindwing, dull Raw Umber interfacing rather unevenly with remaining ground color. Recurved lobe of hindwing Chestnut. Fringe brownish on forewing, lighter on hindwings with vein-ends and basal areas darker. Under

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Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 15 specimens (AMNH), 15.0 mm., range 14.0 mm. to 15.5 mm. Male Genitalia. Fig. 241. Valvae, caudad saccus, clear, mid-rimmed, parabolic and indented. Valvae, lateral view, round-tapered. Valvae, caudal extension, "three-step." Saccus parabolic; base of vinculum not flared; spurs evident as rounded edges if at all. Cornuti as illustrated. Female Genitalia. Fig. 242. Lamella postvaginalis hemisperical, lips of lamella antevaginalis about one-fourth length of former. Antrum not much wider than ductus, opague. Transparent area immediately cephalad antrum, about one-fourth remaining length of ductus; ductus long, about four times length of lamellae or antrum. Signa deeply bifurcate spines, both curved.

TYPES: If the type of acaste is extant, it is probably in one of the three museums in Europe which house Prittwitz material: Munich, Berlin, or Greisswald (Clench, 1944: Vane-Wright, pers. comm.); the type has not been seen by me. Type Locality: Corcovado, near Rio de Janeiro, Brazil.

DISTRIBUTION. Spatial: Fig. 533. Presently known from the Atlantic coast of southeastern Brazil and the Parana Delta of Argentina and Uruguay. Temporal: Many specimens are undated but known times of capture range from January to June.

REMARKS. The absence of genitalic examination of the type (wing facies are known from the description and original figure) is made less problematic in dealing with the identity of acaste since Clench (1946) discovered his error of placing the type locality of the taxon lycimna Hewitson as Rio de Janeiro in an attempt to relegate Hewitson's name clearly to synonymy (Clench, 1944). The staff of the British Museum had misinformed him about Hewitson's type not being in the BMNH, and hence he assumed the specimen's data was unknown. The type of lycimna was discovered later, a male from Espirito Santo, Brazil,

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and my subsequent examination of its genitalia indicate that it is not conspecific with acaste whose wing patterns and genitalia can at least be tentatively associated without the type by the preponderance of specimens of acaste from the region of its type locality. In all I have identified eighteen males and twelve females as acaste by dissection of genitalia, along with legs and palpi.

Mesocyanophrys lycimna (Hewitson) new combination, status revised

Figs. 243, 244, 447

Thecla lycimna Hewitson, 1868, p. 33; 1877, p. 203, pl. 80, figs., 663, 664, 665. Hayward, 1973, p. 152.

Thecla acaste Prittwitz, 1865, p. 318. Draudt, 1919, p. 763 (placed as synonym of lycimna, in error). Kirby, 1896, p. 399. Clench, 1944, p. 229; 1946, p. 155, 188, 189.

Thecla acaste f. lycimna: Clench, 1946, p. 188 (placed as synonym of acaste catharinensis, in error).

species lycimna: Comstock and Huntington, 1961, p. 117. (placed as synonym of acaste, in error).

species acaste: Comstock and Huntington, 1959, p. 59 (placed lycimna as synonym of acaste, in error).

DIAGNOSIS. As one of the species in the acaste group, this species resembles all of its other representatives and especially acaste and catharinensis superficially. Superficial characters in the accompanying key help identify lycimna and characters of the male and female genitalia listed in the second key can be used to confirm identification.

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DESCRIPTION. Male. Head, thorax, abdomen, legs, and palpi (Fig. 447) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color brilliant irridescent Deep Dull Violaceous Blue to Endive Blue. Only extreme borders of both wings and apex of forewing darker fuscous. Scent patch distad in discal cell, same color as rest of wing. Recurved lobe of hindwing Chestnut, bordered black basad. Fringe, both wings, fuscous basad, lighter distad, blackened along the veins, especially in the limbal area. Under Surface of the Wings: Ground color Light Oriental Green to Oriental Green. Area of forewing immediately cephalad hindwing grayish nearly to margin. Hindwing with transverse median line, partially entire, usually broken into fine crescents; this line paralleled distad by reddish to brown blotches usually in cells Cu_1 and Cu_2, sometimes most costad. Margin of hindwing often with similar reddish blotches variously expressed, but not always. Recurved lobe nearly all black, fringed profusely distad. Length of Forewing: $\bar{X}$ of 10 specimens (AMNH, CMNH, BMNH), 15.6 mm., range 14.8 mm. to 16.0 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 447) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color Violaceous Gray to Payne's Gray. Wide areas of costa, apex, margins and submargins of both wings, dull Raw Umber to fuscous, often junctured unevenly with bluish ground color. Recurved lobe of hindwing Chestnut. Fringe both wings dark to Raw Umber, often lighter distad, blackened on the vein-ends. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 6 specimens (BMNH), 15.3 mm., range 14.2 mm. to 15.7 mm. Male Genitalia: Fig. 243. Valvae, caudad saccus, clear, unevenly-rimmed, parabolic to elliptical, indented; valvae, lateral view, round-tapered; valvae, caudal extension tapered; saccus very reduced, equalling width of vinculum immediately caudad; base of vinculum flared; evidence of spurs basad only; cornuti narrow-tapered. Female Genitalia: Fig. 244. Females not definitely

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associable with Hewitson's early type. Genitalia of specimens from Espirito Santo, similar to acaste, but differing mainly as follows--antrum much more distinctive, at least twice width of ductus; this could be a significant character (see female characters, other members of species group) if association is proper.

TYPES. Hewitson's type, a male, is in the BMNH and is from Espirito Santo, Brazil. The staff of the BMNH evidently informed Clench that the type was not there, as he designated the type locality as Rio de Janeiro (1944), in an attempt to insure the synonymy of lycimna with acaste. Later, in 1946, he was informed that this was in error, but he did not see the type at that time; he corrected the type locality designation (1946) but retained lycimna as a synonym of acaste. Type Locality: Espirito Santo, Brazil.

DISTRIBUTION. Spatial: Fig. 533. Entire distribution unknown at this time due to apparent sympatry with acaste eastward along coastal Brazil. Examination of large series across southern Brazil was not possible, since nonconspecifity of this species and acaste was not indicated at time of research on long series in BMNH. Temporal: Dates on specimens range from March to June, but most are undated.

REMARKS. I have already summarized much about the confusion concerning lycimna and acaste. The remaining issue has involved whether the taxa are conspecific. As already mentioned, I have not viewed or dissected the types of acaste, which have not been available to me. However, as noted, they are from an area well represented with specimens, and with very distinct genitalic configurations. The type of lycimna, however, shows a different configuration as summarized in the accompanying keys and descriptions. This was contrary to my own assumption that lycimna and acaste were synonyms and noted only by me after dissecting Hewitson's type in the BMNH. I do not think they can be considered conspecific in the context of the facies of the entire acaste groups

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and its cladistic relations with other taxa. The recognition of lycimna as a distinct species at least with a westward distribution from acaste, if not sympatric with it, may cause some confusion, but it must be remembered that the very superficially similar catharinensis has a distribution coincident with acaste, but its genitalia show it obviously as the immediate sister species of abnormis, and acastoides. I would have not suspected that catharinenis was anything distinct from others in this group if I had not studied the types along with many dissections from throughout the various distribution areas. My only conclusion is that framed in my treatment of this entire group.

Further dissection of many specimens spanning the distribution of lycimna (westward in southern Brazil) and acaste (eastward in southern Brazil) will be necessary to map their entire distributions. Series available in the United States are too small, although these and those dissected at time of work in BMNH indicate that the taxa must not be conspecific. Not knowing species limits of characters, nor all species, at time of BMNH work hindered complete examination of genitalia all populations that could allow definite mapping of those two taxa's ranges.

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Mesocyanophrys bertha (Jones), new combination

Fig. 245.

Thecla bertha E. Jones, 1912, p. 897. Draudt, 1919, p. 762, pl. 155, fig. i.

species bertha: Comstock and Huntington, 1959, p. 95.

DIAGNOSIS. This species is one that cannot be confused with any other. On the undersurface there is a broad white postmedian line on the forewing and this is repeated in an extremely wide tranverse post-discal bar across the hindwing which is edged basad and distad with more white, and complemented by other splashes of white basad on the wing.

DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, legs, and palpi as typical of the genus. Frons green. Upper Surface of the Wings: Ground color dark dull Violaceous Gray with a slight sheen. Wide areas of margins and submargins both wings and costa and apex of forewing darker fuscous to Raw Umber. No scent patch distad in discal cell. Recurved lobe of hindwing basically black, light brown centrad. Fringe, both wings, fuscous, lighter distad, darker to Raw Umber or black at the vein-ends. Under Surface of the Wings: Ground color Light Oriental Green. Forewing with broad postmedian white line, costa to vein Cu_1, suffused distad and basad with lighter white. Area of forewing immediately cephalad hindwing, broadly gray-brown to margin. Hindwing with emphatic wide transverse white bar, heavily white (appearing almost as enamel) and suffused widely distad and basad with white. Limbal area with hoary suffusion, especially anad near tail and with large "Thecla-spot," centered and circumferenced dark brown to black. Fringe, both wings, light red-brown, darker anad on hindwing. Length of Forewing: holotype, 16 mm. Male

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Genitalia: Unknown. Female Genitalia: Fig. 245. Very simple configuration, lamellae without any emphatic sclerotizations, except extremely distad on the lips. Lamellae eliptical with margin entire. Antrum gradually tapering; wide transparent area cephalad. Ductus long, three times length from antrum to caudal tip of lamellae; signa broadly based spines, widely bifurcate.

TYPES. Jones' type is in the BMNH, a female. Type Locality: Castro, Paraná State, Brazil.

DISTRIBUTION. Spatial: Fig. 533. Known only from type locality. Temporal: Unknown.

REMARKS. Jones' specimen remains the only known record of this species. Corroborative of my observation that numerous unique species occur in local collections from the tropics, not to be seen again unless from an area collected extensively for many years, Jones' bertha is one example of a specimen distinctive enough that even early workers named it. Many other odd specimens were shunted aside in the major collections as "undetermined". Dissection of such specimens as bertha shows that cladistic analysis allows for their easy placement in the hierarchy of characters adding further certainty to their specificity and intergeneric relations.

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Tertiary Series Paracyanophrys

(including Paracyanophrys, Cyanophrys, Callophrys, Mitoura)

(IB2b)

Quaternary Series Paracyanophrys

(including Paracyanophrys, Cyanophrys)

(IB2ba)

PARACYANOPHRYS, NEW GENUS

including remuborealis / rindgei--remus / sapphirus; mykros; amphoteros.

A. Cladogram and Characters, Fig. 566.

B. Distribution, Fig. 534.

Thecla Fabricius, 1807, p. 286 (in part). Cramer, 1782, p. 259. Hewitson, 1869, p. 34; 1877, p. 205. Kirby, 1871, p. 399. Burmeister, 1879, p. 24. Godman and Salvin, 1887, p. 33. Draudt, 1919, p. 762. Kohler, 1923, p. 31; 1928, p. 4. Anon., 1926, p. 462. W. Holland, 1931, p. 228. Huntington, 1932, p. 210; 1933, p. 3. Bates, 1935, p. 190. Hoffman, 1940, p. 707. Biezanko and Piton, 1941, p. 11. Schweitzer and Webster-Kay, 1941, p. 19. Clench, 1944, p. 231; 1946, p. 284. Schwanwitsch, 1948, p. 256. Franz and Schroeder, 1954, p. 85. Comstock and Garcia, 1960, p. 420. Comstock and

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Huntington, 1961, p. 115. Lipes, 1961, p. 56. dos Passos, 1964, p. 55. Zikan and Zikan, 1968, p. 56. Hayward, 1973, p. 152.

Tecla (sic) (in part): Kohler, 1923, p. 31.

Callophrys Billberg, 1820, p. 80 (in part): Field, 1939, p. 347. F. Brown, 1968, p. 19. Scott, 1970 (1971), p. 249.

Callophrys (Mitoura) (Mitoura Scudder, 1871, p. 52) (in part): Kendall and Freeman, 1969, p. 3.

Callophrys (Cyanophrys) Clench, 1961, p. 211 (in part): Clench, 1963, p. 248. Gorelick, 1971, p. 3. Brown and Heineman, 1972, p. 233. McGuire and Rickard, 1974, p. 56. Scott, 1975, p. 297. Ross, 1976, p. 190. (108).

Cyanophrys (in part): Ehrlich, 1961, p. 211. Clench, 1966, p. 7. Riley, 1975, p. 100. Beattie, 1976, p. 16.

DIAGNOSIS. Taxa of this genus retain a significant number of the primitive character states of their Quaternary Series. The frons is brown (though this state is retained in a few Cyanophrys). The under surface of the hindwing (except in some more apomorphic taxa) is generally characterized by a mesial line of disjunct dashes or mottling formed by their coalition. Characters in the genitalia are more distinct. In males, disc-like cornuti are retained, along with a tapered caudal extension of the valvae (Cyanophrys has a three-step); a unique bulbous valval end develops in some taxa. In females, the side ductal configuration is apparent (see Cladistic Analysis) and formation of plates ventrad on the lamella antevaginalis is limited to sclerotized patches.

DESCRIPTION. Adult: Legs without any elongation relative to width which would indicate apomorphy within Callophryina. Frons with distinct spining and brown coloration; eye-lining variously white to only slightly flecked white. Palpi without exclusively distinct pattern in genus, variously derived in different

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species groups. Wings, above, iridescent blue on males lined variously along the edges with black to fuscous. Females with wings above variously brown of fuscous along the margins and apices, sheened with blue or purplish structural color basad. Wings below green, both sexes, pattern of variously mottled, complete, or disjunct mesial line of white or yellowish spots, not complemented with distad brown markings as many of the other groups, but with variously yellow to reddish mottling along the terminus of the hindwing in some taxa or with unique additions of postbasal or submarginal white in others. None of the taxa has tails. Male Genitalia: Characterized by a generally primitive condition, aside from the distinct apomorph characters. Cornuti recognizably wide and disclike. Caudal extension usually very long, proceeding from a variously parabolic bilobed configuration, usually mid-rimmed. Terminus of valvae usually bulbous. Saccus diminutive, often not exceeding width of vinculum immediately caudad. Vinculum base usually distinctly flared, vincular spurs present, usually rounded. Female Genitalia: Characterized by relatively primitive characters for Cyanophrys sens. lat. but obviously more derived than South American conserials of Secondary Series Plesiocallophrys or Plesiocyanophrys: ductus between one third and one half breadth of lamellae, with consequent development of obvious antrum; not as narrow as the extremely narrow ductal configurations of Cyanophrys, these latter with width less than one fourth or one fifth breadth of lamellae. Transparent area cephalad antrum not as well developed in Paracyanophrys as in more apomorph states of Cyanophrys.

BIOLOGY. Early Stages: None of the early stages of any species has been described. Foodplant: None is known.

TYPE SPECIES. Paracyanophrys rindgei, new species.

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DISTRIBUTION. Spatial: All the species are Neotropical, and only one is found in northern South America (Colombia, Venezuela, or the Guyanas).

REMARKS. Cladistically, this group exhibits the largest array of primitive characters of any of the Neotropical genera which have been familiar as "Cyanophrys" and "Thecla" with the bright iridescent blue upperside and green undersurface with white spots and/or distal brown blotches. For the type species I pick rindgei instead of remus, the latter which is a familiar and widely distributed species, because there has been a tendency among pheneticists to include remus as a subspecies of longula Hewitson (the latter belongs in the sister genus Cyanophrys) on the basis of primitive characters. C. longula is a highly derived insect relative to remus, as numerous characters indicate. Thus, a continued use or opinion subsequent to this writing including the superficially similar remus and longula as congeneric would not destroy the status of the genus relative to Cyanophrys.

KEY TO THE SPECIES

The species of Paracyanophrys are included in the previous key to all taxa formerly included in Cyanophrys sens. lat. or "Thecla" in part.

Paracyanophrys remuborealis, new species

Figs. 60, 246, 247, 448.

DIAGNOSIS. Superficially remuborealis differs from remus in the hindwing undersurface having the median line much more entire and less wavy, and the

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parallel submarginal coloration distad much more emphatic. The genitalia of remuborealis have females characterized by much smaller antrumal configuration than remus, hardly any tapering between ductus and lamellae, and a much less sclerotized ventral surface of the lamella antevaginalis; the males have valvae caudal extensions much longer than remus and bulbous-ended, not tapered; the primitive disclike cornuti are smaller in both species.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 448) as typical of the genus. Frons brown. Upper Surface of the Wings: Bright iridescent Violet Ultramarine with moderate (circa 2 mm.) margins of both wings dark Raw Umber. Scent patch distad in discal cell. Recurved lobe slightly Chestnut. Under Surface of the Wings: Ground color dull Warbler Green. Area of forewing immediately cephalad hindwing smokey to margin. Hindwing with median wavy (not jagged) but entire deep brown line costa to anal margin. Distad this, submargin a lighter brown-suffused line, costa to anal margin. Hindwing margin gray-brown, with marginal suffusions in the cell interspaces. Recurved lobe between outer and anal margins suffused Chestnut; white spot anad. Fringe, both wings, gray-brown. Length of Forewing: 13.5 mm. (holotype). Female: Head, thorax, abdomen, legs, and palpi as typical of the genus. Frons brown. Upper Surface of the Wings: Ground color bright iridescent Alice Blue; broad areas of margins and apex of both wings dark Raw Umber to blackish. Recurved lobe of hindwing between outer and anal margins slightly Chestnut, fringed black distad. Fringe, both wings, gray-black. Under Surface of the Wings: As on males, but submarginal line distad median band much darker; marginal suffusion of cell interspaces much darker. Length of Forewing: 11 mm. (allotype). Male Genitalia: Fig. 246. Characterized by extremely long bulbous-ended valvae. Valvae, caudad saccus, clear, narrow-rimmed, parabolic and indented, slight shoulder before caudal extension; valvae, lateral view,

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round-tapered with extreme caudal elongation; caudal extension tapered, bulbous-ended. Saccus slightly pointed, cornuti disclike. Female Genitalia: Fig. 247. Lamellae nearly triangular in shape, moderate central line; lamella antevaginalis about one-half caudal expanse of lamella postvaginalis, only slightly sclerotized ventrad. Ductus and lamellae joined so as to leave little antrum-like configuration; transparent area caudad this juncture about one-fifth rest of length of ductus, with sclerotized centrad line. Signa broadly bifurcate spines, one pronglike, the other reduced to near absence.

TYPES. Holotype male (Fig. 60), Vilcabamba, Loja, Ecuador, 1600 m., May 1974, R. de la Fabre. Allotype female, Rio Pilaton, Pichincha, vic. Quito, Ecuador, December, 1970, R. de la Fabre. Deposited AME.

DISTRIBUTION. Spatial: Presently known along the northern to southern extremes of the Andes in Ecuador. Temporal: Flight periods of September to late March are indicated.

REMARKS. The occurrence of these two unique specimens from the extremes of northern and southern Andes in Ecuador indicates that there must be a sister species of remus with quite a broad distribution in the western Andes. P. remus is only known from the extreme southern areas of southern Brazil, Uruguay, Paraguay and northern Argentina.

ETYMOLOGY. The name refers to remuborealis being the northern sister species of remus; the Latin boreali (of the north) is added to the vowelled root of remus.

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Paracyanophrys remus (Hewitson), new combination, status revised

Figs. 248, 249, 449.

Thecla remus Hewitson, 1868, p. 34; 1877, p. 201, pl. 80, figs. 655, 656. Kirby, 1871, p. 398. Draudt, 1919, p. 763, pl. 154, fig. b. Clench, 1944, p. 234; 1946, p. 190. Zikan and Zikan, 1968, p. 57. Hayward, 1973, p. 152.

Thecla deidamia Burmeister, 1879, p. 24. Clench, 1944, p. 234.

Thecla longula remus: Clench, 1946, p. 190.

DIAGNOSIS. Recognized by its lack of a gray-suffused red-brown terminal band on the underside, the brilliant blue upperside, extremely pointed recurved lobes of the hindwing between the outer and anal margins, and especially the jagged and irregular pattern of white to yellow broken and/or continuous slashes making up the postmedian band of the hindwing underside. In this regard the species is confusable only with rindgei, which has a distinct band of broken spots for a postmedian line, not the jagged continuous slashes of remus. The genitalia of these two species differ greatly, as noted below and under rindgei.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 449) as typical of the genus. Frons brown. Upper Surface of the Wings: Ground color brilliant Alizarine Blue. Male scent patch distad in discal area, also bright blue. Margins of both wings deep Raw Umber to black; recurved lobe of hindwing deep Burgundy. Fringe black to brown. Undersurface of the Wings: Ground color Oriental Green to Rheinemann's Green on both wings. Area of forewing immediately cephalad hindwing, gray-brown, blackish basad. Hindwing with prominent median arc of jagged white to yellowish slashes variously connected from costa to anal margin. Distad these occasional evidence of reddish suffusion

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forming a parallel arc, especially between veins M_3 and Cu_2. Margin with very vague row of reddish spots variously irregular or connected and heavily suffused gray. Recurved lobe between outer and anal margins deep Burgundy. Length of Forewing: $\bar{X}$ of twelve specimens (AMNH), 14.5 mm., range 13.5 mm. to 15.5 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 449) as typical of the genus. Frons brown. Upper Surface of the Wing: Ground color dull Violaceous Gray to Deep Green Blue Gray. Wide areas of costa, apex, margin, and submargins of forewing, and margins and submargins of hindwing, deep Raw Umber. Recurved lobe of hindwing between outer and anal angles Chestnut; fringes of wings gray, occasionally lighter distad. Under Surface of the Wings: Ground color as on male, but marginal reddish spots usually more emphatic than on males, and median arc of white occasionally bordered basad with brown or black-brown, and with parallel reddish arc distad usually more prominent than on males. Length of Forewing: $\bar{X}$ of eight specimens (AMNH, AME), 15.2 mm, range 13.2 mm to 15.5 mm. Male Genitalia: Fig. 248. Valvae, caudad saccus, clear, narrow-rimmed, with cephalad parabolic configuration not indented; valvae, lateral view, round, unevenly tapered; valvae, caudal extension, tapered. Saccus, extremely short, length one-third to one-half width of vinculum directly caudad; base of vinculum flared; vinculum moderately spurred; cornuti as illustrated. Female Genitalia: Fig. 249. Ductus wide, width about one-third breadth of lamellae; antrum widely flared, toward two times width of ductus; lamella postvaginalis with distinct centrad transparent line; lamella antevaginalis wide, one-half or more of lamella postvaginalis and with lightly sclerotized plates ventrad; signa widely bifurcate spines.

TYPES. Hewitson's holotype of remus is a female in the BMNH. I have examined and dissected it. The Burmeister deidamia type is of unknown deposition, l.c. (See Remarks.) Type Locality: The information on the remus

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type specimen is limited to Novo Friburgo, Brazil. The type locality of deidamia is "eastern Argentina."

DISTRIBUTION. Spatial: Fig. 534. Known from throughout montane eastern Brazil from Bahia south to Uruguay and Paraguay and into northern Argentina (Poscidas). In Paraguay known north as far as Sapucay and adjacent Mato Grosso State, Brazil. Temporal: Dates of capture span September to May.

REMARKS. Burmeister (1879) uses the name Thecla deidamia (TL Las Conchas, Argentina, near Buenos Aires). Clench (1946) considered this taxon conspecific with remus, based on wing pattern and coincidence of distribution with that characteristic of the latter. The location of Burmeister's type is unknown (deposition not mentioned in his description and not found by Clench, Goodson [in Clench (1946)], or me). Burmeister's figure agrees with the external facies of remus, not rindgei (which is distributed generally more northwestward in Paraguay and Ecuador). Further, since Burmeister's specimen is from eastern Argentina, not Tucuman, it is not likely acastoides Berg (which I have synonymized with portoena Clench; see remarks and discussion under acastoides and abnormis). Therefore, until further information is available, the evidence, even without the genitalia, strongly supports Clench's notion of deidamia, with which I concur.

The taxon remus has often been considered a South American subspecies of longula Hewitson (Clench, 1946, and others; see synonymy). This decision was based on the general similarity of wing pattern, notwithstanding some notable differences, and the idea that their allopatric distributions indicated conspecificity.

Clench's (1946) desire to place remus as a subspecies of longula was part of his attempt to simplify the South American "Thecla" in this group to a scheme of a few taxa. T. remus appeared as a southern variety of longula due to its

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scattered mesial band on the hindwing undersurface and very light terminal reddish patches. However, these are primitive, and in this case, also convergent characters. The genitalia of the two taxa are very different; they belong in different genera, as indicated in the cladogram. There is also a sister species remuborealis which occurs northward in South America in an allopatric vicariant pattern from the more southerly distributed remus.

P. remus has also been included with a third species, herein named rindgei, which has very distinct genitalia and wing characters. P. remus series have included both specimens with mottled mesial bands on the hindwing underside, and those with clear, broken crescents. The latter are rindgei and can be further diagnosed by their very distinct male and female genitalia. P. remus and rindgei are broadly sympatric in eastern South America but the range of rindgei widely exceeds that of remus northward and includes Bolivia, Ecuador, and Colombia. In Ecuador remuborealis is also found. There is little variation in the gentalia of rindgei across these regions, while there is an abrupt difference between the genitalia of remus and remuborealis, indicating their non-conspecificity.

In all I examined the genitalia, legs, and palpi of seventeen males and fifteen females of remus from across its range.

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Paracyanophrys rindgei, new species

Figs. 61, 62, 250, 251, 450.

Thecla remus (of authors): see below.

Thecla longula remus (of authors): see below.

Cyanophrys remus (of authors): see below.

Cyanophrys longula remus (of authors) (this species has undoubtedly been identified as remus Hewitson, but the nature of most South American literature, as lists, makes rendering a synonymy impossible).

DIAGNOSIS. Recognized by its brilliant blue upperside, the extremely pointed lobes of the recurved areas of the hindwing between the outer and anal margins, and a postmedian band of broken spots on the underside of the hindwing, not a connected or frequently broken band of jagged slashes as occurs on remus. Genitalia of rindgei differ from those of remus as noted below.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 450) as typical of the genus. Frons brown. Upper Surface of the Wings: Extremely bright iridescent Ultramarine Blue, except for slight Dark Raw Umber margins. Scent patch distad in discal cell bright blue, hardly noticeable. Recurved lobe of hindwing between outer and anal margins of hindwing especially elongate, Chestnut distad, black basad. Fringe Raw Umber. Undersurface of the Wings: Ground color Rheinemann's Green. Area of forewing immediately cephalad hindwing gray to tan, extending entirely to margin. Hindwing with median arc of small white spots complete across wing, white distad, black to red-brown basad. Spot most immediate anal angle displaced far distad, next spot far basad, falling almost in same plane as next. Submarginal area of hindwing noticeably lighter green, giving marginal arc of contrasting ground color. Recurved lobe Chestnut

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distad, black basad; vague white slash anad. Fringe rusty-brown extending basad along the veins. Length of Forewing: 15.0 mm. (holotype); $\bar{X}$ of five specimens (AMNH), 14.8 mm., range 14.5 mm. to 15.5 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 450) as typical of the genus. Frons brown. Upper Surface of the Wings: Ground color lightly iridescent Payne's Gray. Broad areas of margins and submargins, both wings, and apex forewing deep Raw Umber. No scent patch distad in discal area. Recurved lobe of hindwing slightly Chestnut but heavily overscaled fuscous. Fringe black on veins, white between veins. Under Surface of the Wings: As on males. Length of Forewing: 14.0 mm. (allotype); three females, 14.0 mm., 14.0 mm., 12.0 mm. Male Genitalia. Fig. 250. Valvae, caudad saccus, clear, narrow-rimmed, parabolic, indented; juncture of bilobed area and caudal extension slightly cornered; valvae, lateral view, round-tapered, bulbous at the caudal end; saccus, funnel, very long, exceeding length of bilobed configuration; base of vinculum not flared; hardly spurred; cornuti, dorsal, narrow-tapered, ventral, disc-like. Female Genitalia: See Fig. 251. Similar to remus and remuborealis but differing mainly by much longer ductus, approaching two and one-half times breadth of lamellae, antrum almost completely lacking; plane of distad extension of lamellae not bent cephalad and with very prominent hemispherical plates ventrad on lamella antevaginalis.

TYPES. Holotype male (Fig. 61), Petropolis, Rio de Janeiro, Brazil, 900 m., 24 March 1971, G. Callaghan. Allotype female (Fig. 62), Sao Paulo, Brazil, circa 800 m., E. D. Jones. Deposited holotype AMNH, allotype, BMNH. Paratypes. AMNH: Massaranduba-Blumenau, Santa Catarina State, Brazil (three males); Caviuna, Parana State, Brazil (one male). AME: Petropolis, Independencia, Rio de Janeiro State, Brazil, 900 m. altitude, 24 March 1971, C.

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Callaghan (two males); Nova Teutonia, Santa Catarina State, Brazil, 7 January 1952 (one female).

DISTRIBUTION. Spatial: Fig. 534. Known from numerous montane areas of central South America, from southeastern Brazil through Bolivia and north to Peru and central Ecuador. Temporal: Dates on specimens range from January to March.

REMARKS. This is a very distinct and widely distributed species that has been lumped with remus previous to this revision. It was first discoverd by genitalic dissection; it was then noted that the distinct dashed markings on the mesial line of the hindwing undersurface are a consistent character, separating rindgei from the mottled and jagged mesial line of remus. Specimens of rindgei also lack the terminal mottling on the hindwing which has been used to misplace remus with longula of the sister genus Cyanophrys. Males of rindgei are noted to be more brilliant blue above than remus, making rindgei the most spectacularly blue species in the entire worldwide Callophryina. The range of rindgei exceeds that of remus, the former extending northward in South America to the northwestern Andes.

ETYMOLOGY. I am pleased to name this species for Dr. Frederick H. Rindge.

Paracyanophrys sapphirus, new species

Figs. 63, 252, 451.

DIAGNOSIS. This species, while it should be identified by dissection, differs superficially from its congeners by the upperside iridescent being lighter silvery blue, not the deep blue of other Paracyanophrys. Beneath, it is green

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except for a mottled mesial line on the hindwing, separating it further from rindgei's distinct dashes, and with no coloration of the terminus, separating it further from remus. The genitalia differ markedly as follows: The bilobed configuration is unevenly rimmed; the base of the vinculum is not much flared and the saccus is large, well exceeding the width of the vinculum immediately caudad.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 451) as typical of the genus. Frons brown. Upper Surface of the Wings: Ground color distinctly light silvery Parula Blue. Only extreme areas of forewing and hindwing and forewing apex darker, fuscous to deep Raw Umber. Scent patch distad in discal area, same color as rest of wing. Recurved lobe of hindwing obscured by wear in known specimen. Under Surface of the Wings: Ground color entirely obscured by water or chemical stains. Area of forewing immediately cephalad hindwing gray-brown nearly to margin. Hindwing with faint, mottled mesial line across entire wing. Length of Forewing: 14.0 mm (holotype). Female: Unknown. Male Genitalia: Fig. 252. Valvae, caudad saccus, clear, unevenly rimmed, parabolic, indented; valvae, lateral view, round-tapered; very slight funnel caudad; valvae, caudal extension, tapered, bulbous; base of vinculum not, to only slightly, flared; saccus, broadly parabolic; cornuti wide-tapered. Female Genitalia: Unknown.

TYPES. Holotype male (Fig. 63), Buenos Aires, Argentina, Hayward, February, 1923; deposited BMNH.

DISTRIBUTION. Spatial: Fig. 534. Known only from the type locality. Temporal: Known only from February.

REMARKS. This species exemplifies in Paracyanophrys what is also noted in tropical Mesocyanophrys and Cyanophrys, that limited local collecting, along

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with the low density occurence of these taxa (see other comments, this revision and Ross, 1976) results in new taxa appearing represented by only a specimen, or a few, and not appearing in number until an area is thoroughly collected for many years. This species is very recognizable even by the silvery blue upperside and genitalic dissection, along with its brown frons. These then place it within this species group. The upper surface and genitalia are in good condition in the holotype, but the undersurface has been obscured by water or chemical stains.

ETYMOLOGY. The name, meaning "sapphire," refers to the silvery blue upperside; it is formed by adding the Latin suffix us to sapphire.

Paracyanophrys mykros, new species

Figs. 64, 253, 452.

DIAGNOSIS. Recognized by its extremely small size (see below), long recurved lobe of the hindwing exaggerating the pointed caudal configuration of this wing and by a white postmedian line on the forewing underside complemented by white crescent-shaped slashes in the cell and postmedian area of the hindwing.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 452) as typical of the genus. Frons green. Upper Surface of the Wings: Entire wing except magin and apex of forewing shiny deep Madera Blue; margins of wings and apex of forewing dark Raw Umber, fringe white on hindwing, brown on forewing. Recurved lobe between outer and anal margin of hindwing light brown; no tail. Under Surface of the Wings: Entire wing Yellowish Oil Green except area of forewing just cephalad the hindwing, whitish gray. Forewing with postmedian line of white spots from costa to gray-suffused area, white distad,

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faintly red-brown basad. Extreme margin of forewing deep red-brown. Hindwing with cephalad postmedian marking fused as white line into two arc-shaped slashes, veins M_3 to M_1 and M_1 to $Sc + R_1$. A complementary white postbasal slash in discal cell to vein M_3. Submarginal line of red-brown spots across entire wing. Margin of hindwing slightly crennated, fringe brown basad, white distad. Length of Forewing: 10.5 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 253. Valvae, caudad saccus, clear, parabolic with slight concave sides, indented; Valvae, lateral view, round-tapered, with slight cephalad funnel; valvae, caudal extension, bulbous then tapered; saccus widely parabolic; base of vinculum flared; vinculum moderately spurred; cornuti unknown (missing on type specimen). Female Genitalia: Unknown.

TYPES. Holotype male (Fig. 64), Tucuman, Argentina, September; deposited AMNH. Paratype: BMNH: same locality (one male). MPC: Cerrillos, Salta, Argentina, 9 October, 1976, B. MacPherson (two males).

DISTRIBUTION. Spatial: Fig. 534. Presently known from Tucuman and Salta Provinces, Argentina. Temporal: Known only from September and October.

ETYMOLOGY. The Greek name refers to the extreme small size of this species, probably also a reason that no prior worker noticed its unique wing characters and gave it a name.

Paracyanophrys amphoteros, new species

Figs. 65, 254, 453.

DIAGNOSIS. Immediately recognized by the males resembling the upper surface facies of the females, except for scent patch. Females similar to

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congeners, but genitalia unfortunately unknown. Distinguishable from similarly non-sexually dimorphic Cyanophrys andromimikos by lack of tails on amphoteros, and by andromimikos exhibiting under surface hindwing median line more entire (typical of miserabilis Group, Cyanophrys), and discal areas of forewing in both sexes of andromimikos having distinct blackened patch.

DESCRIPTION. Male. Head, thorax, abdomen, legs, and palpi (Fig. 453) as typical of the genus. Frons brown. Upper Surface of the Wings: Like females of most species. Wide margin of hindwing and at least marginal one-third, more at apex, of forewing dark Raw Umber to blackish. Scent patch distad in discal cell. Coloration of rest of wing dull iridescent Payne's Gray with bluish overcast. Recurved lobe of hindwing between outer and anal margins slightly more brown than marginal colors; no tails. Fringe, both wings, grayish black, whitish distad on hindwing. Under Surface of the Wings: Ground color Courge Green. Area of forewing immediately cephalad hindwing, grayish black extending to margin, gray slash at distal end, discal cell. Hindwing with mesial arc of small grayish-black crescents, bordered distad thinly with white. Emphatic gray-black slash in cell Cu_1 distad the mesial line. Recurved lobe deeply black; margin of entire wing somewhat suffused gray-brown. Fringe grayish, both wings. Length of Forewing: 10.5 mm. (holotype). Female: Head, thorax, abdomen, legs, and palpi (Fig. 453) as typical of the genus. Frons brown. Upper Surface of the Wings: As on males, but without scent patch distad in discal area and with duller blue-gray coloration. Under Surface of the Wings: As on males, but mesial line on hindwing more mottled with distad gray suffusions of the small dots. Margin more extensively hoary with brown and gray scaling, appearing somewhat crennated in shape between the cell interspaces. Length of Forewing: 12.5 mm. (allotype). Male Genitalia: Fig. 254. Valvae, caudad saccus, clear, narrow-rimmed, parabolic, indented; valvae, lateral view, round-tapered; valvae, caudal

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extension, tapered. Base of vinculum flared; spurs triangular. Saccus, thinly parabolic; cornuti, thin-tapered. Female Genitalia: Unknown (see Remarks).

TYPE. Holotype male, allotype female (Fig. 65), Pelotas, Rio Grande del Sol, Brazil, 24 March 1953, C. M. de Biezanko. Deposited AMNH.

DISTRIBUTION. Spatial: Fig. 534. Known only from the type locality. Temporal: Both specimens were caught in March.

REMARKS. This is one of the several unique taxa that Biezanko turned up in his extensive and long term collections near Pelotas, Brazil. Much of his material has been placed aside as "undetermined" in collections. Even workers like Clench, who checked the major American and British collections for new taxa in this group, did not wish to deal with the volume of very similar but odd and confusing specimens available. Only the more obvious were picked out and named. Less attractive specimens, like these, were overlooked. This species is unique because both the sexes look like dwarf females of the general grade group Cyanophrys. The species was discovered by dissection, indicating firstly that a non-iridescent male is present; the scent patch was then noted dorsad, and the unique genitalic configuration placed in the cladogram. Finally the female, looking very much the same, was located, but unfortunately lacked an abdomen. Examination of the labels indicates probably duplicate locality and time of capture.

Etymology. The Greek name amphotero, meaning "exchanging identity," refers to the look-alike nature of the sexes, highly unusual in this group, but paralleled by a species of the sister genus Cyanophrys.

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CYANOPHRYS CLENCH, status revised

A. Cladogram and Characters, Fig. 567.

B. Distribution, Figs. 535-541 (and subsequent species groups figures).

Papilio Linnaeus, 1758, p. 458. Donovan, 1842, p. 93.

Hesperia Fabricius, 1793, p. 258. Fabricius, 1793, p. 286.

Polyommatus Latrielle, 1804, p. 24. Godart, 1823, p. 641.

Polyommate (sic): Latrielle, 1819, p. 602.

Strymon Hübner, 1816-1819 [1823], p. 22. Butler and Druce, 1872, p. 105, 106; 1874, p. 355. Butler, 1873, p. 178. Kohler, 1923, p. 31. McDunnough, 1938, p. 24. Stallings and Turner, 1947, p. 39. dos Passos, 1964, p. 56.

Chalybs Hübner, 1816-1819 [1823], p. 76. Kaye, 1921, p. 103.

Thecla Fabricius, 1807, p. 286 (in part). Cramer, 1782, p. 259. Prittwitz, 1865, p. 318. Hewitson, 1869, p. 34; 1874, p. 157; 1877, p. 205. Burmeister, 1879, p. 25. Godman and Salvin, 1887, p. 33. Kirby, 1896, p. 399. Weeks, 1905, p. 19. Draudt, 1919, p. 762. Kohler, 1923, p. 31; 1928, p. 4. Anon., 1926, p. 462. W. Holland, 1931, p. 228. Huntington, 1932, p. 210; 1933, p. 3. Bates, 1935, p. 190. Hoffman, 1940, p. 707. Biezanko and Piton, 1941, p. 11. Schweizer and Webster-Kay, 1941, p. 19. Clench, 1944, p. 231; 1946, p. 284. Avinoff and Shoumatoff, 1946, p. 284. Schwanswitsch, 1948, p. 256. Franz and Schroeder, 1954, p. 85. Comstock and Garcia, 1960, p. 420. Comstock and Huntington, 1943, p. 73; 1961, p. 115. Lipes, 1961, p. 56. dos Passos, 1964, p. 55. Zikan and Zikan, 1968, p. 56. Hayward, 1973, p. 152.

Tecla (sic): Kohler, 1923, p. 31.

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Chlorostrymon Clench, 1961, p. 189 (in part). Brown and Heineman, 1971, p. 4.

Callophrys Billberg, 1820, p. 80. Field, 1939, p. 347. F. Brown, 1978, p. 19.

Callophrys (Mitoura)[Mitoura Scudder, 1871, p. 52]: Kendall and Freeman, 1969, p. 3.

Callophrys (Cyanophrys) Clench, 1961, p. 211; 1963, p. 248. Gorelick, 1971, p. 3. Brown and Heineman, 1972, p. 233. McGuire and Richard, 1974, p. 56. Scott, 1975, p. 297. Ross, 1976, p. 190 108 .

Cyanophrys: Ehrlich, 1961, p. 211. Clench, 1966, p. 7. Riley, 1975, p. 100. Beattie, 1976, p. 16.

DIAGNOSIS. There are no superficial primitive characters that can distinguish all the species in this genus as a group. The included species as a whole have primitive or derived characters of the wing which confuse some of them with members of the genus Mesocyanophrys. However, some distinctions of very obvious wing patterns in certain species groups are helpful in locating a species in this genus, if such characters are present. These include: all known species with a terminal red, suffused-gray, border on the hindwing under surface, either entire or broken, belong in this genus. All species with an under surface pattern that is highly mottled green, brown, or yellowish, in successively distal bands, belong in this genus. This phenetic description includes about two-thirds of the Cyanophrys species. The most accessible apomorphic characters distinguishing Cyanophrys include the following. Male Genitalia: The caudal extension of the valvae, from the caudal end of the bilobed configuration has a "three-step" structure, that is, it proceeds in three successive stepped planes as it terminates. The saccus becomes long, approaching closely, equalling, or exceeding the caudal length of the bilobed configuration. The cornuti become distended with tapered ends pointed with spines. Recurvature of the caudal

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extension occurs. Female Genitalia: The ductus is narrow, width one-fourth or usually less than the breadth of the lamellae. The antrum is consequently exaggerated. A transparent area developed variously from mid-antrum to some degree cephalad along the ductus, sometimes with centrad sclerotized line. Sclerotized plates develop in complicated patterns on the lamella antevaginalis on highly derived species.

DESCRIPTION. Adult: Legs of several apomorph clades characterized by foreleg, both sexes, being extensively elongated relative to width. Frons spiny and green; eye-lining around compound eye, white. Palpi variously derived in the genus, all characterized by elongated second segment, both sexes. Wings above, iridescent blue with various borders of fuscous and dark to black. Under surfaces, generally green, but variously derived in different species groups to include (aside from the usual mesial white line of the hindwing undersurface) extreme suffusion of the hindwing terminus, various expression of a "Thecla-spot" in the limbal area, or complete variously colored mottling of the entire wing. Taxa variously with or without tails. Male Genitalia: Highly derived configurations varying from species group to species group, but generally including derivation of distinct "three-step" caudal extension; extremely long saccus; ovate configurations of the bilobed structure; long vincular spurs; extreme flaring of the vinculum base, various or uneven shapings of the rims of the bilobed structures. Female Genitalia: Highly derived in various species groups, but generally including development of sclerotized folds of plates on both lamellae, extremely long ductus bursae (up to eighteen times width), signa with sculptured bases or signum entirely lacking, and highly sculptured shapes of the lamellae.

BIOLOGY. Early Stages: There are no accounts of early stages of any of the Cyanophrys species in the literature. However, my survey of uncurated

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material in the NMNH yielded six reared specimens of two species with accompanying pupae. I will study and describe these pupae at a later date. Foodplants: There are no foodplant records in the literature except for miserabilis (Parkinsonia, Fabaceae). However, the notes on the reared adults and associated pupae of the species mentioned above, C. herodotus and C. longula, name Lantana camara L. (Verbenaceae) as the foodplant and note caterpillars fed on the blossoms.

TYPE SPECIES. Clench (1961) designated Thecla agricolor Druce as the type species of Cyanophrys.

DISTRIBUTION. Spatial: Cyanophrys are broadly distributed on both sides of the isthmus of Panama throughout South America and through Central America north to the southern United States. As defined in this study, only one of the species (herodotus) has trans-Panamanian distributions, though some species occur regionally distributed around Panama (e.g., quinterorum, distractoides). Temporal: Dates on specimens span the "summer" periods of both Central and South America.

REMARKS. Clench (1961) named Cyanophrys as a subgenus of Callophrys (see under Callophrys for discussion of extended use of this latter taxon as grade group inclusive genus for numerous subgenera within this group), but did not define what species were in the group. By general understanding he was referring to the Neotropical species which are iridescent blue above in the males and green underneath with white spot patterns. In this group he clearly included both Nearctic representatives of this group, miserabilis and goodsoni. Numerous other species relatable to the phenetic concept of Cyanophrys still remained in the grade-group Thecla (no one has published any list removing them to Cyanophrys).

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A cladistic analysis of these "Thecla" and related groups (see Appendix 1) clearly indicates that Cyanophrys Clench is polyphyletic (sensu Nelson). The species goodsoni, argentinensis, and eight new species, primarily from Argentina, represent four primitive genera. This would explain goodsoni's long known departure from general Cyanophrys grade group characters (upper surface only dull blue with black covering wide area of margin and apex), a character also shared by argentinensis, though its blue is iridescent and the margin less dark. The rest of the "blue above, green beneath" taxa fall into four genera in the cladistic analysis in which genera have equal ranking in the cladogram: these are two genera (Paracyanophrys and Cyanophrys) from which emerge Mitoura and Callophrys as a sister group, a large genus of apomorphic species called Mesocyanophrys (containing several further apomorphic intrageneric clades) and a few species (e.g., the fucius group) in Sandia. The latter is a relatively primitive sister group of Mesocyanophrys in which are derived the Nearctic and northern Neotropical angiosperm-feeding "Incisalia" (now considered Sandia according to this study).

Hence, Cyanophrys should not be applied as a comprehensive genus or subgenus for all the species in the Neotropics with the superficially similar wing characters that have been once included in it. Rather, the species formerly of Cyanophrys represent a polyphyletic assemblage that must be broken into eight monophyletic genera.

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KEY TO THE SPECIES

All the species of Cyanophrys are included in the larger key presented previously for the taxa formerly included either in Cyanophrys (sensu Clench et al.) or "Thecla", in part.

SPECIES GROUPS

The numerous species groups in Cyanophrys are arranged according to the following cladistic hierarchy. The generic cladogram is presented at the beginning of the sections including the species groups, their cladograms and characters.

The longula Primary Group
The miserabilis Primary Group
    The longula Secondary Group
        The longula Tertiary Group
            The longula Group
            The distractus Group
        The amyntor Tertiary Group
            The platnicki Group
            The amyntor Group
    The miserabilis Secondary Group
        The iggii Tertiary Group
            The iggii Group
            The circumcyanophrys Group
        The miserabilis Tertiary Group
            The herodotus Group
            The miserabilis Group

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1. The longula Group

including agricolor/banosensis--kirki/longula--pseudolongula/aluta--longuloides--paralonguloides.

A. Cladogram and Characters, Fig. 568.

B. Distribution, Fig. 535.

Cyanophrys agricolor (Butler and Druce)

Figs. 266, 267, 460

Strymon agricolor Butler and Druce, 1872, p. 105, 106. Butler, 1873, p. 158, pl. 57, fig. 4. Butler and Druce, 1874, p. 355.

Thecla agricolor: Godman and Salvin, 1887, p. 34. Draudt, 1919, p. 762, pl. 154, fig. a. Hoffman, 1940, p. 707. Clench, 1944, p. 231.

species agricolor: Comstock and Huntington, 1959, p. 64.

Callophrys (Cyanophrys) agricolor: Clench, 1961, p. 211. Ross, 1976, p. 191 [109].

DIAGNOSIS. Distinguishable from all congeners except immediate sister species bañosensis by underside of hindwing having terminal gray-suffused red-brown borders with submarginal markings yellow-brown to red-brown mottled over the green ground color. Tailless. The only species apart from bañosensis with a recurved caudal extension of the valvae, male genitalia. Can be distinguished from bañosensis by distribution and genitalia (see below and under bañosensis).

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DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 460) as typical of the genus. Frons brown. Upper Surface of the Wings: Dull iridescent Violaceous Blue, margins and occasionally submarginal areas dark Raw Umber. Costa blackish on forewing, brownish on hindwing with fuscous suffusion basad. Scent patch distad in discal cell very small (less than one-fourth length of discal cell). Recurved lobe of hindwing bright Chestnut, black distad. No tail. Under Surface of the Wings: Ground color, forewing Rheinemann's to dull Oriental Green; area cephalad margin of hindwing gray at least to vein M_3, with blackened area along cephalad border with green. Terminus of forewing dark Mouse Gray. Red-brown discal line from costa to vein M_3 or Cu_1, paralleled by fainter submarginal line of same color. Hindwing with broad colored terminus, gray suffused distad, red-brown suffused basad, becoming orangish distad in cells M_3 and 2A. This pattern mottled by broad discal line, dark green distad, reddish-brown basad from costa to anal margin ending with blackish caudad base. Coloration of recurved lobe of hindwing emphatic, red-brown to Maroon. Length of Forewing: $\bar{X}$ of 15 specimens (AMNH, AME), 13.0 mm., range 12.3 mm. to 13.5 mm. Female: Head, thorax, abdomen, legs, and palpi as typical of the genus. Frons brown. Upper Surface of the Wing: Ground color bright iridescent Parula Blue, often with silver sheen, especially distad. Broad areas of costa, apex, margin and submargins of forewing, and margins and submargins of hindwing, dull Raw Umber. No scent patch distad in discal area. Under Surface of the Wings: As on male. Length of Forewing: $\bar{X}$ of 10 specimens (AMNH, AME), 14.0 mm. range 13.8 mm to 14.5 mm. Male Genitalia: Fig. 266. Characterized by the unique recurvature of the caudal extension. Valvae, caudad saccus, clear, mid-rimmed, parabolic and indented; valvae, lateral view, round-tapered with slight funnel in area of recurvature; valvae, caudal extension, recurved. Saccus parabolic, slightly longer than width of vinculum immediately

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caudad. Base of vinculum flared; vincular spurs rounded. Cornuti as illustrated. Female Genitalia: Fig. 267. Characterized by wide appearance of both lamella antevaginalis and ductus. Former, at least one-half caudal expanse of lamella postvaginalis, latter with width one-third breadth of lamellae, with little antrum and transparent area cephalad ductus with centrad sclerotized line. Signa bifurcate spines as illustrated.

TYPES. The holotype male is in the BMNH. Type Locality: Cartago, Costa Rica.

DISTRIBUTION. Spatial: Fig. 535. Distributed over a vast area of Central America and Mexico, from north central Mexico south through Honduras, El Salvador and Nicaragua. Temporal: Dates on specimens range from March to September.

REMARKS. Clench (1961) designated this species as the type of a new subgenus Cyanophrys of Callophrys, erected to include North American representatives of a part of the grade group Thecla related to Nearctic Callophryina. He did not list, however, what species he included in that new subgenus. Clench (1944) also named a southern subspecies of agricolor, designated bañosensis, from a few specimens in Ecuador. Examination of these types and other specimens indicates that the latter is a distinct species, the most immediate sister species of agricolor. It is treated separately and exhibits characters related to but quite divergent from the range of variation in more northernly distributed agricolor.

It is in some ways unfortunate that agricolor was chosen as the type of Cyanophrys because it and its sister taxon bañosensis represent quite apomorphic character states in the group. Thus, cursory examination of the genus by the type species (ill-advised anyway) would yield erroneous ideas of the characters of the group.

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In all I dissected five males and five females from across the distribution of agricolor for genitalia, legs and palpi.

Cyanophrys bañosensis (Clench), new status

Figs. 268, 461

Thecla agricolor bañosensis Clench, 1944, p. 231, 233; 1946, p. 190.
subspecies agricolor bañosensis: Comstock and Huntington, 1959, p. 90.
Callophrys (Cyanophrys) agricolor[bañosensis]: Clench, 1961, p. 211.

DIAGNOSIS. Distinguishable from agricolor by the more brilliant blue upperside of both the males and the females, by the absence of the marginal dark Mouse Gray on the forewing underside, by the reduced extent of black caudad on the discal line of the hindwing, and by the division of the marginal band of the hindwing into two parallel patterns each suffused gray distad, reddish-brown basad, and orangish toward cells M_3 and 2A.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi as typical of the genus. Frons brown. Upper Surface of the Wings: Bright iridescent Violaceous Blue; apex, costa and margins of forewing deep Raw Umber to black; hindwing grayish basad, along costa, and deep Raw Umber to black along margins. Recurved lobe between outer and anal angles of hindwing bright Chestnut, extending basad and also distad toward vein Cu_2. Fringes, both wings, Raw Umber to black on the veins, grayish to brown between the veins. Under Surface of the Wings: Ground color Rheinemann's Green. Margin of forewing lighter green; two to three vague red-brown spots in cells M_1, M_2, and M_3. Area just cephalad hindwing gray, blackish along margin with green. Band of Chestnut

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along margin of gray and green at cell Cu_1. Hindwing mottled green, red-brown, orangish, basal area of black basad in discal cell; arc across discal area heavily suffused gray (wide from anal angle to cell Cu_1, narrower cephalad vein Cu_1); submarginal arc of vague red-brown blotches becoming green-suffused to entirely green cephalad; margin Burgundy, heavily suffused with gray (jagged from vein M_1 to the anal angle). Recurved lobe of hindwing deep Burgundy. Fringe, both wings, white, grayish basad and tipped on the vein-ends with black. Length of Forewing: 15.0 mm (male, BMNH). Female: Head, thorax, abdomen, legs and palpi (Fig. 461) as typical of the genus. Frons brown. Upper surface of the Wings: Very similar to males though brilliance of iridescence considerably duller and areas of margins and apices colored darker brown to black moderately more extensive. Under Surface of the Wings: As on males. Length of Forewing: 15.0 mm (holotype female). Male Genitalia: Similar to agricolor; recurvature characteristic of that species much less exaggerated caudad, and with longer terminal caudal extension. Valvae, caudad saccus, clear, mid-rimmed, parabolic, indented. Valvae, lateral view, round-tapered; valvae, caudal extension, recurved, but recurvature quite cephalad and long terminal extension caudad. Saccus parabolic. Cornuti as illustrated. Female Genitalia: Fig. 268. Lamellae hemispherical; lamella postvaginalis exceeding length of lamella antevaginalis about one-half. Distad, sclerotized plates ventrad on lamella antevaginalis followed cephalad by sclerotization distad on the lips. Antrum hardly distinguishable from ductus; transparent areas immediately cephalad lamella antevaginalis with central sclerotization. Breadth of lamella about one-half length of ductus. Ductus not noticeably flared caudad or cephalad; signa as single spines, bifurcate centrad, with prongs hooklike.

TYPES. The holotype female is in the AMNH. Type Locality: San Pablo, near Baños, Tungurahua, Ecuador.

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DISTRIBUTION. Spatial: Fig. 535. Presently known from two specimens, the type, and a male found in the BMNH from Argentina. Temporal: Unknown.

REMARKS. The differences in wing pattern, genitalia, and distribution areas of the known specimens indicate that this taxon merits species status. As the sister species longula has an immediate sister taxon in South America, bañosensis is the sister taxon of agricolor (along with longula distributed throughout Central America and Mexico) found far to the south in South America.

Cyanophrys kirki, new species

Figs. 68, 69, 258, 259, 456

DIAGNOSIS. This is the immediate sister species of longula, which is distributed far to the north of kirki. Superficially the facies are similar; the genitalia are very distinct, with lamella antevaginalis nearly two-thirds caudal expanse of lamella postvaginalis and with ventral plates on same, latter not present on longula. Since longula has not been found in South America per se, and this species is from Argentina, no further diagnosis should be necesary. Both are large, tailed species, characterized by a variously spotted mesial band on the undersurface hindwing and reddish-gray suffusion along the terminus.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 456) as typical of the genus. Frons brown. Upper Surface of the Wings: Ground color deep iridescent Dull Violet Blue. Moderately (circa 2 mm.) areas, margins and apices, both wings black. Recurved lobe of hindwing bright Chestnut bordered widely with black. Fringe, both wings, dark fuscous, lighter distad on hindwing. Under surface of the Wings: Ground color Rheinemanns to Civette Green. Area

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of forewing immediately cephalad hindwing gray to blackish, nearly to margin. Hindwing with broken mesial line and lighter green ground color in submarginal cellular interspaces. Recurved lobe of hindwing reduced, thin, uniformly fuscous. Fringe both wings, deep fuscous, lighter distad, especially in limbal area, hindwing. Length of Forewing: 15.0 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 456) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color shiny Delft Blue, slightly greenish distad. Broad areas of margins and submargins, both wings, and apex, forewing dark fuscous. Tail at end of vein Cu_2, hindwing. Recurved lobe bright Chestnut, heavily circumferenced black. Fringes, both wings, fuscous to black; pale to white between veins, especially on hindwing. Under Surface of the Wings: Ground color Rheinemann's Green to lighter Fiorite Green distad. Area of forewing immediately cephalad hindwing grayish-brown nearly to margin. Hindwing with dotted mesial line across entire wing. Ground color distad variously variegated green. Terminus with reddish-gray suffusions in the cell interspaces, often overscaled with gray. Recurved lobe of hindwing red-brown, white slash distad. Fringe fuscous to red-brown; whitish between veins. Length of Forewing: 15.0 mm. (alloptype); 14.5 mm. (paratype). Male Genitalia: Fig. 258. Characterized by unique bulbous juncture between bilobed configuration and caudal extension. Valvae, caudad saccus, clear, narrow-rimmed, broadly parabolic, indented. Valvae, lateral view, thinly round-tapered. Valvae caudal extension as noted above then tapered to caudal tips. Saccus broadly parabolic, vinculum slightly flared caudad, no "spurs," cornuti as illustrated. Female Genitalia: Fig. 259. Lamella antevaginalis extremely wide, exceeding two-thirds caudal extension of lamella postvaginalis; lateral areas of lamella antevaginalis lightly sclerotized as plates. Cephalad margins of lips heavily sclerotized. Lamella postvaginalis with caudal tip. Antrum flared, transparent

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area caudad antrum with central sclerotization. Ductus long, nearly two times breadth of lamellae. Signa as broad spines, bifurcate centrad, with longer spines very curved.

TYPES. Holotype male, allotype female (Figs. 68, 69), San Pedro, Jujuy Province, Argentina, 26 April 1979, R. Eisele. Deposited AMNH. Paratype. BMNH: Tucuman, Argentina (one female).

DISTRIBUTION. Spatial: Fig. 535. Known only from the type locality and adjacent Tucuman. Temporal: Known only from April.

REMARKS. Similarity to longula, along with extreme southern locality data (Tucuman, Argentina) suggested the possibility of incorrect data. However, dissection indicated a very distinct genitalic configuration relative to longula's range of variation, strongly indicating a sister species relationship. Since the longula group is the plesiomorph group of Cyanophrys, it is entirely possible that there is a southern vicariant form in southern South America , while longula is distributed well across Central America. this is further indicated because Argentine material (especially that from the Andes) has summarily been ignored in collections prior to this revision. The number of specimens actually available from that region was numerous in most major collections, most were placed with the undetermined material, and numerous new taxa in this revision are from this region. Later, more specimens of kirki were found, further confirming the logic of its designation above.

ETYMOLOGY. This species is named for Fr. David Kirk.

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Cyanophrys longula (Hewitson)

Figs. 260, 261, 457

Thecla longula Hewitson, 1869, p. 34 (nec. longula Hewitson, 1877, and subsequent authors). Kirby, 1871, p. 399. Draudt, 1919, p. 762, pl. 154, fig. a (figured and described in error; this species subsequently named pseudo-longula Clench). Biezanko and Piton, 1941, p. 11. Clench, 1944, p. 230; 1946, p. 157, 190; 1966, p. 69. Zikan and Zikan, 1968, p. 56.

species longula: Comstock and Huntington, 1961, p. 113.

Strymon pastor Butler and Druce, 1872, p. 105. Butler, 1873, p. 157, pl. 57, fig. 5. Kohler, 1923, p. 31. McDunnough, 1938, p. 24. Clench, 1944, p. 230 (placed as synonym of longula Hewitson, 1869). dos Passos, 1964, p. 56.

species pastor: Comstock and Huntington, 1962, p. 104.

Thecla pastor: Godman and Salvin, 1887, p. 34, pl. 52, fig. 8, 9, 10. Draudt, 1919, p. 762, pl. 154, fig. a. Kohler, 1923, p. 31; 1928, p. 4. Hoffman, 1940, p. 707. Schweitzer and Webster-Kay, 1941, p. 19. Clench, 1944, p. 230 (placed pastor as synonym of longula Hewitson, 1869, nec. longula Hewitson, 1877, and of authors); 1946, p. 190; 1961, p. 211. Lipes, 1961, p. 56.

Strymon longula: Stallings and Turner, 1947, p. 39.

Thecla viridaena Zikan, 1952, p. 11; 1964, p. 7 (placed as subspecies of longula).

Thecla remus: Clench, 1946, p. 157, 190 (placed as synonym of longula Hewitson, 1869, nec. longula Hewitson 1877 and of authors, in error), p. 190 (placed as subspecies of longula, in error).

Thecla deidamia Burmeister: Clench, 1946, p. 157 (by virtue of synonymy with remus, Clench, 1944, p. 234).

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Thecla miserabilis: as T. pastor, W. Holland, 1931, p. 228 (misidentified). As S. pastor, Stallings and Turner, 1957, p. 39. Clench, 1966, p. 68 (placed as misidentifications of T. miserabilis).

Callophrys (Cyanophrys) longula: Ross, 1976, p. 191 [109].

DIAGNOSIS. Above the males are brilliant blue, rivaled by few if any taxa of the group occurring in Central America. Prominent tail on both sexes. Under surfaces similarly characteristic of both sexes: bright green beneath with a dotted white to yellowish mesial line across the hindwing and with variously broad red suffusion in the cell interspaces along the margin, these sometimes overscaled with gray or whitish scales. The ground color of the hindwing is also distinctly variegated.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 457) as typical of the genus. Frons brown. Upper Surface of the Wings: Brilliant iridescent Alizarine Blue. Scent patch distad in discal cell same color as rest of wing. Narrow (1 to 2 mm.) dark blackish borders, both wings, wider along apex of forewing and near tail at vein Cu_2 and recurved lobe, hindwing. Recurved lobe deep Chestnut, blacker distad, heavily fringed. Fringe, both wings, dark fuscous, lighter distad, often black on the veins. Under Surface of the Wings: Ground color bright Oriental Green to Rheinemann's Green. Ground color of hindwing noticeably variegated. Area of forewing immediately cephalad hindwing broadly gray, nearly to margin. Hindwing with mesial line of white to yellowish spots forming somewhat continuous line across the wing. Mottled ground color apparent distad with terminus often broadly suffused reddish between the veins, and this area variously overscaled with gray or white. Area of recurved love and Cu_2 tail somewhat more blackened; fringe, dark fuscous, lighter distad, often black on the veins. Length of Forewing: $\bar{X}$ of 10 specimens

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(AMNH), 15.1 mm., range 14.5 mm. to 15.5 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 457) as typical of the genus. Frons brown. Upper Surface of the Wings: Ground color bright sheen of slightly grayed Parula Blue. Large areas of margins and submargins, both wings, and apex forewing dark fuscous. No scent patch distad in discal area. Tail at Cu_2 of hindwing prominent, often white tipped. Area anad near recurved lobe lighter brown, toward Chestnut. Fringe, both wings, dark basad, lighter distad. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 10 specimens (AMNH, AME), 15.3 mm., range 14.5 mm. to 16.0 mm. Male Genitalia: Fig. 260. Valvae, caudad saccus, clear, narrow-rimmed, parabolic and indented; valvae, lateral view, round-tapered; valvae, caudal extension, extremely long, exceeding terminus of falces, tapered in two planes, one gradually from bilobed configuration, second from there to thin valval terminus. Saccus parabolic, slightly longer than width of vinculum immediately caudad. Base of vinculum slightly flared; vincular spurs rounded. Cornuti narrow-tapered. Female Genitalia: Fig. 261. Ductus moderately wide, tapering to broad lamellae with very little evidence of antrum. Lamella antevaginalis about one-half caudal expanse of lamella postvaginalis, margin entire, widely extended across entire lamellal breadth, bevelled distad. Juncture of lamellae and ductus with transparent area, sclerotized centrad. Signa broad birfurcate spines.

TYPES. The holotype male of longula is in the British Museum, as is the holotype male of Strymon pastor Butler and Druce. Type Localities: C. longula, Mexico. The type locality of pastor is Cartago, Costa Rica.

DISTRIBUTION. Spatial: Fig. 535. Distributed over a large area of Central America from northern Mexico south across isthmus of Panama to extreme northern Colombia. Temporal: Dates on specimens range from February to August.

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REMARKS. Several problems have surrounded the identity of this taxon. The name has been frequently interchanged with pastor Butler and Druce, as noted in the synonymy, and as pastor has even been used for Mexican and southern United States taxa actually representing miserabilis Clench (which he distinguished from pastor or longula in 1946) and necopina. I have examined and dissected the type of pastor. It is conspecific with longula, indicated by similar examination of its type.

Clench (1946) used longula as a taxon into which he placed remus Hewitson as a subspecies. However, the genitalia of remus and longula do not place them as immediate sister taxa. This study has discovered an immediate sister species of longula in South America, kirki, fulfilling Clench's suspicion (1946) that the Mexican and Central Americal range of longula was complemented by a distribution in South America. The South American sister species is not remus, but a sister species, specimens of which were unknown to Clench.

Another problem concerning the identity of longula was solved by Clench's (1944) description of pseudolongula. It was this latter species, formerly confused with longula but actually a distinct species distributed northwestward in South America, that Hewitson had figured as longula though it did not match his 1868 description.

The above-reviewed confusion between longula, pseudolongula, pastor and miserabilis was inadvertently, if only partially resolved by Clench (1944, 1946, 1961, 1966) without examination of the types. But his works further complicated the problem in this regard: Clench (1944) stated that the type of longula was "apparently" not in the British Museum. He goes on to designate a neotype, and other associated types in the MCZ. Clench did not mention the existence of the original type in his 1946 work after a trip to England. He apparently did not locate the type, or it was temporarily misplaced as a result of storage during

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World War II. The type of longula does exist, however, and is in the type collection of the BMNH. It is clearly labelled and there is little doubt it is the type. Hence, the neotype and associated neoallo-and neoparatypes of Clench are invalidated.

In all, I dissected six males and six females across the distribution of longula for genitalia, legs, and palpi.

Cyanophrys pseudolongula (Clench)

Figs. 262, 263, 458.

Thecla pseudolongula Clench, 1944, p. 235. Hayward, 1973, p. 152.

Thecla longula Hewitson, 1877, p. 200, pl. 80, figs. 651, 652, 653, 654. Draudt, 1919, p. 762, pl. 154a (nec. longula Hewitson, 1868). Clench, 1944, p. 235 (placed as synonym of pseudolongula).

Cyanophrys pseudolongula: Clench, 1966, p. 70.

DIAGNOSIS. Frons brown. Separated from other brown fronsed taxa by lack of red-brown, suffused gray terminus on the hindwing underside. Here it resembles only longuloides Clench, but instead of having a uniformly green underside as does the latter, the hindwing of pseudolongula has obvious bands of more or less greenish ground color. The scent patch of the male in longuloides is black, while on pseudolongula it is blue like the rest of the wing.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 458) as typical of the genus. Frons brown. Upper Surface of the Wings: Bright iridescent Alizarine Blue. Extremely small (less that one-fourth length of discal cell) scent patch distad in discal area, nearly invisible in bright blue coloration.

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Marginal border blackish on both wings, slightly broader on forewing, becoming wide across apex and then thin along the costa. Recurved lobe of hindwing Chestnut fringe, forewing, brown, hindwing white to grayish, darker basad and blackened on the vein-ends. No tail. Under Surface of the Wings: Ground color Rheinemann's Green to lighter Florite Green distad. Area of forewing immediately cephalad hindwing broadly grayish, darker basad. Hindwing with grayed areas, green ground color forming two noticeable broad transverse arcs of lighter or dulled green, one discal to median, the other submarginal. Basal area, discal to median band, usually with a few vague spots, suggestive of median or discal line. Base of hindwing usually duller green or brownish; recurved lobe Chestnut extending to, or adjoined by, a heavily suffused red-brown patch, cell Cu_2. Length of Forewing: $\bar{X}$ of 15 specimens (AMNH), 14.2 mm., range 13.5 mm. to 15.5 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 458) as typical of the genus. Frons brown. Upper Surface of the Wings: Ground color bright iridescent Parula Blue darker distad. Wide area of costa, apex, margins and submargins of forewing, narrower areas of hindwing dull Raw Umber. Border of marginal Raw Umber and blue on hindwing crennated. Fringe brownish on forewing, lighter on hindwing with vein-ends and basal areas darker. Under Surface of the Wings: As on male, but tendency for discal to median line of spots to be more pronounced. Length of Forewing: $\bar{X}$ of 10 Specimens (AMNH), 14.5 mm., range 14.0 mm. to 15.2 mm. Male Genitalia: Fig. 262. Valvae, caudad saccus, clear, narrow-rimmed, parabolic, indented. Valvae, lateral view, round-tapered, with slight funnel centrad. Valvae, caudal extension, tapered to slightly two-planed. Saccus parabolic. Base of vinculum slightly flared, spurs rounded. Cornuti as illustrated. Genitalia slightly variable, probably due to montane disjuctions. Female Genitalia: Fig. 263. Similar to longula but with more hemispherical lamellae and wider lamella antevaginalis, at least one half

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the caudal expanse of lamella postvaginalis. Ductus hardly any antrum; transparent area cephalad lamellae with centrad sclerotized line. Ductus long, length circa two times breadth lamellae. Signa bifurcate spines.

TYPES. Holotype male, and allotype female, in the MCZ. Type Locality: Mapota, Turgurahua, Ecuador.

DISTRIBUTION. Spatial: Fig. 535. Known from an extensive region of northern South America: in the Andes throughout Colombia and Ecuador and out onto adjacent foothills and immediate plains, thence southward into central Peru in the montane regions and northern Bolivia. Temporal: Known dates of capture range from February to July.

REMARKS. Clench (1944) has clarified the misidentification of this taxon as longula Hewitson by Hewitson in 1877, which perpetuated the use of Hewitson's 1868 name for this northern South American species. Clench described the taxon pseudolongula to apply to the species Hewitson misfigured as longula in 1877, and in 1966 clarified the confusion between longula and pastor Butler and Druce along with the latter's early use for what Clench later named Thecla miserabilis. See the discussions and synonymies under the above mentioned species.

In all, I dissected ten males and ten females of this species from across its distribution area, for genitalia, legs, and palpi.

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Cyanophrys aluta, new species

Figs. 70, 71, 264, 265, 459

DIAGNOSIS. Recognized by the completely brown underside of the hindwing, mottled only slightly by green and by the extreme dark borders of the female extending nearly in a straight line from the apex of the forewing down one half of both wings.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 459) as typical of the genus. Frons brown. Upper Surface of the Wings: Bright iridescent Violaceous Blue except for extreme Raw Umber margins. Scent patch, blue, distad in discal area. Recurved lobe of hindwing elongate and straight, Chestnut. Fringe Raw Umber. No tail. Under Surface of the Wings: Ground color, hindwing, Liver Brown with vague green beneath; area of forewing immediately cephalad hindwing gray, heavily suffused with brown, darker basad. Rest of forewing green suffused over Liver Brown, with bright Rheinemann's Green patch between gray area cephalad hindwing and rest of wing. Hindwing Liver Brown mottled with green at median and submarginal areas. Recurved lobe between outer and anal margin Maroon, with white. Length of Forewing: 14.0 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 459) as typical of the genus. Frons brown. Upper Surface of the Wings: Broad areas of apex, costa, margins and submargins of forewing, and margin of hindwing light Raw Umber. Rest of wing light Violet Plumbeous to Deep Violet Plumbeous. Margin of Raw Umber and Plumbeous on hindwing slightly crennated. Fringe of forewing brown, hindwing brown but with crennated white between the veins. Recurved lobe Chestnut. Under Surface of the Wings: As on male. Length of Forewing: 15.5 mm. (allotype). Male Genitalia: Fig. 264. Valvae, caudad

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saccus, clear, narrow-rimmed, parabolic, indented; valvae, lateral view, area between articulations of valvae to vinculum deeply and sharply concave, tapered; valvae, caudal extension extremely long-tapered, tapered area exceeding twice length of bilobed configuration; capped tips. Base of vinculum slightly flared; spurs absent; cornuti narrow-tapered. Female Genitalia: Fig. 165. Similar to pseudolongula and longula, differing mainly as follows: slight antrum caudad lamellae, transparent distad extending into transparence of ductus, both with sclerotized centrad line. Lamella antevaginalis less than one-third caudal expanse of lamella postvaginalis. Ductus with caudal length and distal width markedly less than on above sister species. Signa short spines, bifurcate basad.

TYPES. Holotype male (Fig. 70), Beleu, Municipio San Cristobal Verapaz, Alta Verapaz, Guatemala, 27 October 1966. Allotype female (Fig. 71), Mpio. Acatenango, Quisache, Chimaltenango, 1750 m. Guatemala, 5 August 1965, both by E. C. Welling, both deposited AMNH.

DISTRIBUTION. Spatial: Fig. 535. Presently known only from central Guatemala. Temporal: Dates are August and September.

REMARKS. This is the immediate sister species of pseudolongula Clench, which is found in northwestern South America, and not longula Hewitson as Clench suspected. The similarities can be seen not only in the brown frons and the genitalia, but by looking at the pattern beneath the deep brown underside of aluta. The latter is the distinctive character of this insect, but the same pattern that is faintly traceable in the green of pseudolongula is apparent in aluta as well. The female of aluta evidences the widest marginal and apical dark areas of any species in the tropical Callophryina.

ETYMOLOGY. The Latin name alutus (deep brown) refers to the under surface of the wings, a unique character.

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Cyanophrys longuloides (Clench), new combination

Figs. 257, 455

Thecla longuloides Clench, 1944, p. 237; 1946, p. 156. Hayward, 1973, p. 152.
species longuloides: Comstock and Huntington, 1961, p. 113.

DIAGNOSIS. May be separated from many other species by its lacking a red-brown, suffused-gray terminus on the hindwing underside, and by its brown frons. Herein it resembles only pseudolongula Clench. The scent patch on the forewing upperside is black on longuloides and blue (like the ground color) on pseudolongula. Also longuloides has a uniform green hindwing underside ground color, whereas pseudolongula has obvious bands of more or less greenish coloration.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 455) as typical of the genus. Frons brown. Upper Surface of the Wings: Brilliant iridescent Deep Dull Violaceous Blue. Scent patch distad in discal cel, noticeable, black and elongate. Only narrow areas of costa, apex, and margins of forewing and margins of hindwing dark Raw Umber, but tendency for this coloration to extend basad along the veins into the blue. Recurved lobe of hindwing between outer and anal margins Chestnut. Fringe brown on forewing, grayish distad; on hindwing brown, more whitish distad. Undersurface of the Wings: Ground color, both wings, Winter Green to Ackermann's Green. Area of forewing immediately cephalad hindwing broadly gray, at least to vein Cu_2, and black along the border with the green. On hindwing, two vague white spots often lined basad with red-brown, median in cell Cu_1 and submarginal in cell 2A, or nearly on vein 2A. Extremely slight darkening of the green as a submarginal arc

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usually noticeable. Recurved lobe of hindwing between outer and anal margins green suffused heavily with red-brown. Fringe as on upper surface. Length of Forewing: Holotype male, 14.0 mm.; two other specimens (AMNH, BMNH), 14.0 mm., 14.5 mm. Male Genitalia: Fig. 257. Valvae, caudad saccus, clear, narrow-rimmed, shouldered; valvae, lateral view, area between articulation to vinculum extremely wide, concave area between, broad; lateral view, caudal extension of valvae, extremely thin and pointed; valvae, caudal extension, three-step; saccus parabolic; base of vinculum not flared; rectangular spurs on vinculum; cornuti wide, disclike. Female Genitalia: Unknown.

TYPE. Holotype male in MCZ. Type Locality: Coroico Province, Bolivia.

DISTRIBUTION. Spatial: Fig. 535. Known from central Colombia southward through Peru into Bolivia. Temporal: Dates on specimens range from May to December.

REMARKS. The extensive survey of Cyanophrys of South America has added only a few specimens to those known of this species.

Cyanophrys paralonguloides, new species

Figs. 66, 67, 255, 256, 454

DIAGNOSIS. This species is one of two species in two different genera whose males are iridescent blue above except for thin dark marginal lines, and which have immaculate green undersides except for a median to postdiscal arc of emphatic white spots. Other species having this under surface pattern occur throughout Primary series Plesiocyanophrys and generally have reduced blue above which is especially dull on the forewing apices and along the margins

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which are dull fuscous. The species paralonguloides can be identified by the characters of its genus and by the distinctive genitalia described below.

DESCRIPTION. Male. Head, thorax, abdomen, legs and palpi (Fig. 454) as typical of the genus. Frons green. Upper Surface of the Wings: Bright iridescent Dull Blue Violet with margins, both wings, fuscous. Scent patch distad in discal area. Fringe fuscous, both wings; recurved lobe nearly same color as fringe. No tail. Under surface of the Wings: Ground color Courge Green; area of forewing immediately cephalad hindwing gray, extending distad to margin. Hindwing with faint mesial row of white spots, larger anad, especially anad vein 2A. Recurved lobe of hindwing deeply blackish-maroon; slight white bar basad; maroon coloration extending slightly cephalad along margin. Fringe, both wings, brown. Length of Forewing: 14.5 mm. (allotype). Female: Head, thorax, abdomen, legs, and palpi (Fig. 454) as typical of the genus. Frons green. Upper Surface of the Wings: Margins of hindwing and wide areas of margin and apices, forewings, dull Raw Umber. Rest of wing slightly shiny Payne's Gray. No tails. Fringe of forewing dull brown, hindwing, white in the cell interspaces. Recurved lobe of hindwing light Chestnut, fringed black distad. Under Surface of the Wings: As on males. Length of Forewing: 14.0 mm (holotype). Male Genitalia: Fig. 255. Valvae, caudad saccus, clear, mid-rimmed, squarely shouldered, not indented; valvae, lateral view, distinctly funneled centrad. Saccus widely parabolic. Base of vinculum not flared, not spurred. Cornuti thin, tapered. Female Genitalia: Fig. 256. Characteristic of the species group--transparent area of ductus with centrad sclerotization. Lamella postvaginalis broadly hemi-elliptical; lamella antevaginalis with heavily sclerotized lips and slight sclerotized plates caudad. Ductus about one and one-half times breadth of lamellae. Antrum reduced, about equal to caudad expanse of lamella ante-vaginalis. Signa single wide spines, only slightly bifurcate distad.

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TYPES. Holotype female (Fig. 66), Santissima Trinidad, Cordillera Province, Paraguay, August, B. Podtiaguin. Deposited AMNH. Allotype male (Fig. 67), Paraguay, deposited BMNH.

DISTRIBUTION. Spatial: Fig. 535. Presently known only from central and southern Paraguay. Temporal: Known only from August.

REMARKS. This is the immediate sister species of longuloides Clench. The affinity is obvious from the genitalia, but there are differences in the wing pattern and general distribution.

ETYMOLOGY. the name indicates the immediate sister species affinity to familiar longuloides Clench, adding the Latin para (like) to the name longuloides.

2. The distractus Group

including distractus/distractoides--pseudoherodotus/quinterorum.

A. Cladogram and Characters, Fig. 569.

B. Distribution, Fig. 536.

C. Characteristic Genitalic Configurations, Fig. 547.

Cyanophrys distractus (Clench), new combination, new status

Figs. 270, 271, 463

Thecla amyntor distractus Clench, 1946, p. 153.

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DIAGNOSIS. Like its immediate sister species distractoides, this species can be superficially identified by the displacement of the white spot most immediate the anal angle distad as part of a parallel line of red-brown spots, usually extending to veins Cu_1 or Cu_2. The genitalia confirm the species, recognized by the configurations illustrated for males and females in the accompanying figures (Figs. 270, 271).

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 463) as typical of the genus. Frons Green. Upper Surface of the Wings: Bright iridescent Violaceous Blue. Broad deep Raw Umber to black submarginal border, widening at apex of forewing and along cephalad edge of hindwing. Scent patch distad in discal area, blue as ground color. Recurved lobe of hindwing Chestnut. Tail at distal end of vein Cu_2. Under Surface of the Wings: Ground color Oriental Green to darker Winter Green. Area of forewing immediately cephalad hindwing grayish to at least vein Cu_2, blackened basad. Hindwing with faint and variously expressed median line of whitish spots edged basad with red-brown, with the spot most immediate the anal margin displaced distad and in line with row of red-brown to Burgundy blotches paralleling the white median line from cell Cu_2 to Cu_1, and occasionally more cephalad, though these smaller. Recurved lobe deep Chestnut extending cephalo-distad often to cell C_2. Fringe of both wings red-brown, whitish distad especially on the hindwing and there most prominent along the limbal area. Length of forewing: $\bar{X}$ of 10 males (BMNH, AMNH, CMNH), 17.0 mm., range 15.7 mm. to 18.0 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 463) as typical of the genus. Frons green. Upper Surface of the Wings: Margins and submargins of both wings, and costa and apex of forewings dark Raw Umber to blackish. Rest of wing shiny Violaceous Gray. Faint indication of a tail at vein Cu_1. Fringe blackish, whitish distad on hindwing and especially in limbal area. Under Surface of the Wings:

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As on male, but all markings usually more emphatic; ground color usually lighter in hue. Length of Forewing: $\bar{X}$ of 10 specimens (BMNH, AMNH, CMNH), 16.5 mm., range 15.8 to 17.2 mm. Male Genitalia: Fig. 270. Valvae caudad saccus, clear, mid-rimmed, broadly parabolic, indented; valvae lateral view, round-tapered; valvae, caudal extension three-step; saccus, short funnel, not exceeding length of bilobed configuration; base of vinculum not flared; broad triangular spurs on vinculum; cornuti broad-tapered. Female Genitalia: Fig. 271. Lamellae bluntly eliptical. Lamella antevaginalis about one-half length of lamella postvaginalis, latter structure more darkly sclerotized cephao-distally, and with rectangular sclerotizations distad the antrum. Antrum long equally about one-half length of lamellae. Ductus long and narrow, about four times length of antrum; clear transparent area cephalad antrum about one-fourth rest of length of ductus. Cephalad tip of ductus bulb-ended with crescent shaped juncture to corpus bursa; signa broad-based spines, broadly bifurcate centrad, one prong about half the length of the other.

TYPES. Holotype male, allotype female, deposited in BMNH. Type Locality: Rio Minero, Muzo State, Colombia.

DISTRIBUTION. Spatial: Fig. 536. As defined in this study, known from montane Colombia and very adjacent northwest Venezuela; also northern Ecuador. Temporal: Dates on specimens range from May to September.

REMARKS. Clench (1946) named this taxon as a subspecies of amyntor Cramer. The name amyntor has been one of the largest "catch-all" grade taxa into which countless specimens have been placed at various institutions. The general criteria for such placement has been anything that was iridescent blue above with wide dark borders was "amyntor," while anything blue above with narrow dark borders went into "herodotus". This common generalization gave the impression that there were two broadly distributed species in South and

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Central America. Neither the types of Cramer's amyntor nor Fabricius' herodotus are apparently extant. Dissection and other examination of specimens of these grades over the entire South American and Central American regions yielded a very different picture, and within this, distractus found its place as a distinct species with several sister taxa north and south of the Panamanian isthmus. The species distractus is several species distant, cladistically, from amyntor (as defined by the neotype designated in this paper). In all seven males and eight females identified as distractus were dissected from across its range.

Cyanophrys distractoides, new species

Figs. 73, 272, 273, 464

DIAGNOSIS. Similar to distractus, both with white spot most immediate anal angle on hindwing under surface displaced distad into parallel line of red-brown spots. Genitalia distinctly different from distractus as follows: males with rims of bilobed configuration much thinner than distractus and bilobed configuration more than one-third entire caudal length of valvae as opposed to less than one-third on distractus; caudal expanses of central and terminal portions of "three-step" valvae of distractoides consequently less outstanding. Females of distractoides lacking antrum-like configuration distad at juncture of lamella antevaginalis and ductus.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 464) as typical of the genus. Frons green. Upper Surface of the Wings: Bright iridescent Violaceous Blue, submarginal border broad Raw Umber, wider at forewing apex, and along cephalad edge of hindwing. Scent patch distad in discal area, same color as ground blue. Recurved lobe bright Chestnut; tail distad on

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vein Cu_2. Under Surface of the Wings: Ground color Winter Green to Rheinemann's Green except for extensive gray area on forewing immediately cephalad hindwing. Hindwing with median line generally expressed only anad, spot most immediate anal angle markedly displaced distad, entering row of red-brown blotches in postmedian area at least from veins Cu_2 to Cu_1. Recurved lobe deep Chestnut to Maroon. Fringe, both wings, red-brown. Length of Forewing: 15.5 mm. (holotype), $\bar{X}$ of 3 males (AMNH, BMNH), 16.0 mm., range 15.5 mm. to 16.5 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 464) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color Violaceous Gray; margins and submargins, both wings, and costa and apex of forewing dark Raw Umber to blackish. Tail distad on vein Cu_1. Fringe fuscous to black, sometimes whiter distad especially in anal area, hindwing. Under Surface of the Wings: As on male, but with markings more emphatic especially distad median row of white spots anad on the hindwing. Length of Forewing: 15.5 mm. (allotype), $\bar{X}$ of four specimens (AMNH, BMNH), 16.3 mm., range 15.5 mm. to 17.5 mm. Male Genitalia: Fig. 272. Valvae caudad saccus, clear, thin to mid-rimmed, broadly parabolic, indented; valvae lateral view, round-tapered; valvae, caudal extension three-step, but bilobed area more emphatic in dominating caudal length of entire configuration; saccus, short, nearly pointed; base of vinculum not flared; spurs sharply triangular, cornuti broad-tapered. Female Genitalia: Fig. 273. Lamella postvaginalis broadly eliptical to somewhat rectangular; lamella antevaginalis with caudal expanse one-fourth to less that of lamella postvaginalis. Distad juncture of lamella antevaginalis with ductus a slight slope (not slightly antrumnal with sclerotizations as on distractus). Ductus long and narrow, about four times length of antrum, clear transparent area cephalad about one-fifth length of ductus. Cephalad tip of ductus bulb-ended with crescent-shaped juncture to corpus bursa; signa broad-based spines, broadly bifurcate centrad.

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TYPES. Holotype male, (Fig. 73) Gualan, Guatemala, no other data (AMNH). Allotype female, Acajutla, El Salvador, P. Wrightly, July 1946 (BMNH). Paratypes: BMNH: same data as allotype (two males); Achupa (= Acuapa?), Nicaragua (?) (one male, two females).

DISTRIBUTION. Spatial: Presently identified from the western coastal areas of Guatemala, El Salvador and Nicaragua (by genitalic dissection), associated by wing pattern with specimens extending southward in Central America to Panama. Temporal: Known only from July.

REMARKS. This species has been identified from among numerous specimens labelled either amyntor or herodotus from Central America but evidencing the displacement distad of the median spot most immediately anad and thus resembling series of distractus from northwest South America. Study of the genitalia of the Central American specimens indicates they represent a sister species of the South American population heretofore unrecognized. Specimens of the type series were all dissected for genitalia, legs, and palpi.

ETYMOLOGY. The latinized name refers to the superficial resemblance of this species to distractus.

Cyanophrys pseudoherodotus, new species

Figs. 74, 274, 275, 465

Thecla amyntor (of authors): see below

Cyanophrys amyntor (of authors): see below

Thecla herodotus (of authors): see below

Cyanophrys herodotus (of authors): this species has undoubtedly been identified as the above taxa, but the nature of much South and Central America literature as lists make rendering a synonymy impossible.

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DIAGNOSIS. This species and its immediate South American sister species quinterorum are actually quite easily identified. Among the specimens which stand out as deep blue above on the males with wide blackish borders and under surfaces suggestive of the familiar amyntor sens. lat. or herodotus sens. lat. (see Remarks under species distractus, amyntor, herodotus and quinterorum), pseudoherodotus and quinterorum will be the only species with male genitalia evidencing the extremely distinct male and female configurations illustrated in the accompanying genitalic characterizations (Figs. 547-549), descriptions and figures and which can be generally characterized as a male caudal extension of extreme length and narrowness, with diminutive bilobed configuration and female with ductus very long relative to distal and caudal expanse of lamellae, but not the extreme length and apomorph sclerotized plating of herodotus. The differences between South American quinterorum and Mexican pseudoherodotus are most apparent in the male valvae. The former has a tapered caudal extension while the latter is distinctly three-step with the bilobed configuration very diminutive. See Remarks for comments on the similarity of this group's females to those of primitive Sandia, whose males are brown above.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 464) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color bright iridescent Tyrian Blue darker distad and basad. Marginal, costal, and apical area of forewing with wide (2 mm.) border of deep Raw Umber. Hindwing similar, but border narrower anad and juncture with blue iridescence irregular. Recurved lobe of hindwing deep chestnut, thickly bordered circumferentially with black. No tail. Fringe black. Under Surface of the Wings: Ground color Winter Green to duller. Area of forewing immediately cephalad hindwing gray-black nearly to margin. Hindwing with spots sporadically as follows: one red-brown in cell Cu_1 (usual position of "Thecla-spot"); one white, often bordered

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red-brown basad in cell Cu_2; and one white, usually bordered red-brown basad in cell 2A. Recurved lobe of hindwing diminutive, slightly Chestnut in color, but heavily circumferenced with black. Fringe black along the veins, deep red-brown distad. Length of Forewing: 16 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 464) as typical of the genus. Frons green. Upper Surface of the Wings: Wings expansive and with broadly rounded margins. Costa, apex and submargins of forewing, margins of hindwing dull Prout's Brown. Basad this, light sheened Payne's Gray. Juncture of wing coloration variegated, especially on hindwing. Tail at vein Cu_2, hindwing, long; another vague extension at vein end Cu_1. Recurved lobe dark brown, but brown extending cephalad slightly along margin. Fringe dark, lighter distad especially in the limbal area. Under Surface of the Wings: Similar to male but with exaggerations of the general markings, especially the red-brown blotches and crescents distad in the submargin, expecially anad. Red-brown spots in cell Cu_1, 2A and Cu_2 expansive and often suffused proxad into the ground color. All white spots, when present, emphatic, especially anad, edged heavily brown basad. Recurved lobe brightly Chestnut with color suffusing distad. Fringe markedly red-brown, paler distad. Length of Forewing: 16.0 mm. (allotype). Male Genitalia: Fig. 272. Characteristic three-step about equal in length. Valvae, caudad saccus, clear, mid-rimmed, indented; valvae, lateral view, round-tapered; saccus, pointed to blunt-ended; valvae, caudal extension, three-step; cornuti dorsal narrow-tapered, ventral disc-like. Female Genitalia: Fig. 273. Lamella postvaginalis hemispherical; lamella antevaginalis as wide lips distad caudal opening of antrum. Antrum long, equal in length to caudal expanse of lamellae. Transparent area immediately cephalad, about one-fourth the remaining length of ductus. Ductus long, four times length of antrum or caudal expanse of lamellae. Signa straight deeply bifurcate spines.

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TYPES. Holotype male (Fig. 74)and allotype female, Catameo, Vera Cruz State, Mexico; deposited AMNH. Paratypes: AME: Vera Cruz, Mexico, Robert Wind, October, 1969 (female); San Luis Potosi, Mexico 26 July 1973, H.A. Freeman (female).

DISTRIBUTION. Spatial: Fig. 736. Presently known from east central Mexico, Veracruz and San Luis Potosi states. Temporal: Dates on specimens range from July to October.

REMARKS. This species and its immediate sister species quinterorum became apparent when dissecting across the wide regional ranges of the grade taxa amyntor and herodotus early in the study. Their more complete place in Cyanophrys became apparent as the study progressed, as summarized more particularly under Remarks on quinterorum. Both species represent morphs many workers have thought to be typical of herodotus or amyntor. All the types were dissected for genitalia, legs, and palpi.

ETYMOLOGY. The latinized name denotes the superficial similarity of this species to herodotus Fabricius.

Cyanophrys quinterorum, new species

Figs. 75, 76, 276, 277, 466

Thecla amyntor (of authors): see below.

Cyanophrys amyntor (of authors): see below.

Thecla herodotus (of authors): see below.

Thecla detesta: Clench, 1946, p. 155 (possibly in part). This species has undoubtedly been identified as the above taxa but the nature of most Central and South Americal literature as lists makes the rendering of a synonymy impossible.

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DIAGNOSIS. This species is the immediate sister species of pseudoherodotus and resembles it most. The wing characters of the male resemble all those in the "amyntor group", while those of the female resemble Sandia fucius, marialis, and ampulla superficially and less resemble the species amyntor, howei, platnicki, durstorum, distractus and amyntoides within the "amyntor group". Genitalia of quinterorum resemble pseudoherodotus and amyntor but can be distinguished as follows: male valvae of quinterorum are elongate, have a cephalad tapering configuration in the bilobed area that is only slightly indented, and a cornered configuration before a distinctly tapered caudal extension.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 466) as typical of the genus. Frons green. Upper Surface of the Wings: Entire surface bright iridescent Tyrian Blue, darker in some specimens toward Dusky Blue. Marginal, costal and apical area, forewing, with dark Raw Umber to black border, distinct as border, not just marginal edge. Hindwing same, but margin narrower; juncture with blue slightly crennated. Recurved lobe of hindwing hardly exceeding in length the outer margin, slightly Chestnut in color. No tail. Fringe black. Under Surface of Wings: Ground color dull Winter Green to Florite Green. Wings nearly immaculate except for deep gray area of forewing immediately cephalad hindwing and spots on the hindwing: one emphatically red-brown submarginal in cell Cu_1 (usual position of "Thecla-spot"), another in cell 2A just basad recurved lobe usually white distad, red-brown basad; sometimes a third in cell Cu_2 between the former two, vaguely red-brown; very occasionally another in the median area (where some congeners have complete transverse bar). Coloration of recurved lobe bright red-brown. Fringe distinctly red-brown, emphatic on the veins and especially noticeable because of slightly crennated condition of same in limbal area. Length of Forewing: 16.0 mm. (holotype); $\bar{X}$ of 6 specimens (AME), 17.3 mm., range 14.0 mm. to 20.0 mm. Female: Head,

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thorax, abdomen, legs, and palpi (Fig. 466) as typical of the genus. Frons green. Upper Surface of the Wings: Costa, apex, and submargins of forewing, margins of hindwing dull Prout's Brown. Rest of wing Pale Payne's Gray. Juncture of this coloration and marginal dark color crennated on hindwing. Long tail at Cu_2, vague extension of vein at Cu_1 similar to male. Recurved lobe of hindwing dull Chestnut, extending slightly cephalad along margin, fringed black distad. Under Surface of the Wings: Very similar to amyntor, less so herodotus as strictly defined in this paper (see below in Remarks). As male described above but significant exaggerations of some characters giving quite distinct appearance. All red-brown spots, cell Cu_1, 2A, and Cu_2 much larger and usually suffused proximad into green ground color. White spot at cell 2A emphatic and followed cephalad by one to two others into cell Cu_1, these edged obviously with red-brown basad. Various other spots in median line, some specimens. Recurved lobe of hindwing brightly Chestnut and suffused Chestnut cephalad and distad into the green ground color. This and wide red-brown fringe of hindwing, markedly paler between the veins. Length of Forewing: 18.5 mm. (allotype). Male Genitalia: Fig. 276. Valvae, caudad saccus, clear, narrow-rimmed, elliptical, broadly indented; valvae, lateral view round-tapered; valvae caudal extension tapered, extremely long, length caudad bilobed configuration 2 times length of bilobed configuration; saccus parabolic; base of vinculum flared; sharp spurs on vinculum; cornuti, dorsal broad but tapered narrowly at terminus, ventral, disclike with pointed caudal tooth. Female Genitalia: Fig. 277. Lamella postvaginalis hemispherical to elliptical; lamella artevaginalis as distad lips on opening of ductus. Antrum long, equally caudal length of lamellae. Transparent area immediately cephalad antrum equalling length of antrum, slightly club-ended. Signa broad based spines, widely bifurcate with straight prongs, one about one-half the size of the other.

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TYPES. Holotype male (Fig. 75) and allotype female (Fig. 76), El Centro, Magdalena Valley, Colombia; deposited AMNH. Paratypes. AMNH: La Boca, Canal Zone, 21 January 1908 (one female); Ancon, Canal Zone, 22 July 1907 (one female). AME: Los Rios, Canal Zone, 15 February 1968, (one male), 13 February 1969 (one male), 5 February 1968 (one male), 16 February 1968 (one male), 10 February 1968 (one male), same data, different label, 5 February 1968 (one male); Madden Dam, Canal Zone, 26 February 1969 (two males); Colon, Panama, 13 February 1969 (one male).

DISTRIBUTION. Spatial: Fig. 536. Known from northwestern South America in central Andes of Colombia, northwestward through Panama to Costa Rica. Temporal: Dates on specimens range from February to July.

REMARKS. This species may be what Clench (1946) referred to in his description of detesta from Colombia, though this is unimportant since the types of detesta are clearly conspecific with herodotus when dissected (see description of herodotus). Clench, using wing characters, was describing basically a sister species of herodotus which lacked tails on the male. However, my study of the series in the BMNH indicates that tailless males with genitalia exactly like herodotus form a cline in South America, and Clench's types include these. However, the same study indicated two sister species of herodotus with very distinct genitalia, one in South America and one in Mexico and northern Central America. At the time of my study in London I was unaware of these species, so I cannot say if or how many of Clench's paratypes of detesta from Colombia actually represent the presently described species. I did not dissect all of Clench's paratypes, only several of them; all of these were conspecific with herodotus. This species, quinterorum, and its immediate sister species pseudoherodotus in Mexico fit the common idea of many lepidopterists concerning the relationship of species amyntor and herodotus. The taxa quinterorum and

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pseudoherodotus are not immediate sister taxa of either amyntor or herodotus. This is especially obvious from the female genitalia. When supposed herodotus and amyntor are dissected area by area over the entire region of South and Central America, the pattern of many sibling species becomes apparent.

In all, I dissected seven males and eight females identified as quinterorum for genitalia, legs, and palpi.

ETYMOLOGY. This species is named for Eric and Janice Quinter.

3. The platnicki Group

including platnicki/hiulcus--misiones.

A. Cladogram and Characters, Fig. 569b.

B. Distribution, Fig. 536.

C. Characteristic Genitalic Configurations, Fig. 547.

Cyanophrys platnicki, new species

Figs. 77, 78, 278, 279, 467

Thecla amyntor: Seitz, 1919, p. 152, fig. 1 (misidentified).

DIAGNOSIS. Considering characters of the male wings, this species is similar to all those of the amyntor group. Female characters of the wings resemble Sandia fucius, ampulla, and marialis and less resemble species quinterorum, pseudoherodotus, and Mesocyanophrys caramba, M. kyanos, and M.

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rachelae. Characters of the genitalia, however, are very distinctive as noted in the accompanying figures and relate to the unique hiulca and misiones configurations. The male genitalia of platnicki can be recognized by the broadly parabolic bilobed configuration of the valvae, which comprise over one-half the entire length of this structure; the clear bilobed areas are distinctly large and they are also spiny caudad toward the caudal extension, which tapers briefly from the large bilobed area. The female genitalia are immediately recognizable by the broadly hemispherical to hemirectangular lamella postvaginalis and the complete lack of an antrum due to the extreme narrowing of the ductus cephalad the lamella antevaginalis.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 467) as typical of the genus. Frons green. Upper Surface of the Wings: Entire wing except margins and apex of forewing, and extreme margin of hindwings, bright iridescent Indigo Blue. Rest of wing dull Raw Amber to blackish. Tail at terminus of vein Cu_2, hindwing. Recurved lobe of hindwing Chestnut basad, black distad. Fringe dark basad, lighter distad, black on the veins. Under Surface of the Wings: Ground color dark Winter Green, to Brighter Oriental Green. Forewing with area immediately cephalad hindwing Drab Gray nearly to margin. Hindwing with completely obsolescent mesial line, except faint spot costad. Anad bright white slash basad deep Maroon recurved lobe. Prominent red-brown patches suffused circumferencially basad and costad recurved lobe and at area of "Thecla-spot". Fringes, both wings, bright red-brown. Length of Forewing: 16.5 mm. (holotype); $\bar{X}$ of 6 specimens (BMNH), 17.2 mm., range 15.5 mm. to 18.5 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 467) as typical of the genus. Frons green. Upper Surface of the Wings: Wide areas of margins, submargins, both wings, and apex, forewing deep Raw Umber. Rest of wing shiny. No scent patch distad in discal area. Tail at vein Cu_2, long, often

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white-tipped. Slight exaggeration of vein at Cu_1. Both wings expansive and with rounded margins. Recurved lobe of hindwing between outer and anal margins Chestnut, circumferenced black. Fringe, both wings, dark basad, lighter distad. Under Surface of the Wings: As on males, but with all markings exaggerated and much more "lush": especially occasional spots in mesial line emphatic enough to be white, and area of red-brown basad and anad recurved lobe emphatic and broadly circumferenced with suffusion. Length of Forewing: 16.5 mm. (allotype); $\bar{X}$ of 4 specimens (BMNH), 17.0 mm. range 16.0 mm. to 19.0 mm. Male Genitalia: Fig. 278. Valvae, caudad saccus, slightly spiny; mid-rimmed, widely elliptical, indented; valvae, lateral view, round-tapered; valvae, caudal extension tapered; saccus, parabolic; base of vinculum only slightly flared; vinculum with triangular spurs; cornuti, dorsal narrow tapered; ventral, spiked. Female Genitalia: Fig. 279. Lamella postvaginalis broadly hemispherical, caudad extension four times that of lamella antevaginalis; lips of lamellae unevenly sculptured; ductus slightly longer than breadth of lamellae, flared cephalad to club-end; singa broad spines, bifurcate centrad, with longer spine nearly straight.

TYPES. Holotype male (Fig. 77), Polochic Valley, Guatemala, Godman and Salvin. Allotype female (Fig. 78), Pacific Coast, Guatemala, Godman and Salvin. Deposited BMNH. Paratypes: BMNH. Same data as holotype (one male, one female); same data as allotype (one male, one female); Geronimo, Guatemala, Godman and Salvin (one female).

DISTRIBUTION. Spatial: Fig. 536. Known from several localities in Guatemala, adjacent El Salvador and Honduras, and also from Oaxaca and Veracruz states, Mexico, and Panama. Temporal: Dates on specimens range from January to September.

REMARKS. The extreme configuration of both the male and female genitalia of this species, and their affinity to two sister taxa to the south in

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central South America, while their wing patterns are those thought typical of "amyntor" sens. lat. is further testimony to the complexity and intricate phylogenetic and zoogeographical relationships that characterize the Neotropical Callophryina. The identification of this species as amyntor in Seitz's work is known through dissection of the specimen he figured. It is in the BMNH. Other known records of platnicki not included in the type series are listed in Material Examined. In all, the entire type series, plus a male and female each from all localities listed were dissected for genitalia, legs, and palpi.

ETYMOLOGY. I am pleased to name this species for Dr. Norman I. Platnick.

Cyanophrys hiulcus, new species

Figs. 80, 281

DIAGNOSIS. Though known only from the female, this is quite recognizable by the relatively small size and simple rounded wing shape; forewing margin arc-shaped, not as straight as in other taxa of species group; hindwing gently rounded suggesting more elliptical configuration than sister taxa of species group. Under surface characterized by rounded arc of median spots offset by small "Thecla-spot." Female genitalia unmistakable, with ductus relatively wide for species of Cyanophrys and lamellae with broad distal expanse (Fig. 547), reminiscent only of misiones and platnicki and distinguishable from these by characters below and in Figs. 279, 280, 281.

DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, and legs as typical of the genus; palpi unknown. Frons green. Upper Surface of the Wings: Entire surface dull Violaceous Gray to fuscous (specimen worn). Tail

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distad on vein Cu_2. Under Surface of the Wings: Ground color Rheinemann's Green. Forewing immaculate; hindwing with median arc of obsolescent wide spots, vaguely bordered basad with red-brown, especially anad. Vague evidence of "Thecla-spot" distad on hindwing. Length of Forewing: 14.5 mm. (holotype). Female Genitalia: Fig. 281. Lamellae extremely expansive distad, more than three-fourths caudal length of ductus. Lamella postvaginalis broadly eliptical to nearly rectangular; lamella antevaginalis about one-third caudal expanse of lamella postvaginalis, with heavy sclerotization distad. Signa widely bifurcate spines, one much longer and thicker than other; mounted on sclerotized base.

TYPE. Holotype female, Achinamiza, San Martin, Peru, 29 October 1927, deposited AMNH.

DISTRUBUTION. Spatial: Fig. 536. Known only from the type locality. Temporal: Known only from October.

REMARKS. This species placed within the distractus Group on basis of the female genitalia which exhibit characters similar to platnicki and misiones.

ETYMOLOGY. The Latin name means "gaping" referring to the configuration of the ductus and lamellae.

Cyanophrys misiones, new species

Figs. 79, 280

DIAGNOSIS. Cannot be separated from congeners except by genitalia. Female genitalia can be recognized by the extremely expansive spatulate lamellae (breadth = three-fourths length of ductus) and large club end at the cephalad end of the ductus (one-fourth the length of the ductus and two times its

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width). This characteristic shape is indicated in the accompanying figure of genitalic structures for the distractus species group and in the illustration of misiones particular genitalia. The male is unknown.

DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen, and legs as typical of the genus. Frons green. Upper Surface of the Wings: Costa, apex and submargins of forewing and margins of hindwing light Raw Umber. Rest of wing shiny Light Gull Gray to Neutral Gray with tail at end of vein Cu_2, and recurved lobe of hindwing light brown. Under Surface of the Wings: Entire wing surface save area of forewing immediately cephalad hindwings, Lime Green. Areas of forewing immediately cephalad hindwings, Very Pale Olive Gray. Hindwing with postmedian white spots, very reduced, in cells Cu_2, Cu_1, M_3, and M_1, bordered red-brown basad. Submarginal area distad spots in cells Cu_1 and M_3 with crescent shaped patches of diffused brown scales. Recurved lobe of hindwing deeply black to suffused red-brown; suffusion of red-brown extending into margin of cell Cu_1. Length of Forewing: 15 mm. (holotype, female). Male Genitalia: Unknown. Female Genitalia: Fig. 280. Lamellae expansive (breadth = three-fourths length of ductus); lamella postvaginalis indented caudad, shaped as two hemispherical lobes. Lamella antevaginalis with irregular margin; antrum narrow (width one-tenth length of ductus). Cephalad end of ductus club-ended, comprising one-fourth length of ductus and two times width. Signum single broad based spine.

TYPE. Holotype female (Fig. 79), Misiones Province, Breyer Collection; deposited NMNH.

DISTRIBUTION. Spatial: Known only from the type locality, a montane area of northeast Argentina. Temporal: Unknown.

ETYMOLOGY. This species is named for the province of Argentina from which the type specimen comes.

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4. The amyntor Group

including amyntor/amyntoides--howei/durstorum; pseudocallophria--innocuus.

A. Cladogram and Characters, Fig. 570.

B. Distribution, Fig. 537.

C. Characteristic Genitalic Configurations, Fig. 548, 549.

Cyanophrys amyntor (Cramer)

Figs. 81, 282, 283, 468

Thecla amyntor Cramer, 1775, p. 76, pl. 48, fig. E. Kirby, 1871, p. 398. Draudt, 1919, p. 762, pl. 153, fig. i. Hoffman, 1940, p. 707. Clench, 1944, p. 229, 256; 1946, p. 152. Schwanswitsch, 1948, p. 256. Zikan and Zikan, 1968, p. 55.

Polyommate amyntas (sic): Latrielle, 1819, p. 607.

Strymon amyntor: Stallings and Turner, 1947, p. 39.

species amyntor: Comstock and Huntington, 1959, p. 69.

Thecla menalcas Cramer, 1782, p. 259. Kirby, 1871, p. 398 (placed as synonym of amyntor). Hoffman, 1940, p. 707. Clench, 1946, p. 152.

species menalcas: Comstock and Huntington, 1961, p. 166.

Thecla amyntor distractus: Clench, 1946, p. 153 (distractus recognized as distinct species in this revision).

subspecies amyntor distractus: Comstock and Huntington, 1959, p. 208.

Callophrys (Cyanophrys) amyntor distractus: Ross, 1976, p. 190 [108].

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DIAGNOSIS. Male characters of the wing resemble those of the amyntor Group. Female characters of the wing resemble also Sandia fusius, ampulla, and marialis, and are similar to species Mesocyanophrys caramba, M. rachelae, C. quinterorum and C. pseudoherodotus. Genitalia in the males resemble only quinterorum and pseudoherodotus within the amyntor Group. The species amyntor can be recognized by the expansive bilobed configuration which exceeds one-third the length of the entire valvae and on which the clear areas are expansive and irregularly shaped. Female genitalia of amyntor resemble more numerous congeners but can be distinguished by the characters outlined below and in the figures.

DESCRIPTION: Male: Head, thorax, abdomen, legs and palpi (Fig. 468) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color dark Violaceous Blue. Only most marginal areas, hindwing but increasingly wide areas costad, forewing (to 2 mm.) fuscous to black. Scent patch distad in discal area, dull blue. Tail at vein Cu_2. Recurved lobe of hindwing dull Chestnut, pointed caudad. Fringe, both wings, fuscous to black, vein ends tipped black and extended distad at vein Cu_1 before tail. Under Surface of the Wings: Ground color Rheinemann's Green to slightly more bright Oriental Green. Forewing with area immediately cephalad hindwing smokey gray, blackish basad. Hindwing with anad area of mesial line nearly complete with white spots and to cell M_2. Each bordered basad with red-brown. Submarginal area costad red-brown recurved lobe with three red-brown blotches, one at area of "Thecla-spot", other in cell either side of this. Fringe, red-brown, slightly whitish between veins near tail. Length of Forewing: $\bar{X}$ of 7 specimens (BMNH), 17.0 mm., range 16.0 mm. to 18.0 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 468) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color wide areas of margins, both wings and especially apex of forewing, fuscous to dull

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Raw Umber. Rest of wing slightly shiny dull Violaceous Gray. Recurved lobe of hindwing dull Chestnut circumferenced black. Tail at vein Cu_2 prominent, white-tipped, often slight tail at vein Cu_1. Fringes, both wing fuscous to slightly red-brown, often white between veins, limbal area, hindwing. Under Surface of the Wings: As on males but with markings more "lush" and emphatic, especially white markings of mesial line and red-brown blotches in limbal area, hindwing costad recurved lobe. Wing shape much more rounded than on male. Length of Forewing: $\bar{X}$ of 7 specimens (BMNH), 17.5 mm., range 16.5 mm. to 19.0 mm. Male Genitalia (from the neotype, specifically): Fig. 282. Valvae, caudad saccus, clear, wide-rimmed, parabolic, indented; clear areas of bilobed configuration not uniformly sculptured, rather, narrowing caudad, increasing the sudden width of the rims. Valvae, lateral view, round-tapered; valvae, caudal extension, tapered. Vinculum not flared at base; spurs only apparent basad. Saccus reduced, equal in length to width of vinculum directly caudad; cornuti, dorsal, narrow-tapered, ventral, spiked. Female Genitalia: Fig. 283. Characterized by lamellae and antrum of about equal caudal expanse. Former pointed centrad on the lamella postvaginalis. Caudad antrum, transparent area in ductus. Ductus long, exceeding three times caudal expanse of antrum. Signa broad based deeply bifurcate spines.

TYPE. Richard Vane-Wright and I have searched the BMNH collection for the type of amyntor. We are sure that if it exists it would be in the BMNH with the other Cramer types. We have assured ourselves that it is lost. I therefore have designated a neotype as follows: a male from French Guiana (labelled Guyane Francaise), by C. Bar; BMNH. It is clearly labelled as the neotype of amyntor. Clench's holotype of amyntor distractus is in the BMNH. The location of the type of menalcus Cramer is unknown. Type Locality: Cramer's type locality of amyntor: Surinam. Locality of the neotype: French Guiana.

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Clench's type locality of amyntor distractus is Rio Minero, Colombia. Cramer's type locality for menalcus is Surinam.

DISTRIBUTION. Spatial: Fig. 537. As defined in this paper, known only from French Guiana, Guyana, Surinam, montane eastern Venezuela, Trinidad and Tobago, and the adjacent states of Brazil: Rio Blanco, northern Amazonas, and Amapa. Temporal: Dates on specimens range from February to August.

REMARKS. The name distractus has been accorded full species recognition and is part of a larger group of sister taxa distributed in various vicariant patterns north and south of the isthmus of Panama. The long-standing synonymy of menalcus Cramer has been maintained through comparison of the original descriptions, though the types of the latter have not been located or examined.

In all, I dissected thirteen males and ten females of amyntor not including those assignable to species discovered with the amyntor grade group during the course of the study.

Cyanophrys amyntoides, new species

Figs. 82, 83, 284, 285, 469

Thecla amyntor (of authors): This taxon has undoubtedly been identified as amyntor, but the nature of most South American literature as lists makes it impossible to render a synonymy.

DIAGNOSIS. This species, though it resembles members of the amyntor group in male wing characters, has very distinct genitalia, immediately noticeable in the male by the diminished caudal extension of the valvae to barely reaching or hardly exceeding the caudal tips of the falces articulation to the

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vinculum. The base of the vinculum is also so flared as to extend the entire vinculum distad. There are also other characters of the genitalia as mentioned below. Genitalia of the female resemble more species of the "amyntor group" but are distinct as outlined below. The characters of the wing in females resemble superficially Sandia fucius, ampulla, and marialis, also, and less so, the species Mesocyanophrys caramba and M. rachelae.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 469) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color dull iridescent Violaceous Blue. Thin areas of margins hindwing, and wider areas of forewing, especially costad, dull Raw Umber. Scent patch distad in discal area, blue. Recurved lobe of hindwing dully fuscous to slightly Chestnut, heavily fringed black. Tail at vein Cu_2, vein Cu_1 often extended distad. Fringe, both wings dark Raw Umber. Under Surface of the Wings: Ground color dull Winter Green to slightly brighter Dark Oriental Green. Area of forewing immediately cephalad hindwing smokey gray to Light Drab, blackish basad. Hindwing with faint areas of mesial band, anad, with white spots anal margin to vein Cu_1 M_2, bordered faintly basad red-brown. Distad deep red-brown recurved lobe dark red-brown blotches at "Thecla-spot" and in cell on either side. Fringe dark Raw Umber, slightly paler between veins near tail. Length of Forewing: 16.5 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 469) as typical of the genus. Frons green. Upper Surface of the Wings: Wide areas of forewing and hindwing, especially forewing costad, dark Raw Umber. Rest of wing shiny but dull Violaceous Gray. No scent patch distad in discal area. Tail at vein Cu_2 and slight tail at vein Cu_1, hindwing. Recurved lobe fuscous to slightly Chestnut, heavily fringed. Fringe, both wings, fuscous to slightly red-brown. Under Surface of the Wings: As on males, but marking on hindwing more emphatic, especially frequency and size of white mesial spots and extent of

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submarginal red-brown blotches and suffusion in limbal area, hindwing. Length of Forewing: 17.0 mm. (allotype). Male Genitalia: Fig. 284. Valvae, caudad saccus, clear, narrow-rimmed, broadly parabolic with slight corner at juncture with caudal extension, indented. Valvae, lateral view, round-tapered with extreme slope between narrow caudal area of caudal extension and area just caudad the caudal articulation. Valvae, caudal extension tapered. Saccus very short, equalling length of vinculum directly caudad. Base of vinculum extremely wide and flared; broad ovate spurs on vinculum; cornuti narrow-tapered. Female Genitalia. Fig. 285. Lamella postvaginalis hemispherical with caudal tip. Lamella antevaginalis only as distal lips at the caudal opening of the ductus. Antrum long, equally caudal length of lamella postvaginalis. Transparent area cephalad antrum comprising one-fourth to one-third remaining length of ductus; ductus narrow and straight except for slight club-end, four times length of antrum. Signum as bifurcate spine, one short prong and one widely hook-like prong.

TYPES. Holotype male (Fig. 82), Buena Vista, Province del Sara, Bolivia, July 1913. Allotype female (Fig. 83), Cuatro Ojos, Bolovia, November, 1913. Both deposited CMNH. Paratypes: CMNH: Puerta Guerta (Guertha?), Bolivia (two males, two females).

DISTRIBUTION. Spatial: Fig. 537. Known from several areas of the foothills and adjacent plains of the western Andes of northwestern South America: from northern Bolivia, the mountains of southeastern Peru and adjacent Acre State, Brazil, south to northwest Argentina. Temporal: Dates on specimens range from November to June.

REMARKS. Superficially, this species' wing patterns are like amyntor. The genitalia cannot be placed with any known species, only as a vicariant sister species of amyntor far to the west. I make the distinction because several

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species groups show distinct species which have evidently vicariated west of the Amazon. Their genitalia consistently differ from their eastern counterparts categorically. Thus, such taxa have significance to zoogeographical considerations which must be based on evaluations of apomorphic characters. Clench called my attention to Bolivian "amyntor." For further distribution records, see Material Examined. I dissected the entire type series, for genitalia, legs, and palpi.

ETYMOLOGY. The name latinized indicates the affinity to amyntor, the immediate sister species.

Cyanophrys howei, new species

Figs. 84, 286

DIAGNOSIS. Male characters of the wing resemble those of the amyntor group; the female is unknown. Genitalically, howei resembles no other; rather, it represents a configuration reminiscent of, but yet different from the herodotus group. C. howei can be recognized by the near "three-step" configuration of the caudal extension of the valvae and the wide-rimmed and ovate bilobed configuration. An immediate sister species is apparent in South America, durstorum; it resembles this configuration but with the valval structures much more elongate.

DESCRIPTION. Male: Head, thorax, abdomen, and legs as typical of the genus; palpi unknown. Frons green. Upper surface of the Wings: Brilliant Smalt Blue, brighter basad. Wide marginal band on both wings, becoming wider on apex of forewing deep Raw Umber to blackish. Scent patch distad in discal area, bright blue as ground color. Hindwing with margins slightly crennated, tail at Cu_2, and recurved lobe between outer and anal margins brightly chestnut above.

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Under Surface of the Wings: Ground color bright Chromium Green to Lettuce Green; occasional specimens more dull Stone Green; area of forewing immediately cephalad hindwing (nearly approaching one-half of wing area on this species) deep smoky gray, blackened basad. Hindwing with vague white spots, submarginally from cells 2A to M_3, some specimens only in cell Cu_1, other specimens appearing in all cells vein 2A to Rs. These edged basad deeply red-brown. Spot along vein emphatically white and 2A displaced distad to be in line with spots. Paralleling these are blotches of red-brown distad along margin, emphatic at cell M_3, less so in other cells. Fringe of hindwing obviously whitish paralleling black marginal line, and invading recurved lobe between anal and outer margins, which is bright Chestnut, edged black distad. Tail at vein Cu_2, white tipped. Length of Forewing: 17.0 mm. (holotype); 16.0 mm. (paratype). Female: Head, thorax, abdomen, legs and palpi as typical of the genus. Frons green. Upper Surface of the Wings: Extremely broad area of both wings, two-thirds of area, forewing, one-half of area, hindwing, deep Raw Umber to blackish. Bases of wings dull Violaceous Gray. No scent patch distad in discal area. Fringe, both wings, black. Tails at veins Cu_2, slight at vein Cu_1 and recurved lobe deeply black distad, latter with Chestnut centrad area. Tail at Cu_2 very long. Under Surface of Wings: Similar to males but with unique markings as follows: general markings as male but much more emphatic in occurrence and clarity, mesial line and limbal area; recurved lobe strikingly black with white slash basad; basad marking in area of "Thecla-spot" and nearly invading basad to mesial line, large patch of unique red-brown suffusion. Fringes, hindwing lush black-fringed interspaced with white in the areas of the tails. Length of Forewing: 18.0 mm. (allotype); 19.0 mm. (paratype). Male Genitalia: Fig. 286. Resembling characteristic configuration of herodotus group but with extreme wide rims in the bilobed area. Valvae, caudad saccus, clear,

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wide-rimmed, ovate, indented; valvae, lateral view, round-tapered slight funnel caudad; valvae, caudal extension, three-step; saccus, reduced length barely exceeding that of vinculum directly caudad; vinculum hardly flared, spurs largely rectangular. Cornuti, thin tapered. Female Genitalia: Fig. 286[17]. Lamellae quite hemirectangular, lamella antevaginalis about one-half caudal expanse of lamella postvaginalis. Antrum extremely elongate, nearly equal to caudal expanse of lamellae. Ductus long, thin, length equalling two and one-half times breadth of lamellae. Signa bifurcate spines, one diminutive.

TYPES. Holotype male (Fig. 84), Presidio, Vera Cruz State, Mexico, June 1942, T. Escalante. Allotype female, same data, no date; both deposited AME. Paratypes. AME: Dos Amates, Veracruz State, Mexico, October 1969, Robert Wind (one female).

DISTRIBUTION. Spatial. Fig. 537. Presently known from only several localities in Vera Cruz State, Mexico. Temporal: Known from June to October.

REMARKS. This is another species which presents itself by the occurrence of a unique genitalic configuration. The precision of the cladistic system of analysis is demonstrated by its ability to find the sister taxon in South America, thus adding another vicariant species pair to the data available for such considerations from this Neotropical genus.

ETYMOLOGY. This species is named for William H. Howe.

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[17] figured with male because of subsequent addition to text.

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Cyanophrys durstorum, new species

Figs. 85, 287

DIAGNOSIS. Characters of the wing in males superficially resemble all taxa in the amyntor group; female is not known. Male genitalia of durstorum recognizable by very elongate "three-step" configuration of valval caudal extension with bilobed configuration exaggeratedly parabolic to nearly ovate (Fig. 549). Only other taxon with similar widely parabolic to nearly ovate bilobed condition is immediate sister species howei (see Fig. 549).

DESCRIPTION. Male: Head, thorax, abdomen, and legs as typical of the genus; palpi unknown. Frons green. Upper Surface of the Wings: Entire surface except thin areas of margins, bright iridescent Elton Blue. Scent patch distad in discal areas, blue as rest of wing. Wing fringe, black, both wings, white in cell interspaces, hindwing; margin of hindwing slightly crennated; recurved lobe of hindwing between outer and anal margin Chestnut, black distad. No tail. Under Surface of the Wings: Nearly immaculate bright Rheinemann's Green, tinted more yellowish. Area of forewing immediately cephalad hindwing deep gray-black nearly to margin, basad and distal areas more blackish. Hindwing with very slight arc of small black dots submarginal in all cells. Recurved lobe deeply black, slight white spot anad, becoming Maroon distad and with brownish Maroon margin and fringe. Length of Forewing: 16.0 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 287. Characterized by diminutive bilobed configuration in relation to rest of valvae. Valvae, caudad saccus, clear, narrow-rimmed, widely parabolic to ovate, slightly indented; valvae, lateral view, nearly irregular; valvae, caudal extension, slightly recurved caudad bilobed configuration, then tapered; saccus, reduced, barely longer than vinculum immediately

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caudad; base of vinculum hardly flared; spurs curved to rectangular; cornuti, narrow-tapered. Female Genitalia: Unknown.

TYPES. Holotype male (Fig. 85), Pelotas, Rio Grande del Sol, Brazil, 29 March 1953, C. M. de Biezanko. Deposited AMNH.

DISTRIBUTION. Spatial: Fig. 537. Known only from the type locality. Temporal: Known only from March.

REMARKS. The unique genitalic configuration of this species assures species status and suggests strongly its affinity as a vicariant sister species of howei. The Biezanko collection, representing many years of collecting in one Brazilian area, has produced a number of unusual new taxa known from only a few specimens. Given the low density and infrequence of regular geographic occurrence in many tropical biota, it may be that Biezanko's intensity of collecting is responsible for the number of new species represented in his highly localized collection.

ETYMOLOGY. This species is named for Dr. and Mrs. Mose Durst.

Cyanophrys pseudocallophria, new species

Figs. 86, 87, 288, 289, 470

DIAGNOSIS. An amazingly distinct species, with wing patterns resembling species in the amyntor group, but with female genitalia unique. Females with an extremely sculptured lamellae, not like Cyanophrys but quite like European members of the genus Callophrys. Male configuration similar to other males of amyntor group. Males also with a unique wing character: white markings anad on the mesial line, including one displaced distad, are all connected as a jagged line.

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DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 470) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color bright Violaceous Blue; margins, both wings, fuscous to blackish, about 2 mm., widening at apex of forewing and anad along hindwing. Scent patch distad in discal area, slightly duller than rest of wing; tail at vein Cu_2; recurved lobe Chestnut centrad, circumferenced fuscous to black; fringe blackish, white distad, especially anad on the hindwing. Under Surface of the Wings: Ground color bright Winter Green to Oriental Green. Forewing with wide area cephalad hindwing dull blackish-gray. Hindwing with median band of white spots, obsolescent to absent cephalad, brightly white and bordered basad with black to red-brown anad. Spot most anad in median line displaced distad, but this spot and others immediately costad in median line connected as bright white line, bordered strongly basad with black, giving slight appearance of jagged line. Recurved lobe black distad, Chestnut to Maroon centrad; fringe blackish, but white distad in the cell interspace, anad. Length of Forewing: 16.0 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 470) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color dull Violaceous Gray, wide areas of forewing (especially at apex) and hindwing (especially cephalad) dull fuscous to black. Tail at vein Cu_2. Recurved lobe dull brown to Chestnut; fringe, both wings fuscous to blackish, slightly lighter distad in cell interspaces, hindwing, almost white occasionally anad. Under Surface of the Wings: Generally similar to males but pattern of median arc of spots more widely rounded (as is wing shape) and generally more prominent. Displaced spot anad not connected obviously with others of median arc as on male; but attached more prominently with various blotches of red-brown in the submargin anad. Recurved lobe emphatically circumferenced black, centrad variously bright Chestnut to Maroon, often bordered white basad. Fringe both wings, fuscous to

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black; anad on hindwing blacker with obvious white distad in crennated cellular interspaces. Length of Forewing: 16.5 mm. (allotype). Male Genitalia: Fig. 288. Valvae caudad saccus, clear, wide-rimmed, bevel-rimmed, deeply indented. Bilobed configuration with clear areas irregularly shaped, narrowed caudad. Valvae, caudal extension tapered. Saccus reduced, no longer than width of vinculum directly caudad; base of vinculm flared; vinculum only slightly spurred; cornuti, dorsal narrow-tapered, ventral spiked. Female Genitalia: Fig. 289. Remarkably similar to Palaearctic Callophrys. Lamella postvaginalis distinctly lobed, trilobed, like a "clover," with distinct convolution between. Lamella antevaginalis distinctly sloped caudad; ductus very narrow, especially centrad, two times length of antrum to caudal tip of lamellae. Signa as single long spines, only vaguely bifurcate centrad.

TYPES. Holotype female and allotype male, S. Paraguay, Perens deposited BMNH. Paratypes: BMNH: as on holotype (one female); Sabara-Balho Horizonte, Rio das Velhao, Brazil (one female); Menatoas, Brazil? (one female). AMNH (AIL): Calilegua, Jujuy, Argentina, 12 February 1950 (one male).

DISTRIBUTION. Spatial: Fig. 537. Known only from the localities of the type series. Temporal: Known only from February.

REMARKS. The configuration of the female genitalia of this species is so bizarrely like that of European females of the genus Callophrys as to indicate perhaps a misplaced abdomen, if other specimens had not been located. Callophrys is one of the immediate sister genera of Cyanophrys but any reason other than extreme convergence cannot be suggested for this remarkable resemblance. The male configuration does not approach that of Callophrys in any similar way. The entire type series was dissected for genitalia, legs, and palpi.

ETYMOLOGY. The Latin name indicates the similarity to Callophrys characters.

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Cyanophrys innocuus, new species

Figs. 89, 291, 292, 471

DIAGNOSIS. This species can only be confused with the others having an immaculate green underside, Cyanophrys embolos and members of the legionis species group, Mesocyanophrys. From the latter taxa, innocuus is easily separated by its smaller size (forewing length about three-fourths or less that of the former) and light silvery blue of the male upperside (whereas legionis et al. are deep indigo blue). C. innocuus lacks lighter green submarginad on the hindwing (on legionis et al. this appears nearly as a lighter green broken band), though they are sometimes indistinguishable. C. innocuus has female genitalia characteristic of Cyanophrys, while those of embolos and legionis et al. characterize Mesocyanophrys.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 471) as typical of the genus. Frons green. Upper Surface of the Wings: Entirely iridescent Clear Green-Blue Gray except for extreme margins which are dark Raw Umber. Scent patch distad in discal cell. Fringe, both wings, brown. Under Surface of the Wings: Completely immaculate Rainette Green. Dark markings in limbal area on type specimen are result of a patching of the wing by a preparator. Length of Forewing: 11.0 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 471) as typical of the Genus. Frons green. Upper Surface of the Wings: Distal one-half of forewing curving from costa across apex and caudad along outer margin light Raw Umber, rest of wing slightly shiny Payne's Gray. Hindwing marginal one-half light Raw Umber, rest dull Payne's Gray. Fringe, Raw Umber, both wings. Under Surface of the Wings: As on male. Length of Forewing: 11.0 mm. (allotype). Male Genitalia: Fig. 291.

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Valvae, caudad saccus, clear, parabolic, indented; valvae, lateral view, round-tapered; valvae, caudal extension, tapered; configuration of bilobed area and caudal extension quite ellipsoidal, resembling no other species; saccus, reduced (length less than one-half length of bilobed configuration), parabolic; cornuti not known, aedeagus broken. Female Genitalia: Fig. 292. Resembling sicrana but without any lamella antevaginalis. Lamella postvaginalis hemispherical, transparent line centrad; lamella antevaginalis only as slight sclerotized lips distad caudal opening of ductus; ductus only slightly longer than breadth of lamellae; transparent area caudad antrum about one-sixth length of ductus; signum a single curved spine anchored on sclerotized plate.

TYPES. Holotype male (Fig. 89) and allotype female, Pelotas, Rio Grande de Sol, C. M. de Biezanko, 27 June 1956. Deposited MCZ.

DISTRIBUTION. Spatial. Fig. 537. Known only from the type locality. Temporal: Known only from June.

REMARKS. The male and female are associated by wing pattern and collection data. This species is evidently another example of a new species known from only a few specimens turned up by Biezanko's many years of highly localized collecting.

ETYMOLOGY. The name, rendered in Greek, refers to the uninteresting appearance of this species, evidently causing it to be ignored by those who have examined the MCZ collections.

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5. The iggii Group

including iggii--chapadaensis/fragmentus.

A. Cladogram and Characters, Fig. 567a.

B. Distribution, Fig. 538.

Cyanophrys iggii, new species

Figs. 90, 293, 472

DIAGNOSIS. Male immediately recognized by reduced expanse of iridescent blue on forewing upper surface. Ground color very dull iridescent Violaceous Blue, but as on no other congener, wide area of forewing apex dull fuscous, emphatic distad and blending gradually with blue iridesecnce toward discal area. Female unknown.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 472) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color very dull Violaceous Blue; wide area of forewing apex dull fuscous blending gradually with blue iridescence in discal area. Rest of wings with narrower submarginal to marginal fuscous. Scent patch distad in discal area, appearing slightly visible above dull fuscous. Hindwing with noticeable white cellular interspace distad along anal margin. Fringe otherwise generally fuscous. Recurved lobe dull fuscous; tail at vein end Cu_2. Under Surface of the Wings: Ground color Bice Green to noticeably more yellowish. Forewing immaculate save emphatic gray-brown area immediately cephalad hindwing. Hindwing with variously emphatic median line of white spots, occasionally slash-like in

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appearance, becoming more prominent and frequent anad. These bordered noticeably basad with black, especially anad, giving meandering appearance. Tail at Cu_2often bordered basad with gray or black; recurved lobe mostly black, slightly brown basad. Marginal fringe somewhat checkered white, anad on hindwing. Length of Forewing: 16.5 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 293. Similar to chapadaensis. Valvae, caudad saccus, clear, mid-rimmed, broad parabolic, indented; valvae, lateral view, round-tapered; valvae caudal extension, tapered. Saccus extremely wide and long, length exceeding three-fourths length of entire valvae, width nearly one-third length. Cornuti dorsal, wide-tapered, ventral blunt. Base of vinculum only slightly flared; vinculum only slightly spurred, spurs rectangular.

TYPE. Holotype male, Petropolis, Rio de Janeiro State, Brazil, C. Callaghan, 3 October 1971, deposited AME.

DISTRIBUTION. Spatial: Fig. 538. Known only from type locality. Temporal: Known only from October.

REMARKS. The very different upper surface markings of iggii testify to the species diversity of Cyanophrys and how few of the actual species had been described prior to this paper.

ETYMOLOGY. This species is named for Mr. Ignacio ("Iggi") Fajardo.

Cyanophrys chapadaensis, new species

Figs. 91, 92, 294, 295, 473

DIAGNOSIS. Not easily recognized by wing characters though it can be suspected by nearly complete postmedian line of white spots on the hindwing underside, each edged with deep red-brown, and the spot in cell 2A being in the

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same plane as two red-brown spots distad the white spots in cells Cu_2 and Cu_1. This pattern is similar to distractus but the genitalia relate the species to this small cluster, the iggii species group. The two taxa in this cluster may be recognized by the wide-parabolic bilobed configuration and the extremely tapered and short (not exceeding caudal extension of uncus) caudal extension of the valvae, among other characters (see below under Genitalia). The female genitalia have a very flared antrum adjoining hemispherical lips of the lamella antevaginalis only slightly less extended caudad than those of the lamella postvaginalis and an extremely bifurcate signum with one prong exaggeratedly long and curved (see also below under Genitalia).

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 473) as typical of the genus. Upper Surface of the Wings: Brightly iridescent Dark Diva Blue, except for extreme apex and margin of forewing (though margin wide enough to be a band, not a border), and extreme margin of hindwing (here a border, not a band) which are extremely dark, nearly black Raw Umber. Presence or absence of tail not entirely confirmed on known specimens (known specimens lack tail and are in good condition, however). Fringe of hindwing, especially between veins 2A and M_3, white; recurved lobe of hindwing, bright Chestnut. Under Surface of the Wings: Entire under surface Turtle Green except area of forewing immediately cephalad hindwing; here wing Light Drab and at forewing base, suffused black. Hindwing with postmedian line of spots across entire wing, white in cells 2A, Cu_2, Cu_1, and M_1; brown in cells Rs cephalad and very reduced in cell M_2. White spot in cell 2A not in same plane as others but with two brown spots distad the white spots in Cu_2 and Cu_1. Margin of hindwing thinly Chestnut brown; recurved lobe at junction of outer and anal margin, black caudad, russet cephalad. Length of Forewing: 16 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi as typical of the genus. Frons

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green. Upper Surface of the Wings: Entire wing except apex and submargins of forewing and margins of hindwing shiny Light Gull Gray to Gray, somewhat suffused gray-blue. Recurved lobe at junction of outer and anal angle bright Chestnut, tipped caudad with black. Length of Forewing: 15 mm. (allotype). Male Genitalia: Fig. 294. Valvae, caudad saccus, wide parabolic, indented; valvae, lateral view, irregular. Valvae, caudal extension, extremely tapered; saccus reduced, parabolic; cornuti as illustrated, teeth along entire side of cephalad cornutus. Female Genitalia: Fig. 295. Ductus very long (length under three times breadth of lamellae). Antrum very flared to wide lips of lamella antevaginalis, these only slightly less extended caudad than lips of lamella postvaginalis; arcs of margins of lamella nearly parallel. Transparent area in ductus cephalad antrum; ductus ended cephalad with club-end, only slightly wider than ductus (only circa one-ninth length). Signum widely bifurcate, caudad spine very long and curved.

TYPE. Holotype male (Fig. 91), Chapada, Mato Grosso, Brazil; no other data, deposited AMNH; allotype female (Fig. 92), same data, deposited BMNH.

DISTRIBUTION. Spatial: Fig. 538. Known only from the type locality. Temporal: Unknown.

REMARKS. The male and female are associated by locality and similarity of wing pattern.

ETYMOLOGY. The latinized species name indicates the type locality, which is quite northwest of the distribution of most congeners.

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Cyanophrys fragmentus, new species

Figs. 72, 269, 462

DIAGNOSIS. A number of characters are unique: underside of the forewing costad, Light Drab, area cephalad hindwing, a definite arc of blue (Parula Blue with a green cast). Postmedian line reduced to very small white dots, one each in cell Sc + R_1, M_2, and Cu_1 being quite basad one in 2A and two small brown spots distad this in Cu_2 and Cu_1. Male genitalia, very distinct, and extremely long saccus (length = breadth of vinculum caudad saccus) resembling those of herodotus and miserabilis but valval configuration resembling longula and chapadaensis: extremely tapered caudal extension barely exceeding caudal tips of falces where they articulate on vinculum. Like longula and chapadaensis, bilobed configuration caudad saccus parabolic and indented, but fragmentum has much narrower rims, and a gently shouldered condition not as extremely concave as it tapers caudad. The edges of the cephalad cornutus are entire, and the caudad cornutus has a definite spiny knob at its end.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi as typical of the genus. Frons green. Upper Surface of the Wings: Ground color dark iridescent Tyrian Blue. Only thin areas of margins black to fuscous; scent patch distad in discal area, same blue as ground color. Tail at vein Cu_2. Recurved lobe dark Raw Umber, only vaguely Chestnut centrad. Under Surface of the Wings: Ground color bright Oriental Green to Rheinemann's Green. Forewing with area immediately cephalad hindwing, Light Drab and junctured with rest of green ground color by dark Parula Blue border. Hindwing with very faint whitish marking in mesial line in cells Rs, M_2, and Cu_1, and with three very prominent submarginal markings anad from anal margin to cell Cu_1, the latter

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being a clear black crescent at the area of the "Thecla-spot". Recurved lobe deep Maroon. Fringe blackish, especially black at tip of vein Cu_1, slightly extended, and at tail, vein Cu_2. Length of Forewing: 15.0 mm (holotype). Female: Unknown. Male Genitalia: Fig. 269. Valvae, caudad saccus, clear, narrow-rimmed, parabolic, indented; valvae, lateral view, round-tapered; caudal articulation of valvae to vinculum strongly curved cephalad; valvae, caudal extension, tapered; saccus, extremely long, over one-half entire length of valvae and narrow nearly entire length; base of vinculum, not flared; vinculum not spurred; cornuti, narrow-tapered. Female Genitalia: Unknown.

TYPE. Holotype male (Fig. 72). Parecis Mountains, Guaporo State, Brazil; deposited AMNH.

DISTRIBUTION. Spatial: Fig. 535. Presently known only from the type locality, an area with few Cyanophrys other than this species known. Temporal: Unknown.

REMARKS. This unique specimen is a fine example of how limited local collecting in the tropics often produces specimens representing new taxa from little known areas. This common phenomenon is one explanation of the vast number of new taxa discovered during this study from the tropical genera of Callophryina, and applies to most new Cyanophrys species represented by only a few specimens.

ETYMOLOGY. The name is Latinized meaning "fragment". It refers to the distantly allopatric range indicated by this species relative to other distributions on this species group.

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6. The circumcyanophrys Group

including eiselei/clenchi--circumcyanophrys--embolos.

A. Cladogram and Characters, Fig. 567b.

B. Distribution, Fig. 539.

Cyanophrys eiselei, new species

Figs. 94, 95, 296, 297, 474

DIAGNOSIS. This species with numerous unique genitalic characters may best be recognized superficially by its being from the western Amazon of Brazil and the Amazon headwaters in Colombia, Peru and Ecuador. Males, above, appear slightly like herodotus or sicrana but are deeper blue above and boldly green beneath with various white mesial lines of spots and bold red-brown to maroon limbal margins. Females look like amyntor but with a sharply medianly angled hindwing. The genitalia have relatively primitive characters and since such might place its phenetic characters between those of the herodotus and amyntor groups, this best explains the very distinct genitalic configuration: males with distinctive lobe on cephalad end aedeagus, otherwise appearing slightly like herodotus, sicrana, clenchi or andromimikos, except caudal extension of valvae relatively much shorter, only equalling or barely exceeding caudal length of bilobed configuration, saccus short and pointed, not funnel, and ventrad cornutus much more widely hemispherical than on any of these four species above; females appearing like amyntor group, but with ventral sclerotization of lamella antevaginalis resemblant of herodotus group, as illustrated.

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DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 474) as typical of the genus. Frons green. Upper Surface of the Wings: Bright iridescent Diva Blue; narrow areas of the margin, hindwing, and margin and apices forewing deep Raw Umber to blackish. Scent patch distad in discal cell, same color as wing. Recurved lobe of hindwing between outer and anal margins Chestnut, but dull from hairy overscaling; fringe, both wings, blackish, slightly whitish, limbal area, hindwing. Under Surface of the Wings: Ground color emphatic Caliste Green to Light Bice Green. Area of forewing immediately cephalad hindwing brownish gray, overscaled smoky, extending distad to margin. Hindwing with mesial row of emphatic white spots, usually in cells Sc + R_1, M_1, and Cu_1 anad, occasionally complete, edged basad red-brown to Maroon. Distad these in limbal area, small to medium red-brown or Maroon blotches especially in cell Cu_1. Recurved lobe of hindwing deep maroon, heavily fringed black distad. Fringe, both wings, maroon to red-brown, whitish distad in limbal area anad cell Cu_1. Length of Forewing: 14.5 mm. (holotype), $\bar{X}$ of four males, AME, 14.6 mm., range 14.0 mm. to 16.0 mm. Female: Head, thorax, abdomen and palpi (Fig. 474) as typical of the genus. Frons green. Upper Surface of the Wings: Base of forewing and discal area of hindwing Deep Violet Plumbeous to Payne's Gray. Very wide areas of costa, apices, and margins of both wings being Raw Umber to fuscous. Margin of wings angled centrad making distal wing shape appear as formed by two straight lines intersecting to form an obtuse angle. Recurved lobe of hindwing bright Chestnut edged distad with black and extending somewhat anad. Long tail at vein Cu_2 and slight tail-like tuft at Cu_1. Fringe, both wings, black, white in limbal area between costa and anad tails. Under Surface of the Wings: As on males, but red-brown markings distad white mesial line in limbal area much more expansive, and slash or crescent in shape. Length of Forewing: 14.5 mm. (allotype). Male Genitalia: Fig. 296. Characterized by

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cephalad bulbous end on aedeagus. Valvae, caudad saccus, clear, narrow-rimmed, oval slightly indented; valvae, lateral view, slightly irregular due to ovate bilobed shape; valvae, caudal extension, tapered. Saccus, pointed; cornuti, ventral, widely hemispherical, dorsal, blunt-ended and spined; cephalad end of aedeagus with secondary terminal bulbous knob. Female Genitalia: Fig. 297. Lamella postvaginalis pointed centrad; lamella antevaginalis sclerotized distad, angled sharply caudad relative to antrum; rest of lamella antevaginalis approaching about one-half caudal expanse of lamella postvaginalis. Antrum very distinct; cephalad antrum wide transparent area, exceeding one-fourth remaining length of ductus. Ductus long, nearly four times length of antrum; signa deeply bifurcate spines first much broader basad and longer than second, set on highly sclerotized base.

TYPES. Holotype male (Fig. 94) and allotype female (Fig. 95), Obidos, Amazones State, Brazil, leg. Le Moult. Deposited AME. Paratypes: AME: Teefe, Amazones State, Brazil, leg. Le Moult (one male); Satipo, Peru, June 1944, Leg. P. P. (one male); Tolima Province, Colombia, Rio Prio, Payande, Mina Vieja area, 950 m., 24 March 1974, S. and L. Steinhauser (slightly variant male); Para Obidos, Amazones State, Brazil, October 1930, leg. Le Moult (one female).

DISTRIBUTION. Spatial: Fig. 539. Known from several areas in the headwaters region of the Amazon River in western Brazil, eastern Colombia and eastern Peru. Temporal: Known from March to October.

REMARKS. This species and its sister taxa of the circumcyanophrys group are of particular interest because they are regionally sympatric with sicranoides but have characters relatively more primitive than the entire herodotus group, as especially evident in the female genitalia which are much more reminiscent of the relatively more primitive states of the amyntor group. The entire type series was dissected for genitalia, legs, and palpi.

ETYMOLOGY. This species is named for Rev. Roberto C. Eisele.

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Cyanophrys clenchi, new species

Figs. 93, 298, 475

DIAGNOSIS. Though reliability of wing characters uncertain, mesial white band on hindwing nearly lacking on presently known specimens; prominent markings amounting only to the distal red-brown limbal dots on hindwing under surface. Male genitalia unmistakable: caudal extension of clenchi very long, far exceeding caudal extent of the uncus, while on eiselei caudal length approaches or barely exceeds that of uncus; bilobed configuration of eiselei ovate and cornered prior to the caudal extension, in clenchi no corner and entire bilobed structure broadly eliptical. Ventral cornutus of clenchi not broadly hemispherical as on eiselei but blunt ended like dorsal; bulbous knob on cephalad end of aedeagus reduced on clenchi about half the size as on eiselei.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 475) as typical of the genus. Upper Surface of the Wings: Violaceously iridescent Navy Blue; narrow areas of the margins, both wings, and apices forewings dull Raw Umber to blackish; short tail at vein Cu_2; fringe, both wings brown. Under Surface of the Wings: Ground color Paris Green area of forewing immediately cephalad hindwing smoky gray-black, extending to margin. Hindwing with three vague red-brown limbal markings cells Cu_1 to the anal margin. There is only slight evidence of a recurved lobe between the outer and anal margins; it is colored red-brown. Fringe, both wings, red-brown. Length of Forewing: 14.0 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 297. Somewhat resembling eiselei in general shape but markedly different as follows: caudal extension of valvae extremely long, far exceeding caudal end of uncus; ventral cornutus not disclike but blunt-ended; cephalad knob on aedeagus reduced. Valvae, caudad saccus, clear, mid-rimmed roundly parabolic and unindented;

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valvae, lateral view, nearly irregular due to character of bilobed configuration; valvae, caudal extension, tapered; saccus pointed; vinculum not flared cephalad; pointed spurs caudad. Female Genitalia: Unknown.

TYPES. Holotype male (Fig. 93), Rio Mamore, Bolivia, deposited, AMNH.

DISTRIBUTION. Spatial: Fig. 539. Known only from the type locality. Temporal: Unknown.

REMARKS. The genitalia of this species indicate it is the immediate sister species of eiselei, especially since it exhibits a reduced state of the noted aedeagal character of this species. However, the extent of the genitalic differences make species differentiation between the two taxa absolutely necessary, marked differences occurring in cornuti, valvae and aedeagus well exceeding those generally associated with species limits in Cyanophrys. A good standard for morphological species limits in Cyanophrys is that of the several allopatric populations of Cyanophrys herodotus from Mexico south to Panama (see REMARKS under herodotus).

ETYMOLOGY. I am happy to name this new species after the late Mr. Harry K. Clench.

Cyanophrys circumcyanophrys, new species

Figs. 96, 299, 476

DIAGNOSIS. Consistently smaller than congeners (known forewing length 11-12.0 mm.); underside of hindwing with markings limited to vague red-brown blotches in the limbal cell spaces on males, females with a few complementary white mesial spots in the same area. Genitalia characteristic of the circum-

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cyanophrys group, thus similar to clenchi and eiselei, differing mainly as follows: female with "amyntor-like" configuration--no sclerotized plate ventrad on the lamella antevaginalis, lamella antevaginalis almost equalling lamella post-vaginalis in caudal expanse, transparent area caudad antrum very constricted. Male genitalia of circumcyanophrys resembling taxa of circumcyanophrys and herodotus groups but bilobed configuration extremely shouldered and both cornuti uniquely disclike, representing a relatively primitive condition.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 476) as typical of the genus. Frons green. Upper Surface of the Wings: Iridescent dark Cyanine Blue with broad (2-3 mm.) marginal borders of dark Raw Umber to black on both wings. Scent patch distad in discal cell. Short tail at vein Cu_2. Recurved lobe between outer and anal margins black, fringes, both wings, black. Under Surface of the Wings: Bright Rheinemann's Green to Grass Green; area of forewing immediately cephalad hindwing smoky gray nearly to margin. Hindwing nearly immaculate except for occasional mesial spot in limbal area, small, white, and scattered red-brown blotches distad in the limbal submargin. Fringe, both wings, red-brown to smoky, recurved lobe of hindwing between outer and anal margins black, with small white spot anad. Length of Forewing: 12 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 476) as typical of the genus. Upper Surface of the Wings: Basal half to third of forewing and area of hindwing except submargin dark Payne's Gray with bluish cast, rest of wings very deep Raw Umber to black. Fringe, both wings black. Tail at vein Cu_2, tuft at vein Cu_1; recurved lobe between outer and anal margins Chestnut, fringed black distad. Under Surface of the Wings: As on males, but with a few more mesial spots visible in limbal area. Length of Forewing: 11 mm. (allotype). Male Genitalia: Fig. 299. Characterized by shouldered shape of bilobed configuration, generally ovate in other species and by both cornuti being

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disclike, not one tapered. Valvae, caudad saccus, clear, narrow-rimmed, shouldered and not indented; valvae, lateral view, nearly irregular due to shape of bilobed configuration; valvae, caudal extension, modified "three-step" because of shouldered bilobed configuration, only caudal one-third of extension tapered; saccus funneled; base of vinculum not flared; vincular spurs elliptical to rectangular. Both cornuti disc-like.

TYPES. Holotype male (Fig. 96), Colon, Pina, Panama, 300 m., 27 April 1971, H.L. King; allotype female, same data as holotype, but 100 m., 20 March 1971,
H.L. King. Deposited AME.

DISTRIBUTION. Spatial: Fig. 539. Presently known only from Panama. Temporal: Presently known only from March and April.

ETYMOLOGY. The latinized name infers "connecting", referring to the nature of the male and female genitalia, characterizing this species as one with characters quite "herodotus-like" in males and "amyntor-like" in females.

Cyanophrys embolos, new species

Figs. 88, 290

DIAGNOSIS. In Cyanophrys, this species, because of its immaculate green underside, resembles only Cyanophrys innocuus from which it can be separated by the distinct female genitalia of that genus (see below and under C. innocuus). It also, however, resembles the species of the legionis group in Mesocyanophrys. From the latter it can be distinguished by its lack of any lightening of the green in the submargins of the hindwing. In the latter species group this tendency causes an almost lighter, though broken, submarginal band. Further, the black

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margins on the wing upper surface are far more extensive on embolos. The genitalia are distinct, embolos having quite angled tapering between the antrum and the caudal slope of the lamella antevaginalis, instead of widely flaring, and with the ductus of embolos noticeably constricted caudad the antrum and then flaring again to its cephalad extension. The signa of embolos are widely bifurcate and anchored on a broadly sclerotized plate, while on the other they are a single spine with only a slight bifurcation extremely basad.

DESCRIPTION. Male: Unknown. Female: Head, thorax, abdomen and legs as typical of the genus; palpi unknown. Frons green. Upper Surface of the Wings: Forewing with distal two-thirds apically, and distal one-half marginally dark Raw Umber, rest of wing dull Payne's Gray. Hindwing with distal one-half cephalad and distal one-third caudad dark Raw Umber, rest of wing dull Payne's Gray. Fringe Raw Umber, vein ends darkened. Under Surface of the Wings: Entirely immaculate Migonette to Rainette Green. Length of Forewing: 12.0 mm. (holotype). Male Genitalia: Unknown. Female Genitalia: Fig. 290. Ductus particularly thin for group, slightly constricted caudad lamellae. Lamellae broadly elliptical, lamella antevaginalis markedly shorter in caudal expanse than lamella postvaginalis. Signa moderately bifurcate spines, one considerably longer than other.

TYPE. Holotype female (Fig. 88), Lanhares, Espirito Santo State, Brazil, May 1973 by C. Elias; deposited AME.

DISTRIBUTION. Spatial: Fig. 537. Known only from the type locality. Temporal: Known only from May.

REMARKS. This was a dull little specimen placed with undetermined material. It proved to be a new species.

ETYMOLOGY. The Greek name embolo means "dull", referring to the uninteresting appearance of this insect.

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7. The herodotus Group

including herodotus-- --ruthi/alexanderorum--sicranoides-- -- --priscilla/andromimikos--sicrana.

A. Cladogram and Characters, Fig. 571.

B. Distribution, Fig. 540.

C. Characteristic Genitalic Configurations, Fig. 548.

Cyanophrys herodotus (Fabricius), new combination

Figs. 300, 301, 477.

Hesperia herodotus Fabricius, 1793, p. 258.

Polyommate herodote: Latrielle, 1819, p. 602.

Polyommatus herodotus: Godart, 1823, p. 641, no. 89.

Papilio herodotus: Donovan, 1842, p. 93, pl. 39, f. 2.

Chalybs herodotus: Kaye, 1921, p. 103.

Thecla herodotus: Hewitson, 1869, p. 33; 1877, p. 205, t. 82, f. 680. Godman and Salvin, 1887, p. 33. Seitz, 1919, p. 762, pl. 153, fig. 1. Huntington, 1932, p. 210. Hoffman, 1940, p. 707. Clench, 1944, p. 230; 1946, p. 152. Comstock and Garcia, 1960, p. 420. Hayward, 1973, p. 152.

Thecla heredotus (sic): Zikan and Zikan, 1968, p. 56.

Thecla leucania Hewitson, 1868, p. 33. Kirby, 1896, p. 399. Seitz, 1919, p. 762 (placed as synonym of herodotus). Clench, 1946, p. 284.

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Thecla lucania (sic): Comstock and Huntington, 1961, p. 115.

Thecla sicrana E. Jones, 1912, p. 897, pl. 97, fig. 3. Franz and Schroeder, 1954, p. 85. Clench, 1946, p. 159 (placed as synonym of herodotus).

Callophrys herodotus: Field, 1939, p. 347.

species herodotus: Comstock and Huntington, 1960, p. 181.

Thecla detesta Clench, 1946, p. 155. NEW SYNONYMY.

DIAGNOSIS. This species represents only one taxon within an array of species which have formerly been included under its name. It is quite distinct from these as outlined below. Superficially the male wing characters are like those of the entire "herodotus group", but the genitalia resemble only the immediate sister taxa sicrana and sicranoides which I have chosen to consider distinct species, based mostly on allopatry and the female genitalia. The male genitalia of these three taxa are thin-rimmed and emphatically ovate on the bilobed configuration like no other species in the genus; they also share a distinctly compact three-step caudal extension. However, the bilobed area on sicrana and sicranoides is more elongate cephalad, tending toward or being indented, and tapered much less ovate. On the female genitalia, herodotus has a ductus which is two times or exceeding two times breadth of its lamellae, while on sicrana this ratio is about equal; the ratio on sicranoides is about one and one-half times. These ductal differences are enough to immediately separate the species and are reinforced by differences in the shape and degree of sclerotization on the lamella antevaginalis and the character of the signa. The species herodotus has a moderately sclerotized lamella antevaginalis which has a caudal expanse never exceeding one-half that of the lamella postvaginalis; on sicrana the lamellae are almost of equal expanse, and on sicranoides the lamella ante-

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vaginalis is about three-fourths the expanse of the lamella postvaginalis. The latter species has sclerotizations so thick as to become "plates."

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 477) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color bright Violaceous Blue. Only most extreme margins of both wings dark Raw Umber to fuscous. Scent patch distad in discal area, same color as rest of wing. Tail at vein Cu_1, sometimes disappearing westward in Colombia; hindwing, recurved lobe thin, circumferenced black, Chestnut within. Under Surface of the Wings: Ground color Rheinemann's Green, Winter Green to brighter Oriental Green. Area of forewing immediately cephalad hindwing dull gray brown nearly to margin. Thinnest areas of margins with black marginal line. Forewing immaculate, hindwing with variously occurring to obscure white or yellowish specks, sometimes dots or small mesial lunules across the wing from anal margin to costa. Most anad of these sometimes slightly bordered red-brown basad. Occasional slight parallel red-brown spots distad these. Recurved lobe of hindwing dark Chestnut to Maroon, often circumferenced black, bordered immediately cephalad with thin white slash. Tail at vein end Cu_2, but disappearing in some regional populations westward to Colombia. Length of Forewing: $\bar{X}$ of 10 specimens, AMNH, 15.2 mm., range 14.8 mm. to 15.5 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 477) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color Violaceous Gray to duller Payne's Gray; wing shape more rounded and broad than on males. Wings above often sheened bright, with broad areas of costa, margins and submargins, both wings, and apex, forewing dull fuscous to Raw Umber. Tail at vein Cu_2 hindwing, sometimes disappearing westward in Colombia populations. Recurved lobe of hindwing dully circumferenced black, Chestnut within. Fringes fuscous, lighter

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distad. Under Surface of the Wings: Similar to males, but with spots of anad to costad transverse line consistently more emphatic. Complementary red-brown suffusions distad in the anal region consistently less expressed than on males. Length of Forewing: $\bar{X}$ of 10 specimens (AMNH, AME), 14.6 mm., range 14.0 mm. to 15.0 mm. Male Genitalia: Fig. 300. Characterized by distinct three-step configuration of the caudal extension and by the broadly ovate and thin-rimmed bilobed configuration. Valvae, caudad saccus, clear, narrow-rimmed, largely ovate, generally unindented; valvae, lateral view, round tapered but with thickened area between the "round" and "tapered" due to the short three-step caudal configuration; valvae, caudal extension, distinctly three-step, each step quite short. Saccus broadly thickened caudad, then long and parabolic cephalad. Base of vinculum not flared; spurs long, rectangular and spinelike. Cornuti as illustrated. Female Genitalia: Fig. 301. Characterized by the sclerotized plates ventral on the lamella antevaginalis and by the short ductus. Lamellae somewhat hemispherical, lamella antevaginalis about one-half caudal expanse of lamella postvaginalis. Former with ventrad trapezoidal sclerotized plates very apparent. Ductus length about two to two and one-half times breadth of lamellae, consequently wide, slightly flared cephalad. Signa with broad base, then bifurcate centrad.

BIOLOGY. Early Stages: The larvae feed on blossoms (see below). I have located uncurated material in NMNH, several specimens reared, which have accompanying notes and pupal cases. I will describe this material in a separate paper. Foodplant: The foodplant of material noted as reared in the NMNH collection was raised on Lantana camarra L. (Verbenaceae), following observation of oviposition on the blossoms of these plants. This is the only known foodplant data for any of the South American Cyanophrys sens. lat.

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TYPES. Information available on the types is limited to Comstock and Huntington's work which states the location of the type as not known, and Zimsen's study of Fabricius types which also does not record its location. See Remarks below for further discussion involving possible existence of the types. Because of these considerations, I do not designate a neotype. If, however, one is desired in the future, specimens from Trinidad-Tobago would satisfy Fabricius' type locality "in Indies". Since herodotus is the only Cyanophrys sens. lat. occurring in the Antilles (other than the unique species crethona endemic to Jamaica), I use Trinidadian material as the basis for my own appraisal of the meaning of the name herodotus. A remaining specimen of Hewitson's series of leucania was located by me in the BMNH and fixed as a lectotype holotype male of detesta, BMNH. See Remarks. Type Locality: Fabricius' type locality: "in Indies". Available material for appraisal of characters of same: Trinidad and Tobago. Type locality for Hewitson's leucania is "Mexico"; detesta St. Fe' de Bogota, Colombia.

DISTRIBUTION. Spatial: Fig. 540. I recorded herodotus from all the countries ringing the Carribean region and from islands within it from Trinidad and Tobago, northern Venezuela, Surinam and Guyana, westward through northern Colombia, across the isthmus of Panama and northward through the Central American countries and Mexico north nearly to the United States in Coahuila and Nuevo Leon States, Mexico. Temporal: Dates on specimens range from February to late August.

REMARKS. The location of the type specimens of Fabricius' herodotus is unknown. They are not listed as extant in the study of the Fabricius types. However, R. I. Vane-Wright (British Museum of Natural History) has informed me that some Fabricius material may have been sent to Australia and it is premature to assume loss of the type and designate a neotype (pers. com. R. I.

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Vane-Wright), without further details available. The type localities "in Indies" indicates that any neotype would need to be designated from the existing antillean populations which are limited to Trinidad and Tobago, but quite common and differing little from Venezuelan and north and westward material.

The synonymy of Hewitson's leucania with herodotus is correct and I have located one remaining Hewitson specimen of this taxon in the British Museum. I have designated this specimen, labelled "Mexico" with a Hewitson label, as the lectotype and so labelled it. Clench's synonymy of herodotus and sicrana was premature, and sicrana is retained by me as a species name for the extremely allopatric but sister taxon of herodotus distributed from southern Brazil into Argentina and Paraguay.

The synonymy of Clench's detesta has been determined by me during this study. I have dissected the types and specimens of the herodotus complex locality by locality across northern South America. The genitalia of the type of detesta are identical with those of herodotus and leucania. Populations of this complex in Colombia without tails, a character indicated as unique by Clench, also include tailed individuals of which Clench was apparently unaware. The frequency of tailed specimens, however, increases eastward. There is a northern South American new species of Cyanophrys which I have named quinterorum. It occurs in Colombia. Clench may have seen representatives of this species when he surveyed detesta and may have meant for his detesta to include them. However, the types of detesta chosen by Clench are undoubtedly conspecific with herodotus. The genitalia of quinterorum are unmistakably different from herodotus.

As can be noted, use of the name herodotus is accorded a strict definition in this revision in relation to the accompanying keys, descriptions, genitalic characterizations, genitalic descriptions and illustrations and commentary. This

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is because the taxon is actually only one of many species, and when understood within this context, assumes a much more limited distribution than that accorded it when it (along with amyntor Cramer) was used as a broad grade name related to the very general and primitive wing characters. Further usage of the name herodotus in such a broad way is ill-advised as it can only completely obscure actual phylogenetic and zoogeographical relationships.

In all, I dissected for genitalia, legs and palpi eighteen males and sixteen females of herodotus, not including those assignable to taxa discovered or recognized as nonconspecific during this study.

Cyanophrys ruthi, new species

Figs. 106, 320, 488

DIAGNOSIS. Readily identified by its brown frons and the median arc of spots on the hindwing under surface being black, not white as on similar congeners. Genitalia of male similar to herodotus group but saccus shorter, bilobed configuration round as on herodotus, but caudal extension less three-step and less elongate on ruthi.

DESCRIPTION. Male: Head, thorax, abdomen, and palpi (Fig. 488) as typical of the genus. Frons brown. Forelegs with elongation of terminal segment. Upper Surface of the Wings: Ground color dark iridescent Violaceous Blue. Area of costa, apex, and margin (1 mm.) blackish. Hindwing similar, with hairlike tail at end of vein Cu_2. Under Surface of the Wings: Ground color rather glossy Lettuce Green. Forewing immaculate except for broad gray brown area immediately cephalad hindwing. Hindwing immaculate except for median arc of black spots in each cell interspace across the wing, some variously

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obsolescent. "Thecla-spot" prominently black. Tail at Cu_2 hairlike, recurved lobe reduced, brownish to black basad. Fringe, both wings, fuscous. Length of Forewing: 13.0 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 320. Valvae, caudad saccus, bilobed configuration generally ovate, clear, not indented Lateral view as on sister species, caudal extension hardly as three-step, especially caudad, and not long; saccus shorter than length of bilobed configuration. Cornuti similarly blunt ended. Female Genitalia: Unknown.

TYPE. Holotype male (Fig. 106), San Pedro, Jujuy Province, Argentina, 22 May, 1979, Roberto Eisele. Deposited AMNH.

DISTRIBUTION. Spatial: Fig. 541. Known only from type locality. Temporal: Known only from type specimen.

ETYMOLOGY. This species is named for Ruth Eisele.

Cyanophrys alexanderorum, new species

Figs. 98, 306, 480

DIAGNOSIS. Readily recognized by small size and dull blue upperside characteristic of species group. However, lacks tail and under surface is immaculate save faint evidence of white slash distad in discal cell of hindwing. Male genitalia with an extremely long caudal extension unique within the group (Fig. 306).

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 480) as typical of the genus. Frons green. Upper Surface of the Wings: Distad bright iridescent Violaceous Blue, basad more silvery, toward Clear Blue Gray. Only thin areas of margins black to fuscous. Scent patch distad in discal area, slightly

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lighter than ground color. Hindwing with no tail; fringes, both wings, fuscous to black, lighter distad especially anad on hindwing. Under Surface of the Wings: Entire surface immaculate bright Winter Green. Hindwing, vague evidence of lightened to white slash distal end, discal cell; recurved lobe circumferenced black, slightly Chestnut to Maroon centrad. Fringe, both wings, as on upper surface, but lighter distad, especially anad on hindwing. Length of Forewing: 15.5 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 306. Characteristic of the herodotus group, but with extremely elongate valvae; bilobed configuration nearly parabolic, not ovate, caudal extension sloping to elongate shape far exceeding uncus in caudal expanse. Vinculum only slightly flared basad; spurs thin, tightly encompassing centrad area of valvae. Saccus funneled, but not excessively long for herodotus group. Cornuti as illustrated.

TYPE. Holotype male (Fig. 98), San Pedro, Jujuy, Argentina, 17 July 1978, leg. R.C. Eisele, deposited AMNH.

DISTRIBUTION. Spatial: Fig. 540. Known only from type locality. Temporal: Known only from July.

REMARKS. This is a remarkably distinct species, further testimony to the regional diversity of Cyanophrys in southern South America where many species have been overlooked by the grade group concept of herodotus.

ETYMOLOGY. This species is named for Mr. and Mrs. Stanley Alexander.

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Cyanophrys sicranoides, new species

Figs. 99, 100, 302, 303, 478

DIAGNOSIS. The differences between this species and its immediate sister species sicrana and herodotus are diagnosed in detail under herodotus. Characters of the bilobed configuration of the valvae (male genitalia), and of the ductus, signa and lamellae (female genitalia) distinguish the species.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 478) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color light iridescent Violaceous Blue. Only extreme outer edges of margins, both wings, blackened with marginal line. Scent patch distad in discal area, same color as rest of wing. Tail prominent, hindwing, vein Cu_2. Recurved lobe not pronounced, black distad, lighter basad, occasionally red-brown to Chestnut. Fringe fuscous to black, lighter distad. Under Surface of the Wings: Ground color Rheinemann's Green to brighter Oriental Green. Area of forewing immediately cephalad hindwing gray-black nearly to margin. Hindwing nearly immaculate except for vague hint of anad to costad transverse line, usually expressed only in occasional spots anad. These sometimes edged red-brown. Tail at Cu_2 and recurved lobe bordered with more marginal black. Fringe fuscous to black, lighter distad. Length of Forewing: 14.5 mm. (holotype), $\bar{X}$ of 5 specimens AMNH, AME, EC, 15.3 mm., range 14.0 mm. to 16.0 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 478) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color basad, dull Violaceous Gray to Payne's Gray. Broad areas of margins and submargins, both wings, and apex, forewing dark fuscous to Raw Umber. No scent patch distad in discal area. Tail prominent at vein Cu_2, hindwing; recurved lobe not prominent, circumferenced black, Chestnut to dully fuscous centrad. Under Surface of the Wings: As on

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males, but hindwing with more emphatic expression of mesial spots anad to costad, but with reduction of associated red-brown edging basad. Length of Forewing: 15.0 mm. (allotype), $\bar{X}$ of 4 specimens AMNH, EC, AME, 15.4 mm., range 15.0 mm. to 16.0 mm. Male Genitalia: Fig. 302. Similar to sicrana but with widely ovate narrow-rimmed bilobed configuration more distally expansive and tapered cephalad toward the saccus. Valvae, caudad saccus, clear, narrow-rimmed, generally ovate but more expanded distad, tapered cephalad above the saccus; valvae, lateral view, round tapered but thick between round and tapered because of three-step caudal extension; valvae, caudal extension, distinctly three-step. Saccus broad caudad, tapered longly parabolic cephalad. Base of vinculum not flared; spurs long, nearly spinelike. Cornuti as illustrated. Female Genitalia: Fig. 303. Similar to sicrana and herodotus but with ductus far more elongate than sicrana, and shorter than herodotus; with very distinct plates on lamella antevaginalis. Lamella postvaginalis hemispherical to hemielliptical; lamella antevaginalis with caudal expanse at least three-fourths to four-fifths caudal expanse of lamella postvaginalis. Heavily sclerotized plates distad on lamella antevaginalis. Ductus about one-third longer than breadth of lamellae. Signa broadly bifurcate spines, one only slightly visible, other highly curved.

TYPES. Holotype male (Fig. 99) and allotype female (Fig. 100), Iquitos, Peru, 4 November, 1931, deposited AMNH. Paratypes: AME: Guanabara, Brazil, 1 November 1923, C. Callaghan (one male, one female); Huanico, Peru, 19 November, 1960, leg. Jae (one female), June, 1962, leg. Jae (one female), Napo, Rio Shinquipino, Ecuador, November 1973, leg. R. de Lafebre (one female); Peru, October, 1941 (one male); BMNH: Bolivia, Chulumani, 19 January 1899, leg. A. G. Weeks (one female), 12 December, 1898, leg. A. G. Weeks (one male).

DISTRIBUTION. Spatial: Fig. 540. Presently recorded from several areas of western South America--along the eastern flank of the Andes and out onto

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adjacent plains from southern Ecuador southward through Peru (and adjacent Acre State of Brazil) into northern Bolivia. Temporal: Known from November to June.

REMARKS. The occurrence of this sister species of sicrana north and westward across the Amazon River barrier is paralleled by similar situations in the amyntor group, distractus group and others. The genitalia of the western population are quite distinct, indicating it as a sister species of sicrana and herodotus, not conspecific with either. In all, I dissected thirteen males and fourteen females from across the range of sicranoides.

ETYMOLOGY. The latinized name indicates the affinity to sicrana.

Cyanophrys priscilla, new species

Figs. 97, 304, 305, 479

DIAGNOSIS. Similar to sicrana, superficially separable by marked recurvature of forewing apex and by absence of cephalad spots, costa to vein M_2 in the median arc of spots, under surface of the hindwing. Otherwise, genitalia differing as follows: female with ductus long, two and one-half times breadth of lamellae, not less than one and one-half as in sympatric sicrana; male with long sloping three-step caudal extension, not compactly three-step as in sicrana.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 479) as typical of the genus. Frons green. Upper Surface of the Wings: Forewing noticeably recurved at apex. Ground color bright Violaceous Blue, only thin areas of margins, hindwing and forewing black to fuscous. Scent patch distad in discal area. Tail at vein end Cu_2; recurved lobe deep fuscous to black; fringe fuscous, lighter distad, toward whitish anad on hindwing. Under Surface of the

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Wings: Both wings, ground color deep Winter Green, but forewing with moderate area immediately cephalad hindwing dull brownish gray. Hindwing with median arc of white to yellow spots, emphatic anad but obviously absent from costa to vein M_3. "Thecla-spot" reduced to simple spot. Recurved lobe light Chestnut, circumferenced slightly black. Fringe fuscous basad, lighter, toward white distad, especially in cellular interspaces. Length of Forewing: 15.0 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 479) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color dull Violaceous Gray; thin areas of both wings dull fuscous to blackish along margins, wider at apex, forewing and cephalad on hindwing. Tail at vein end Cu_2. Under Surface of the Wings: As on males, but median arc more gently rounded. Length of Forewing: 14.8 mm. (allotype). Male Genitalia: Fig. 304. Similar to herodotus and necopina with caudal extension very long and tapering in gradual three-step configuration, not dramatic three-step as in sicrana. Valvae, caudad saccus, thin-rimmed, clear, ovate, not indented; valvae, caudal extension, gradually tapered three-step. Saccus funneled with long cephalad point; signa blunt-ended, ventral. Female Genitalia: Fig. 305. Similar to herodotus, not sicrana, with ductus long, nearly two and one-half times breadth of lamellae. Lamella antevaginalis with crescent-shaped plates distad. Signa two bifurcate spines, one far larger than other, mounted on sclerotized base.

TYPES. Holotype male (Fig. 97) and allotype female, Curitaba, Parana State, Brazil, deposited Argentine National Collection, Institute Miguel Lillo. Paratype: Same data as primary types, same deposition (one male).

DISTRIBUTION. Spatial: Fig. 540. Presently known only from the type locality. Temporal: Unknown.

REMARKS. There may be other specimens of priscilla in collections, but since it was discovered late in this study I have not re-examined larger series of

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sicrana with regard to locating specimens with the uniquely long ductus bursa indicative of this new species. There can be no doubt, given the long ductal configurations characteristic of species like herodotus, and especially miserabilis and necopina, that priscilla is not conspecific with sympatric sicrana.

ETYMOLOGY. This species is named for Priscilla Eisele.

Cyanophrys andromimikos, new species

Figs. 104, 105, 318, 319, 487

DIAGNOSIS. This species readily can be identified by both sexes displaying a distinct dark patch distad in the discal area, resembling the typical androconia of male Cyanophrys. Males otherwise are similar to sicrana; females distinctive because of the discal marking. Genitalia of both sexes are distinct from sicrana, males with valvae more diminutive in relation to arch of vinculum and bilobed configuration more roundly parabolic than oval, cornuti basad broadly hemispherical, dorsal blunt-ended with spines; females with ductus much longer than sicrana, length exceeding eight times its width (five times to six times, maximum for sicrana) and ventrad area of lamella antevaginalis on andromimikos with trapezoidal sclerotizations similar to miserabilis rather than simple sclerotizations as on sicrana.

DESCRIPTION. Male: Head, thorax, abdomen and palpi (Fig. 487) as typical of the genus. Frons brown. Forelegs with elongation of terminal segment. Upper Surface of the Wings: Ground color bright iridescent Alizarine Blue; narrow areas of margin, both wings, and apices forewings, dull Raw Umber; scent patch distad in discal area scattered along the veins at distal cell end, this and area in between appearing darker blackish; tail at Cu_2; fringes, both wings,

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brown. Under Surface of the Wings: Ground color dirty Grape Green, often overscaled brownish; area of forewing immediately cephalad hindwing smoky-black to gray, extending to the margin and fringe; hindwing with meandering arc of white spots, bordered red-brown basad from costa to anal margin, sometimes obscured costad; dull red-brown blotch in cell Cu_1; cell Cu_2 distad recurved lobe of hindwing between outer and anal margins, suffused red-brown or slightly grayish; recurved lobe blackish, fringed paler distad. Fringe, both wings, gray to brown. Length of Forewing: 12.0 mm. (holotype), $\bar{X}$ of 3 specimens, AME, 13.0 mm., range 12.0 to 14.0 mm. Female: Head, thorax, abdomen, and palpi (Fig. 487) as typical of the genus. Frons brown. Forelegs with elongation of terminal segment. Upper Surface of the Wings: Ground color dull Payne's Gray, narrow area of hindwing margin and extensive area of forewing margin (just under one-half of wing expanse) dull Raw Umber; distal area of discal cell distinctly blackened, appearing as male scent patch (see below, Remarks). Tail at vein Cu_2, hindwing, vein Cu_1 with elongated tuft; recurved lobe Chestnut, often appearing narrow, fringed distad, black. Juncture of gray ground color with dark margin crennated in shape along hindwing margin. Narrow white fringe caudad tail at vein Cu_2. Under Surface of the Wings: As on males, but with red-brown suffusion often in cell interspaces cephalad of vein Cu_2. Length of Forewing: 11.5 mm. (allotype), $\bar{X}$ of five specimens, AME, 13.0 mm., range 12.0 to 14.0 mm. Male Genitalia: Fig. 318. Similar to sicrana but differing markedly in diminution of bilobed configuration, breadth expanse of funnel-shaped saccus, and breadth of ventral cornutus at terminal tip of aedeagus. Valvae, caudad saccus, clear, narrow-rimmed, roundly parabolic, slightly indented; valvae, lateral view, slightly irregular due to character of bilobed configuration; valvae, caudal extension, tapered; saccus, funnel, very wide caudad; cornuti, ventral disclike, dorsal blunt-ended with spines. Female Genitalia: Fig. 319. Similar to sicrana

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but different markedly as follows: Ductus long, at least eight times its width (five to six times width maximal). Lamella antevaginalis caudal expanse very long, nearly equalling lamella postvaginalis. Ventral sclerotizations on lamella antevaginalis trapezoidal rather than limited and simple as on sicrana. Large area cephalad antrum transparent; signa deeply bifurcate spines on solidly sclerotized base.

TYPES. Holotype male (Fig. 104, right), Pichanal, Salta Province, Argentina, 21 May 1972, Roberto C. Eisele; allotype female (Figs. 104, left, 105), same data, 29 May 1970. Deposited AME. Paratypes: AME: four females, two males, same data as holotype, respective dates 12 June 1969, 13 May 1972, 13 May 1972, 24 May 1972, 16 May 1972, 29 May 1972, all R. C. Eisele.

DISTRIBUTION. Spatial: Fig. 541. Known only from type locality. Temporal: Known from May to June.

REMARKS. The presence of a dark patch appearing as a scent patch on the females of this species is curious. Examination of this area under the microscope reveals tightly packed scales of a duller, darker color than those on the rest of the wing. Most interestingly the scales appear the same as those which form the scent patch on the males, but appear scattered along the distal ends of the veins bordering the discal cell. The value of males and females looking alike, as is the case in Paracyanophrys amphoteros, and a number of species in Novosatsuma, is not known. Several species (e.g., Sandia henrici, and Mitoura turkingtoni) lack scent patches on the males. I dissected the type specimens and associated the paratypes by the identical collection data and facies.

ETYMOLOGY. The name is constructed from the Greek roots for "male" and "mimic" referring to the appearance of the female having a dark scent patch in the discal cell of the forewing.

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Cyanophrys sicrana (Jones), new combination, status revised

Figs. 307, 308, 481

Thecla sicrana: E. Jones, 1912, p. 897, pl. 97, fig. 3. Draudt, (in Seitz), 1919, p. 762, pl. 153, fig. i. Franz and Schroeder, 1954, p. 85.

Species sicrana: Comstock and Huntington, 1963, p. 159.

Thecla herodotus: Clench, 1946, p. 154 (placed sicrana as synonym of herodotus in error).

DIAGNOSIS. The differences between this species and its immediate sister species sicranoides and herodotus have been treated in detail under herodotus; the reader is referred to that diagnosis. Characters of the bilobed configuration of the valvae on male genitalia, and of the ductus, signa, and lamellae on the female genitalia distinguish these species.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 481) as typical of the genus. Frons green. Upper Surface of the Wings: Ground color bright Violaceous Blue only most extreme areas of margins, both wings and apex forewing darkly bordered fuscous to black. Scent patch distad in discal area. Tail on hindwing at vein Cu_2. Recurved lobe of hindwing black circumferenced, light Chestnut within. Fringe, both wings, grayish black. Under Surface of the Wings: Ground color Rheinemann's to Winter Green. Area of forewing immediately cephalad hindwing grayish-black nearly to margin. Hindwing with variously faint anad to costad line of small white or yellowish dots, occasionally edged red-brown, especially anad. Tail prominent at vein Cu_2, recurved lobe dark, Chestnut to Maroon with white slash immediately cephalad, variously apparent. Fringe, both wings, fuscous basad, lighter to white distad. Length of Forewings:

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$\bar{X}$ of 10 specimens AMNH, NMNH, 14.6 mm., range 13.8 mm. to 15.2 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 481) as typical of the genus. Frons green. Upper Surface of the Wings: Similar to males but wing shape more rounded and broad, and ground color above only sheen of bordered by wide fuscous to Raw Umber, margins and submargins both wings, apex, forewing. Tail prominent at vein Cu_2, hindwing. Recurved lobe bright Chestnut centrad, circumferenced black. Under Surface of the Wings: As on males, but with more emphatic expression of the mesial line of spots, and reduction of any accompanying brown markings basad, distad, anad, or along the margin. Length of Forewing: $\bar{X}$ of 10 specimens AMNH, NMNH, BMNH, 13.9 mm., range 13.5 mm. to 15.5 mm. Male Genitalia: Fig. 307. Valvae, caudad saccus, clear, narrow to mid-rimmed, broadly ovate, slightly indented to not indented; valvae, lateral view, concave area between cephalad and caudad articulations of valvae to vinculum widely arched; beginning of caudad extension, lateral view, often short but pronouncedly funneled followed by extreme tapering; valvae, caudal extension, three-stepped; saccus, long, at least equal length of bilobed configuration, pointed; cornuti, dorsal narrow-tapered, ventral, disc-like. Female Genitalia: Fig. 308. Length of ductus hardly exceeding breadth of lamellae; compression of lamellae, antrum and ductus making transparent area less obvious. Lamella antevaginalis with broadly sclerotized plates ventrad and usually obvious "hump" shape centrad in relation to lamella postvaginalis. Caudal end of ductus gradually flaring cephalad; signa broad-based bifurcate spines, one much smaller than other and the latter quite hooked; often joined to corpus bursa with heavily sclerotized base extending out as circular base on the corpus surface.

TYPE. Holotype male, BMNH. Type Locality: Castro, Parana State, Brazil.

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DISTRIBUTION. Spatial: Fig. 540. Limited to extreme southern Brazil, southern Bahia, Minas Gerais, Mato Grosso, Sao Paulo, Rio de Janeiro, Parana, Santa Catharina, and Rio Grande du Sul states; thence westward into southeastern Paraguay and south through extreme northeast Argentina and Uruguay. Temporal: Specimens known from February to early August.

REMARKS. Jones named sicrana from Brazilian specimens. Clench placed the name in synonymy with herodotus because his concept of herodotus was of one cosmopolitan species ranging from South America northward across Central America into most of Mexico. Dissection and other study of the populations across the entire geographic area indicate a number of morphologically distinct, allopatric populations which in relation to apomorphic characters and their consideration for vicariant distribution patterns leads me to prefer recognition of several sister taxa which are the result of Amazon-related and Panamanian isthmus-related vicariance events. The name sicrana is maintained by me as a species name for the population in southern Brazil, Paraguay, and northern Argentina. In all, I dissected ten males and twelve females for genitalia, legs, and palpi.

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8. The miserabilis Group

including miserabilis/necopina--necopinoides/crethona--marianna

A. Cladogram and Characters, Fig. 572.

B. Distribution, Fig. 541.

C. Characteristic Genitalic Configurations, Fig. 548.

Cyanophrys miserabilis (Clench)

Figs. 107, 309, 310, 482

Thecla miserabilis Clench, 1946, p. 156.

Mitoura miserabilis: Kendall and Freeman, 1969, p. 3.

Cyanophrys miserabilis: Clench, 1961, p. 211; 1966, p. 70.

Callophrys (Callophrys) miserabilis: dos Passos, 1964, p. 59.

Callophrys (Cyanophrys) miserabilis: Clench, 1961, p. 211, fig. 402. McGuire and Rickard, 1974, p. 13. Scott, 1975, o. 297. Ross, 1976, p. 108.

species miserabilis: Comstock and Huntington, 1961, p. 170.

Strymon pastor Butler and Druce, 1872, p. 105: Stallings and Turner, 1947, p. 39. H. Freeman, 1950, p. 66. Klots, 1951, p. 139 (misidentified).

Strymon pastor pastor: dos Passos, 1964, p. 56 (misidentified).

Thecla pastor (nec. Butler and Druce, 1872): Barnes and McDunnough, 1913, p. 183. W. Holland, 1931, p. 228, figs. 14-15 (misidentified).

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DIAGNOSIS. This species is indistiguishable by wing characters from its immediate sister species necopina. Both species also have extremely elongate ductus bursae, with length of ductus exceeding four times breadth of lamellae. The male genitalia of miserabilis have a parabolic bilobed configuration and a caudal extension of the valvae in which the final caudal step of the "three-step" configuration exceeds the length of the second at least by one-half. On necopina, the bilobed configuration is extremely ovate as on herodotus, sicrana, and sicranoides, and the caudal extension has the final caudal "step" nearly or equal to the second. There are also differences in the sclerotized plates ventrad on the lamella antevaginalis of the females (see below, and under the species listed above).

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 482) as typical of the genus. Frons brown. Upper Surface of the Wings: Ground color iridescent Violaceous Blue. Costa, apex, and extreme margin of forewing, costa and extreme margin hindwing, deep Raw Umber. Recurved lobe circumferenced black, Chestnut centrad, distinctly displaced anally. Small scent patch (less than one-fourth length of discal cell) distad in discal area. Fringe black-brown, lighter distad, and especially light on the mid-veins. Tail at vein Cu_2. Under Surface of the Wings: Fig. 107. Ground color Rheinemann's Green to more yellowish. Area of forewing immediately cephalad hindwing grayish to gray-brown, darker basad, extending at least to vein Cu_2. Hindwing with terminal markings of distinct red-brown suffused with white or gray and of various maculation--usually a submarginal transverse red-brown slash in cell Cu_1, another in cell Cu_2, or a third in cell M_3; a marginal red-brown blotch suffused gray or white in cell 2A joining the deep red-brown coloration of the recurved lobe; a small blotch marginal in cell Cu_1; an indistinct blotch marginal in cell M_1. Complementing this pattern a indistinct median row of dark red-brown

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spots edged darker basad, and white or yellowish distad. Fringe red-brown. Length of forewing: $\bar{X}$ of 7 males in BMNH, 16.2 mm., range 15.5 mm. to 16.5 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 482) as typical of the genus. Frons brown. Upper Surface of the Wings: Distad one-third of forewings, more exaggerated at apex, deep Raw Umber to black. Basal and postbasal areas Violaceous Gray, often tinted bluish. Hindwing with more extensive bluish hue, extending at least to submargin, often farther. Tail at vein Cu_1. Fringe dark brown to black basad, grayish distad, whitish between the veins, especially in the limbal area. Under Surface of the Wings: As on males, but with median row of white spots on hindwing underside usually more emphatic. Length of Forewing: $\bar{X}$ of 5 specimens in BMNH, AMNH, 15.7 mm., range 14.5 mm. to 16.5 mm. Male Genitalia: Fig. 309. Characterized by the general three-step caudal extension of the valvae but in this species extremely elongated. Valvae, caudad saccus, clear, narrow, widely parabolic, indented. Valvae, lateral view, round tapered, without thickening between round and tapered. Valvae, caudal extension, three-step, but very elongated. Saccus extremely long, equalling two-thirds entire caudal length of valvae. Vinculum not flared basad; spurs short rectangular projections. Cornuti as illustrated. Female Genitalia: Fig. 310. Characterized by extreme length of ductus, circa 16 to 18 times width. Lamellae broadly hemispherical; lamella antevaginalis almost equalling lamella postvaginalis in caudal expanse. Sclerotized plates ventrad on lamella antevaginalis. Antrum hardly present; juncture of lamellae and ductus with broad transparent area just cephalad lamellae. Signa broad spines, with vague bifurcation basad.

BIOLOGY. Early Stages: Described by McGuire and Rickard, 1974. Foodplant: Noted by McGuire and Rickard as Parkinsonia (Fabaceae).

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TYPES. Holotype male and allotype female, in BMNH. Fourteen paratypes, eight males, six females, all in BMNH. One of the paratypes from Guerrero is actually necopina, new species. Type Locality: Rincon, Guerrero State, Mexico.

DISTRIBUTION. Spatial: Fig. 541. In several evidently allopatric populations: in montane Costa Rica; Tabasco State west through Oaxaca to Guerrero, Hidalgo and Veracruz states; thence north from Jalisco State across north central Mexico to southern Texas. Temporal: Dates on specimens range from April to December.

REMARKS. See Remarks under necopina. In all, thirty-three specimens of miserabilis were dissected for genitalia, legs, and palpi, from across its range. For reference, the under surface of miserabilis has been figured in an addended section to Cyanophrys photos.

Cyanophrys necopina, new species

Figs. 101, 311, 312, 483

DIAGNOSIS. Superficially resembling miserabilis and necopinoides: male wing under surface appearing slightly more heavily marked with terminal suffusions and anal patterns not approaching general limbal suffusion of necopinoides, crethona and marianna. Female of necopina with broad wings reminiscent of the amyntor group. Genitalically, necopina very distinct: male with ovate bilobed configuration distinctly oblongate caudad and with caudal extension recurved for nearly half its length (same structures on miserabilis are parabolic in the bilobed configuration and elongated three-step in the caudal extension; necopinoides has bilobed configuration more ovate but tapered in the

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caudal extension with a reduced valval length similar to crethona; herodotus has distinct circularly ovate bilobed configuration and obvious three-stepped caudal extension characterized by reduced valval length and no recurvature). Female genitalia of necopina display more primitive characters than miserabilis, and resemble females of the amyntor and circumcyanophrys groups. Particularly lacking on necopina are the sclerotized plates ventrad on the lamellae vaginalis typical of miserabilis, necopinoides, crethona and marianna.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 483) as typical of the genus. Frons brown. Upper Surface of the Wings: Ground color iridescent dark Tyrian Blue. Narrow areas of the margins both wings, and wider area of the apex, forewing dark Raw Umber. Scent patch distad in discal cell, same color as blue ground color. Fringe, forewing dark, hindwing bright white; tail at vein Cu_2, white tipped. Recurved lobe bright Chestnut, fringe white then black distad, white mark anad, light blue suffusion distad. Under Surface of the Wings: Ground color bright Rheinemann's Green to more yellowish. Area of forewing immediately cephalad hindwing smoky gray to margin. Hindwing with mesial line of white dashes complete across wing except in cells Rs or M_1. Submargin in limbal area suffused with gray-red markings: distad the black recurved lobe in cell Cu_2, entirely red suffused gray; cell Cu_1 similar distad, with broad red-brown basad across cell and invading cell Cu_2, the above areas joined by black "Thecla-spot." Slight red-gray suffusion cephalad along the margins toward costa. Fringe, both wings, red-brown. Length of Forewing: 17.0 mm. (holotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 483) as typical of the genus. Frons brown. Upper Surface of the Wings: Basal half of forewing and two-thirds of hindwing violaceous Payne's Gray. Wide areas of margins and apices both wings, deep Raw Umber to blackish. Fringe, both wings, dark, white in limbal area of hindwing. Tail at vein Cu_2 long and white-tipped;

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tuft at terminus of vein Cu_1. Recurved lobe Chestnut, fringed black distad, then white. Under Surface of the Wings: Similar to males, but hindwings' white mesial markings edged basad with distinct black and red-brown markings in cell Cu_1, these more extensive costad, invading adjacent cells Cu_2 and M_3. Markings generally more "lush" than on male. Length of Forewing: 17.5 mm. (allotype). Male Genitalia: Fig. 311. Characterized by elongate caudal extension of valvae and nearly recurved area cephalad on the extension. Valvae, caudad saccus, clear, oblongly ovate, narrow-rimmed, not indented; valvae, lateral view, somewhat irregular due to ovate bilobed condition; valvae, caudal extension, slightly recurved on cephalad half, tapered on caudad half; saccus slightly funneled, pointed; base of vinculum not flared; vincular spurs rectangular. Cornuti as illustrated. Female Genitalia: Fig. 312. Similar to members of the circumcyanophrys group in that numerous primitive characters are retained making it unlike miserabilis. Lamella antevaginalis without ventral sclerotized plates, but antrum distinct with transparent area cephalad antrum very concise as typical of congeners herodotus, miserabilis and necopina, and the circumcyanophrys groups, but not swollen as in marianna, necopinoides and crethona. Signa bifurcate spines on broad base, first twice as long as second.

TYPES. Holotype male (Fig. 101), Catemaeo, Veracruz State, Mexico, September 1960, T. Escalante. Allotype female, same data as holotype, August 1960. Deposited AME.

DISTRIBUTION. Fig. 541. Presently known from the type locality and several other north central Mexican localities cited in Material Examined. Temporal: Known from July to September.

REMARKS. This species is the immediate sister species of miserabilis. They are sympatric northward from central Mexico into the extreme southern

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United States. The range of miserabilis, however, extends southward at least to Costa Rica.

From extensive genitalic survey of nearly all specimens in major collections, I am convinced that two distinct entities are involved whose phylogenetic relations to each other and related taxa are clear within the nested sets of derived characters defining sister taxa of the miserabilis species group. There are distinct genitalic differences in the males and females of miserabilis and necopina. Further, obvious apparent resemblance in necopina females to the more primitive wing character shapes characteristic of necopinoides and the iggi-circumcyanophrys and amyntor outgroups distinguish miserabilis and necopina where they occur together. Genitalic characters corroborate the relationships apparent in these wing characters.

Characters of the male genitalia in miserabilis remain consistent throughout its entire range as do those of necopina from the latter's scattered and generally more restricted range. In sympatric areas, the resemblance of the necopina male genitalia to facies characteristic of the herodotus group is striking enough to separate miserabilis and necopina readily. The possibility of confusion in associating male and female pairs in necopina, miserabilis and their sister taxa have been diminished by (1). dissection of males and females from identical locations and times, (2). dissection of series from areas where taxa are sympatric, (3). analysis of the above results in relation to the distributions of congeneric taxa and their characters, (4). the very noticeable datum that whereas male genitalia of necopina strongly resemble those of the herodotus group, the wing patterns of the miserabilis and herodotus groups themselves differ markedly, pointing to the significance of the genitalic differences noted above, and (5). a most parsimonious cladogram for sister taxa of the miserabilis group, which includes congruence within the above-mentioned wing and genitalic characters.

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In all, thirteen specimens of necopina were identified by dissection from the localities listed in the Material Examined. It is not known if other specimens of necopina than the one already discovered are within Clench's paratype series of miserabilis since the entire series was not dissected.

ETYMOLOGY. The Latin name means "unexpected", referring to the complex sister groups within the constellation of species groups related to the taxon, and the numerous new taxa discovered within these complexes.

Cyanophrys marianna, new species

Figs. 102, 313, 484

DIAGNOSIS. Presently known only from western Brazil, this species can be confused only with crethona which is endemic to Jamaica. From the latter it can be recognized by the extreme extent of the red-brown, suffused white and gray, terminal markings, which occur on both wings in marianna (only on the hindwing in crethona) and which extend farther basad (nearly one-fourth of wing in limbal area) and are bordered basad with emphatic mottled bright red-brown. A black "Thecla-spot" is also emphatic on marianna, submarginal in cell Cu_1, and white slashes bordered brightly red-brown occur basad the bright red-brown mottling in cells Cu_1, Cu_2, and 2A, with faint traces of spots, small and red-brown, at cells M_2, and Rs. The genitalia of the females are very distinct (see below).

DESCRIPTION. Male: Unknown (see Remarks). Female: Head, thorax, abdomen, legs and palpi (Fig. 484) as typical of the genus. Frons brown. Upper surface of the Wings: Broad slanted areas of costa, apex, and submargin deep Raw Umber to black, forewing; same in submargins cephalad and margins caudad

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on hindwing. Rest of wing bright iridescent Light Grayish Violet Blue, especially lustrous basad on forewing. Scent patch distad in discal area, hidden in the black distal-apical markings. Recurved lobe of hindwing brightly Chestnut, black distad. Tail at Cu_2 very long, white tipped. Fringe black on forewing, distinctly white between the veins, hindwing, and distad on the recurved lobe. Under Surface of the Wings: Ground color bright Rheinemann's Green. Area of forewing immediately cephalad hindwing light grayish tan to whitish, especially toward the margin. Forewing with marginal area deep red to Maroon, suffused whitish and gray along border, for about 1 mm. Hindwing with wide red-brown terminus suffused as above extending cephalad from about distal one-fifth and caudad about one-fourth. Basad this terminal border, indiscriminate bright mottling transverses entire wing immediately basad the submarginal area. Basad this from cells 2A to Cu_1 white slashes are distinctly bordered basad with black to deep Maroon. Further hints of these slashes, only as vague dots, occur in cells M_2 and Rs. There is an emphatic black spot submarginal in cell Cu_1; recurved lobe of hindwing is black, with distal edge bent distad to slight white-fringed tail-like point. Fringe on forewing is dull Raw Umber, reddish brown distad; hindwing fringe is black basad, white distad, and black to red-brown on the veins. Length of Forewing: 16.2 mm. (holotype). Male Genitalia: Unknown (see Remarks). Female Genitalia: Fig. 313. Similar to sister taxa crethona and necopinoides, sharing swollen antrum. Ductus long as on crethona, but lamella antevaginalis not recurved cephalad and with large sclerotized plates ventrad surrounded by crescent shaped rims.

TYPE. Holotype female (Fig. 102), Mt. Roraima, Brazil, "Aradupu 4200", 26 January 1927, deposited AMNH. There is also a male and female pair mentioned by Comstock and Huntington, 1943, from another high plateau (Duida) immediately northward in Venzuela.

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DISTRIBUTION. Spatial: Fig. 541. Presently known from the localities mentioned by Comstock and Huntington, and from the type locality. Temporal: Known only as January.

REMARKS. This remarkably exotic species has been noted by several authors, Comstock and Huntington loc. cit., and F. Brown. It has never been named. It is of extreme interest zoogeographically because it is the obvious immediate sister species of crethona, long thought to be totally unique, endemic to Jamaica, and, because of its extreme morph, sometimes placed with groups as divergent as Chlorostrymon. The insect becomes less exotic with the description of marianna, and even less so considering crethona's immediate sister species from Mexico, necopinoides. The latter taxon also evidences the dense suffusion of the hindwing under-surface and the exotically more pointed and long-tailed hindwing. All share the markedly swollen antrum, taken as synapomorphic. See Remarks under these other taxa. The Mt. Duida specimens (Comstock and Huntington, 1943) and a male also listed by them from Mt. Roraima have not been located.

ETYMOLOGY. This species is named for my wife, Marianna.

Cyanophrys necopinoides, new species

Figs. 103, 314, 315, 485

DIAGNOSIS. Resembles miserabilis and necopina though limbal red-brown suffusion on the hindwing under surface is more expansive. Male genitalia like miserabilis but entire valval configuration more elongate than on any taxon of group except crethona and saccus extremely long. Female with swollen antrum

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like crethona and marianna very apparent, differing markedly from thin ductus and wide lamellae of miserabilis and necopina.

DESCRIPTION. Male: Head, thorax, abdomen, and palpi (Fig. 485) as typical of the genus. Frons brown. Forelegs evidencing terminal elongation. Under Surface of the Wings: Ground color bright Winter Green. Area of forewing just cephalad hindwing grayish to gray-brown, extending at least to vein Cu_2, darker basad. Hindwing with terminal red-brown markings, suffused with gray and white as on miserabilis (see description of miserabilis above) and an obsolescent median line of brownish to red-brown spots, edged basad with black, and lightly distad with white or yellowish. Fringe, red-brown. Upper Surface of the Wings: Ground color dull iridescent Tyrian Blue over entire wings. Costa, apex, and extreme margins of forewing along with costa and extreme margins of hindwing deep Raw Umber. Recurved lobe of the hindwing black, distinctly curved anad. Scent patch distad in discal area small, less than one-fourth length of discal cell. Fringe black to brown, grayish distad, especially light between the veins. Length of Forewing: 16.0 mm. (holotype). Female: Head, thorax, abdomen, and palpi (Fig. 485) as typical of the genus. Frons brown. Forelegs evidencing terminal elongation. Upper Surface of the Wings: Basal and postbasal areas of forewing, and entire hindwing save extreme margin, dull Violaceous Gray with blue iridescent tint. Distal one-third of forewing, and more at apex, deep Raw Umber to black; outer margin of hindwing, same. Tail at vein Cu_1. Fringe dark brown to blackish basad, grayish distad, lighter between the veins especially in the limbal area. Under Surface of the Wings: As on males. Length of Forewing: 15.5 mm. (allotype). Male Genitalia: Fig. 314. Similar to crethona, differing mainly as follows. Both with long saccus, but necopinoides with funnel shape; vincular spurs of necopinoides widely triangular; valvae, bilobed configuration, necopinoides with more rounded parabolic

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configuration, though both diminutive relative to entire length of valvae (as opposed to congeners); slight corner between bilobed configuration and caudal extension on necopinoides not swollen as on crethona; both with thin tapered caudal extension. Aedeagus extremely long, exceeding two times caudal expanse tip of saccus to cephalad rim, labides. Female Genitalia: Fig. 315. Similar to marianna and crethona with swollen antrum, differing mainly as follows: ductus much shorter than on above two taxa (with antrum, length slightly over two times breadth of lamellae--three times on two sister taxa). Lamellae more like crethona, slightly recurved cephalad, plates ventrad on lamella antevaginalis not as obvious as on marianna. Signa broadly based bifurcate spines.

TYPES. Holotype male (Fig. 103) and allotype female, Nayarit, Playas Novilleros, Mpio. Tecaula, Mexico, November, 1967, P. Hubbell. Deposited AMNH.

DISTRIBUTION. Spatial: Fig. 541. Presently known only from the type locality. Temporal: Known only from type specimens.

REMARKS. See Remarks under the sister taxa of the miserabilis Group for understanding of the particular significance of necopinoides. The discovery of this species was important to the understanding of the relevance of necopina and the cladistic position of the crethona and marianna sister species. Without necopinoides the hierarchy might be unresolvable. The particular zoogeographical implications of the necopinoides, crethona, marianna three-taxon cladogram are discussed in detail in the Zoogeographical Discussion.

ETYMOLOGY. The Latinized name indicates the sister species affinity to necopina and related taxa.

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Cyanophrys crethona (Hewitson)

Figs. 316, 317, 486.

Thecla crethona Hewitson, 1874, p. 157, pl. 62, figs. 420, 421. Draudt, 1919, p. 799, pl. 158, fig. f. Anon., 1926, p. 462. Huntington, 1933, p. 3. Bates, 1935, p. 190. Comstock and Huntington, 1943, p. 73. Avinoff and Shoumatoff, 1946, p. 284.

species crethona: Comstock and Huntington, 1959, p. 196.

Chlorostrymon crethona: Brown and Heineman, 1971, p. 4 [related to C. simaethis, Comstock and Huntington, 1943, p. 73; with Chlorostrymon group, Draudt, 1919, p. 799].

Callophrys crethona: F. Brown, 1968, p. 19.

Callophrys (Cyanophrys) crethona: Clench, 1963, p. 248, 252. Brown and Heineman, 1972, p. 233.

Cyanophrys crethona: Riley, 1975, p. 100.

DIAGNOSIS. Endemic to Jamaica and only species of Callophryina there. Easily recognized by broad red-brown suffused patch transversing limbal area of hindwing under surface, and deep blue iridescent upper surface with two noticeable tails, blackish patch basad these, and bright contrasting Chestnut recurved lobe.

DESCRIPTION. Male: Head, thorax, abdomen, and palpi (Fig. 486) as typical of the genus. Frons brown. Forelegs with elongation of terminal segment. Upper Surface of the Wings: Ground color deep iridescent Tyrian Blue. Forewing, costa, apex, and broad area (2 mm.) margins black, hindwing highlighted by two noticeable tails at veins Cu_1 and Cu_2, bordered basad with white lines and a blackened patch in the vein interspace. Under Surface of the Wings:

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Ground color deep Winter Green to Rheinemann's Green distad. Hindwing with extremely broad transverse patch of red-brown suffusion across entire limbal area, highlighted by emphatic "Thecla-spot" and "W" shaped intrusion of markings from the median line. Length of Forewing: $\bar{X}$ of 6 specimens (AMNH, BMNH) 15.8 mm., range 15.5 to 16.3 mm. Female: Head, thorax, abdomen, and palpi (Fig. 486) as typical of the genus. Frons brown. Forelegs with elongation of terminal segment. Upper Surface of the Wings: Ground color dull iridescent Violaceous Gray, often with bright iridescent hue. Broad areas of costa, apex, and margin, forewing, fuscous to blackish. Hindwing similar, tails conspicuous at veins Cu_1 and Cu_2; shape of hindwing more rounded than on male. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 3 specimens (AMNH, BMNH) 15.6 mm., range 15.5 to 16.0 mm. Male Genitalia: Fig. 316. Characterized by extremely elongate and thin caudal extension of valvae, and extremely long saccus. Valvae caudad saccus, clear, narrow-rimmed and vaguely indented, slight shoulder between parabolic shape and elongate tapered caudal extension. Vinculum appearing large relative to thin valvae, not flared basad. Saccus very long and thinly parabolic, length of saccus two-thirds or more entire caudal expanse of valvae. Aedeagus long, twice length of vincular arc. Cornuti tapered. Female Genitalia: Fig. 317. Characterized by extremely long thin ductus and swollen antrum expanding broadly caudad to the lamellae. Lamella slightly recurved cephalad distad antrum; lamella antevaginalis with sclerotized plates ventrad. Antrum emphatic, narrowing very gradually cephalad to thin ductus, latter about one-fourth width of broadest expanse of former. Signa broadly based bifurcate spines.

BIOLOGY. Early stages: Unknown. Foodplants: Riley, 1975, mentioned the collection of crethona on flowers of Lantana. This is the foodplant of several Cyanophrys species, and has been indicated for C. miserabilis, a relatively derived taxon of more immediate sister relation to crethona. Eggs of

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Lantana-feeding species of Cyanophrys are laid on the blossoms and larvae feed on them. As noted, however, Lantana is not native to South America and so its indicated usage must be secondarily derived to some other, as yet unknown, plant.

TYPE. Holotype male, BMNH. Type Locality: Jamaica.

DISTRIBUTION. Spatial: Fig. 541. Jamaica only. Temporal: February to August.

REMARKS. This species has occasionally been associated with species of Chlorostrymon which have the mottled terminal red border on the under surface of the hindwing and which occur throughout the Antilles, while crethona is known to be endemic to Jamaica. The association is spurious and based on primitive wing characters which are convergent in crethona and the Chlorostrymon taxa. C. crethona gains its wide reddish terminal border as a derivation of the character present in numerous Cyanophrys (e.g., longula, miserabilis, etc.) and its wide transverse white line on the hindwing underside is a derived character which converges with this trait in Chlorostrymon. Dissection of several species in Chlorostrymon indicates that this genus has many derived characters related to those of Strymon sens. lat. These are more widely distributed than Eumaeini genera, including Africa and Indo-Australia. The genitalia of crethona characterize some of the most derived states in Cyanophrys, along with its immediate sister species marianna (a species found on the high uplifted crustal plateaus of western Venezuala and northeastern Brazil) and necopinoides of western Mexico. These species also exhibit the highly derived foreleg condition in males and females shared by members of the miserabilis and necopina clades and characterized by extreme elongation of the leg segments relative to their width. The three-taxon relationship of crethona, marianna, and necopinoides has particular zoogeographical significance as treated in the Zoogeographic Discussion.

In all, I dissected four males and two females of crethona.

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Quaternary Series Callophrys

including Callophrys, Mitoura (IB2bb)

CALLOPHRYS BILLBERG

Papilio Linnaeus, 1758, p. 483. Linnaeus, 1761, p. 284. Poda, 1761, p. 77. Scopoli, 1763, p. 176. Hufnagel, 1766, p. 82. Schiffenmuller, 1775, p. 186. Fuessly, 1775, p. 31. Fabricius, 1775, p. 700; 1776, p. 210; 1779, p. 250. Rottemburg, 1776, p. 12. Mueller, 1776, p. 112. Bergstrasser, 1789, p. 28, p. 22, fig. 8, 9, pl. 31, fig. 4. H.G. Lang, 1782, p. 50. Brahm, 1783, p. 652; 1790, p. 1; 1791, p. 2. Retzius, 1783, p. 225. H.C. Lang, 1884, p. 47. Geoffroy, 1785, p. 245. Schneider, 1785 [1787], p. 225. Borkhausen, 1788, p. 138; 1789, p. 218. Goeze, 1792, p. 61. Schwarz, 1793, p. 47. Lewin, 1795, p. 92, pl. xliv, figs. 3, 4, 5, 6. Hübner 1799, p. lxxii, figs. 365, 365, "1800", fig. 1, a, b, c; 1805, p. 55; 1823, p. 786. Herbst, 1804, p. 110, 308, fig. 5, 6. Ochsenheimer, 1808, p. 91. Hemming, 1937, p. 143, 1967, p. 91.

"[Papilio-] Plebeius" (sic) Plebeius: Kirby, 1871, p. 653 . Jackson, 1913, p. 48.

"[Papilio-Plebeius-] Ruralis"[18] (sic) [Ruralis: Barbut, 1781 (according to Tutt, 1907, in error), authorship to Tutt, 1907 in Hemming, 1967; citations apparently in. litt. before authorship.] Linnaeus, 1767, p. 791. Fabricius, 1775, p. 523. Sulzer, 1776, p. 36, pl. 28, fig. 11, 12. Goeze, 1780, p. 29. Fabricius, 1781, p. 121. Borkhausen, 1793, p. 294. Haworth, 1803, p. 39.

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[18] Ruralis, according to Hemming (1967) can be traced only to Tutt (1907) who (in error) gave authorship to Barbut (1781). The name has apparently been in the literature with no known author.

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"[Plebeius-] Ruralis" (sic): Esper 1779, p. 279; 1777, pl. 11, fig. 2; 1785, pl. scviii, figs. 1, 2, 3, 4.

"[Papilio-] Ruralis" (sic): DeVilliers, 1789, p. 68.

"[Hesperia-] Ruralis" (sic) Hesperia: Fabricius, 1793, p. 258 : Fabricius, 1793, p. 258, pl. 1.

Cupido Schrank, 1801, p. 218. Ibid. loc. cit., p. 218.

Lycaena Fabricius, 1807, p. 285. Ibid. loc. cit., 1807, p. 285. Leach, 1815 (911), p. 129. Ochsenheimer, 1816, p. 27. Treitschke, 1834, p. 77. Zetterstadt, 1840, p. 910. Eversmann, 1844, p. 65.

Hesperia: Ochsenheimer, 1815, p. 721, pl. 2.

Zephyrus Dalman, 1816, p. 94. Ibid, loc. cit., p. 94.

Heodes Dalman, 1816, p. 94. Ibid, loc. cit., p. 94.

Chysoptera Zincken, 1817, p. 75. Ibid, loc. cit., p. 75.

Polyommatus Latrielle, 1805, p. 117. Ibid, loc. cit., p. 117; 1809, p. 207; 1819, p. 673. Godart, 1821, p. 206, pl. 10, fig. 3, pl. 10, fig. 5. Boisduval, 1829, p. 10. Duplacey, 1845, p. 29. J. Morris, 1860, p. 11.

Lycus Hübner, "1816-1818" [1819], p. 74. Stephens, 1835, p. 404. J. Morris, 1860, p. 11. Dale, 1890, p. 44.

Strymon Hübner, 1816-1818 [1819], p. 22. Fabricius, 1807, p. 286.

Thecla Fabricius, 1807, p. 286. Esper, 1829, pl. 21, fig. 2. Stephens, 1828, p. 78; 1829, p. 21; 1870, p. 78. Freyer, 1830, p. 102. Meigen, 1830, p. 46. Wood, 1839, p. 7, pl. 2, fig. 55. Rambur, 1839, p. 259; 1858, p. 32. Boisduval, 1840, p. 8. Humphrey and Westwood, 1841, p. 90. Schneider, 1843, p. 135. Duponchel, 1844, p. 206, pl. 10. Doubleday, 1847, p. 17; 1859, p. 2. Westwood and Hewitson, 1852, p. 486. Lederer, 1852, p. 19. Gerhard, 1853, pl. 3, fig. 5. Wallengren, 1853, p. 189. Humphrey, 1857, p. 8. Stainton, 1857, p. 54. Kirby, 1858, p. 3; 1862, p. 7; 1863, p. 490; 1871,

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p. 398; 1879, p. 59, pl. 15, fig. 3. Speyer, 1858, p. 259. Staudinger, 1861, p. 3; 1871, p. 7; 1881, p. 279. W. Edwards, 1862, p. 224; 1877, p. 41. J. Morris, 1862, p. 100. Berce, 1867, p. 125. Snellen, 1867, p. 66. Nolcken, 1868, p. 52. Curo, 1874, p. 107. Frey, 1880, p. 9. Elwes, 1881, p. 8685. Anon., 1881, p. 3. H. Edwards, 1884, p. 478. Lang, 1884, p. 81. Buckler, 1885, p. 89. Aurivillius, 1889-1891, p. 8. Dale, 1890, p. 44. Smith, 1891, p. 12. Barrett, 1893, p. 53. Oslar, 1893, p. 226. Hoffman, 1894, p. 6. Rühl, 1895, p. 195. Meyrick, 1895, p. 195. Tutt, 1896, p. 197. Barnes, 1900, p. 330. Snyder, 1900, p. 305. Burrison, 1901, p. 244. Smith, Skinner, and Kearfoot, 1903, p. 7. Ter Haar, 1904, p. 8. Grinnell, 1905, p. 136. Williams and Grinnell, 1905, p. 235. Barrett, 1907, p. 8. Skinner, 1907, p. 305. Coolidge, 1908c, p. 83; 1910, p. 375. Spuler, 1908, p. 54. Williams, 1909, p. 69; 1910, p. 36; 1914, p. 264. Newcomer, 1910, p. 312. Gelin and Lucas, 1912, p. 35. Parkin and Grinnell, 1912, p. 6. Haskin and Grinnell, 1912, p. 3. W. Comstock, 1914, p. 35. Draudt, 1919, p. 763. Horn, 1928, p. 40. Davenport and Dethier, 1938, p. 71. Brown and Opler, 1970, p. 21.

Callophrys Billberg, 1820, p. 80. Scudder, 1875, p. 132. Krulikowsky, 1890, p. 19. Fuchs, 1891, p. 211. F. Morris, 1894, p. 142. Moschlowsky, 1893, p. 164. Tutt, 1896, p. 196; 1907, p. 91. Staudinger, 1901, p. 70. Staudinger and Rebel, 1901, p. 70. Dyar, 1904, p. 39; 1911, p. 15. Sovinsky, 1905, p. 109. Chapman, 1909a, p. 153; 1909b, p. 302. Coolidge, 1908c, p. 83. Rebel, 1909, p. 59; 1917, p. 16. Blanchier, 1909, p. 379. Oberthur, 1910, p. 84; 1914, p. 254; 1920, p. 190; 1922, pl. DXXX. Swinhoe, 1910-1911, p. 257. A. Bang-Haas, 1912, p. 106. O. Bang- Haas, 1920 [1926], p. 74. H. Miller, 1912, p. 222. McDunnough, 1914, p. 107; 1938, p. 25. Sheldon, 1914, p. 272. Rivertigat, 1915, p. 154. Verity, 1913, p. 187; 1926, p. 125. Barnes and McDunnough, 1917, p. 15. Barnes and Benjamin, 1923, p. 64;

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1926, p. 18. Cabeau, 1923, p. 25. Stauder, 1923, p. 66. Blackmore, 1927, p. 10. Comstock, 1927, p. 168. Pfeiffer, 1927, p. 40. Kimball, 1928, p. 44. Matsumura, 1929, p. 103. Romanisyn and Sohille, 1929, p. 97. Gunder, 1930, p. 42. Klots, 1930, p. 161; 1951, p. 141. Wright, 1930, p. 25. Fender, 1931, p. 185. Rondou, 1932, p. 132. Garth, 1935b, p. 48; 1950, p. 32. Querici and Romei, 1936, p. 9. Sak, 1937, p. 179. Federley, 1938, p. 400. McDunnough, 1938, p. 25. Dell'egeo, 1949, p. 232. Rocci and Taccani, 1940, p. 61. Clench, 1944, p. 94; 1946, p. 225; 1957, p. 58; 1961, p. 200; 1963, p. 52. Sibatani, 1946, p. 64. Sirkowitz, 1946, p. 242. Schwanwitach, 1948, p. 256. Podgorek, 1950, p. 47. Bowman, 1951, p. 131. Daniel, Forster and Osthelder, 1951, p. 14. J. Jones, 1951, p. 20. De Lattin, Jost, and Heuser, 1957, p. 127. Bernardi, 1951, p. 30. Daniel, Forster, and Osthelder, 1952, p. 14. Chneour, 1953-54, p. 231. Barraque, 1954, p. 185. Martin and Truxel, 1955, p. 23. Rothschild, 1956, p. 209. DeFoliart, 1956, p. 97. Powell, 1958, p. 30. Zerkowitz, 1958, p. 109. Larsen, 1959, p. 147. Langer, 1959, p. 101. Remington and Maeki, 1960, p. 138. Downey, 1962, p. 235. Emmel and Emmel, 1962a, p. 34. Tilden, 1959, p. 61; 1963, p. 288. F. Brown, 1964, p. 55. Wright, 1964, p. 55. Ostrogovich, 1965, p. 247. Hubbard, 1965, p. 231. Higgis, 1965, p. 10. Bretherton, 1966, p. 14. Moucha, 1966, p. 49. R. Brown and Opler, 1967, p. 133; 1970, p. 67. Scott, Ellis, and Eff, 1968, p. 164. Shields, 1967, p. 83. Langston and Opler, 1968, p. 97. LeCerf, 1968, p. 101. Pyle, 1968, p. 172. Gorelick, 1968 (1970), p. 99; 1971, p. 5. Ferris, 1970, p. 4; 1974, p. 279. Riley, 1970, p. 238. Scott, 1968 (1970), p. 192; 1975, p. 18. Anon., 1972, p. 9. Hoegh-Guldberg, 1972, p. 127. Korschunov, 1972, p. 359. Langer, 1972, p. 2. Leighton, 1972, p. 12. Ritterbush, 1972, p. 9. Emmel and Emmel, 1973, p. 61. Povolny, 1973, p. 68. Langston, 1974, p. 92. R. Morris, 1975, p. 1.

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Shapiro, 1975, p. 100. Downey and Allyn, 1976, p. 1. McCabe and Post, 1976, p. 97. Monserrat, 1976, p. 364. Wood, undated, p. 301. Langer, undated, p. 191.

[Plebeii-] Callophrys: Heath, 1971, p. 16.

Callophrys (Xamia) [Xamia Clench, 1961, p. 205]. Brown and Opler, 1970, p. 63.

Callophrys (Callophrys): Clench, 1959, p. 58; 1961, p. 210; 1963, p. 131. Ziegler, 1960, p. 21. Garth and Tilden, 1963, p. 36. dos Passos, 1964, p. 58; 1970, p. 33. Gorelick, 1968 (1970), p. 99; 1971, p. 3. Brown and Heineman, 1971, p. 7. Ferris, 1971a, p. 34, 1971b, p. 24. Gregory, 1975, p. 34. Scott, 1975, p. 294.

DIAGNOSIS. Superficially Callophrys can be recognized by their brown uppersides and green undersides with variant white arcs of spots on the forewing and/or hindwing and the lack of a tail. These, however, are primitive characters. Callophrys are Holarctic in occurrence, adding readily to their recognition.

DESCRIPTION. Adult: Head with frons fuscous; eye-lining white. Legs without elongation relative to width (latter indicative of apomorphy in Callophryina). Palpi typical of the Quaternary Series Callophrys except some convergence of dimorphism in some apomorph taxa. Wing length moderate, 14.0 mm. to 17.0 mm. (forewing); without structural coloration above. All species untailed but with prominent recurved lobe. Under surface pattern limited to various expressions of mesial spots, hindwing, over green ground color. Male Genitalia: Palaearctic and Nearctic representative disparate. Former with tapered caudal extension of valvae much exceeding caudal tip of labides or with unique configurations, e.g., recurvation. Latter with thickly tapered caudal extension barely exceeding caudal tip of labides. Male genitalia of Nearctic species very similar, more so than in any genus in Callophryina. Palaearctic

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species more various, with unique characters (like recurvation) above. Female Genitalia: Palaearctic and Nearctic representatives disparate. Former with highly derived lamellal configurations--convoluted, lobed, etc., and narrow ductus bursae. Latter with primitive condition of wide ductus bursae and lamellae variously flared only slightly distad.

BIOLOGY. Early Stages: The early stages of numerous species are known (see descriptions of individual taxa); all species feed on herbaceous dicotoledons, the primitive condition for the group of genera Callophrys, Cyanophrys, Paracyanophrys. Numerous species are characterized by polyphagy. Foodplants: A wide range of herbaceous dicotyledons (see individual descriptions of taxa). The vast majority of species are polyphagous at the generic level.

TYPE SPECIES. Papilio rubi Linnaeus, by Billberg's original description.

DISTRIBUTION. Spatial: Figs. 542 to 545. Holarctic as described in the following remarks: species characterized infraspecifically by broad clines: Palaearctic--one species from British Isles eastward through Europe and Asia to Japan; other species limited in vicariant montane areas of Europe, Africa, and East Asia respectively; Nearctic, several broadly distributed and species infraspecifically clinal; all in the western montane areas.

REMARKS. The taxon Callophrys has had varied usage as a generic or subgeneric category in Callophryina. Based on consideration of primarily the Nearctic taxa, Ziegler (1961), Clench (1961), dos Passos (1970) and Howe (1975) have considered the placing of Callophrys as a genus encompassing the subgenera Callophrys, Cyanophrys, Incisalia, Mitoura, Sandia, and Xamia as an improvement over the usage of each of these as genera. From a phenetic concept of similarity and difference in relation to horizontal clustering, and with emphasis on such character states in the Nearctic only, this appraisal is definitely correct.

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The difficulty with it, however, vis-a-vis former use of each as genera (e.g. Klots, 1951, F. Brown, 1957, dos Passos, 1965, Shields, pers comm.) is that it breaks down even phenetically when one includes areas outside North America. This is because paraphyly of the group becomes apparent when one considers groups outside North America. Part of the problem, notwithstanding that the majority of the phenetic characters used by above workers are relatively primitive, has been that no one has known what species were phenetically included in Cyanophrys; in addition, Sandia and Xamia were monotypic genera, each including one unique Nearctic species, whose sister relationships were undefined.

Palaearctic representatives of Callophrys, as defined in this study, have been viewed in a simplified manner prior to this investigation. This is because only two species were presumed present in western Europe. Because of the differences inherent in taxonomic studies of entire trans-continental groups, an introduction to this problem is useful prior to taxonomic descriptions within the revision.

Common usage of specific names in Callophrys of western Europe has involved consideration of two taxa--rubi (1758), and avis (1909). The latter is a rather late addition, especially considering the myriad of infraspecific and other names that accumulated within the distribution area of rubi sens. lat. However, Chapman's distinction of avis, an isolated montane species feeding on Arbeutus (rubi is broadly ploy phagous), has remained valid. Since avis is from western Europe it could easily be accepted because of a general ignorance of lepidopterists of the actual status of other populations eastward within rubi sens. lat.'s range which had been described formerly as distinct. Application of the species category within rubi sens. lat. eastward through its Asian, Middle Eastern, and north African ranges becomes problematic utilizing the superficial characters

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traditionally ascribed to rubi in western Europe. In eastern Eurasia there are five names which have been variously used as species or subspecies for Callophrys or in some cases have been published and then ignored. These names include kolak (Higgins) (described as a species from extreme eastern Turkey), paulae Pffeifer (described as a species from northern Syria), mystaphia Miller (described as a species from east central Turkey), sauveola Staudinger (described as a variety from northern Pakistan, with evidence of his actually meaning subspecies or suspecting it perhaps of not being conspecific), and schamyl Sheldon (described as a subspecies of rubi from Chitral). Another name, fervida Staudinger, described as a form of rubi in North Africa, has been actually used as a subspecies (e.g., Riley and Higgins, 1970). All of the above names have received various usage depending on different authors' popular books, or on museum curation. To further complicate the situation, myriads of forms and aberrations have been named within rubi sens lat. and have been variously changed in status. Considered as forms, each of the infraspecific taxa could be assumed as occurring in any of the above taxa, or could be associated as forms within only some of the taxa above depending upon what status species level taxa were given in relation to each other. Hence, this situation has required a complete review.

Under the treatment of rubi I clarify the relationships of names kolak, paulae, mystaphia, sauveloa, schamyl, and fervida. When they are synonyms of rubi or another species, or when they are valid species in their own right, I respectively treat them as synonyms or describe them separately. I also review under each species the numerous form or aberration names which have been proposed. I make lectotype designations as necessary within the six taxa mentioned above, but I do not designate lectotypes or neotypes in relation to form or aberration names. In one case, virgatus Verity, a name generally ignored

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in the literature but actually denoting species rank, I have made the appropriate exception. As a result of this study, the names kolak, paulae, mystaphia, sauveola, schamyl and fervida all fall into synonymy under rubi. The name virgatus, having been described as a subspecies of rubi (i.e., race = subspecies) and applying to a population accorded species status in this paper (though over a much larger distribution area than in earlier usage), takes on species status by priority. There are also two species described entirely as new.

Callophrys cynthia, new species

Figs. 110, 321, 322, 489

DIAGNOSIS. Female genitalia with very long ductus (length, two times breadth of lamellae; rubi always less than one and one-half times this length); antrum enlarged to cuplike configuration, not tri-lobed as rubi but with central lobe highly contoured. Male genitalia similar to neofervida, caudal extension not tapered, but recurved with sharply tapered caudal tip after recurvation; wing characters similar to boreal or montane rubi populations, under surface deep green, hindwing beneath with only costad white spot.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 489) as typical of the genus. Frons fuscous or with slight green dorsad only. Upper Surface of the Wings: Ground color warm Raw Umber; scent patch distad in discal cell, slightly darker than rest of wing; wing veins outlined, darker than ground color. Margin of hindwings moderately crennated; fringe, forewing light brown, hindwing, white in limbal area. Under Surface of the Wings: Fluorite Green to Shamrock or Chromium Green. Immaculate except for small median white spot on hindwing in cell Sc + R_1. Both wings widely fringed; pale brown

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basad, pale distad on forewing, whitish distad, hindwing. Length of Forewing: 15.0 mm. (allotype). Female: Head, thorax, abdomen, legs and palpi (Fig. 489) as typical of the genus. Frons fuscous unless slightly green dorsad only. Upper Surface of the Wings: As on male. Under Surface of the Wings: As on males but fringe of hindwing whiter. Length of Forewing: 15.0 mm. (holotype). Male Genitalia: Fig. 321. Similar to neofervida. Characterized by recurved and sharply tapered caudal extension caudad the recurvature. Valvae, caudad saccus, clear, narrow-rimmed, eliptical, indented; valvae, lateral view, round-tapered; valvae, caudal extension, recurved immediately after bilobed configuration then tapered sharply caudad; saccus, long and pointed; cornuti as illustrated. Female Genitalia: Fig. 322. Characterized by long ductus, cuplike antrum, and centrally convoluted lobe of lamella postvaginalis as follows: ductus length two times breadth of lamellae from tip of lamella antevaginalis; antrum exaggerated to embrace lamella antevaginalis in cuplike configuration; lamella postvaginalis with distinct central lobe variously convoluted caudad. Signa single pointed spines.

TYPES. Holotype female (Fig. 110) and allotype male, Tunkinsck, Weissgbg [Weissgebirge?], southwest Irkustsk, Soviet Union, 2,000 m., July. Deposited AMNH. Paratypes: CMNH: Irkutsk, Avinoff (one female); BMNH: Ursk, Soviet Union (one male, one female); AMNH: Chadan, Soviet Union (one female). There is a small series in BMNH not included in the genitalic survey brought by me to the United States which I assume now to represent this species. Their genitalia must be checked to confirm the identification. S.E. Altai, Tehuja Valley (one specimen, sex not noted); Ongodai, Altai Mountains (four specimens, sex not noted). In Remarks below I list areas of Trans-Baikal where I have dissected rubi.

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DISTRIBUTION. Spatial: Fig. 545. Apparently, the high altitudes of the montane regions west and south of Lake Baikal [i.e., Tannu Mountains (Ur Tannu Ola, Khr Sangalin, southern Sayan Mountains, northwest Altai ranges) in Tuva region of the Soviet Union and adjacent montane Mongolia (southeast Altai ranges, Turgen Ula, Han Hohey)]. Either regionally allopatric or sympatric with rubi which occur in lowland areas of Trans-Baikal, in Khangarulsk Khrebet Mountains south of Lake Baikal, east of Lake Baikal in Buryat Mongol, and west of Lake Baikal in the lowland Urkutsk region. Temporal: Known only from July.

REMARKS. I am according species status to this insect from the montane Tuva regions west and south of Lake Baikal because of their genitalic distinctness from regionally sympatric rubi also occurring in the trans-Baikal. From the time of Staudinger, there has been mention of a distinct species of Callophrys from this region. Staudinger mentioned the locality Lepsa, in the foothills south of Lake Baikal as part of his syntype series of suaveola, which also included Armenian specimens. The preoccupation with wing character forms in rubi evidently obscured the understanding of relationships, for as noted under rubi, Staudinger later discussed many areas where "suaveola" was supposed to occur including the Altai Mountains. The taxon suaveola appears superficially different from normal rubi. Staudinger's syntype series has led me to designate an Armenian specimen of rubi as the neotype of suaveola and place suaveola as a synonmy of rubi. I have seen no specimens from Lepsa, but dissections from nearby foothills indicate typical rubi. The species cynthia is not conspecific with rubi, and Staudinger may well have seen cynthia but classified it as suaveola. C. rubi has been dissected by me from the following localities: Jbi Dist. E. Turkestan; Pompejetka, Little Chingan Mountains; Apfelgebirge, Transbaikalia; Amur River basin; Irkutsk; Region de Baikal; Russia, trans-Baikal; Tsakir, trans-Baikal; Ulan, trans-Baikal. All of the above specimens called rubi have genitalia

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associable with typical rubi and have a green frons. The type specimens of cynthia have a generally fuscous frons, as does the Chadan paratype. The two specimens from Ursk (accuracy of label unknown but this locality is farther out on the lowlands north of the Tannu mountain area) have slight green noticeable dorsad on the frons under a binocular scope. The entire type series of cynthia was dissected for genitalia, legs, and palpi. (See Remarks under rubi.)

ETYMOLOGY. This species is named for Cynthia Clevenger.

Callophrys virgatus (Verity), new status

Figs. 111, 223, 224, 490

Thecla rubi var. virgatus Verity, 1913, p. 187.

Callophrys rubi virgatus: Rocci and Taccani, 1940, p. 61. Bernardi, 1951, p. 30. Daniel, Forster, and Osthelder, 1951, p. 14.

DIAGNOSIS: Endemic to Corsica, Sardinia, and Elbe, and also occurring along the Tuscan coast of Italy; an immediate sister species more similar to avis, atlasensis, and neofervida than to rubi. Distinguished superficially by the following characters: frons fuscous (not bright brown as in avis and atlasensis, or bright green as in rubi) and white eye lining; irregular white median line on the hindwing under surface extremely bold; margin of the hindwing is greatly crennated, with an emphatic recurved lobe; female genitalia with ductus much longer than any species except cynthia and lamella postvaginalis smooth (only vaguely reminiscent of the tri-lobed structure of rubi); male genitalia with bilobed configuration nearly equal in caudal expanse to caudal extension of valvae and latter wide until at least centrad in the caudal extension, then

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extremely tapered to narrow tips; saccus extremely broad and elliptical, not short and parabolic as in rubi.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 490) as typical of the genus. Frons fuscous to vaguely speckled green dorsad. Upper Surface of the Wings: Ground color dull Sudan Brown overscaled bright shiny Cinnamon-Rufous. Scent patch distad in forewing discal area, nearly same color as wing. Fringe, both wings, brown, noticeably paler distad, especially between the veins. Margin of hindwing deeply crennated, recurved lobe of hindwing emphatic, white fringe especially noticeable between the two vein interspaces distad the lobe. Under Surface of the Wings: Ground color Oil Green to Parrot Green appearing heavily dusted, except for broad areas of forewing immediately cephalad the hindwing. This latter area is brown, as the upper surface, with this brown often extending cephalad into the discal area. Hindwing with emphatic postmedian line of white rectangular spots from the costa to vein Cu_2; postmedian line of similar white spots occasionally repeated on forewing. Fringe, forewing, distinctly brown, pale distad; hindwing, same, with white more emphatic between the veins anad, especially around the recurved lobe, and with crennated vein-ends 2, Cu_2 and Cu_1 distinctly edged blackish distad. Length of Forewing: $\bar{X}$ of four specimens (AMNH), 15.5 mm., range 14.5 mm. to 17.2 mm. Female: Head, thorax, abdomen, palpi and legs (Fig. 490) as typical of the genus. Frons as on male. Upper Surface of the Wings: As on males but with brown more expansive basad and no scent patch distad in the discal area of the forewing. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of three specimens (AMNH, NMNH), 15.9 mm., range 14.5 mm. to 17.4 mm. Male Genitalia: Fig. 323. Characterized by bilobed configuration approaching same caudal expanse as caudal extension, and caudal extension remaining wide extremely caudad then tapering abruptly. The saccus is also unusually widely

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elliptical and long. Valvae caudad sacacus, clear, narrow-rimmed, extremely expansive caudally, vaguely indented and elliptical; valvae, lateral view round-tapered, slight funnel centrad; valvae, caudal extension, about equal in length to bilobed configuration, extremely wide caudad then abruptly tapering centrad. Saccus, broadly elliptical, almost as long as bilobed configuration. Cornuti as illustrated. Female Genitalia: Fig. 324. Most similar to atlasensis and avis, with lamella postvaginalis nearly entire but with slightly tri-lobed tendencey along caudal edge. Antrum much more reduced than on rubi or cynthia.

TYPE. Holotype male, BMNH. Type Locality: North Tuscan coast, Italy.

DISTRIBUTION. Spatial: Fig. 546. Endemic to Corsica, Sardinia, and Elbe, and along the Tuscan coast of Italy (see Remarks below). Temporal: Known only from April.

REMARKS. Once the specificity of this entity was defined, it became apparent that Verity's name virgatus took priority for it at the species level. The genitalic configuration of the virgatus type is so extreme in relation to continental rubi that it is at first very confusing. However, when material from Elbe, Corsica, and Sardinia is dissected, these and the Tuscany specimens are all seen to represent one population. Further examination of facies in this population reveals the uniqueness of the consistently spotted median band on the hindwing under surface and the fuscous-colored nature of the frons, an apparently primitive condition. If green occurs at all, it is limited to slight scaling dorsad. Genitalic consideration does not link virgatus closely with rubi, but indicates virgatus as a taxon sharing characters of a relatively more primitive nature with avis and atlasensis. Cladistic analysis indicates that the characters of virgatus are not simply unusual facies of rubi (as thought by Bretherton, De Worms, and Johnston, 1963) but represent a distinct species akin to avis and atlasensis of Europe and North Africa.

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The morphological hypothesis in the cladogram of Callophrys invites study of biological and larval foodplant relations of virgatus especially as regards what mechanism isolates the Tuscan distribution area within sympatric rubi. The thorough investigation by me of Corsican, Sardinian, and Elban Callophrys was prompted by the presence of two other endemics to these islands--Papilio hospiton Gene (Papilionidae), limited to Corsica and Sardinia, and Coenonympha corinna Hübner (Satyridae), limited to Corsica, Sardinia, and Elbe, but like virgatus also occurring on the Tuscan coast near Monte Argentario.

Callophrys avis Chapman

Figs. 325, 326, 491

Callophrys avis Chapman, 1909a, p. 302. Oberthür, 1910, p. 84; 1914, p. 26; 1922, pl. DXXX. Rothschild, 1925, p. 209. Rondou, 1932-1935, p. 132. Zerkowitz, 1946, p. 242. Chneour, 1954, p. 231. Bretherton, 1966, p. 14. Le Cerf, 1968, p. 101. Higgins and Riley, 1970, p. 238. Higgins, 1975, p. 113. Langer, undated, p. 191.

[Plebeii-] Callophrys rubi: Heath, 1971, p. 16.

DIAGNOSIS. Bright Chestnut brown frons and eye lining, in north Africa sharing this character only with atlasensis. Genitalia consistent and distinctive: female lamella postvaginalis hemispherical and entire, with ventral striated folds (not tri-lobed as rubi, vaguely tri-lobed as virgatus and atlasensis, or comletely entire without ventral convolutions as in neofervida). Male caudal extension of the valvae always distinctively elongate and evenly tapered (not recurved or tapering only centrad after a distinctly wide area cephalad).

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DESCRIPTION. Male: Head, thorax, abdomen, palpi (Fig. 491) and legs as typical of the genus. Frons bright Chestnut brown. Upper Surface of the Wings: Ground color bright nearly iridescent Cinnamon-Rufous, usually covering even base of forewing. Male scent patch distad in discal area, same color to slightly darker than rest of wing. Fringe, forewing, as ground color, paler distad; hindwing same, but cell interspaces distinctly whitish, vein ends distinctly blackish. Margin of hindwing very mildly crennate, recurved lobe only mildly apparent. Under Surface of the Wings: Ground color variously Lettuce Green to deeper Cress Green, often suffused basad with darker overscaling. Area of forewing immediately cephalad hindwing narrowly brown, becoming grayed in some specimens distad. Forewing with entire to occasionally broken white postmedian line costa to vein Cu_1; repeated on hindwing from costa to vein Cu_2 or occasionally 2A. Fringe, both wings, bright brown, paler distad on forewing, distinctly whitish in the cell interspaces on hindwing. Small recurved lobe usually brightly suffused Cinnamon-Rufous. Length of Forewing: $\bar{X}$ of 12 specimans (BMNH), 14.6 mm., range 14.2 mm. to 14.8 mm. Female: Head, thorax, abdomen, palpi (Fig. 491) and legs as typical of the genus. Frons as on male. Upper Surface of the Wings: As on males, but with bright brown ground color usually extending more basad on both wings; lacking scent scale distad in discal cell. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 10 specimens (BMNH), 14.8 mm., range 14.5 mm. to 15.0. mm. Male Genitalia: Fig. 325. Characterized by the elongate and evenly tapered caudal extension of the valvae. Valvae, caudad saccus, clear, narrow-rimmed, roundly parabolic and slightly indented; valvae, lateral view, round-tapered; valvae, caudal extension tapered; saccus pointed; cornuti as illustrated. Female Genitalia: Fig. 326. Characterized by hemispherical shape of lamella postvaginalis and the ventrad convolutions beneath it. Lamella antevaginalis extending about one-third the

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length of the lamella postvaginalis, with distad sclerotizations; tapered cephalad in antrum like fashion to ductus. Ductus about same length or slightly longer than breadth of lamellae; signa single broadly based spines, moderately bifurcate distad, one prong about half the length of the other.

BIOLOGY. Early Stages: Not described in detail other than Chapman, 1912. Foodplant: Arbutus unedo Linnaeus (Ericaceae).

TYPE. Holotype male and allotype female, BMNH. Type Locality: Amelie-les-Bains, southern France.

DISTRIBUTION. Spatial: Fig. 545. Occurring in several disjunct, probably relict, ranges in southern Europe: France--eastern Pyrenees, Var, Alpes Maritimes; Spain--southwest San Marina and Guadiana Mountains, and north in the southwest areas of the Cantabrian Mountains. Entering Portugal in the western ranges of the above montane areas. In North Africa in the Atlas Mountain chains up to 1,700 m. (Higgins and Riley, 1970) in Tunisia, Algeria, and Morocco. Apparently not well distributed in the southern Atlas chains of this region or westward to Gibraltar; rather more limited to regions eastward from the West Muduya River. Temporal: Single brooded, April through May.

REMARKS. The preponderance of interest in phenetic concepts of wing characters and the idea of sports and forms led to much overlooking of actual species of Callophrys in the Palaearctic. Only after myriads of form and aberration names had appeared in the literature did Chapman demonstrate the specificity of avis by the obviousness of its frons and eye-lining characters, its limitation to disjunct montane environs and its foodplant monophagy (1909a, 1909b). Since that time, no one seems to have applied the characters of frons and eye-lining to a systematic study of all populations across the Palaearctic region and no one has looked at genitalia. A cladistic concept of the group based

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on palpal, genitalic, frons, eye-lining and wing characters indicates six species are present and which represent few of the former ideas of species level taxa in the group. The six Callophrys taxa form two groups, generally lowland (rubi, neofervida) and generally montane (avis, atlasensis, virgatus, cynthia). The former are broadly distributed; the latter almost all indicate disjunct distributions within each species, probably evidencing former larger distribution broken by subsequent vicariance. All of the latter taxa have a fuscous or brown frons, the development of the exotically haired brown frons and adjacent eye-lining indicated as a derived character of the former fuscous state. The lowland forms have a green frons, indicated as also derived from the fuscous state. These relations of species are corroborated by genitalic characters and also corroborate the general hypothesis of polarity for the Callophryina. Of Palaearctic Callophrys, avis is indicated as the immediate sister species of atlasensis and virgatus, the latter being two vicariant species divided from a north-south ancestral distribution now apparent in central North Africa and on Mediterranean islands, and avis representing western species vicariantly now occurring in North Africa and Europe (but only in scattered disjunct colonies). C. virgatus has the most primitive characters; parsimony indicates that the brown frons of avis and atlasensis is independently derived, since characters of both male and female genitalia link atlasensis and virgatus in synapomorphy. Persons hesistant to entertain the concept of Callophrys in this paper should use the situation of avis as precedent for the understanding of the presence of further montane vicariant species occurring disjunctly in the Palaearctic. The relation of these distributions to that of African and European plate tectonics is discussed in the latter sections of this monograph.

I dissected thirteen males and fourteen females of avis from across its range. (See Remarks under rubi.)

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Callophrys neofervida, new species

Figs. 112, 327, 328, 492

DIAGNOSIS. A north African species, distinguished from sympatric C. avis by the latter's chestnut-brown frons and eye borders. The new species has white borders on the eyes and a green frons, but not as broadly green as rubi, and tufted dorsal with brown hairs.

DESCRIPTION. Male: Head, thorax, abdomen, palpi (Fig. 492) and legs as typical of the genus. Frons green. Upper Surface of the Wings: Ground color dull Sudan Brown overlaid with bright, nearly iridescent Cinnamon Rufous. Scent patch distad in discal area nearly same color as rest of wing; margin of hindwings entirely or almost entirely smooth, evidence of any recurved lobe between outer and anal angles almost nil. Wing surface along anal margin often very lightened. Under Surface of the Wings: Ground color bright Florite Green with heavily dusted appearance. Apices of forewing and broad area of forewing immediately cephalad hindwing shiny Sudan Brown overscaled with shiny Cinnamon Rufous. Fringe, both wings, brown. Hindwing usually immaculate to expressing a few whitish spots in the median line costad. Length of Forewing: 15.2 mm. (holotype); $\bar{X}$ of 7 males (BMNH), Morocco, Algeria, Mauritania, 14.8 mm., range 14.5 mm. to 15.5 mm. Female: Head, thorax, abdomen, palpi (Fig. 492) and legs as typical of the genus. Frons as on male. Upper Surface of the Wings: As on males but usually brighter in discal area of forewing and basal area of hindwing. Under Surface of the Wings: As on males. Length of Forewing: 14.8. mm. (allotype); $\bar{X}$ of 7 females (BMNH), Algeria, Morocco, Mauretania, 14.9 mm., range 14.5 mm. to 15.8 mm. Male Genitalia: Fig. 327. Characterized by the recurved condition of the caudal extension of the valvae, present only in

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congener cynthia. Valvae, caudad saccus, clear, narrow- to mid-rimmed, broadly parabolic, unindented; valvae lateral view, round-tapered; valvae caudal extension recurved, sharply tapering after recurvature about centrad in the caudal extension. Saccus short, less than lengh of bilobed configuration, blunt-ended; cornuti as illustrated. Female Genitalia: Fig. 328. Characterized by broadly hemispherical and entire lamella postvaginalis and diminutive lamella antevaginalis with sclerotizations distad. Ductus long, about one and one-half times breadth of lamellae, flared emphatically cephalad. Signa single broad based spines mildly bifurcate distad.

BIOLOGY. Early Stages: As far as I know, no one has described the early stages of specifically African material. A search of the literature listed by Tutt (1907) yields no such commentaries and Oberthür (1922) gives no information that could be tied directly to neofervida, per se. Foodplants: Not specifically mentioned for any population in Africa known to represent neofervida.

TYPES. Holotype male (Fig. 112) and allotype female, Ain Drahaw, Tunisia, 23 April 1941, A. Chenour. Deposited AMNH. Paratypes: BMNH: Data as on holotype (one specimen, sex not noted).

DISTRIBUTION. Spatial: Fig. 546. Coastal lowlands and adjacent areas of Tunisia, Morocco, Algeria, Mauretania, probably also the western Sahara and Canary Islands (Crompton in Tutt; 1907-1908). Temporal: Higgins and Riley (1970), Oberthür (1914, 1922), Chenour (1954), and Tutt (1907) mentioned evidence of a small second brood (specimens into mid- or late July) differing from the usual extremes of late February to mid-June considered normal. This needs to be verified in relation to the distinction of the north African populations described here as neofervida and may or may not be significant.

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REMARKS. The north African populations formerly considered rubi are designated as a valid species on the basis of the genitalia of both sexes, the relations of the taxon to sister taxa discribed in this paper, and the lack of evidence in dissections from throughout the north African, European and Asian areas of any cline between populations spanning from Syria to Tunisia west across Gibraltar into Spain and Portugal. The genitalia of populations in north or south Spain and Portugal conform with the configuration typical of rubi throughout its Eurasian distribution. All African genitalia conform to the configuration herein described for neofervida. Perhaps rubi or neofervida may be found sympatrically around Gibraltar and Algeciras, but an examination of all material available (28 specimens) does not indicate this. The genitalic configuration of the females of neofervida is deemed significant because of its departure from the characteristic three-lobed lamella postvaginalis of rubi. When placed in a cladogram of characters for species named in this paper, the neofervida characters suggest a more primitive condition relative to rubi and a slightly more derived condition than the entire lamella postvaginalis characteristic of the clade of montane species avis, atlasensis, and virgatus. The recurved condition of the caudal extension in male valvae of neofervida is significant because it corroborates the same cladogram. This opinion of Palaearctic taxa is consistent with the characters of Nearctic Callophrys. In the latter, extreme tapering is indicated as derived. Holarctic characters are consistent with the concept that a fuscous frons is primitive, and an exotically haired and colored frons derived (in this case chestnut and green, independently).

I wanted to use the name fervida for this species, since it is commonly used as the form name for lowland North African material. However, the very frequent usage of this name for southern European aberrations (especially in France) of rubi made this inadvisable.

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The types and eight males and seven females were dissected for genitalia, legs, and palpi. (See Remarks under rubi.)

ETYMOLOGY. The name is formed from fervida to indicate the affinity with this familiar name for the north African form by adding the Greek prefix "neo" (new). This is also to distinguish it from the usage of that name in southern Europe.

Callophrys atlasensis, new species

Figs. 113, 329, 330, 493

DIAGNOSIS. This extremely high altitude species differs from rubi and neofervida by its having the bright brown frons and eye lining and genitalia characteristic of the montane clade of taxa avis, atlasensis and virgatus. It differs from avis (with which it co-occurs regionally but seems not actually sympatric) by the male and female genitalia as follows: female genitalia of atlasensis akin to the three-lobed configuration of rubi (see Remarks for cladistic analysis) and male genitalia with the caudal extension more extremely tapered in relation to a much larger bilobed configuration. The species atlasensis resembles its most immediate sister species virgatus, but they are widely allopatric.

DESCRIPTION. Male: Head, thorax, abdomen, palpi (Fig. 493) and legs as typical of the genus. Frons bright Chestnut brown. Upper Surface of the Wings: Ground color dull Sudan Brown. Scent patch distad in discal area nearly same color as rest of wing; fringes both wings same color as rest of wing; margin of hindwings nearly entire, little evidence of recurved lobe. Under Surface of the Wings: Ground color light Florite to duller Winter Green, appearing grizzled

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especially at base of hindwing. Fringe, both wings, dull brown. Hindwing nearly immaculate except for vague dash-like mesial white spots variously present to obsolescent. Length of Forewing: 14.2 mm. (holotype). Female: Head, thorax, abdomen, palpi (Fig. 493) and legs as typical of the genus. Upper Surface of the Wings: As on males except for slightly lighter brown centrad, forewing; limbally, hindwing. page missing: Figs. 329, 330. Length of Forewing: 14.3 mm. (allotype).

BIOLOGY. Early Stages: Since the poplations of this species are from quite unique areas, it is doubtful that any of the descriptions in the literature for African rubi coincide with this species. Foodplant: Unknown for reasons stated immediately above.

TYPES. Holotype male (Fig. 113), Aflou, (Algeria), marked "High Mts., Aflou, Good species, very rare, 6 pounds/pair, Algiers, 12 April 1928." Allotype female, companion specimen with only latter data, Algiers, 10 April 1928, same handwriting. Deposited AMNH. Paratypes: CMNH: Agouti m'journ, "High Atlas", Morocco, 17 April 1950 (one female), "High Atlas", Algeria (one male). BMNH: Aflou, Algeria, 1920 (two specimens, sex not noted); Sud-Oranaiz, Aflou, Algeria, 1920 (one specimen, sex not noted).

DISTRIBUTION. Spatial: Fig. 546. Three, possibly more (data unclear), areas of the very high Atlas Mountains in Morocco (Agouti m'journ) and Algeria (only one locality precisely listed--Aflou, in southern central Atlas chain). Temporal: Known only from April.

REMARKS. This species is judged distinct because it has a brown frons and eye lining like avis but genitalia not allowing its placement in that species. Rather, the genitalia suggest a closer cladistic relation to virgatus. Other evidence for the specific distinctness of this species is its disjunct range,

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scattered (with only minor character variation) through three disjunct high areas of the Atlas mountains, one distinctly in the "back" range of the Greater Atlas mountains of Algeria, unlike any other Callophrys, even avis. The genitalia of the Moroccan material from Agouti m'journ vary little from typical in the female (showing evidence of the bilobed configuration completely uncharacteristic of avis, and brown frons and eye lining) and only slightly in the male (the caudal extension of the valvae being slightly more reduced and less tapered to a slight degree caudad). As avis is known to occur in four widely disjunct high mountain areas of Europe as well as north Africa, atlasensis seems to be a high mountain, perhaps relict, species occurring in disjunct high montane areas of central north Africa. Cladistically the characters of atlasensis place it as the immediate sister species of avis (by color of frons) or virgatus (by genitalia). I prefer the hypothesis that atlasensis is the immediate sister species of virgatus by parsimony. This latter view is also more fitting with the geographic distributions and the fact that avis itself is widely distributed in north Africa. Someone should investigate the foodplant relationships of these taxa to determine possible bases for their distribution. The approach to Palaearctic Callophrys in the classic literature (e.g. Tutt, 1907) is so phenetic (witness the proponderance of forms with no regard to consideration of spatial or reproductive isolation) that the associated foodplant data is nearly useless.

The entire type series except the BMNH paratypes were dissected for genitalia, legs, and palpi. (See Remarks under rubi.)

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Callophrys rubi (Linnaeus)

Figs. 114, 115, 331, 332, 494

[Papilio-] Plebeius rubi Linnaeus, 1758, p. 483. Jackson, 1913, p. 48.

Papilio rubi: Linnaeus, 1761, p. 284. Poda, 1761, p. 77. Scopoli, 1763, p. 176. Hufnagel, 1766, p. 82. Schiffenmüller, 1775, p. 186. Fuessly, 1775, p. 31. Fabricius, 1775, p. 700; 1776, p. 210; 1779, p. 270. Rottemburg, 1776, p. 12. Mueller, 1776, p. 112. Berg, 1780, p. 28. pl. 22, fig. 8, 9; pl. 31, fig. 4. Gotz, 1780, p. 185. Lang, 1782, p. 50. Brahm, 1783, p. 652; 1790, p. 1; 1791, p. 227. Retzius, 1783, p. 227. Geoffroy, 1785, p. 245. Schneider, 1785, p. 225. Borkhausen, 1788, p. 138; 1789, p. 218. Lang, 1789, p. 47. Schwarz, 1791, p. 47. Goeze, 1792, p. 61. Lewin, 1795, p. 92, pl. xliv, fig. 3, 4, 5, 6. Hübner, 1799, p. lxxii, figs. 364, 365; "1800", fig. a, b, c; 1805, p. 55; 1823, p. 786. Herbst, 1804, p. 119, p. 308, fig. 5, 6. Ochsenheimer, 1808, p. 91. Hemming, 1937, p. 143; 1967, p. 91.

[Papilio-Plebeius-] Ruralis rubi: Linnaeus, 1767, p. 791. Fabricius, 1775, p. 723. Sulzer, 1776, p. 36, pl. 121. Borkhausen, 1793, p. 294. Haworth, 1803, p. 39.

[Plebeius-] Ruralis rubi: Esper 1779, p. 279; 1777, pl. 11, fig. 2; 1785, pl. mcviii, figs. 1, 2, 3, 4.

[Papilio-] Ruralis rubi: DeVilliers, 1789, p. 68.

[Hesperia-] Ruralis rubi: Fabricius, 1793, p. 287, pl. 1.

Cupido rubi: Schrank, 1801, p. 218.

Polyommatus rubi: Latrielle, 1805, p. 117; 1809, p. 207; 1819, p. 673. Godart, 1821, p. 206, pl. 10, fig. 3, pl. 10, fig. 5. Boisduval, 1829, p. 10. Duplacey, 1845, p. 29.

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Lycaena rubi: Fabricius, 1807, p. 285. Leach, 1815, p. 129. Ochsenheimer, 1816, p. 27. Treitschke, 1834, p. 77. Zetterstedt, 1840, p. 910. Eversmann, 1844, p. 65.

Hesperia rubi: Oshsenheimer, 1815, p. 721, pl. 2.

Zephyrus rubi: Dalman, 1816, p. 94.

Heodes rubi: Dalman, 1816, p. 94.

Chysoptera rubi: Zincken, 1817, p. 75.

Lycus rubi: Hübner, "1816-1818" [1819], p. 74. Stephens, 1835, p. 404. Dale, 1890, p. 44.

Thecla rubi: Semper, 1819, p. 241. Esper, 1829, pl. 21, fig. 2. Stephens, 1828, p. 78; 1829, p. 21; 1850, p. 78. Freyer, 1830, p. 102. Meigen, 1830, p. 46. Wood, 1839, p. 7, pl. 2, fig. 55. Rambur, 1839, p. 259; 1858, p. 32. Boisduval, 1840, p. 8. Humphrey and Westwood, 1841, p. 90. Schneider, 1843, p. 135. Dupouchel, 1844, p. 206, pl. 10. Doubleday, 1847, p. 17; 1859, p. 2. Westwood and Hewitson, 1852, p. 486. Lederer, 1852, p. 19. Gerhard, 1853, pl. 3, fig. 5. Wallengren, 1853, p. 189. Humphrey, 1857, p. 8. Stainton, 1857, p. 54. Kirby, 1858, p. 3; 1862, p. 7; 1863, p. 490; 1871, p. 398; 1879, p. 59, pl. 15, fig. 3. Speyer, 1858, p. 259. Heinemann, 1859, p. 91. Staudinger, 1861, p. 3; 1871, p. 7; 1881, p. 279. W. Edwards, 1862, p. 224. Berce, 1867, p. 125. Snellen, 1867, p. 66. Nolcken, 1868, p. 52. Curo, 1874, p. 107. Frey, 1880, p. 9. Elwes, 1881, p. 865. H. Edwards, 1884, p. 478. Lang, 1884, p. 18, fig. 3. Buckler, 1885, p. 89, pl 13, fig. 3. Aurivillius, 1889-1891, p. 8, pl. 7, fig. 3. Dale, 1890, p. 44. Barrett, 1893, p. 53, pl. 8, fig. 4, 4c. Hoffman, 1894, p. 6, pl. 4. Rühl, 1895, p. 195. Meyrick, 1895, p. 195. Strand, 1901, p. 45. Ter Haar, 1904, p. 8. Barrett, 1907, p. 8. Spuler, 1908, p. 54. Gelin and Lucas, 1912, p. 35. Horn, 1928, p. 40. Coleman, 1945, p. 146, p. 14.

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Strymon rubi: Pierce and Beirne, 1941, p. 25.

[Plebeii-] Callophrys rubi: Heath, 1971, p. 16.

Callophrys rubi: Billberg, 1820, p. 80. Scudder, 1875, p. 132 (as type of Callophrys). Krulikowsky, 1890, p. 19. Fuchs, 1891, p. 211. Moschlowsky, 1893, p. 164. Tutt, 1896, p. 196; 1896, p. 220; 1907, p. 91. Staudinger, 1901, p. 70. Staudinger and Rebel, 1901, p. 289. Sovinsky, 1905, p. 109. Chapman, 1907, p. 153; 1912, p. 302. Coolidge, 1908, p. 83. Rebel, 1909, p. 59; 1917, p. 16. Blanchier, 1909, p. 379. Oberthür, 1910, p. 84. Swinhoe, 1910-1911, p. 257. A. Bang-Haas, 1912, p. 106. O. Bang-Haas, 1920, p. 74. Miller, 1912, p. 222. Sheldon, 1914, p. 272. Rivertigat, 1915, p. 154. Verity, 1913, p. 187; 1926, p. 125. Oberthür, 1922, p. 190. Cabeau, 1923, p. 25. Stauder, 1923, p. 66. Pfeiffer, 1927, p. 40. Kimball, 1928, p. 44. Matsumura, 1929, p. 103. Romanisyn and Sohille, 1929, p. 97. Pfeiffer and Pfeiffer, 1932, p. 30. Querici and Romei, 1936, p. 7. Anon., 1937, p. 179. Federley, 1938, p. 400. Dell'egeo, 1940, p. 232. Rocci and Taccani, 1940, p. 61. Sibatani, 1946, p. 64. Schwanwitach, 1948, p. 256. Podgorek, 1950, p. 47. Daniel, Forster and Osthelder, 1951, p. 14. Cambell, 1954, p. 109. de Lattin, Jöst, and Heuser, 1957, p. 127. Bernardi, 1951, p. 30. Chneour, 1953-54, p. 231. Barraque, 1954, p. 185. Rothschild, 1956, p. 209. Zerkowitz, 1958, p. 109. Larsen, 1959, p. 147. D'azevedo, 1959, p. 164. Langer, 1959, p. 191; 1972, p. 2. Remington and Maeki, 1960, p. 138. Capuse, 1963, p. 189. Wright, 1964, p. 55. Ostrogovich, 1964, p. 247. Higgins, 1965, p. 10. Moucha, 1966, p. 49. Higgins and Riley, 1970, p. 238. Gorelick, 1971, p. 5. Korschunov, 1972, p. 359. Hoegh-Guldberg, 1972, p. 127. Povolny, 1973, p. 68. Morris, 1975, p. 1. Downey and Allyn, 1976, p. 1. Monserrat, 1976, p. 364.

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Callophrys rubi var. chalybeitincta Sovinsky, 1905, p. 109. Korschunov, 1972, p. 359 (listed as species, in error).

Callophrys chalybeitincta: Korschunov, 1972, p. 359 (species status in error).

Callophrys (Callophrys) rubi: Scott, 1975, p. 293.

Papilio caecus Geoffrey, 1785, p. 245. Rühl, 1895, p. 196. Tutt, 1896, p. 196. Wheeler, 1903, p. 46. Tutt, 1907, p. 94 (placed as synonym of immaculata Fuchs and as an ab. of rubi).

Papilio rubi caecus: Fourcroi, 1785, p. 245.

Callophrys rubi caecus: Tutt, 1907, p. 94.

Thecla suaveola Staudinger, 1881, p. 279. Rühl, 1895, p. 196. Tutt, 1896, p. 197.

Callophrys mystaphia Miller, 1912, p. 222. O. Bang-Haas, 1920, p. 74. Korschunov, 1972, p. 359. NEW SYNONYMY.

Callophrys schamyl Sheldon, 1914, p. 272. NEW SYNONYMY.

Callophrys paulae Pfeiffer, 1932, p. 30. NEW SYNONYMY.

Callophrys kolak, Higgins, 1965, p. 10. NEW SYNONYMY.

DIAGNOSIS. Superficial characters distinguishing rubi from avis include: frons and facial hairs green (rubi), frons and facial hairs red-brown (avis); upper surface ground color general dull and fuscuous (rubi), bright rust-brown (avis); under surface pattern white spots variously absent (rubi), white spots ample, usually forming lines on both fore and hindwing (avis). Genitalia best for diagnosis: female genitalia with lamella postvaginalis distinctly tri-lobed (rubi), broadly hemispherical and striated with thin convolutions ventrad (avis); male genitalia, valvae of male caudad extension characterized by a slight corner cephalad then a rounded tapering first wide, then very narrow (rubi), directly tapered, quite evenly and often with much longer configuration (avis) though some convergence seems apparent in north African avis. From cynthia, rubi is

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immediately known by the former's unique genitalic characters: female with lamella postvaginalis not tri-lobed, but multi-lobed, male with caudal extension of valvae being distinctly recurved caudad.

DESCRIPTION. Male: Head, thorax, abdomen, palpi (Fig. 494) and legs as typical of the genus. Frons green (fresh specimens). Upper Surface of the Wings: General description (see Remarks for full elucidation of all named color and pattern forms)--ground color bright warm brown to dull brown, to blackish. Scent patch distad in discal area, small, less than one-fourth length of cephalad vein of cell. Fringe of wings sometimes brown, sometimes pale, sometimes distinctly white. Fringe of hindwing often coupled with crennated black marginal line to give speckled appearance. Under Surface of the Wings: General description (see Remarks for full elucidation of all named color and pattern forms)--ground color various shades of green, not mottled, sometimes immaculate. Other times, postmedian line on forewing from costa to vein M_3, Cu_1, or Cu_2 variously light or obsolescent. Median band of white spots on hindwing variously present from costa to vein M_2, M_3, or Cu_1, or simply random, variously light or obsolescent. Fringe brown to pale; sometimes distinct speckled in appearance due to interplay of white fringe with a black marginal line. Length of Forewing: $\bar{X}$ of 20 specimens (BMNH) over entire distribution (see list of genitalia dissected and Material Examined) 15.2 mm., range 11.5 mm. (north Pakistan) to 16.8 mm. (Sicily). Female: Head, thorax, abdomen, palpi (Fig. 494) and legs as typical of the genus. Upper Surface of the Wings: Similar to the males. Under Surface of the Wings: Similar to the males. Length of Forewing: $\bar{X}$ of 20 specimens (BMNH) over entire distribution (see list of genitalia dissected, and Material Examined), 16.1 mm., range 12.5 mm. (north Pakistan) to 17.0 mm. (Sicily). Male Genitalia: Fig. 331. Valvae, caudad saccus, clear, narrow-rimmed, parabolic, slightly indented; valvae, lateral view round-tapered;

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valvae, caudal extension, slightly cornered in relation to bilobed configuration cephalad, then tapered from wide cephalad area to very narrow caudal area, making tapering very curved-sloped; saccus parabolic; cornuti as illustrated. Variation: There is mild variation throughout the range of rubi, usually involving the bilobed configuration becoming more or less broadly parabolic, and caudal extension of more or less directly tapered; the lateral view of the valvae may have the dorsal articulation of the valvae extreme or elongated in some cases. Female Genitalia: Fig. 332. Lamella postvaginalis distinctly tri-lobed, middle lobe occasionally slightly indented caudad in highly variant populations; no noticeable antrum as distinct from the lamella antevaginalis. Ductus slightly longer than breadth of lamellae, flared gradually caudad; signa deeply bifurcate spines on a rounded base. Variation: There is only slight variation across the entire range of rubi. The signa are always deeply bifurcate but the prongs may differ in size; the particular sculpturing of the three lobes on lamella post-vaginalis varies slightly.

BIOLOGY. Early Stages: The early stages of this common insect are well known. Among many others, they have been described in detail by Tutt, 1907. Foodplant: The foodplant usages of rubi include a wide polyphagy of several plant famlies. The most exhaustive list, with regional notations, is in Tutt, 1907. Higgins and Riley (1970) list plants of Fabaceae and Ericaceae.

TYPE. The type is apparently lost, as has been assumed for some time (Verity 1943). Because of the familiarity of this butterfly and because it can be confused with no other in western Europe, I do not consider a neotype designation useful. Type Locality: Sweden (designated by Verity, 1943).

DISTRIBUTION. Spatial: Across western Europe except extreme northern England and Ireland; eastward across Eurasia to northern Japanese Archipalego

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(Sachulin Island). In Asia south only through the Amur River Basin and Trans-Baikal, in the lowlands, but not in China. In Middle East southward from Turkey to Syria, eastward through Iraq, Iran, and Afghanistan to northern Pakistan. The population in Mongolia, China, is a distinct species. Temporal: Appearing as early as late February (25th) in a single brood flying until at least mid- to late June.

REMARKS. Following below is a list of the taxa accorded species or subspecies rank previous to this paper which are considered synonyms as a result of this investigation. Though the wing patterns may vary somewhat the genitalia do not. Following this discussion will be a listing of all the color and pattern forms named within rubi. Included below are also the lectotype or neotype designations for several taxa which are herein included as synonyms of rubi. Two of these taxa, suaveola and schamyl, may be considered clinal subspecies representing the extreme phenes of far-flung regional distribution areas. Three others, kolak, mystaphia and paulae, are best considered forms, since they seem to represent only altitudinal (or montane ecologically-related) morphs. Another taxon, borealis, named as a species by Kroulikousky but which has received little usage except occasionally as a subspecies (though sometimes simply a form), may be applicable also as a clinal subspecies. C. r. borealis has a complex synonymy but as defined below is applicable as a trinomen to extreme north Siberian specimens which are deep green and immaculate beneath.

kolak Higgins, 1965. Type Locality: Turkey. Holotype: BMNH: Maden, Turkey, 5,400 feet (=circa 1,800 m.), 29 May 1962. Status after present study: variant isolate, rubi.

schamyl Sheldon, 1914. Type Locality: Chitral. Types: BMNH: Movorossisk, 18 May 1914, W. G. Sheldon, two males, first labelled Call: rubi var. schamyl

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Type W. A. (sic) Sheldon; second labelled W. G. S. Type Ent. XLVII p. 272. I hereby designate the first male listed as the lectotype, and have clearly labelled it as such. Status after present study: clinal subspecies.

Infrasubspecific names within schamyl: There are two form names within rubi whose locality of designation indicate they occur within populations attributable to the name schamyl. These are: (1). caerulescens A. Bang-Haas (variation of rubi A. Bang-Haas, 1912, D. ent. Zeits. (Iris) 26: 106). Type Locality: "Persia". Type: Unknown. (2). herculeana Pfeiffer ([variation of rubi] 1927, Mitt. munchen ent. Ges. 17: 40). Type Locality: Anotolin, southeast Turkey. Type: Unknown. According to the Code of Zoological Nomenclature, any form name can now have status if elevated by an author, but such would be ill-advised with either of the above two form names. They are best considered ill-conceived infrasubspecific names left over from an era of archaic taxomomy, and with an uncertain relation to schamyl as well as Standinger's name suaveola (see below).

suaveola Staudinger, 1881. The type locality was Saisan, Armenia, and Lepsa, Kazakstan (Soviet Union), two areas unfortunately circa 3,000 km. apart. Type: unknown, presumed lost. Staudinger considered this broad area a region for discussion of his name suaveola as indicated in 1901 when he refered to suaveola specimens from the Tarbagatai Mountains, Ala Tau and Fergana. These localities are in the region east of Lake Baikal (far to the west in Uzbek S.S.R., on the plains west of Samarkand and in the Fergana Basin in the Mountains, respectively). To rectify this situation permanently, I have designated a neotype of suaveola as follows: Fig. 114. Male closely fitting Staudinger's description--upper surface less brown, scent patch distinctly lighter than forewing; under surface with white spot only costad on hindwing; rounded hindwing with very reduced recurved lobe

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between outer and anal margins (but not fulfilling Staudinger's description of the underside being lighter). Locality: Alma Ata, Kazakstan S.S.R., deposited AMNH. This designation is useful for two reasons: the name suaveola had been used for material from northern Pakistan, across Turkestan S.S.R., and westward at least to eastern Turkey, apparently in accordance with Tutt's (1907) discussion of further distribution areas in which specimens match Staudinger's description. None of these have genitalia different from rubi. There is, however, a distinct species in the Tannu Mountain region of trans-Baikal which I am describing as new in this paper. The latter species distribution does not extend beyond the south-west end of the Lake Balkash region, northeast Kazakstan S.S.R., and could never, therefore, be conspecific with Staudinger's Saisan types. The new species could not be conspecific with Staudinger's Lepsa types, because Lepsa is in the foothills south of Lake Baikal and the species I am describing as new is found only in the higher montane regions of the Tannu region (see under C. cynthia). Specimens from the entire lowland area of trans-Baikal are rubi. Status of suaveola after present study: clinal subspecies.

Infrasubspecific names within suaveola: There is one name within the previous synonymies of borealis Moeschler Kroulikowsky (e.g., Tutt, 1907) which should be associated with suaveola, not borealis. This name is sibirica Ruhl ([named as species] Ruhl, 1895, Pal. Gross-Schmett. 740). Type Locality: southern Siberia. Type: unknown. "Southern Siberia" here probably means the trans-Baikal area to which Staudinger also applied his name suaveola and from which some of his syntypes came. The descriptions are almost exactly the same. To alleviate any future confusion between suaveola and borealis as regional clinal subspecies of rubi, I have designated a neotype of

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each (see under borealis). Their morphs are quite similar, but suaveola is southern montane Asian and borealis is northern boreal Asian, in purported occurrence.

paulae Pfeiffer, 1932. Type Locality: north Syria. Type: exact location unknown but may be in Naturhistorische Abteilung, Munich, Germany (correspondence to date unable to clarify this). Specimens from Syria in the BMNH fitting the description and labelled paulae are clearly conspecific with rubi by genitalia but have the extreme (apparently montane induced) dark upper surface and deeper green under surface with more random median spots on the hindwing characteristic of Higgins' kolak. It is clear from Pfeiffer's description that these characters are the ones he had in mind as primary. Higgins also considers such characters extreme enough for the designation species. Higgins did not dissect his type; it would be extremely unusual if Pfeiffer's has been dissected (his description does not mention it) and no types in the entire group Callophryina had ever been dissected prior to this study, except my own. Since Pfeiffer's name falls within the distribution area in which rubi manifests a broad cline, and since these areas have all been thoroughly studied by genitalia dissection in this study, these and the above circumstances lead me to place paulae in synonymy with rubi. Status after present study: variant isolate or clinal altitudinal form of rubi.

mystaphia Miller, 1912. Type Locality: Kars, central Turkey. Type: unknown. This taxon occurs within the cline of rubi as expressed by other names like paulae, and notedly kolak from just east of the region where Miller named mystaphia. The BMNH has specimens labelled mystaphia from central Turkey and adjacent areas (now Iraq) which fit Miller's description; they are most characterized by the burnished deep brown upperside and

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lightened scent patch. Again, like kolak and paulae, this is quite different from western European rubi but otherwise not significant. The genitalia of these specimens are like rubi. I am assuming from the genitalic study of this entire area and the availability of the types of kolak named from similar characters just circa 400 km. to the east in the same montane region that mystaphia is a synonymy of rubi. Status after present study: altitudinal form of rubi, clinal between rubi per se and kolak.

borealis Kroulikowsky, 1890. Type Locality: unknown. Type: unknown. In his commentary on borealis occurring in Kasan (now in southwest Turkman, S.S.R., several provinces southwest of the central Urals) Kroulikowsky uses the name borealis Moeschler. Tutt (1907) says he has been unable to trace the original description, and gives Kroulikowsky the authorship. Although I have found an earlier version of Kroulikowsky (apparently not the "new series" of Tutt's bibliography), it gives no further clue. The morph of borealis is a familiar northern boreal variation of rubi. My dissections (see below) do not indicate any differences. (To clarify the meaning of the name borealis I am designating a neotype as follows: a male in the AMNH, clearly labelled as the neotype, from "Urals, Avinoff" [Fig. 115].) Status after present study: at best a clinal subspecies of rubi including the distribution areas of those synonyms listed below.

Infrasubspecific names within borealis: The following names were independently attributed to morphs of the same nature and general boreal distribution as borealis: (1). polaris [Gerhardt] Kroulikowsky ([synonym of borealis] Kroulikowsky, 1893, Soc. Ent. 7: 164). Also Rühl (as polaris Gerhardt [species] Rühl, 1895, Pal. Gross-Schmett, 196). Type Locality: Kasan, Russia. Type: unknown. Status after present study: synonym of borealis. (2). nordlandica Strand ([named as aberration of rubi] Strand, 1901, Nyt.

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Mag. for Naturvid. 39: 45) (Tutt, 1907, lists 1900, Nyt. Mag. for Naturvid. XXXIX, 27, 75). Type Locality: Langöen, Denmark. Type: unknown. By description and locality this aberration expressed to Strand the familiar montane or northern boreal morph of rubi as those listed above.

Following is a taxon which has been generally accepted as the western European subspecies of rubi, and whose authorship requires a change in recognition in this revision.

caesus Bernardi, 1951 (formerly caecus Geoffroy [ab. of rubi] 1785). Bernardi elevated the name caecus as a subspecific designation for central European rubi. According to recognition of taxa having or having had this status prior to this revision, the International Commission on Zoological Nomenclature requires the authorship to be cited as Bernardi. The superficial morph of caecus is that of the immaculate under surface of the hindwing.

Following is treatment of another name which, considering general definition of the category subspecies, should be added to the list of names which might be useful as trinomens.

sachalinensis Matsumura, 1929, new status (form of rubi). This section of Remarks has sought to clarify which names associated with the rubi complex deserve use as species, subspecies, or warrant no status according to the International Commission on Zoological Nomenclature current rules concerning infraspecific names. The name sachalinensis applies to a distinctly allopatric distribution of rubi on Sachalin Island, north of Japan, and therefore the meaning of its designation as a "form" of rubi may assume significance at the level of subspecies.

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No other names warrant the treatment of the above eight taxa and, except for those warranting use as species newly recognized in this paper, the rest can be considered as having no status according to the ICZN unless elevated by a subsequent author.

Listed below is a compilation of the infraspecific taxa which have been described within C. rubi sens. lat. but which have no taxonomic status. Notable morph names are categorized below as consistent with Tutt (1907) and curation at the BMNH:

1. Emphatic median line on forewing and hindwing--punctata Tutt, 1907.
2. Emphatic median line on hindwing only--inferopunctata Tutt, 1907.
3. Hindwing with incomplete median line--incompleta Tutt, 1907.
4. Hindwing with only two spots in median line--bipunctata Tutt, 1907.
5. Hindwing with only one spot in median line--typical rubi.
6. Immaculate hindwing--formerly caecus Geoffroy, now immaculata Fuchs, 1891.

Other names which may appear in the literature but were designated as forms or aberrations and remain such, without any status, are these (original descriptions cited by author in bibliography, as available): amphichloros Cabeau, 1923; androflarus Capuse, 1963; brunnea Tutt, 1907; connexa Tutt, 1907; typica Tutt, 1907; intermedia Tutt, 1907; leucosticta Stauder, 1923; major Tutt, 1907; minor Tutt, 1907; olivacea Blanchier, 1909; pallida Tutt, 1907; pigmentocarens Verity, 1926; caeurlescens Bang-Haas, 1912; chalybeitincta Sovinsky, 1905; cinerascens Rebel, 1909; suffusa Tutt, 1907; supraviridis Conovoisier (cit. unknown); viridis Courvoisier (cit. unknown); pallida Tutt, 1907; and the combinations of Tutt (1907)--intermidia-punctata, intermedia-inferopunctata, intermedia-incompleta, intermedia-bipunctata, intermedia-typica, intermedia-caecus, fervida-punctata, and suffusa-punctata.

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In this study I have dissected at least two males and two females (unless fewer were available) from the following general localities of Palaearctic Callophrys (precise local data for each species recognized in this revision is given in the Material Examined): regions east, west, and south of Lake Baikal, Soviet Union; Sachalin Island, Soviet Union; northeastern Siberia, Soviet Union; Urak, Soviet Union; Moscow, Soviet Union; Amur region, Soviet Union; Ural Mountains, Soviet Union; Armenian S.S.R.; Latvian S.S.R.; Caucasia, Soviet Union; Bulgaria; Turkey (several areas); Chitral; north Pakistan; Iraq (Mesopitania); Syria; Tunisia; Morocco; Algeria; Mauretania; Greece; Hungary; Italy (many areas, including Sicily, Elbe, Sardinia); Austria; Switzerland; Germany; Finland; Sweden; Norway; Holland; Belgium; France (including Corsica); England; Spain (several areas including Catalonia); Gibraltar; and Portugal.

Callophrys dumetorum (Boisduval)

Figs. 333, 334, 335, 336, 495, 496

Thecla dumetorum Boisduval, 1852, p 291; 1869, p 15. J. Morris, 1862, p. 100. W. Edwards, 1877, p. 41; 1884, p. 57. Schaupp and Smith, 1882, p. 3. H. Edwards, 1884, p. 478. Smith, 1891, p. 12. Oslar, 1893, p. 226. Burrison, 1901, p. 244. Smith, Skinner and Kearfoot, 1903, p. 7. Grinnell, 1905, p. 136. Williams and Grinnell, 1905, p. 235. Skinner, 1907, p. 303. Coolidge, 1908, p. 83. Williams, 1909, p. 69; 1910, p. 36. Newcomer, 1910, p. 312. Parkin and Grinnell, 1912, p. 3. W. Comstock, 1914, p. 35. Draudt, 1919, p. 763. Davenport and Dethier, 1938, p. 171. Brown and Opler, 1970, p. 66.

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Polyommatus dumetorum: J. Morris, 1860, p. 11.

Lycus dumetorum: J. Morris, 1860, p. 11.

Strymon dumetorum: Butler, 1882, p. 470.

D. (sic) dumetorum: Twogood, 1897, p. 24.

Thecla (Callophrys) dumetorum: W. Holland, 1931, p. 229. Hoffman, 1940 p. 708.

Callophrys dumetorum: Dyar, 1904, p. 39. McDunnough, 1914, p. 196; 1938, p. 25. Barnes and McDunnough, 1917, p. 15. Barnes and Benjamin, 1923, p. 64; 1926, p. 18. Blackmore, 1927, p. 10. J. Comstock, 1927, p. 168. Gunder, 1930, p. 42. Wright, 1930, p. 25. Fender, 1931, p. 185. Garth, 1935, p. 28. Clench, 1944, p. 94; 1963, p. 152. Bowman, 1951, p. 131. J. Jones, 1951, p. 20. Martin and Truxel, 1955, p. 23. Powell, 1958, p. 30. Tilden, 1959, p. 261; 1963, p. 288. Downey, 1962, p. 235. Emmel and Emmel, 1962, p. 34. R. Brown and Opler, 1967, p. 113. Shields, 1967, p. 83. Gorelick, 1968 (1970), p. 99. Langston and Opler, 1968, p. 97; 1970, p. 13. F. Brown and Opler, 1970, p. 66. Leighton, 1972, p. 12. Emmel, 1972, p. 3. Anonymous, 1972, p. 9. R. Holland, 1972 (1973), p. 157. Langston, 1974, p. 92. Scott, 1974, p. 18. Shapiro, 1975, p. 100. Wood, undated, p. 301.

Callophrys (Callophrys) dumetorum: Ziegler, 1960, p. 21. Clench, 1961, p. 210. Garth and Tilden, 1963, p. 36. dos Passos, 1964, p. 58; 1970, p. 33. Gorelick, 1968 (1970), p. 99; 1971, p. 3. Gregory, 1975, p. 34. Scott, 1975, p. 294.

species dumetorum: Comstock and Huntington, 1959, p. 212.

Thecla viridis W. Edwards, 1862, p. 223. Kirby, 1896, p. 402. W. Edwards, 1884, p. 57 (placed as synonym of dumetorum). Skinner, 1907, p. 303. Coolidge, 1908, p. 83. Barnes and McDunnough, 1917, p. 15. Seitz, 1919, p. 763.

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Barnes and Benjamin, 1926, p. 18. McDunnough, 1938, p. 25. Brown and Opler, 1970, p. 2.

Callophrys viridis: McDunnough, 1914, p. 196. Clench, 1944, p. 226. Hopfinger, 1953, p. 84. Tilden, 1963, p. 288. Brown and Opler, 1967, p. 113; 1970, p. 65. Shields, 1967, p. 83. Gorelick, 1968, p. 102. Emmel and Shields, 1973, p. 27. Langston, 1974, p. 92.

Callophrys (Callophrys) viridis: Ziegler, 1960, p. 21. Clench, 1961, p. 211. dos Passos, 1964, p. 59; 1970, p. 33. Gorelick, 1971, p. 3.

species viridis: Comstock and Huntington, 1964, p. 184.

Thecla affinis W. Edwards, 1862, p. 223. Scudder, 1876, p. 104. Coolidge, 1908, p. 83 (placed as a synonym of dumetorum).

Thecla affinis: W. Edwards, 1877, p. 41; 1884, p. 57. Schaup and Smith, 1882, p. 3 H. Edwards, 1884, p. 478. Smith, 1891, p. 12. Kirby, 1896, p. 399. Barnes, 1900, p. 330. Snyder, 1900, p. 366. Smith, Skinner, and Kearfoot, 1903, p. 7. Haskin and Grinnell, 1912, p. 6. Draudt, 1919, p. 763. Brown and Opler, 1970, p. 21.

Thecla (Callophrys) affinis: W. Holland, 1931, p. 220.

Callophrys affinis: Dyar, 1904, p. 39. Coolidge, 1908, p. 83. McDunnough, 1914, p. 197; 1938, p. 25. Barnes and McDunnough, 1917, p. 15. Barnes and Benjamin, 1923, p. 66; 1926, p. 18. Clench, 1944, p. 217; 1945, p. 224. Martin and Truxel, 1955, p. 23. Tilden, 2963, p. 290. Scott, Ellis, and Eff, 1968, p. 164. Scott, 1975, p. 18.

Caallophrys (Xamia) [sic] affinis: Barnes and Opler, 1970, p. 63.

Callophrys (Callophrys) affinis: Ziegler, 1960, p. 21. Clench, 1961, p. 209. Clench, 1963, p. 151. dos Passos, 1964, p. 59; 1970, p. 33. Ferris, 1971a, p. 34; 1971b, p. 24. Gorelick, 1971, p. 3. Gregory, 1975, p. 74. Scott, 1975, p. 295.

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species affinis: Comstock and Huntington, 1959, p. 63.

Papilio rubi Linnaeus: Tutt, 1907, p. 298 (synonymy in error).

DIAGNOSIS. This species resembles apama, both having an extensive fulvous to gray area on the underside of the forewing. The species differ noticeably in the shape of the outer margins of the wings. In dumetorum the shape is convex but only so far as the area of vein M_2; caudad this area the margin is straight or even somewhat concave toward the inner margin. In apama the entire margin is uniformly convex. Specimens formerly separated as species affinis resemble the subspecies homoperplexa of apama, being devoid of any markings on under surface. The green underside is more expansive on affinis, however, without complement of brown or gray being emphatic. Also, on the upperside, the wings are greatly suffused with lighter rich brown to red-brown, much more so than on any congener.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 495-496) as typical of the genus. Upper Surface of the Wings: Ground color dull Prouts Brown to slightly gray to Burnt Sienna, entirely. Male scent patch distad is in discal area. Fringe of wing white distad, grayish basad. Under Surface of the Wings: Forewing ground color cephalad margin of hindwing dull fuscous. Costal area, and submargin to vein Cu_1, Winter to Rheinemann's Green. Light discal line, gray to brown, costa to vein. Hindwing uniformly Winter to Rheinemann's Green with two or three white spots, usually one along costal area, and one in cell Cu_1; third sometimes at Cu_2 or anad. Rocky Mountain populations often immaculate beneath. Fringe white distad, gray basad. Length of Forewing: $\bar{X}$ of 15 specimens AMNH, 13.0 mm., range 12.3 to 13.5 mm. Female: Head, thorax, abdomen, legs, and palpi (Fig. 495-496) as typical of the genus. Upper surface of the Wings: As on male, but no scent patch distad in

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discal area. Under surface of the Wings: As on male, but area cephalad margin of hindwings often more brownish than gray. Length of Forewing: $\bar{X}$ of 15 specimens AMNH 12.8 mm., range 12.3 to 13.5 mm. Male Genitalia: Figs. 333, 335 (affinis). Valvae, caudad saccus, clear, parabolic, unindented; (slight indention, same affinis); valvae, lateral view, round-tapered; valvae caudal extension tapered; saccus long, exceeding length of bilobed configuration, pointed; cornuti disclike, flat-ended. Female Genitalia: Figs. 334, 336 (affinis). Lamellae broadly ovate, lamella antevaginalis as lips on caudal opening of ductus, sclerotized distad. Noticeably transparent line central in lamella postvaginalis. Ductus wide, width about one-third to two-fifth breadth of lamellae, length about two-thirds breadth of lamellae, usually straight, sometimes curved slightly. Signa single long spines.

BIOLOGY. Early Stages: The only known treatment is by Scott, 1975, where the larvae of affinis are briefly described. Foodplant: Polyphagous on Eriogonum sp. [umbellatum, Torr. (Scott, 1975)] (Polygonaceae); Syrmetium sp.; Hosackia sp.; Lotus sp. (Clench, 1961) Fabaceae.

TYPES. The holotype male of dumetorum is in the NMNH; holotype male, perplexa, NMNH; oregonensis, holotype male, CAS; affinis, lectotype male, CMNH; lectotype male, viridis, CMNH. Type Localities: For dumetorum, "California;" perplexa, San Diego, California; oregonensis, Kusshi Creek, Washington; affinis "Utah; viridis, "California" (Clench, 1944); all United States.

DISTRIBUTION. Spatial: Fig. 542. In United States from San Francisco Bay area of Pacific coast southward into northern Mexico. Eastward in Sierra Nevada ranges of central and southern California and northward into eastern British Columbia and western Alberta. In Rocky Mountains from southwest Montana southward through montane Wyoming, Colorado, and Utah into northern montane Arizona and New Mexico. Temporal: February (California) to April,

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emerging May northward extending into June; late May to early June (Rocky Mountains). Small second brood, September, Southern California.

REMARKS. The species dumetorum is presently divided into three subspecies, the nominate and sspp. perplexa and oregonensis. The trinomens are of questionable value, differing from the nominate only in the having minor wing marking differences and representing regional morphs. Specimens from throughout the range of nominate dumetorum, rather, indicate a cline. I have dissected the types, except for oregonensis. They are of negligible difference. Likewise, examination of specimens of affinis from across its range indicates entirely homogeneous genitalic characters of the males and females with dumetorum. With lack of any distinct foodplant or other biological criteria for separating these taxa, I consider affinis and dumetorum conspecific, supporting the synonymy made originally by Scudder and Coolidge.

In all, a male and female from twenty-nine localities across the range of dumetorum were dissected for genitalia, legs, and palpi.

Callophrys apama (Edwards)

Figs. 337, 338, 497

Thecla apama W. Edwards, 1882, p. 137; 1882b, p. 9; 1884, p. 57. Smith, 1891, p. 12. Barnes, 1900, p. 330. Smith, Skinner and Kearfoot, 1903, p. 7. Skinner, 1907, p. 304. Coolidge, 1910, p. 375. Williams, 1914, p. 264. Brown and Opler, 1970, p. 6.

Thecla (Callophrys) apama: W. Holland, 1931, p. 229.

Callophrys apama: Dyar, 1904, p. 40. McDunnough, 1914, p. 197; 1938, p. 25. Barnes and McDunnough, 1917, p. 15. Barnes and Benjamin, 1923, p. 68;

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1926, p. 28. Klots, 1930, p. 161. Clench, 1944, p. 222; 1957, p. 58. Garth, 1950, p. 32. Higgins, 1953, p. 209. DeFoliart, 1956, p. 95. F. Brown, 1957, p. 146. Tilden, 1963, p. 288. Hubbard, 1965, p. 231. Pyle, 1968, p. 172. Scott, 1968 (1970), p. 192. Scott, Ellis, and Eff, 1968, p. 164. Brown and Opler, 1970, p. 67. Ferris, 1970c, p. 4. Ritterbush, 1972, p. 9. Scott, 1975, p. 18. Wood, undated, p. 301.

Callophrys (Callophrys) apama: Ziegler, 1960, p. 1. Clench, 1961, p. 219; 1963, p. 151. dos Passos, 1964, p. 59; 1970, p. 33. F. Brown, 1971, p. 7. Ferris, 1971a, p. 34; 1971b, p. 24. Gorelick, 1971, p. 3. Scott, 1975, p. 294.

species apama: Comstock and Huntington, 1959, p. 74.

Callophrys apama homoperplexa: Barnes and Benjamin, 1923, p. 68.

DIAGNOSIS. This species resembles dumetorum but can be distinguished from the latter by uniformly convex outer margins of the wings, while in dumetorum the convex shape is only cephalad vein M_2 and is straight caudad.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 497) as typical of the genus. Upper Surface of the Wings: Ground color Mummy Brown to Prouts Brown. Small circular scent patch distad in discal area of forewing. Fringe of forewing as ground color, lighter distad; fringe of hindwing white to whitish-gray. Vein-ends, Cu_1, Cu_2 and 2A white, giving checkered appearance. Under Surface of the Wings: Ground color of forewing Lettuce Green to Oil or Winter Green, much grayer basad. Postmedian line from costa to vein Cu_2 of irregular white slashes, edged black-brown basad. Apex of wing distad post-median line usually lighter Green, extending along margin to vein Cu_1. Hindwing entirely Lettuce, Oil to Winter Green. Nominate subspecies with median line of white slashes, broken and irregular, arching across surface of wing from costa to anal margin, displaced distad in vague "W" shape at veins M_3 to Cu_2. Brown line

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basad to median line of white slashes, usually emphatic. Whitish submarginal spot sometimes present in cell Cu_1. Fringe of forewing brownish, gray distad; fringe of hindwing same, but lighter distad and tipped white at vein-ends Cu_1, Cu_2 and 2A. Second subspecies with these marking diminuitive to lacking. Length of Forewing: $\bar{X}$ of 15 specimens in AMNH, 11.7 mm., range 10.3 mm. to 13.2 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 497) as typical of the genus. Upper Surface of the Wings: As on male, with Olivacious Brown area obvious distad on the forewing and often on the hindwing. Under Surface of the Wings: As on male. Length of Forewing: $\bar{X}$ of 15 specimens in AMNH, 10.5 mm., range 10.0 mm. to 11.5 mm. Male Genitalia: Fig. 337. Valvae, caudad saccus, clear, mid-rimmed, tapered to a rounded point cephalad, not indented; valvae, lateral view, shape of area between articulations of valvae to vinculum nearly at right angles; tapered caudad with only slight funnel; valvae, caudal extension, tapered to straight points; saccus long, equally length of caudal extension of the valvae; cornuti disclike. Female Genitalia: Fig. 338. Lamella postvaginalis widely hemispherical with distinct centrad transparent line. Lamella antevaginalis with emphatic distal sclerotizations and lips rolled caudad as extensions of lateral areas of the lamella postvaginalis; ductus wide, more than one-third breadth of lamellae, and long, more than three times expanse of lamellae. Signa as single, small, pointed spines.

BIOLOGY. Early stages: Unknown. Foodplant: The species has long been associated with Eriogonum as the probable foodplant through adult association (F. Brown, 1957; Ferris, 1971b); the only more specific record in the literature is Eriogonum sp. in Mexico mentioned by Scott, 1975.

TYPES. Nominate apama formerly a syntype series in the CMNH. W. Holland (1931) designated one male as lectotype. It is so labelled; hemoperplexa, holotype male, NMNH. Type Localities: Nominate apama: Fort

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Grant, Graham Mountains, Arizona; homoperplexa: Denver, Colorado. Both United States.

DISTRIBUTION. Spatial: Fig. 543. Northern Sonora and Chihuahua states, Mexico, through Arizona and New Mexico, northward through Colorado and into southeastern Wyoming. Temporal: Bivoltine: May through June, August (Rocky Mountains).

REMARKS. This species is presently divided into two subspecies, the nominate and homoperplexa. The latter subspecies occurs in the Rocky Mountain region of Colorado, northern New Mexico and westward into Nevada. It is distinguished by the nearly complete lack of the median band of white slashes on the hindwing underside but is clinal with the nominate. I have not dissected the types of the nominate; I have dissected the types of the taxon homoperplexa, and the latter are similar to topotypical dissections of the nominate. In all a male and a female from twenty localities across the range of apama were dissected for genitalia, legs and palpi.

Callophrys sheridanii (W. Edwards)

Figs. 339, 340, 498

Thecla sheridonii (sic) W. Edwards (in Carpenter), 1877, p. 48. Thecla sheridanii (corrected): W. Edwards, Ibid, loc. cit. Schaup and Smith, 1882, p. 3. W. Edwards, 1884, p. 57. Smith, 1891, p. 12. Bruce, 1897, p. 134. Barnes, 1900, p. 331. Snyder, 1900, p. 366. Smith, Skinner and Kearfoot, 1903, p. 7. Skinner, 1907, p. 305. Draudt, 1919, p. 763. Brown and Opler, 1970, p. 21.

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Thecla Sheridani (sic): Bruce, 1895, p. 15. Bethune, 1896, p. 218. W. Holland, 1931, p. 229.

Thecla (Callophrys) sheridani (sic): W. Holland, 1931, p. 229.

Callophrys sheridanii: Dyar, 1904, p. 39. Barnes and Benjamin, 1926, p. 18. Klots, 1930, p. 161. McDunnough, 1938, p. 25. Clench, 1944, p. 217. Defoliart, 1956, p. 97. Tilden, 1963, p. 290. F. Brown, 1964, p. 55. Gorelick, 1968, p. 102. Ferris, 1970, p. 4; 1974, p. 279. Anon., 1972, p. 9. McCabe and Post, 1976, p. 97.

Callophrys sheridani (sic): Barnes and McDunnough, 1917, p. 15. Barnes and Benjamin, 1923, p. 66. Leighton, 1946, p. 60; 1972, p. 12. Eff, 1953, p. 88. Martin and Truxel, 1955, p. 23. Brown, 1957, p. 145.

Callophrys (Callophrys) sheridanii: Clench, 1957, p. 58; 1963, p. 151. dos Passos, 1964, p. 59; 1970, p. 33. Ferris, 1971a, p. 34; 1971b, p. 24. Scott, 1975, p. 296.

Callophrys (Callophrys) sheridani (sic): Ziegler, 1960, p. 21. Clench 1961, p. 209. Gorelick, 1971, p. 3. Ferris, 1971a, p. 34; 1971b, p. 24. Gregory, 1975, p. 34.

species sheridanii: Comstock and Huntington, 1963, p. 119.

Callophrys comstocki Henne, 1940, p. 71. Clench, 1944, p. 217. Martin, 1953, p. 69. Martin and Truxel, 1955, p. 23. Tilden, 1963, p. 292. Emmel, Emmel, and Sheppard, 1967, p. 144.

Callophrys (Callophrys) comstocki: Clench 1961, p. 210; 1963, p. 151. Callaghan, 1970, p. 228. Gorelick, 1971, p. 3. Emmel, 1972, p. 3. Emmel and Emmel, 1973, p. 61. Ziegler, 1960, p. 21 (placed as synonym of sheridanii). Scott, 1975, p. 296.

species comstocki: Comstock and Huntington, 1959, p. 193.

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Callophrys lemberti Tilden, 1963, p. 292. Garth and Tilden, 1963, p. 47. Anon., 1970, p. 9. Langston, 1974, p. 93. Tilden and Huntzinger, 1977, p. 183.

Callophrys (Callophrys) lemberti: Garth and Tilden, 1963, p. 36. Gorelick, 1971, p. 3. Scott, 1975, p. 18 (placed as a synonym of sheridanii.)

Callophrys (Xamia) [sic] sheridanii: Brown and Opler, 1970, p. 61.

DIAGNOSIS. Generally recognized by median line, under surface, hindwing, being entire and generally straight, appearing to transverse the wing with bold white. Altitudinal morphs comstocki and lemberti, here synonymized with sheridanii, have transverse bar incomplete to absent, diminutive size, grayed coloration above, and regionally isolated montane occurrences making them quite recognizable from the congeners. Genitalia of all Nearctic Callophrys similar, but above three taxa form recognizable cluster of characters (see below).

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 498) as typical of the genus. Upper Surface of the Wings: Ground color dark Mummy Brown to Prouts Brown, sometimes overscaled with lighter Amber Brown. Small ovate scent patch (less than one-third length of cephalad vein of discal cell) distad in discal area. Fringe white, grayish basad. Under Surface of the Wings: Ground color Winter Green to Bice Green, sometimes suffused with gray. Area of forewing just cephalad hindwing gray-brown at least to vein Cu_2. Forewing with median to postmedian line from costa to Cu_2 white, edged brown to black basad, occasionally displaced basad in cell Cu_2. Hindwing with emphatic median line, costa to inner margin, nearly straight or occasionally wavy (but never curved), white with vague basad gray or brown. Occasional spot distad in discal cell, vaguely white. Fringe white, greenish basad. Length of Forewing: $\bar{X}$ of 12 specimens in AMNH 11.5 mm., range 10.0 to 12.3 mm. Female: Head, thorax,

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abdomen, legs and palpi (Fig. 498) as typical of the genus. Upper Surface of the Wings: As on male, but lacking scent patch distad in discal cell. Under Surface of the Wings: As on male. Length of Forewing: $\bar{X}$ of 10 specimens in AMNH, 11.5 mm., range 10.5 to 12.0 mm. Male Genitalia: Fig. 339. Valvae, caudad saccus; clear to slightly spiny, narrow-rimmed, parabolic, indented; valvae, lateral view, area beteween caudad and cephalad articulation of valvae to vinculum nearly at right angle, tapered; valvae, caudal extension, tapered, but valvae very wide tapering to blunt ends; saccus funnel, equalling or moderately exceeding length of bilobed configuration; cornuti disclike. Female Genitalia: Fig. 340. Lamella postvaginalis hemispherical with caudal tip more pointed; emphatic transparent line centrad. Lamella antevaginalis and antrum hardly distinguishable, with hook-shaped sclerotizations distad on the lips of lamella antevaginalis. Ductus wide, width nearly one-half breadth of lamellae, straight, length about two times caudal length from flaring of antrum/lamella antevaginalis to caudal tip of lamella postvaginalis. Signa single pointed spines.

BIOLOGY. Early Stages: Ferris (1973) has described the life history and early stages in detail, figuring all stages and instars. The only other data prior to Ferris' work were notes by Eff (in Brown et al., 1957) and Scott, 1975, apparently prepared prior to Ferris' publication. Foodplants: Ferris (1973) records Eriogonum umbellatum Torr. from Albany, Co., Wyoming. He records E. u. var. dichrecephalum Gand. from Blaine Co., Idaho. In his 1971 treatment of Wyoming butterflies, Ferris mentions the same species as probably feeding on E. umbellatum. Eff (in Brown et al., 1957) lists the same species for Colorado from Boulder Co. Scott, 1975, mentions umbellatum from Washington (K. Roever), a "vine-like" Eriogonum in Arizona (K. Roever), E. compositum Dougl. ex Benth. in Lindl. in Washington (J. Pelham), E. sp., in Washington, and Providence Mountains, San Bernardino Co., California, E. incanum Torr. and Gray in the

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Sierra of California, and E. jamesii Benth. in DC. in the Sacramento Mountains, New Mexico, apparently from his own work.

TYPES. Clench, in 1946, indicates the type specimen is lost. He designates a neotype ("neoholotype" [sic]) from the Bighorn Mountains, state of Wyoming, United States, in the CMNH collected by Sweadner. He judges a previous lectotype designated by Holland (1939) as not valid. This latter specimen, from Denver, Colorado, is invalidated as a lectotype because of its lack of proximity to the region mentioned in Edward's description, and its not representing an original syntype of Edward's. Holotype male lemberti holotype male CAS; comstocki holotype male LACM. Type Localities: Clench's neotype of sheridanii, Bighorn Mountains, Wyoming; lemberti, Tioga Pass, California; comstocki, Providence Mtns., California. All United States.

DISTRIBUTION. Spatial: Fig. 544. Throughout the Rocky Mountain region of western North America from southern New Mexico and central Arizona north to southern British Columbia and southwestern Alberta. Temporal: Univoltine: late March through May in Rocky Mountains.

REMARKS. This species has been divided into two subspecies: the nominate and neoperplexa Barnes and Benjamin (1923, Contr. Nat. Hist. Lepid. North America, p. 67, TL Eureka, Utah). They differ by the latter's having a broader white line on the underside of the hindwing, edged more prominently basad with brown or black. The nominate is considered to range from northern New Mexico through the Colorado and Wyoming Rocky Mountains, while the latter occurs in Utah and western Montana. Other populations in Washington (e.g., Brewster) suggest wing characters of equal uniqueness as those of the nominate or neoperplexa. Same populations in the Sierra Mountains and adjacent ranges of California evidence isolated high montane colonies with extreme macular differences (see Diagnosis). These populations have produced the

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respective species designations lemberti and comstocki. Scott, 1975, based on supposed intergrading reported to him by David Bauer moved to synonymize these two taxa with sheridanii. I have responded to this by dissecting material of the two taxa available in the AMNH, NMNH and CMNH, totalling five males and four females of lemberti from nine localities, and four males and three females of comstocki from three localities. I find no genitalic differences on which nonconspecificity might be further argued. Depending on taxonomic preference the names lemberti or comstocki might be invoked as trinomens in sheridanii, but should not hereafter be considered species.

The various usages of sheridani and sheridanii follow unfortunately on the initial misspelling of the name as sheridonii in the original description. Since the misspelling is corrected subsequently in the original paper (see also Brown and Opler, 1970) the corrected spelling stands as the norm of the name.

In all I dissected twenty males and seventeen females of the sheridanii complex from across its geographic and altitudinal distributions.

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MITOURA SCUDDER, status revised

Thecla Fabricius, 1807, p. 286 (in part). Boisduval and LeConte, 1833, p. 107. Harris, 1862, p. 77. J. Morris, 1862, p. 98. Scudder, 1863, p. 65; 1868, p. 378; 1872, p. 52. Hewitson, 1867, p. 94. Boisduval, 1869, p. 42. W. Edwards, 1877, p. 40; 1881, p. 6; 1884, p. 55. Worthington, 1880, p. 52. Anon., 1882, p. 3. French, 1882, p. 68. H. Edwards, 1881, p. 53; 1884, p. 478; 1889, p. 32. Mead, 1884, p. 48. Godman and Salvin, 1887, p. 48. Skinner and Aaron, 1889, p. 146. Blatchley, 1891, p. 393. Smith, 1891, p. 12. Beutenmüller, 1892, p. 169; 1902, p. 52. Danby, 1894, p. 33. Davis, 1895, p. 46. Knobel, 1895, p. 25. Kirby, 1896, p. 387. Barnes, 1900, p. 330. Smith, Skinner, and Kearfoot, 1903, p. 7. Dyar, 1902, p. 38; 1904, p. 786. Skinner, 1904, p. 29; 1907, p. 283. Brehme, 1907, p. 82. Grinnell and Grinnell, 1907, p. 45. W.S. Wright, 1908, p. 43; 1922, p. 19. Coolidge, 1910, p. 375. Newcomer, 1910, p. 31. J. Comstock, 1914, p. 36. Williams, 1914, p. 264. Barnes and McDunnough, 1917, p. 14. Seitz, 1919, p. 772. Britton, 1920, p. 156. Stone, 1921, p. 114. Barnes and Benjamin, 1926, p. 17. Cockerell, 1934, p. 51. Davenport and Dethier, 1938, p. 171. Comstock and Huntington, 1943, p. 59. Tilden, 1952, p. 95. Gillham and Ehrlich, 1959, p. 102. Brown and Opler, 1970, p. 21. Wood, undated, p. 302.

Thecla (Mitoura): W. Holland, 1931, p. 230. Hoffman, 1940, p. 710.

Mitoura Scudder, 1889, p. 861. Skinner, 1897, p. 156. Dyar, 1902, p. 38. Engel, 1880, p. 34. Barnes and McDunnough, 1911, p. 14; 1912, p. 18; 1916, p. 105; 1917, p. 10. Grossbeck, 1917, p. 24. Britton, 1920, p. 156. J. Comstock, 1922, p. 164; 1925, p. 37; 1927, p. 163; 1940, p. 63. Coolidge, 1924, p. 199.

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Barnes and Benjamin, 1923, p. 62; 1926, p. 17. Blackmore, 1927, p. 10. Forbes, 1928, p. 679. Clark, 1929, p. 115; 1932, p. 282; 1948, p. 80; 1951, p. 84. Brower, 1930, p. 288. Klots, 1930, p. 161; 1951, p. 141. W.S. Wright, 1930, p. 24. Garth, 1931, p. 32. Harris, 1931, p. 191. Richards, 1932, p. 70. Hutchins, 1933, p. 212. Clark and Clark, 1936, p. 68; 1937, p. 24. Comstock and Dammers, 1938, p. 30. Field, 1938, p. 151. Leussler, 1938, p. 277. McDunnough, 1938, p. 25. Clench and Ehrlich, 1939, p. 139. Cockerell, 1939, p. 24. Hoffman, 1940, p. 760. Williams, 1941, p. 218. Blevins and Blevins, 1945, p. 123. Leighton, 1946, p. 60; 1972, p. 12. Dethier, 1948, p. 17. H. Freeman, 1950, p. 71; 1951, p. 38. Garth, 1950, p. 31. Buchholz, 1951, p. 62. J. Jones, 1951, p. 19. Rawson, Ziegler, and Hessel, 1951, p. 128. Clench, 1952, p. 58; 1957, p. 58. Martin, 1952, p. 20. Tilden, 1952 (1953), p. 95; 1953, p. 68. Bauer, 1953, p. 147. F. Chermock, 1953, p. 104. Hessel, 1953, p. 107. Hopfinger, 1953, p. 87. Remington, 1953, p. 102; 1955, p. 77; 1958, p. 14. Guppy, 1954, p. 101. Martin and Truxel, 1955, p. 22. Remington and Pease, 1955, p. 4. DeFoliart, 1956, p. 97. Meiners, 1954, p. 101. F. Brown, 1957, p. 137; 1974, p. 19. Comstock and Huntington, 1958, p. 112. Mather and Mather, 1958, p. 82. McGugan, 1958, p. 23. Dornfield, 1960, p. 183. Eff, 1960, p. 88. Stalling, Turner and Ehrlich, 1959, p. 99. Horning and Barr, 1959, p. 43. Hooper and Hooper, 1960, p. 141. Tilden, 1960, p. 40. Pease, 1963, p. 27. T. Emmel, 1964, p. 369; 1972, p. 3. Hubbard, 1965, p. 232. Kimball, 1965, p. 48. Puckering and Post, 1960, p. 32. Downey, 1966, p. 163. Shapiro, 1966, p. 32. Shields, 1966, p. 127. Covell, 1967, p. 23. Hemming, 1967, p. 295. Johnson and Nixon, 1967, p. 517. Hooper, 1969, p. 5. Masters, 1967a, p. 202; 1967b, p. 120; 1967c, p. 277; 1969, p. 6; 1975, p. 59. O'Byrne, 1970, p. 16. Price, 1970, p. 15. Anon., 1972, p. 8. Kuehn and Master, 1972, p. 4.

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Ritterbush, 1972, p. 9. R. Holland, 1972 (1973), p. 157. Johnson, 1972 (1973), p. 28; 1976a, p. 1; 1976b, p. 60; 1978, p. 3. Eliot, 1973, p. 440. Emmel and Emmel, 1973, p. 57. Anderson, 1974, p. 161. Browner, 1974, p. 18. Beattie, 1976, p. 39. Tilden and Huntzinger, 1977, p. 183.

Mitouri (sic): Scudder, 1871, p. 52. Comstock and Huntington, 1958, p. 112.

Callophrys Billberg, 1820, p. 80. Muller, 1961, p. 144. Emmel and Emmel, 1962, p. 33. Newcomer, 1962, p. 70. Small, 1962, p. 195. Garth and Tilden, 1963, p. 7. dos Passos, 1964, p. 58. Lambremont and Ross, 1965, p. 49. Downey, 1966, p. 164. Huber, 1966, p. 14; 1967, p. 10. Scott, Ellis, and Eff, 1968, p. 164. Opler and Langston, 1968, p. 97. Callaghan, 1970, p. 228. Anon., 1972, p. 9. Masters, 1972, p. 7. Downey and Irwin, 1973, p. 21. Miller, 1975, p. 18. Downey and Allyn, 1976, p. 1.

Callophrys (Mitoura): Ziegler, 1960, p. 21. Clench, 1961, p. 207. Ehrlich, Stallings and Turner, 1962, p. 57. Opler, 1962, p. 193. dos Passos, 1970, p. 32. Shields, 1965 (1966), p. 233. Riotte, 1967, p. 137. Opler and Langston, 1968, p. 97. Johnson, 1972, p. 112; 1976, p. 6; 1977, p. 109; 1978, p. 3. Masters, 1972 (1973), p. 179. S. Miller, 1972, p. 231. Gregory, 1975, p. 34. Howe (with Shields), 1975, p. 293.

DIAGNOSIS. Species of Mitoura generally recognizable by brown or dully steel blue above and brown or green beneath with prominent postdiscal white lines, bands, or arcs of spots across the hindwing under surface supplemented variously by postbasal markings and suffusions of gray, blue and orange in the limbal area.

DESCRIPTION. Adult: Legs not evidencing any elongation relative to width (latter indicates apomorphy in Callophryina). Frons variously spiny and fuscous, eye-lining white to fuscous depending on the species. Wings above dully

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steel blue in spinetorum species group and occasionally on other taxa; rest of species variously brown above usually with lighter hues in patches discal and limbal on forewing and hindwings, respectively. Under surfaces of wings usually with either brown or green ground color, forewing with postmedian band variously expressed postdiscal band, either as transverse arc variously jagged, or as irregular spots. Postbasal area often with prominent slashes or spots. Limbal area suffused blue, gray and orange around prominent "Thecla-spot". Tail at Cu_2 and variously with spots, or flushes of color transversing margin. Palpi with sexual dimorphism convergent, little difference in structures between the sexes, terminal segment always shorter than adjoining. Male Genitalia: Taxa of spinetorum group with unique sclerotization covering entire bilobed area, other groups with clear bilobed configuration variously shaped as parabolic to ovate; caudal extension generally tapered. Cornuti of aedeagus wide and disclike in spinetorum group becoming apomorphically tapered and reduced in other groups. Female Genitalia: Ductual configurations wide with little appearance of lamellae in spinetorum group. Increasing apomorphy narrowing ductus considerably in other taxa after transition through byrnei group, with lamellae becoming more prominent and with various convolutions and sculpturing in most derived states. Signa apparent in spinetorum and byrnei groups, decreasing to absent in more derived states of remaining taxa.

BIOLOGY. Early Stages: Known for many of the species; see treatments of particular taxa. Foodplants: Divided into two general usages: Arcouthobium species (Loranthaceae) in the spinetorum group and Cupressaceae taxa (gymnosperms) in the remaining groups. These usages are considered uniquely derived. Foodplant usage generally well-known in some species (see individual treatments).

TYPE SPECIES. Papilio damon Cramer by Scudder's original description.

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DISTRIBUTION. Spatial: spinetorum group distributed from south-central Mexico northward through western United States. Other groups distributed generally from northern Mexico through entire United States and southern Canada generally conforming to distributions of non-prostrate species of Cupressaceae. Temporal: Taxa are generally of early summer flight periods, late May through June, with some having apparent summer broods including July occurrences.

REMARKS. Mitoura have created taxonomic controversy in regard to the defining of species limits in relation to constellations of morphological or biological characters (see Johnson, 1976a, 1978). Whereas the sister genus Callophrys does not lend to the defining of particular foodplant segregations generally corroborated by morphological criteria, Mitoura have received enough biological study to generally define particular foodplant usages, and the work of Johnson has attempted morphological delineations with general but occasionally limited success (compare Johnson, 1976a with present study). The cladistic methodology suggests definition of species by unique apomorphies. In my opinion, the foodplant segregations of Mitoura taxa (indicating an autapomorph usage of gymnosperms) consititute a spectrum of unique apomorphies. In Callophrys, lack of apparent apomorphies in morphological structures, lack of specificity in usage of foodplants, and evidence of intergrading in apparent altitudinal forms have led to my lumping of taxa. In Mitoura, however, data allows defining species by particular apomorph foodplant usages along with the corroboration of these relationships by morphological characters. However, in one case, species siva and nelsoni, it is impossible to give reliable morphological diagnoses of the species in some areas of their ranges, though two foodplant usages (various Juniperus and Libocedrus, respectively) are known to separate respective eastern and western distributional segregations. Also, the taxon muiri

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(known to feed on Cupressus) differs little morphologically from adjacent nelsoni populations apparently feeding on Libocedrus though in another case the species loki (markedly different in wing characters from siva) feeds on the same foodplant as the latter taxon in one area of its range. Generally, my rationale for splitting Mitoura into the species recognized in this revision is based on the following considerations. If one begins lumping, either on foodplant or morphological criteria, it is difficult to know where to begin or end. With any lumping beyond my present classification, contradictions between biological and morphological criteria occur. For example, lepidopterists may be emotionally attached to the specificity of the taxon hesseli, because of the furor over its discovery or pointing to its particular usage of Chamaecyparis. Morphologicaly, however, hesseli differs less from immediate sister species than the western taxa barryi, plicataria, and byrnei do from each other and in the case of plicataria an autapomorph foodplant usage is also known--Thuja.

Within the following treatments of various Mitoura taxa I recognize as species, the constellations of character relations I feel are most useful indefining Mitoura species are clear. The use of relative apomorphy for species definition has an unparalleled value for biogeographic considerations (see Materials and Methods and Zoogeographic Discussion) and this is another reason I follow this method. Even though in Mitoura a few morphological criteria become blurred due to apparent convergences within the broad clinal variations of some of the species, I feel that the recognition of species of Mitoura in this revision is the most useful and consistent application of the information provided by the characters.

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1. The spinetorum species Group

including spinetorum/millerorum--estella

A. Cladogram and characters, Fig. 574.

B. Distribution, Fig. 546.

Mitoura spinetorum (Hewitson)

Figs. 341, 342, 499

Thecla spinetorum Hewitson, 1867, p. 94, pl. 45, figs. 198, 199. Boisduval, 1869, p. 42. W. Edwards, 1877, p. 40; 1884, p. 55. Anon., 1882, p. 3. H. Edwards, 1884, p. 478. Godman and Salvin, 1887, p. 48. Smith, 1891, p. 12. Kirby, 1896, p. 387. Barnes, 1900, p. 330. Smith, Skinner, and Kearfoot, 1903, p. 7. Dyar, 1904, p. 283. Coolidge, 1910, p. 375. J. Comstock, 1914, p. 36. Williams, 1914, p. 264. Seitz, 1919, p. 772. W.S. Wright, 1922, p. 19. Wood, undated, p. 302.

Thecla (Mitoura) spinetorum: W. Holland, 1931, p. 230. Hoffman, 1940, p. 711.

Mitoura spinetorum: Barnes and McDunnough, 1916, p. 105; 1917, p. 14. Barnes and Benjamin, 1926, p. 17. Blackmore, 1927, p. 10. J. Comstock, 1927, p. 63. Gunder, 1930, p. 42. Klots, 1930, p. 161. W.S. Wright, 1930, p. 24. Comstock and Dammers, 1938, p. 30. McDunnough, 1938, p. 25. Blevins and Blevins, 1945, p. 123. Leighton, 1946, p. 60; 1972, p. 12. Dethier, 1948, p. 17. Garth, 1950, p. 31. Martin, 1952, p. 76, 1953, p. 68. Bauer, 1953, p. 147. Martin and Truxel, 1955, p. 22. DeFoliart, 1956, p. 97.

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F. Brown, 1957, p. 137. Clench, 1957, p. 58. McGugan, 1958, p. 23. Remington, 1958, p. 14. Dornfield, 1960, p. 183. Horning and Barr, 1959, p. 43. Tilden, 1960, p. 40. T. Emmel, 1964, p. 369; 1972, p. 3. Shields, 1966, p. 127. Anon., 1972, p. 8. Ritterbush, 1972, p. 9. W. Holland, 1972 (1973), p. 157. Emmel and Emmel, 1973, p. 57. Tilden and Huntzinger, 1977, p. 183.

Callophrys spinetorum: Newcomer, 1962, p. 70. Opler and Langston, 1968, p. 97. Scott, Ellis, and Eff, 1968, p. 164.

Callophrys (Mitoura) spinetorum: Ziegler, 1961, p. 21. Clench, 1961, p. 207. Opler, 1962, p. 193. Garth and Tilden, 1962, p. 37. dos Passos, 1964, p. 53; 1970, p. 32. Shields, 1965 (1966), p. 233. Brown and Opler, 1970, p. 59. Ferris, 1971a, p. 25; 1971b, p. 35. Tidwell and Callaghan, 1972, p. 12. Howe, 1975, p. 291. Johnson, 1976, p. 6.

species spinetorum: Comstock and Huntington, 1963, p. 196.

Thecla ninus W. Edwards, 1871, p. 70. W. Edwards, 1877, p. 40 (as ninus); 1884, p. 55 (placed as synonym of spinetorum). Britton, 1882, p. 3. Mead, 1884, p. 778. R. Brown, 1970, p. 57. Skinner, 1907, p. 283. Barnes and Benjamin, 1926, p. 17. McDunnough, 1938, p. 25. J. Jones, 1951, p. 19. dos Passos, 1964, p. 53. Brown and Opler, 1970, p. 57.

Callophrys (Mitoura) ninus: Shields, 1965 (1966), p. 233 (as synonym of spinetorum).

Mitoura spinetorum cuyumaca W.S. Wright, 1930, p. 24, and of authors.

Mitoura spinetorum = cuyumaca: Barnes and Benjamin, 1926, p. 17. J. Jones 1951, p. 19. dos Passos (species level synonymy in error).

Callophrys (Mitoura) cuyumaca: Shields, 1965 (1966), p. 233 (species level synonymy in error).

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DIAGNOSIS. Easily recognized by the steel blue upper surface (Dusky Dull Bluish Green) of both sexes and brown under surface marked with a bright white postmedian line forewing, and nearly transverse mesial line, hindwing, markedly jagged anad. No postbasal markings as on millerorum and no extremely bright postmedian red-orange as on estella.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 49) and frons as typical of the genus. Upper Surface of the Wings: Ground color Dusky Dull Bluish except for moderate (2 mm.) areas of margins, both wings, dull Raw Umber to black. Male scent patch distad in discal area, light gray over ground color. Long tail at vein Cu_2; slight extension of vein at Cu_1. Recurved lobe dark Raw Umber; fringe, both wings dark Raw Umber to black. Under Surface of the Wings: Ground color dark Chocolate Brown. Forewing with white postmedian band, costa to vein bordered darkly brown to black basad. Hindwing with white transverse mesial line, white centrad, black basad, brown distad, across entire wing, jagged to variously "w"-shaped anad. Limbal area, hindwing brightly suffused blue-gray with orange around dark "Thecla-spot." Fringe, both wings, dark Raw Umber, paler distad. Length of Forewing: $\bar{X}$ of 15 specimens (AMNH), 17.0 mm., range 15.8 mm. to 17.5 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 499) and frons as typical of the genus. Upper Surface of the Wings: As on males, but wing shape more broad and rounded distad and with black borders slightly more wide and blending with dull blue ground color at their juncture. Blue sheen dingey. Tail at vein Cu_2; vein Cu_1 slightly extended. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 15 specimens (AMNH, NMNH), 16.8 mm., range 15.5 mm. to 17.5 mm. Male Genitalia: Fig. 341. Valvae, caudad saccus, spiny, wide-rimmed, parabolic, unindented. Bilobed configuration heavily sclerotized and spiny; lateral view, valvae, round-tapered, straight; valvae caudal extension saccus parabolic;

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cornuti wide, disclike. Female Genitalia: Fig. 342. Ductus widely cylindrical, flaring out to lamellae; signa broadly bifurcate spines.

TYPES. Holotype male spinetorum NMNH, holotype male cuyumaca CAS; lectotype male ninus CMNH. Type Localities: spinetorum, California; cuyumaca, Julian, California; ninus, Colorado. All United States.

BIOLOGY. Early Stages: Comstock and Dammers (1938) describe and figure the larva and chrysalis. Emmel and Emmel (1973) describe the egg, describe and figure the other stages, and provide notes on behavior. Foodplant: Oligophagous on Arcenthobium sp. (Loranthaceae).

DISTRIBUTION. Spatial: Fig. 546. Montane areas from central Mexico northward into the Rocky Mountains to southern British Columbia and south along mountains of Pacific Coast to Sierras of California. Temporal: Univoltine: May to July, Rocky Mountains; July into August, montane California.

REMARKS. In all, twenty specimens (including males and females) were dissected from across the range of spinetorum.

Mitoura millerorum (Clench)

Figs. 343, 344, 500

Callophrys (Mitoura) millerorum: Clench, 1980, (in press).

DIAGNOSIS. Resembles spinetorum but has two prominent postbasal slashes (white centrad, black distad and basad) on the hindwing under surface.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 500) and frons as typical of the genus. Upper Surface of the Wings: Ground color Dusky

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Dull Bluish Green except for moderate (2 mm.) areas of margins, both wings, dull Raw Umber to Black. Male scent patch distad in discal area, light gray over ground color. Long tail at vein Cu_2; slight extension of vein at Cu_1. Recurved lobe dark Raw Umber; fringe (both wings) Raw Umber to black. Under Surface of the Wings: Ground color dull Chocolate Brown. Forewing with white postmedian band, costa to vein bordered darkly brown to black basad. Hindwing with white transverse mesial line, white centrad, black basad, brown distad, across entire wing, faintly jagged to roundly wavy anad. Postbasad are two distinct white slashes, bordered each side with black. Limbal area suffused gray-blue with orange around dark "Thecla-spot." Fringe, both wings, dark Raw Umber, paler distad. Length of Forewing: 14.5 mm. (Paratype, AMNH). Female: Head, thorax, abdomen, legs, palpi (Fig. 500) and frons as typical of the genus. Upper Surface of the Wings: As on males but broad areas of wings, especially apices, fuscous to dull Raw Umber. Sheen of blue upper surface coloration duller. Under Surface of the Wings: As on males. Length of Forewing: 14.0 mm. (female, BMNH, not included in Clench's type series.) Male Genitalia: Figs. 343. Generally similar to other Loranthaceae-utilizing Callophrys (Mitoura) as listed in general format under spinetorum, differing markedly as follows: aedeagus longer than any other known Callophrys (Mitoura), ratio of length, aedeagus, to maximum breadth, vinculum (dorsal view) = 4.3; same for longest aedeagus, any congener--C. spinetorum (Hewitson) = 3.5 (n = 10), caudal half uniquely curved ventrad; distal end, basal cornutus reduced and slightly bifurcate distad. Saccus extremely long--equalling 40% of the length from tip of saccus to distal end of labides) while this ratio on C. spinetorum is 35% (n = 10). Female Genitalia: Figs. 344. Ductus extremely wide, circa one-fourth length and with little flaring caudad at opening of lamellae. Lamellae hardly expanded

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distad width of ductus and with lamella antevaginalis indented centrad. Signa broadly bifurcate spines.

TYPES. Holotype female, depositd by Clench (AME). Type Locality: Palos Colorados, Durango, Mexico.

DISTRIBUTION. Spatial: Known from type locality and Palos Colorados, Durango, Mexico, 8,000 ft. as listed in Clench's type series. Also a specimen unknown to him (BMNH) from Bolanos, Jalisco, Mexico, July. Temporal: Dates on specimens range from July to August.

REMARKS. The three specimens included in millerorum may represent more than one species. There is some difference in the postbasal spots or slashes on the specimens and I have been unable to compare the genitalia of Clench's single specimen to the AMNH and BMNH material. Clench listed the AMNH specimen as a paratype without examining it (or dissecting it) and the BMNH specimen was unknown to him. I have suspected that Clench's type and the others are not the same species. Our descriptions were in manuscript concurrently and I withdrew mine in deference to him. The descriptions of all the recently named Mitoura of Clench included in this paper have been prepared by me prior to preparation by Miller of Clench's manuscript notes, following Clench's unfortunate and untimely death. Hence, until communication is complete concerning these taxa, I feel it unwise to create a possible unnecessary synonym, and do not describe the AMNH and BMNH specimens as distinct from Clench's millerorum. I dissected genitalia of Clench's types, and the BMNH individual not seen by him, along with selected legs and palpi.

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Mitoura estella (Clench)

Figs. 345, 346, 501

Callophrys (Mitoura) estella: Clench, 1980 (in press).

DIAGNOSIS. This species cannot be confused with any other. As other Mitoura, the upperside is dark steel blue on males, and more brownish on females, but the underside of the hindwing displays bright red-orange throughout the limbal area, extending cephalad along the submargin and highlighted by a bright white postmedian band jagged anad.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 501) and frons as typical of the genus. Upper Surface of the Wings: Ground color deep Raw Umber overscaled heavily with Dusky Dull Bluish Green. Margins and immediate submargins of both wings, and apices of forewings dark Raw Umber. Scent patch distad in discal cell. Hindwing with long tail at vein Cu_2, shorter tuft at Cu_1, and slight tuft along noticeable recurved lobe of hindwing between anal and outer margins. Under Surface of the Wings: Ground color dark blackish brown. Forewing with black ovate ring in discal cell; postmedian line whitish, edged dark brownish black, costa to vein 2A, jagged basad then distad between veins Cu_2 and 2A; narrower blackish submarginal line from costa to vein Cu_1. Hindwing with nearly straight whitish postbasal slash in cell $Sc + R_1$ and discal cell; prominent white postmedian band from costa to anal margin, straight and entire from costa to vein M_3, increasingly jagged in the cell interspaces anad. Entire limbal area and submarginal area cephalad bright orange-red, extending more emphatically basad in cell Cu_2, bordered darkly basad, by lighter ground color distad. Area of recurved lobe marked with crescent-shaped slash, open

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distad; fringe cephalad from here to tail at Cu_1 heavy, dark basad, paler to whitish distad. Length of Forewing: Circa 15 mm. (holotype). Female: Head, thorax, abdomen, legs, palpi (Fig. 501) and frons as typical of the genus. Upper Surface of the Wings: Ground color slightly duller than male, otherwise similar. Wing broad and more rounded. Under Surface of the Wings: As on male. Length of Forewing: Circa 16 mm. (allotype). Male Genitalia: Fig. 345. Similar to immediate sister taxa but differing by wide, thickly parabolic bilobed configuration spiny only caudad and extremely thickened caudal extension with blunt termini. Female Genitalia: Fig. 346. Marked by extremely flared and wide ductus becoming more expansive caudad and with little evidence of distad extension of lamellal lobes. Signum thick extremely bifurcate spines.

TYPE. Holotype male and allotype female, deposited CMNH. Type Locality: 1.5 miles north of East Salto, Durango, Mexico.

DISTRIBUTION. Known only from the type locality. Temporal: Not available to me.

REMARKS. I have seen and dissected Clench's types, and have seen but not dissected his paratypes.

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2. The johnsoni species Group

A. Cladogram and characters, Fig. 574.

B. Distribution, Fig. 546.

Mitoura johnsoni (Skinner)

Figs. 347, 348, 502

Thecla johnsoni Skinner, 1904, p. 298. Grinnell and Grinnell, 1907, p. 45. Seitz, 1919, p. 772. Gillham and Ehrlich, 1959, p. 102.

Thecla (Mitoura) johnsoni: W. Holland, 1931, p. 230.

Mitoura johnsoni: Barnes and McDunnough, 1917, p. 14. J. Comstock, 1922, p. 164. Barnes and Benjamin, 1926, p. 17. Blackmore, 1927, p. 10. McDunnough, 1938, p. 25. Leighton, 1946, p. 60. J. Jones, 1951, p. 19. Dornfield, 1960, p. 183. dos Passos, 1964, p. 53. Shields, 1966, p. 127. Leighton, 1972, p. 12.

Callophrys johnsoni: Emmel and Emmel, 1962, p. 33. Garth and Tilden, 1963, p. 47. Anon., 1972, p. 9.

Callophrys (Mitoura) johnsoni: Ziegler, 1960, p. 21. Clench, 1961, p. 208. Garth and Tilden, 1963, p. 37. Opler, 1963, p. 193. dos Passos, 1970, p. 32. Gregory, 1975, p. 34. Howe, 1975, p. 291. Johnson, 1976a, p. 6.

species johnsoni: Comstock and Huntington, 1961, p. 56.

DIAGNOSIS. Easily recognized by the bright white mesial band on the hindwing distinctly jagged anad as on spinetorum and millerorum, but with the upper surface of the wings not steel blue as on the latter species, but brown.

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DESCRIPTION. Head, thorax, abdomen, legs, palpi (Fig. 502) and frons as typical of the genus. Upper Surface of the Wings: Ground color warm Prouts Brown to Sudan Brown. Narrow areas of margins dull Raw Umber to black. Scent patch distad in discal area. Hindwing with tail at end of vein Cu_2. Recurved lobe dark Raw Umber; fringe, both wings, dark Raw Umber to blackish. Under Surface of the Wings: Ground color Argus Brown to darker Mummy Brown. Forewing with postmedian white band, costa to vein M_3 bordered basad red-brown. Hindwing ground color red-brown to burgandy brown (Mars to Sudan Brown) slightly lighter distad bright white mesial line. Mesial line rounded across wing, anad jagged to slightly wavy, heavily bordered basad brownish to black. Limbal area suffused gray-blue, with orange around dark "Thecla-spot." Length of Forewing: $\bar{X}$ of six specimens (AMNH, NMNH) 16.5 mm., range 15.5 mm. to 17.0 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 502) and frons as typical of the genus. Upper Surface of the Wings: As on males. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of six specimens (AMNH, NMNH) 16.7 mm., range 15.5 mm. to 17.5 mm. Male Genitalia: Fig. 347. Valvae, caudad saccus, spiny, more narrowly parabolic than spinetorum, wide-rimmed, slightly indented; valvae, lateral view, round-tapered, curved; valvae, caudal extension saccus pointed, notched caudad valvae; cornuti, wide, disclike. Female Genitalia: Fig. 348. Ductus widely cylindrical, so wide as to flare only slightly to lamellae; signa broadly bifurcate spines.

BIOLOGY. Early Stages: Unknown. Foodplant: Monophagous on Arceuthobium douglassii Engelm. (Loranthaceae).

TYPES. Holotype male and allotype female, CMNH. Type Locality: Holotype, Seattle, Washington; allotype, British Columbia.

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DISTRIBUTION. Spatial: Fig. 546. In western United States, in disjunct populations, northern California, western Oregon, northwestern Washington, and in Canada on southern Vancouver Island, British Columbia. Temporal: Univoltine: late May into early June.

REMARKS. In all, seven males and six females were dissected for genitalia, legs, and palpi.

3. The byrnei species Group

including byrnei--plicataria/muiri--barryi

Distributions, Fig. 547.

Mitoura byrnei (Johnson)

Figs. 349, 350, 503.

Callophrys (Mitoura) byrnei Johnson, 1976a, p. 21.

DIAGNOSIS. This species is evidently a Thuja-feeder (Cupressaceae) as larvae (see below). Specimens are easily distinguishable by unique genitalia in both sexes: female configuration reminiscent of traits extreme in C. johnsoni, and two large signa occur on the upper and under surface of the bursae, as characteristic in the byrnei group. Males, anterior ends of valvae, caudad saccus, are narrow-rimmed, parabolic, and unindented as in C. siva but lateral shape is obviously highly irregular like others of byrnei group. Saccus is pointed

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(like C.siva) but deep notched caudad (like C. johnsoni). Recognizable by wing traits by tendency of populations to produce deep black-brown upper surface (dark Raw Umber), and darkened dull under surface.

DESCRIPTION. Male: Head, thorax, abdomen, legs and frons as typical of the genus. Palpi apomorph: second and third segment markedly elongate. Upper Surface of the Wings: Very dark--Raw Umber to fuscous, with chevron-shaped Zinc Orange patches, limbal area, hindwings, veins 2A to Cu_1. Forewing scent patch distinct over ground color. Under Surface of the Wings: Ground color yellowish browns most often extremely dark-flecked giving appearance of being smoked to Prouts Brown or Raw Umber, sometimes obscuring submarginal line, forewing, or mesial line, hindwing. Forewing, submarginal line white basad, vaguely black centrad, brown basad. Hindwing, mesial line continuous, outstanding unless obscured by dark overcast, white distad, widely black centrad, usually not noticeably browner than ground color basad. Limbal area, usually four (sometimes five) black spots between veins 2A to M_2 (or M_1), then vague orange, then blue-gray distad these, all sometimes obscured by dark "smoked" effect. Length of Forewing: 13.5 mm (holotype), $\bar{X}$ of four paratypes 13.5 mm., range 12.5 mm. to 14.5 mm. Female: Head, thorax, abdomen, legs and frons as typical of the genus. Palpi apomorph: second and third segments markedly elongate. Upper Surface of the Wings: Hazel to Tawney over entire wing except fuscous or dark Raw Umber along margin and extensively at wing base. Fuscous or dark Raw Umber often flecking entire wing over ground color. Under Surface of the Wings: Same as males except for tendency of mesial line to be more obscured by dark overcast. Length of Forewing: 13.0 mm. (allotype); 13.0 mm. (paratype). Male Genitalia: Fig. 349. Labides distinctively high crowned with crowns widely separated. Valvae, anterior structure, caudad saccus, narrow-rimmed, parabolic and unindented; lateral shape, very shouldered, rounded, irregular, caudal

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extension tapered. Anterior of saccus deeply notched beneath anterior of valvae. Saccus pointed. Female Genitalia: Fig. 350. Lamellae nearly ovate in structure, lamella postvaginalis about half size of lamella antevaginalis, deeply notched above antrum, and lipped with sclerotizations. Ductus long, substantially exceeding breadth of lammellae.

BIOLOGY. Early Stages: Unknown. Foodplant: The limited known range of this species corresponds with the disjunct southeastern populations of Thuja plicata Wats. and not with any known occurrence of any species of Juniperus. C. siva is found in eastern Oregon and southeastern Washington on J. occidentalis Hook and in southern Idaho on J. osteosperma Torr. (Little). Though there is no actual evidence of Thuja usage, I have spoken to lepidopterists who have either collected byrnei or have discussed byrnei with lepidopterists who have. These persons (see below) remember the specimen as coming from Thuja habitats.

TYPES. Holotype, male, allotype, female, deposited AMNH. Type Locality: 5.6 mi. south of Emida, Benewah Co., Idaho, United States.

DISTRIBUTION. Spatial: Known from Benewah, Latah, and Wallace counties in Idaho, all in disjunct ranges of Thuja plicata. Could extend southward to Idaho County and northward in the Rocky Mountain Thuja belt into Canada. Temporal: Dates on specimens range from 18 May to 18 July.

REMARKS. I have retained the name byrnei as a species in Mitoura for the following reasons: (1). Though its distribution is most regionally allied with barryi, barryi (see Remarks under this taxon) is associated with Juniperus occidentalis utilization. Since on the basis of morphological characters byrnei cannot conceivably be synonymized with any species except perhaps barryi, and since byrnei seems to be associated with Thuja plicata usage as an autapomorphy, morphological and biological data both support the hypothesis that

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byrnei is a catagory of equal value to other species-level taxa in Mitoura. (2). The occurrence of apomorphic characters in the palpi of barryi and byrnei support such a decision. Yet unclear is the relation of byrnei to the northern Rocky Mountain distributions of Mitoura formerly named by Johnson as rosneri subspecies rosneri. The foodplant of this entity is unknown and the types ambiguous in this regard. Both Juniperus scopulorum and Thuja plicata occur northward in the area of rosneri rosneri. For this reason, I have elevated the name plicataria Johnson to priority over rosneri to clearly define the westward occurrence (Puget Sound northward) of a known Thuja-feeder, and leave the identity of rosneri open to question. I am grateful for Jon Sheppard and Stanley Jewett for communicating with me regarding collecting sites of these Mitoura and adding therein to the circumstantial, including perching, evidence that Thuja is the foodplant. I have dissected genitalia of nine males and females associated by genitalia and distribution with byrnei along with selected legs and palpi.

Mitoura plicataria (Johnson), new status

Figs. 351, 352, 504

Callophrys (Mitoura) rosneri plicataria Johnson, 1976a, p. 15.

Callophrys (Mitoura) rosneri rosneri: Johnson, 1976a, p. 4. NEW SYNONYMY.

DIAGNOSIS. Generally recognizable by burgundy to russet flush of under surface hindwing and proximity to foodplant Thuja plicata Wats. (see Remarks). Reliably distinguished from C. nelsoni and siva by genitalic characters as follows: corpus bursae with two signa on upper surface, under surface same, often more reduced; male genitalia, valvae irregular, saccus parabolic.

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DESCRIPTION: Male: Head, thorax, abdomen, legs, palpi (Fig. 504) and frons as typical of the genus. Upper Surface of the Wings: Prouts Brown, lightened to Sanford's Amber Brown in limbal area between veins 2A and M_3 (both wings), sometimes more. Forewing, scent patch usually indistinct over ground color. Under Surface of the Wings: Forewings Amber Brown, sometimes russet towards margin; submarginal line, white distad, near black centrad, deeper brown basad and extending costal margin caudad to Cu_1, sometimes basad along tornus to inner margin. Hindwings ground color Vinaceous Russet to Cameo Brown, much darker basad mesial line; mesial line continuous, uniformly bright, white distad, black centrad, deep Cameo Brown basad; limbal area, usually four (sometimes five) black spots betwen veins 2A to M_2 (or M_1), then orange, then blue-gray distad these. Length of Forewing: 14.5 mm (holotype); $\bar{X}$ of eight paratypes, 14.3 mm., range 13.5 mm. to 15.0 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 504) and frons as typical of the genus. Upper Surface of the Wings: As on males but broader areas of discal and limabal areas, forewing and hindwing respectively, lighter brown. Under Surface of the Wings: As on males. Length of Forewing: 14.5 mm. (allotype); $\bar{X}$ of six paratypes 14.6 mm., range 13.5 mm. to 15.5 mm. Male Genitalia: Fig. 351. Valvae, caudad saccus mid-rimmed, unindented, spiney; lateral views irregular, slightly shouldered, rounded; saccus parabolic. Female Genitalia: Fig. 352. Lamellae hemispherical; lamella postvaginalis about one-third size of lamella antevaginalis, indented broadly at antrum; sclerotized lips at juncture of lamellae. Signa two chevroned or arrowed.

BIOLOGY. Foodplant: Thuja plicata based on conclusive knowledge from rearing at Wellington, British Columbia, Canada (Johnson, 1976a).

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TYPES. Holotype male of plicataria in AME; holotype male of rosneri in AME. Type Localities: plicataria, Cameron Lake, British Columbia, Canada; rosneri near Kaslo, British Columbia, Canada.

DISTRIBUTION. Spatial: plicataria is known from Puget Sound region of Washington State, United States, northward along western coast of British Columbia, Canada, on T. plicata. Another population ("rosneri") is known from the eastern allopatric T. plicata range in Canadian Rockies of eastern British Columbia and western Alberta, north to 53° latitude and south into the scattered extensions of T. plicata in northeast Washington State at least to Stevens County, but itself of uncertain taxonomic status due to lack of certainty about foodplant usage. J. scopulorum also occurs in these areas (see Remarks). Temporal: Dates on specimens range from late April to late June.

REMARKS. Since the most recent decision of the ICZN concerning infraspecific names allows equal status to all, regardless of consideration of page priority, I am excercising the right to remove rosneri from species level status and replace it with plicataria. I further place rosneri as a subspecies or synonym of plicataria. I do this because the types of plicataria are unambiguous as to larval foodplant usage and thus plicataria has certain meaning relative to consideration of foodplant criteria in the taxonomy of Mitoura, while rosneri does not. The identity of rosneri may be as a subspecies of plicataria (this is what is indicated by morphological consideration) or possibly as a separate species or subspecies of siva, if it was found to feed exclusively on Juniperus scopulorum Sarg. which grows along with its suspected foodplant Thuja plicata Wats. (Johnson, 1976a).

In all I dissected genitalia of forty-six specimens of plicataria (including both sexes and representatives from the Rocky Mountain range) along with selected legs and palpi.

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Mitoura muiri (H. Edwards), status revised

Figs. 353, 354, 505

Thecla muiri H. Edwards, 1881, p. 53. W. Comstock, 1911, p. 86. McDunnough, 1914, p. 196 (ab. in text). Tilden, 1952, p. 95. Wood, undated, p. 302.

Thecla muri (sic): Anon., 1882, p. 3.

Thecla (Mitoura) muiri: W. Holland, 1931, p. 320.

Thecla nelsoni var. muiri: W. Edwards, 1884, p. 55.

Thecla nelsoni muiri: Beutenmuller, 1892, p. 169. Dyar, 1904, p. 37.

Thecla nelsoni muirii (sic): Smith, 1891, p. 11. Smith, Skinner, and Kearfott, 1903, p. 12.

Mitoura nelsoni muiri: Barnes and McDunnough, 1917, p. 14. J. Comstock, 1922, p. 164. Barnes and Benjamin, 1926, p. 17. McDunnough, 1938, p. 25. Martin, 1952, p. 20. Tilden, 1952 (1953), p. 95. Martin and Truxel, 1955, p. 22. dos Passos, 1964, p. 53.

Callophrys nelsoni muiri: Opler and Langston, 1968, p. 97.

Callophrys (Mitoura) nelsoni muiri: Ziegler, 1960, p. 21. dos Passos, 1970, p. 32. Johnson, 1976a, p. 6 (possible species status).

species muiri: Comstock and Huntington, 1961, p. 174.

DIAGNOSIS. This species can only be separated from nelsoni by knowledge of the larval foodplant. The foodplant of muiri is Cupressus sargentii Jeps., while nelsoni feeds on Libocedrus decurrens Torr. M. nelsoni itself is not separable from western populations of siva except by the latter's usage of various Juniperus species. Another way to identify muiri is from the known localities which are included in its range (see REMARKS, below). Variation in

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the local populations of these western Mitoura is such that no set of species limits of morphological characters can consistently distinguish particular species.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 505) and frons as typical of the genus. Upper Surface of the Wings: Ground color Prouts Brown to Mummy Brown with some areas centrad, forewing and in limbal area, hindwing lighter Amber to Sudan Brown. Areas of margins and apices both wings, darker brown to dull Raw Umber. Scent patch distad in discal area. Tail at vein Cu_2, hindwing. No extension of vein Cu_1. Under Surface of the Wings: Ground color dull Sudan Brown, both wings, with hindwing heavily suffused dark Raw Umber to Black. Forewing with slight postmedian band, costa to vein M_3, white centrad variously brown to blackish edged. Hindwing with basal disc usually heavily suffused with dark overscaling. Mesial line across entire wing usually emphatically yellowish to white (but may be more obsolescent toward absent) and bordered distad by lighter ground color. Limbal area with blue-gray suffusion often reduced, but with dark "Thecla-spot" emphatic and usually surrounded by some orange or yellowish suffusion. Length of Forewing: $\bar{X}$ of six specimens (AMNH, LACM, AME), 13.2 mm., range 12.5 mm. to 13.5 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 505) typcial of the genus. Upper Surface of the Wings: As on males but with areas centrad on forewing and limbal on hindwing sometimes much lighter. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of six specimens (AMNH, LACM, AME), 13.5 mm., range 13.0 mm. to 14.5 mm. Male Genitalia: Fig. 353. Characterized by bilobed configuration with wide bevel-rimmed and ovate condition similar to barryi but more shouldered just cephalad the caudal extension such that clear areas angle markedly disto-caudad. Saccus long and pointed. Cornuti as illustrated. Female Genitalia: Fig. 354. Lamellae hemi-rectangular with

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lamella antevaginalis about one-third to one-half caudal expanse of lamella postvaginalis. Distal juncture of lamellae extremely sclerotized, extreme for characters in sister taxa nelsoni and siva. Ductus often much wider cephalad than caudad causing taper from corpus bursae to lamellae. Signa two small dots, occasionally one on each bursae surface.

BIOLOGY. Early Stages: Unknown. Foodplant: Cupressus sargentii (Cupressaceae) Johnson 1976a (see Distribution, below).

TYPES. Holotype male and allotype female, AMNH. Type Locality: Mendocino County, California.

DISTRIBUTION. Spatial: In scattered localities where the foodplant occurs on serpentine soils of the coastal ranges northeast of San Francisco, California. Relationship to other possible Cupressus sargentii feeding populations, e.g. south of San Francisco Bay, San Mateo and Santa Cruz Counties, California, or on sympatric C. macnabiana in Napa and Lake Counties, or utilization of C. forbesii in San Diego County, presently unknown. Temporal: Questionable due to uncertainty of specimens as muiri.

REMARKS. Prior to this study, except for comments in Johnson (1976a), muiri has been considered a subspecies of nelsoni. However, known diversity of foodplant usage in the latter taxon have long suggested some need for reconsideration of the specific level taxa considered with the usage of "nelsoni." My 1976 work, at the very least, proposed morphological limits which along with foodplant considerations could be used to delimit several other species in a complex utilizing respectively Libocedrus (nelsoni), Cupressus (muiri), and Thuja (plicataria). Studies of all the Mitoura taxa since that time, especially in regard to cladistic methodology, have convinced me that morphological diversity and apparent species limits in the extremely divergent local populations

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characteristic of nelsoni, siva and muiri make morphological criteria for these taxa nearly impossible to use. However, their foodplant usages do stand as autapomorphies useful in defining them as taxa of specific rank. Further considerations of the names barryi, byrnei, acuminata, and plicataria have led me to make some changes in regard to which of their names should be allowed to stand. The types of some are ambiguous in relation to larval foodplant usage, and hence might be considered as having a questionable or unknown meaning. I have made comments on these individual cases throughout the present revision. I have also mentioned the apparent autapomorphic nature of the palpi in barryi and byrnei. The following considerations make it reasonable to elevate muiri to species rank: (1). the criteria of unique autapomorphy of its larval foodplant, (2). consistency within an understanding of species limits defined by larval foodplant and general morphological characters of the congeners. The approach takes into account that wide character divergence in local populations (characterized by local isolation) makes morphological criteria for species their recognition not entirely useful for every locality. Given the consideration of autapomorphic characters as criteria for species, muiri merits species rank, and this conforms to the current popular assumption of its existence as a biological species isolated by its unique monophagy.

In addition to the types, I dissected genitalia of six males and five females from areas known by general Cupressus usage to represent muiri, along with selected legs and palpi.

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Mitoura barryi (Johnson)

Figs. 355, 356, 506

Callophrys (Mitoura) barryi Johnson, 1976a, p. 17.

DIAGNOSIS. Immediately recognized by the following characters: male genitalia with broadly ovate and wide-rimmed anterior valval structure, dorsal or ventral view; by extreme "shouldered, rounded" lateral shape of valvae; and "funnel" shaped saccus; female genitalia with two large chevron-like signa, upper and lower surface, corpus bursa; wings, some specimens, noticeably yellow-brown in ground color, under surface, hindwing and/or some showing yellowing of the limbal area, upper surface hindwings.

DESCRIPTION. Male: Head, thorax, abdomen, legs and frons as typical of the genus. Palpi (Fig. 506) apomorph. Upper Surface of the Wings: Ground color Prouts Brown to Mummy Brown, Hazel to Tawney in limbal area between veins 2A to M_3 (both wings), some more extensively. Forewing, scent patch usually indistinct over ground color. Under Surface of the Wings: Ground color Hazel to Tawney to Cameo Brown, basad mesial line often heavily flecked with dark scales giving appearance of Prouts Brown overcast. Forewing, submarginal line white distad, ground color or slightly darker brown basad. Hindwing, mesial line continuous, bright (sometimes faded caudad if Prouts Brown overcast heavy), white distad, black centrad, brown basad. Limbal area, usually four (sometimes five) black spots between veins 2A to M_2 (or M_1), then orange, then blue-gray distad these. Length of Forewing: 13.5 mm (holotype), $\bar{X}$ of 3 specimens (AME, AMNH) 13.3 mm., range 13.0 mm. to 13.5 mm. Female: Head, thorax, abdomen, legs and frons as typical of the genus. Palpi (Fig. 506) apomorph. Upper Surface

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of the Wings: As on male but wider yellow-brown limbal patches, hindwing. Under Surface of the Wings: As on males. Length of Forewing: 14.0 mm. (allotype). Male Genitalia: Fig. 355. Valvae, anterior end, caudad saccus, distinctly wide-rimmed, oval. Valvae, lateral view, shouldered, rounded, irregular. Saccus, funnel. Cornuti as illustrated. Female Genitalia: Fig. 356. Lamellae "mallet"-shaped, lamella antevaginalis slightly indented at antrum. Ductus longer than breadth. Signa two chevron-shaped spines.

BIOLOGY. Foodplant: Probably Juniperus occidentalis (see below).

TYPES. Holotype, male, in AME; allotype, female, in AMNH. (See REMARKS below). Type Locality: Union County, Oregon.

DISTRIBUTION. Spatial: Fig. 547. The characteristic genitalic configuration of barryi occurs in the Juniperus occidentalis range from the Deschutes Plateau region of eastern Oregon into adjacent Idaho. In areas of uncertain foodplant availability the configuration is also known from localities on the eastern slope of the Cascade range, the western Deschutes Plateau and Vancouver Island. Temporal: Known from May to early June.

REMARKS. The identity of barryi and its subspecies (the nominate and b. acuminata Johnson 1976a, Bull. Allyn Mus., 1976, p. 20. TL: Butte Falls, Oregon) is obscure because I included as nominate subspecies paratypes specimens from "Eagle Fern Park" and "Austin Hot Springs" (assumed by Johnson as "Austin") which could represent localities actually westward in the Cascade region and which are, therefore, possibly in the range of the supposedly allopatric subspecies acuminata. Also, the designation of "Union County" as the type locality of nominate barryi was unfortunate because the location is ambiguous and makes uncertain any biological understanding (especially larval foodplant relations) of the types. Since the nominate subspecies could occur not

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just in the area within the range of acuminata, the meaning of acuminata becomes questionable. I suggest that the name acuminata be considered undefined until its usefulness vis-a-vis biological understanding of populations suggests a particular association of it with a population meaning more than simply its types. Since I have rejected subspecies as being useful within a cladistic method, it is sufficient to note the error of assuming that acuminata (as defined morphologically) is allopatric of nominate barryi.

The question of what barryi represents within Mitoura species involves the following considerations:

(1). If morphological considerations are made primary, the apomorphic nature of characters stressed by Johnson (1976a) [wide and ovate bilobed configurations] define as a species those populations included in the original descriptions of barryi subspecies. It is then to be considered if barryi sens. lat. possibly feeding on Juniperus occidentalis or some other plant can be synonymized with any other species. If one wants to synonymize barryi with some other taxon in Mitoura, it is impossible with morphological and foodplant criteria to select, without contradiction, which taxon it would be. According to this argument barryi remains a species, feeding either on a unique Juniperus monophagy like loki or perhaps on some other plant like Thuja.

(2). If, on the other hand, one assumes that barryi subspecies represent a regional population in eastern Oregon and adjacent areas which feed on synchronic Juniperus occidentalis but for which the morphological characters of Johnson are not of primary importance, then one must consider: (a). the entire group of MItoura within the range of Juniperus occidentalis (siva on occidentalis, and barryi on occidentalis; see Johnson, 1978) as a distinct species, or (b). the entire assemblage named barryi by Johnson as synonymous with siva. Johnson (1977 ms.) in a paper rejected for publication because of different a priori

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positions of reviewers, has clearly shown that siva (as defined by regionally consistent morphological characters which are not convergent with western nelsoni but like topotypical siva) occurs on Juniperus occidentalis in eastern Oregon. He has subsequently documented the foodplant usage (1978). Dornfield (1980) treats Johnson's Oregon work in a suitable manner, given that some biological evidence is as yet unclear. However, an implication of Dornfield's acceptance of the name nelsoni for all eastern Oregon Mitoura is that the range of nelsoni stops at the Nevada border and is replaced thereat by siva.

In considering the above arguments and the further considerations below, I accept the first position. Therefore, I retain the name barryi. Interestingly, I have found a degree of the wide and ovate bilobed configuration character in the following additional populations along with those named under barry as subspecies by Johnson (1976a): the types of muiri and others included under muiri in this paper, and the one specimen known to me from Guadelupe Island off Mexico. I do not know the significance of this and feel that speculation is not useful until studies of larval foodplants are more complete for the entire Mitoura group in the western United States. I connot synonymize barryi with muiri because they do not share the apomorph character of Cupressus utilization which is autapomorph for the latter. The other reason I consider barryi as a valid species is that its palpi (at least from the few specimens known) are distinctly apomorph relative to the possible taxa with which it might be considered synonymous for other reasons (see above). The extended second segment (indicated as apomorph Callophryina; see Cladistic Analysis) does not occur in other congeners except in byrnei of the byrnei species group and in some other apomorph taxa of other species groups (e.g., sweadneri).

In all I have studied the genitalia of nineteen male and female specimens associated by genitalic characters with barryi sens. lat. along with related legs and palpi.

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4. The dospassosi Group

including dospassosi--hesseli/sweadneri-- --turkingtoni

Mitoura dospassosi (Clench)

Figs. 367, 368, 512

Callophrys (Mitoura) dospassosi: Clench, 1980, (in press).

DIAGNOSIS. This species is easily recognized as the only Mitoura with males distinctly blue above (females duller blue), and with both sexes green beneath.

DESCRIPTION. Male: Head, thorax, abdomen, legs and palpi (Fig. 512) as typical of the genus. Upper Surface of the Wings: Ground color bright dusky Dull Bluish Green; margins of both wings and apices of forewings dull Raw Umber. Scent patch distad in discal cell. Fresh specimens with white marginal line visible on hindwing; fringes dark basad, light distad, toward whitish caudad long tail at vein Cu_2, shorter tail at Cu_1, and slight recurved lobe. Under Surface of the Wings: Ground color bright deep green. Hindwing with broad postmedian line of broken rectangular white patches from costa to anal margin, becoming increasingly broken and jagged anad. Postmedian line edged prominently basad with brown. Limbal area with four dark blackish blotches in cells M_3, Cu_1, Cu_2, and 2A, blotch in cell Cu_2 often chevron shaped. Rest of limbal area with slight orangish cast and hoary bluish distad in cells Cu_1 and Cu_2. Fringe, both wings dark basad, lighter to whitish distad, at small tail vein Cu_1

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deeply black. Length of Forewing: $\bar{X}$ of four specimens, CMNH, 12.8 mm., range 12.5 mm. to 13.5 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 512) as typical of the genus. Upper Surface of the Wings: Ground color warm brown, darker basad and distad. Margins fuscous. Slight white marginal line visible on fresh specimens' hindwings; fringe, both wings brown to fuscous basad, paler distad. No scent patch distad in discal area. Tail at Cu_2, smaller projection at Cu_1. Under surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of three specimens, CMNH, 13.0 mm., range 12.8 mm. to 13.8 mm. Male Genitalia: Fig. 367. Similar to sweadneri differing mainly as follows: bilobed configuration less shouldered; caudal extension evidently longer relative to labides and uncus, thicker caudad toward terminus. Female Genitalia: Fig. 368. Lamella hemispherical in shape with postvaginalis having two to three stair-step convolutions ventrad. Lamella antevaginalis flared widely distad, paralleling shapes of convolutions ventrad on lamella postvaginalis. Length of ductus slightly longer than breadth of lamellae, straight, caudal end flared. Signum as single spine, vaguely bifurcate centrad.

TYPES. Clench's types are in the AME. Type Locality: Five miles north of Zimapan, Hildalgo, Mexico.

DISTRIBUTION. Spatial: Fig. 549. Known from two disjunct areas of Mexico, presumably two allopatric populations: area of the type locality in Hidalgo, Mexico, and in Chihuahua State, Mexico, from Cuiteco and Madera; also known from Tecora, southeast Sonora State adjacent the Chihuahua distribution area. Temporal: Known from January to March.

REMARKS. This species may be divided into two allopatric subspecies (see Material Examined). It is related cladistically to sweadneri, hesseli, and turkingtoni, synapomorphies being the elongated valvae and extreme shouldering of the bilobed configuration in males of these species. A synapomorphy of

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sweadneri and dospassosi (the female of turkingtoni is unknown) is apparently the convoluted ventral surface of the lamella postvaginalis in females. These relationships indicate a circum-Carribean population broken up by subsequent vicariance with one species (hesseli) indicating via a foodplant adaptation dispersal and subsequent vicariance within its range (see terminal sections of this paper). This is important in distinguishing sweadneri from gryneus; the former has sometimes been considered a subspecies of the latter (e.g., Clench, in Ehrlich and Ehrlich, 1961).

I dissected genitalia of Clench's types of dospassosi dospassosi and d. searsi, along with two specimens in the AMNH. I was able to examine selected legs and palpi.

Mitoura hesseli Rawson and Ziegler

Figs. 369, 370, 513

Mitoura hesseli Rawson and Ziegler, 1950, p. 74. Klots, 1951, p. 141. Rawson, Ziegler, and Hessel, 1951 (1952), p. 123. Martin and Truxel, 1955, p. 22. Pease, 1963, p. 27. dos Passos, 1964, p. 54. Shapiro, 1966, p. 32. Anderson, 1974, p. 161.

Thecla hesseli: Forbes, 1960, p. 134.

Callophrys hesseli: Muller, 1961, p. 144. Miliotis, 1970, p. 4. L. Miller, 1975, p. 18.

Callophrys (Mitoura) hesseli: Ziegler, 1960, p. 21. Clench, 1961, p. 206. dos Passos, 1970, p. 32. Howe, 1975, p. 293. Johnson, 1976a, p. 7; 1978, p. 3.

species hesseli: Comstock and Huntington, 1960, p. 181.

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DIAGNOSIS. Recognized by the extensive brown which border all the markings on the hindwing underside, especially in two large patches distad the discal cell between veins M_1 and M_3, and the rich deep green (Rheinemann's Green) characteristic of the whole patterning. The female genitalia are remarkably different from congeners, with the antrum flared so broadly as to taper caudad toward the lamellae; other species have a narrow antrum with the ductus tapering widely cephalad.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 513) and frons as typical of the genus. Upper Surface of the Wings: Deep Raw Umber to blackish, sometimes with Tawny to Ochraceous Tawny in discal area, forewing, and along anal angle, hindwing. There is a tail at vein Cu_2, slight tuft at vein Cu_1. Scent scale distad in discal cell, usually yellowish white; outstanding. Fringe, both wings, dark brown, often whitish basad in limbal area, hindwing. Under Surface of the Wings: Ground color, forewing, dark Mars Brown caudal half of wing basad postmedian line, caudal two-thirds distad this line; rest of wing, ground color suffused brignt Rheinemann's Green to overscaled brown. Postmedian line, costa to vein Cu_2, bold white slightly disjunct and irregular rectangular patches, bordered often black. Wing margin Mars Brown broken by white dots in cell interspaces; fringe brownish, black basad. Hindwing ground color bright Rheinemann's Green highly grizzled with Mars Brown. Two bold postbasal spots, thickly crescent shaped, widely bordered basad and distad Mars Brown to Burnt Sienna. Edging of basal disc (median line) arc of disjunct to variously regular bold white crescents or rectangular white marks, edged boldly distad and basad Mars Brown to Burnt Sienna; these markings variously displaced basad or distad but not extremely so as to invade basal disc. Distad median line four to five black dots in cell interspaces, anal margin to cell M_2; "Thecla-spot" boldly black in cell Cu_1, edged with blue suffusion distad, sometimes orange

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basad; other cell interspaces in limbal area variously suffused blue and whitish; black dot often at anal margin in area of slight recurved lobe between anal and outer margins, and often cephalad limbal area along margin in cell M_1 and M_2; margin of entire hindwing marked with thin white crescents forming wavy marginal line, then brownish distad to black-edged fringe; veins of two tail-like projections black. Length of Forewing: $\bar{X}$ of 12 specimens (AMNH) 12.8 mm., range 12.0 mm. to 13.5 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 513) and frons as typical of the genus. Upper Surface of the Wings: As on male, but ground color of lighter brown areas more red-brown (Tawney to Russet). No scent patch distad in discal cell. White marginal line of pale fringe more emphatic on female hindwing. Under Surface of the Wings: As on male. Length of Forewing: $\bar{X}$ of 8 specimens (AMNH) 13.4 mm., range, 12.5 mm. to 14.5 mm. Male Genitalia: Fig. 369. Valvae, caudad saccus, clear, narrow-rimmed, extremely shouldered caudad, broadly rounded, slightly indented; valvae, lateral view, pointed-tapered; saccus, wide-parabolic; cornuti, thin. Female Genitalia: Fig. 370. Ductus flaring outward to lamellae such that it appears to taper caudad rather than cephalad as on other congeners. No signa.

BIOLOGY. Early Stages: Described in detail by Rawson, Ziegler, and Hessel, 1951 (1952). Significantly different markings in the larvae and egg mentioned in relation to non-conspecificity with gryneus. Foodplant: Chamaecyparis thyoides (L.) B.S.P. (Clench, 1961; Rawson, Ziegler and Hessel, 1951 [1952]).

TYPES. Holotype male and allotype female, deposited AMNH. Type Locality: Lakehurst, Ocean Co., New Jersey.

DISTRIBUTION. Spatial: Fig. 549. In disjunct populations along the Atlantic Coast of the United States, in New Hampshire, Massachusetts,

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Connecticut, New Jersey, North Carolina and Florida. Temporal: Bivoltine: April through May; July.

REMARKS. This species was one of the first so-called "sibling species" of Mitoura to be discovered. Certain Atlantic Coast populations attributed to gryneus were shown to utilize a different larval foodplant than gryneus and morphological differences were noticed that had been previously unknown. The similarity of wing patterns in Mitoura along with the spectrum of its foodplant usages have caused workers to be inconsistent in their thinking about such "sibling species." While "hesseli" became a "sacred cow" for eastern U.S. lepidopterists, the naming of other species from different usages westward (like Thuja) was controversial because the morphological differences used to corroborate the uniqueness of the populations were genitalic, not of the wings. The concept of "sibling species" is in this sense an unfortunate one; it simply means that a so-called "species" was not recognized before.

As "sibling species" is defined (e.g. Mayr, 1965), hesseli is actually not a sibling species of gryneus or of any other Mitoura, nor are there any sibling species in Mitoura. Genitalic characters, and in some cases palpal differences, readily separate the species (except in the case of some populations placed in nelsoni and siva). But at the time of the excitement about hesseli as a sibling species, genitalia of Mitoura had received littly study. In relation to morphological characters, the idea of sibling species is circularly defined (e.g., Mayr, loc. cit.) because it says at first that sibling species do not have morphological characters that distinguish them but later that further examination may find such characters. The concept of "sibling species" causes some workers to read biological or evolutionary significance into the idea and to debate what is or is not a valid sibling species, e.g. how "much alike" sibling species must be. In Mitoura, the entire concept might well be abandoned and criteria be placed on

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the coincidence of morphological (esp. apomorphic) and biological (esp. foodplant apomorphies) as criteria for separating categories. Morphological criteria with lack of foodplant data could then be viewed as reasonable hypotheses inviting biological work either corroborating or falsifying the predictions of the former. In this regard, all of the taxa of Mitoura treated as species in this paper fulfill these criteria. These same criteria have, for me, led to lumping in the genus Callophrys.

I dissected fourteen specimens of hesseli, including males and females, for genitalia, legs and palpi.

Mitoura sweadneri F. Chermock, status revised

Figs. 371, 372

Mitoura sweadneri Chermock, 1944, p. 216.

Mitoura gryneus sweadneri: Rawson and Ziegler, 1950, p. 70. Klots, 1951, p. 141. Clench, 1961, p. 207 (by virtue of incorrect synonymy with smilacis). dos Passos, 1964, p. 54. Kimball, 1965, p. 48.

Callophrys (Mitoura) gryneus sweadneri, 1960, p. 21 (by virtue of synonymy with gryneus). dos Passos, 1970, p. 32. Johnson, 1976a, p. 6; 1978, p. 3 (possible status as a species).

Mitoura sweadneri = smilacis: Clench, 1961, p. 207 (synonymy in error).

DIAGNOSIS. Distinguished from M. gryneus and hesseli by: Wings--(1). dorsal surface completely dark, greenish-overcast; (2). hindwing, longer "tails"; (3). hindwing, under surface, mesial band nearly continuous, deeply incised; lined

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basad with expansive brown; (4). hindwing, under surface, black blotches limited area distad on vein 2A, between veins Rs and M_1, and Cu_1 and Cu_2.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 498) and frons as typical of the genus. Upper Surface of the Wings: Dull Raw Umber with distinct bluish sheen , especially basad. Scent patch distad in discal area. Fringe, both wings, noticeably whitish, fresh specimens. Tail on hindwing at vein-end Cu_2 emphatic, slight tail at vein-end Cu_1. Under Surface of the Wings: Deep Bice to Winter Green, both wings. Postmedian line, forewing emphatic, costa to vein M_3, brown basad, white centrad, greenish to brown distad. Hindwing with emphatic and wide mesial line transversing rather straight across wing and jagging in near "w" shape anad --broadly red-brown basad, white centrad, blackish to brown and occasionally broken distad. Distad mesial band in limbal area and areas costad blue-gray suffusion with bright orange about "Thecla-spot." Emphatic black spots or blotches subterminal toward anal area and variously along terminus costad. Fringe, both wings, whitish distad. Length of Forewing: $\bar{X}$ of 8 specimens AMNH 14.3 mm., range 13.5 to 15.0 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 498) and frons as typical of the genus. Upper Surface of the Wings: As on males. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 6 specimens AMNH 14.6 mm., range 14.0 mm. to 15.3 mm. Male Genitalia: Fig. 371. Valvae, lateral view, more concave between dorsal and ventral articulations than gryneus, less than hesseli; anterior view, above saccus, more shouldered than all other Mitoura; often with many spines, cephalad end, as on turkingtoni. Female Genitalia: Fig. 372. Lamella postvaginalis broadly spatulate with outstanding ventral invaginations. Single "u"-shaped signum in corpus bursae.

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BIOLOGY. Early Stages: Undescribed. Foodplant: Johnson (1978) has documented Juniperus silicicola Small (Bailey) Cupressaceae; this is the only Juniperus species synchronic with the distribution of sweadneri.

TYPES. Holotype male, NMNH. Type Locality: St. Augustine, Florida.

DISTRIBUTION. Numerous areas of the J. silicicola range from central Florida north into southern Georgia (Jekyll Island, Glynn Co., by Frank D. Fee; Wilmington Island, Co.?, NMNH identified by Johnson).

REMARKS. Mitoura sweadneri deserves species status for several reasons. Since its description, its wings characters have been recognized as distinct but held by some authors (see synonymy) to represent only subspecies significance. However, in the context of all known Mitoura, its male and female genitalia exhibit distinct characters in the structures which have been demonstrated by Johnson (1976a) to have species level significance. In M. sweadneri, these include configuration of the valvae caudad the saccus, configuration of the genital plate, and presence of one signum on the dorsal and ventral surfaces of the corpus bursae (see Johnson, 1976a).

Its foodplant, Juniperus silicicola (Small) Bailey (Johnson, 1976c) is not part of the tri-parental hybrid swarm of J. scopoulorum Sarg. x J. virginiana L. x J. horizontalis Moench. (foodplant of M. gryneus and siva) which evolved eastward across the plains of North America (VanHaverbeke, 1968; Schurtz, 1970; Johnson, 1976c). Instead, this foodplant has a Gulf Coast and Mexican affinity (Herbarium, University of Florida Gainesville, pers. comm.) which not only accounts for the allopatry of M. sweadneri and M. gryneus, but the affinity of the genitalia of M. sweadneri to M. turkingtoni first of all, and secondly to M. hesseli (see Johnson, 1976c).

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The application of the name smilacis to M. sweadneri is incorrect for several reasons. Though it may be argued that the figure in Boisduval and LeConte (1829-1833) is a poorly copied John Abbot drawing, figuring a Gulf Coast specimen possibly collected at Savannah, Georgia (see Harris, 1972), it is more likely Abbot's specimen was a summer form gryneus because (1). there is no evidence that the larva and pupa of Thecla smilacis figured are not typical gryneus; (2). the unicolorous condition of the upper surface of the wings is not unique to sweadneri but occurs throughout the summer form of gryneus over its entire range; (3). the mesial band of the under surface, hindwings, is incomplete toward the anal angle in Boisduval and LeConte's figure, as it is on numerous summer forms of gryneus (or appears to be due to distad location of the marking between veins 3A and Cu_2) but never on sweadneri; (4). the limbal black spots in the same figure occur as follows--one at vein 2A, small and double between veins Cu_2 and Cu_1, and again singly between veins M_2 and M_3, and M_1 and Rs. This is far more typical of variation in gryneus than sweadneri (see Harris' figure, 1972). Further, one of the diagnostic characters of sweadneri is the length of the "tails." Though it may be argued that Boisduval and LeConte's figures (upper and lower surfaces of the wings) are not consistent in this trait, the "tails" are mentioned in the description as "thin and slight." Likewise, the text mentions orange in the limbal area of the hindwings, under surface, a common trait of gryneus which hardly ever occurs on sweadneri. Also, excepting two specimens located during this study (see above), sweadneri is not known to occur in that state (Harris, 1972). "Georgia" is the type locality given by Boisduval and LeConte for smilacis. A historical review indicates the present coastal borders of Florida and Georgia were established by 1825, well before Boisduval and LeConte's description (Georgia Historical Society, pers. comm.). The relationship of sweadneri's wing and genitalic characters to those of other

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Nearctic Mitoura, along with the characteristics of its larval foodplant, indicate it forms an entity distinct in distribution, morphology, biology, and probable evolutionary affinity which cannot be considered conspecific with any other known congener. Likewise, there seems to be insufficient evidence to apply the name smilacis Boisduval and LeConte to the populations Chermock named Mitoura sweadneri. Considered in relation to other Mitoura species, sweadneri seems most closely related to M. turkingtoni and hesseli. It is suggested that these three species evolved through eastward migrations or vicariance of Mitoura in Mexican Gulf and Atlantic coast regions at about the same time (or somewhat before) M. gryneus vicariated eastward from an extension of Mitoura across the interior of the continent.

I have dissected seventeen specimens, including males and females, of sweadneri for genitalia, legs, and palpi.

Mitoura turkingtoni (Johnson)

Figs. 117, 372a

Callophrys (Mitoura) turkingtoni Johnson, 1976a, p. 6, 1976b, p. 60; 1978, p. 3.

DIAGNOSIS. Compared to all other Mitoura, male forewings, scent scale absent; aedeagus, caudal end, three distinct pointed tips (not two). Compared to siva, gryneus and spinetorum, respectively--upper surface wing coloration Burnt Sienna, not Chamois, Honey Yellow to Zinc Orange, or Dusky dull Bluish Green. Under surface, hindwings, Burnt Sienna to Argus Brown, not green (gryneus and siva) or darker brown (spinetorum). Under surface, hindwings, no postbasal markings (gryneus, some siva); under surface, forewings, no marking at apex of cell (spinetorum).

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DESCRIPTION. Head, thorax, abdomen and legs as typical of the genus. Palpi unknown. Male: Upper Surface of the Wings: Coloration Burnt Sienna confined basad submarginal area, both wings; limbal area, hindwings, brighter. Under Surface of the Wings: Forewings, Burnt Sienna (base to postmedian line); apical area Parrot Green between veins; hindwings, Burnt Sienna to Argus Brown (base distad past mesial line), green marking distal end of cell. Mesial line, white and brighter brown markings nearly continuous. Limbal area, blue, orange, black markings: six marginal black between veins caudad 2_d to M_1 (first, third, large; second, overshadowed blue; latter three, small); five submarginal black between veins caudad 2^dA to M_4. Limbal orange intense. Area distad along outer angle, Parrot Green between veins. Length of Forewing: 13 mm. (holotype). Female: Unknown. Male Genitalia: Fig. 372a. Generally similar to other Mitoura, differing markedly as follows: caudal end aedeagus, three pointed tips; valvae longer, more slender; labides more steeply pointed, not gradually angled; two sculptured distal indentions at suture, vinculum, base peduncullum. Female Genitalia: Unknown.

BIOLOGY. Early Stages: Unknown. Foodplant: Possibly Juniperus flaccida.

TYPE. Holotype, male, AMNH. Type Locality: 10 mi. east of Namiquipa, Chihuahua, Mexico.

DISTRIBUTION. Spatial: Fig. 549. Presently known only from the type locality. If the foodplant indicated is correct, turkingtoni's range is probably within flaccida's Mexican range. Temporal: Unknown.

REMARKS. One specimen is known, its status assured by genitalic study of all currently known Nearctic and Neotropical members of the group, and its other major characters. The species' geographic and possible foodplant

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associations are discussed in Johnson, 1978. Other Mexican material, clearly M. siva and gryneus, were studied, all from Juniperus deppeana Steud. habitats, one from only 60 km. southwest of the type locality of turkingtoni. Mitoura "spinetorum" (shields, 1965 [1966]) studied from Mexico (Durango) proved to be the new species described by Clench as millerorum.

5. The loki species Group

including loki-- --siva--gryneus/macquireorum-- --nelsoni--rhodope.

A. Cladogram and Characters, Fig. 574.

B. Distributions, Figs. 548.

Mitoura loki (Skinner)

Figs. 357, 358, 507

Thecla loki Skinner, 1907, p. 378. W.S. Wright, 1908, p. 43. Seitz, 1919, p. 772. Davenport and Dethier, 1938, p. 171. Gillham and Ehrlich, 1954, p. 103.

Strymon loki: Coolidge, 1925, p. 26.

Thecla (Mitoura) loki: W. Holland, 1931, p. 231. Hoffman, 1940, p. 710.

Mitoura loki: Barnes and McDunnough, 1916, p. 105. J. Comstock, 1925, p. 37; 1927, p. 167; 1940, p. 63. Coolidge, 1924, p. 199. Barnes and Benjamin, 1926, p. 18. W.S. Wright, 1930, p. 24. Garth, 1931, p. 32. McDunnough, 1938, p. 25. Martin and Truxel, 1955, p. 23. dos Passos, 1964, p. 53.

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Emmel, 1972, p. 3. Ehrlich and Ehrlich, 1973, p. 59. Emmel and Shields, 1973, p. 27. R. Holland, 1972 (1973), p. 157.

Callophrys (Mitoura) loki: Ziegler, 1960, p. 21. Clench, 1961, p. 206. dos Passos, 1970, p. 32. Howe, 1975, p. 292. Johnson, 1976a, p. 6; 1978, p. 3.

DIAGNOSIS. Easily recognized by prominence of large, irregular, off-white spots forming postdiscal arc about basal disc of hindwing complemented by large postbasal markings and dark blotches in the cell interspaces along the entire margin. Ground color may range from green to brown, but since sympatric siva and nelsoni lack postbasal markings and have a regular to obsolescent postdiscal band, loki is readily identified.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 507) and frons as typical of the genus. Upper Surface of the Wings: Dull Prouts Brown, often with grayed Amber to Verona Brown patches in discal area of forewing and limbal area of hindwing. Scent patch distad in discal area, forewing. Tail at vein Cu_2. Fringe fuscous to lighter distad. Under Surface of the Wings: Forewing dull Sudan Brown basad to flush Rheinemann's Green distad. Post-median line costa to at least vein Cu_2 white centrad, bordered proxad darker brown to blackish. Hindwing ground color dull Rheinemann's Green to Sudan Brown, sometimes with russet flush. Postdiscal arc of large spots irregularly framing basal disc, large postbasal spots complementing these, white centrad bordered proxad deeper brown. Limbal area flushed brightly blue to gray, "Thecla-spot" emphatic, often circumferenced orange. Brown to black blotches in the cell interspaces distad along the margin. Length of Forewing: $\bar{X}$ of 15 specimens (AMNH), 13.0 mm., range 12.5 mm. to 13.5 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 508) and frons as typical of the genus. Upper Surface of the Wings: As on males, but lacking scent patch and with higher

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frequency and brightness of lightened areas. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 15 specimens (AMNH), 13.2 mm., range 12.0 mm. to 13.8 mm. Male Genitalia: Fig. 357. Valvae, caudad saccus, clear, narrow-rimmed, roundly parabolic, indented slightly; valvae, lateral view, round-tapered; valvae, caudal extension tapered; saccus parabolic; cornuti thin. Female Genitalia: Fig. 358. Ductus very short (barely longer than one and one-half breadth of lamellae). Lamella postvaginalis widely hemispherical; lamella antevaginalis narrow (far less than one-half caudal extension on lamella antevaginalis). No signa.

BIOLOGY. Early Stages: The egg, larva, and chrysalis have been described and illustrated by Comstock and Dammers, 1932. Emmel and Emmel (1973) review these with further notes on life cycle and dispause. Foodplant: Monophagous on Juniperus californica Carr. (Tietz, 1972; Emmel and Emmel, 1973).

TYPE: Holotype, male, CMNH. Type Locality: Mount Springs, San Diego County, California.

DISTRIBUTION. Spatial: Fig. 548. Southern California south from San Bernardino County into Baja California. Sympatric with M. siva in San Bernadino County, California (Sette, unpubl.; Johnson, 1978). Temporal: Univoltine. March into June.

REMARKS. Occasional specimens appear suggesting intergradation with both nelsoni and siva. An unpublished work by Elton Sette concerned a possible area of intergradation where loki and siva are sympatric in the vicinity of Cajon Pass, San Bernadino County, California. Sette (Sette, J. Lane, O. Shields, A. Shapiro, in correspondence) felt allopatry was maintained at the habitat level. Consideration of intergrading as an argument for or against recognition of

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species status is irrelevant, however, to cladistic analysis. Rosen (1978) has explained that if phylogenetic (cladistic) relations are used as the method of clustering taxa and these sister species relations indicate hypothetical ancestor-descendent relations, intergrading can be expected to occur as a shared primitive character (since descendent taxa represent splits of former ancestral species). Intergrading or hybridization is therefore not a criteria upon which conspecificity or non-conspecificity can be evaluated.

I dissected seven males and eight females of loki for genitalia, legs, and palpi.

Mitoura siva (W. Edwards)

Figs. 359, 360, 508

Thecla siva W. Edwards, 1874, p. 110; 1877, p. 40; 1884, p. 55; Anon., 1882, p. 3. H. Edwards, 1884, p. 793. Mead, 1884, p. 48. Danby, 1894, p. 33. Stone, 1921, p. 114. Cockerell, 1934, p. 51. Opler and Brown, 1970, p. 21.

Thecla (Mitoura) siva: W. Holland, 1931, p. 231.

Mitoura siva: Barnes and McDunnough, 1916, p. 105; 1917, p. 14. J. Comstock, 1925, p. 37; 1927, p. 165. Gunder, 1930, p. 42. Leussler, 1938, p. 277. McDunnough, 1938, p. 25. Freeman, 1950, p. 71. Garth, 1950, p. 32. Rawson, Ziegler, and Hessel, 1951 (1952), p. 128. Tilden, 1951, p. 96. Martin, 1952, p. 76; 1953, p. 69. Clench, 1952, p. 58. Bauer, 1953, p. 147. Hopfinger, 1953, p. 87. Martin and Truxel, 1955, p. 22. DeFoliart, 1956, p. 97. F. Brown, 1957, p. 138. Stallings, Turner and Ehrlich, 1959, p. 99. Eff, 1960, p. 88. Hooper and Hooper, 1960, p. 141. Hubbard, 1965, p. 232. Puckering and Post, 1960, p. 32. Johnson and Nixon, 1967, p. 517. Hooper,

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1969, p. 5. Ferris, 1970, p. 4. Emmel, 1972, p. 3. Johnson, 1972 (1973), p. 28. Emmel and Emmel, 1973, p. 58.

Callophrys siva: Callaghan, 1970, p. 228. Downey and Allyn, 1976, p. 1.

Callophrys (Mitoura) siva: Ziegler, 1960, p. 21. Clench, 1961, p. 208. Ehrlich, Stallings and Turner, 1962, p. 57. dos Passos, 1964, p. 54. Kendall and Freeman, 1969, p. 3. Brown and Opler, 1970, p. 59. Ferris, 1971a, p. 35; 1971b, p. 25. Tidwell and Callaghan, 1972, p. 12. Gregory, 1975, p. 34. Howe, 1975, p. 292. Johnson, 1975, p. 225; 1976, p. 6; 1978, p. 3. Johnson and Borgo, 1977, p. 109.

Callophrys (Mitoura) nelsoni siva: Scott, 1975, p. 17.

species siva: Comstock and Huntington, 1963, p. 192.

Mitoura rhodope: Barnes and Benjamin, 1926, p. 17. W. Holland, 1931, p. 231. McDunnough, 1938, p. 25. Hoffman, 1940, p. 710 (synonymies in error).

Callophrys (Mitoura) rhodope: dos Passos, 1970, p. 32 (synonymy in error).

Mitoura siva rhodope: Cockerell, 1939, p. 24 (in error). dos Passos, 1964, p. 53.

DIAGNOSIS. East of the Great Basin of the United States and its adjoining areas of Nevada and Utah siva is recognized by bright green under surface of the hindwing transversed by a variously jagged but regular postdiscal band of white bordered with darker coloration, and lacking postbasal markings (congener gryneus has an irregular band and two to three postbasal markings). In Great Basin and adjoining areas hindwing under surface siva becomes brown, and westward in Nevada and Oregon postdiscal band becomes variously obscured making specimens indistinguishable from nelsoni. Females have sclerotizations distad at the juncture of the lamellae distinctly lacking in gryneus, but there are fewer no consistent characters for always separating siva from nelsoni except

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regionally. The characters noted by Johnson (1976a) become less useful in eastern California and Oregon.

DESCRIPTION. Male: Head, thorax, abdomen, legs, and palpi (Fig. 508) as typical of the genus. Upper Surface of the Wings: Ground color Prouts Brown to Mummy Brown with areas centrad forewing and in limbal area, hindwing, sometimes lighter Sudan to Amber Brown. Scent patch distad in discal area. Areas of margins and apices, both wings, darker brown to dull Raw Umber. Tail at vein Cu_2, hindwing, occasional extension or tuft at vein Cu_1. Under Surface of the Wings: Ground color of forewing usually brown distad and of the ground color of hindwing basad. Hindwing, varying in ground color from browns to greens as below. Eastward in range (plains escarpments and eastern and central Rocky Mountains) Winter Green to Lettuce Green; south and southwest in range (Arizona, New Mexico) toward Lime Green; in Great Basin and central and eastern Oregon russet toward Hays Russet; in southern California and northward in California coastal ranges deep Winter Green to Walnut Brown. Forewing pattern limited to postmedian line from costa to at least vein M_3 white to yellowish centrad, variously edged brown, greenish, to dull Raw Umber. Hindwing pattern usually limited to mesial line across wing, sometimes jagged anad but never extremely. Mesial line always entire, not broken. White centrad, variously edged darker relative to ground color of hindwing. Ground color of hindwing usually somewhat lighter distad mesial line. Limbal area with various suffusion of blue-gray and with emphatic "Thecla- spot" usually surrounded by orange or yellowish suffusion. Length of Forewing: $\bar{X}$ of fifteen specimens (AMNH), 14.2 mm., range 13.5 mm. to 16.0 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 508) as typical of the genus. Upper Surface of the Wings: Similar to males but with centrad areas of forewing and limbal areas of hindwing often lighter than those of males. Under Surface of the Wings: As on

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males. Length of Forewing: $\bar{X}$ of fifteen specimens (AMNH), 14.7 mm., range 14.0 mm. to 16.5 mm. Male Genitalia: Fig. 359. Valvae caudad saccus, clear, narrow-rimmed, parabolic and unindented; valvae, lateral view, round-tapered; valvae caudal extension tapered; saccus, short, parabolic; cornuti thin. Female Genitalia: Fig. 360. Ductus tapering less sharply than in most nelsoni; club-ended. Lamellae hemispherical, much broader than long; bulky ridge and convolutions where lamellae join each other. Lamellae joined strongly to eight abdominal stermite. No signa, except occasional specimens in brown populations with one minute sclerotized spot on corpus bursa.

BIOLOGY. Early Stages: The life history has been described by Coolidge (1924) [misidentified as species loki], and the egg, larva and chrysalis described and figured by J. Comstock, 1927. F. Brown (1957) has described these also, with notes on behavior. Emmel and Emmel (1973) describe the egg, and figure the larva and pupa of the California subspecies juniperaria. Foodplant: Oligophagous on Juniperus sp. (Cupressaceae).

TYPE. siva neotype CMNH. Type Locality: siva, Fort Wingate, New Mexico.

DISTRIBUTION. Spatial: Fig. 548. From western Chihuahua State, Mexico, westward to Pacific coast of the United States and eastward to Davis Mountains of Texas, United States. Northward in Rocky Mountains from southern Arizona and southern New Mexico to eastern Oregon and extreme southeast Washington to western Montana. Eastward on the western Great Plains of the United States to central Nebraska, southwestern South and North Dakota and southern Saskatchewan, Canada. Westward in North America from central Oregon, Modoc County, California, western Nevada and southwestern California. Temproal: Bivoltine: May to mid-June, July into mid-August (Rocky Mountains); April through May, July through August (southwestern California).

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REMARKS. This species is presently divided into three subspecies, all of questionable value in understanding the variation of populations within the species (see Johnson, 1978). This is especially so because other populations, warranting similar recognition as "subspecies" have never been given names. Common usage considers the nominate subspecies as displaying a bright green underside and occurring throughout the Rocky Mountains of the United States. The subspecies siva juniperaria J. Comstock (1925, Bull. So. Calif. Acad. Sci. 24:37. TL, Mint Canyon, California) is less green and often has postbasal spots on the hindwing underside. It occurs from extreme southern California northward to San Luis, Obispo Co., and eastward in the San Barnardino County flatlands. The taxon siva mansfieldi Tilden (1951, Bull. So. Calif. Acad. Sci. 50:96. TL, Simmler, California) is deep green on the underside. It is of doubtful validity because it represents only one of several variant and regionally defined populations occurring throughout this region, and evidencing considerable intergradation. The male and female genitalia of all these populations are similar. For many years, the Mitoura populations in central and eastern Oregon, in the range of Juniperus occidentalis Hook. have been considered species nelsoni Boisduval. (See Dornfield, 1960, 1980; Anon., 1972.) These are actually siva (as recognized by the female and male genitalia which here are unabmiguous in their relation to topotypical siva) with a brown underside, similar to the well-known brown undersided siva from Nevada. A valuable study by this author of these Great Basin populations has not been published due to disagreement by reviewers (who have not studied the group). My concept is that genitalia and foodplant data are more useful taxonomically in this group than the variant wing patterns. The present revision will at least solve the problem of the recognition of siva in central and eastern Oregon. To make any concept of subspecies useful in this species, at least the Nevada Mitoura siva populations feeding on Juniperus

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osteosperma, and the Oregon populations mentioned above on J. occidentalis should be named. Otherwise the subspecies concept should be dropped for this group, especially in regard to the many variant California populations.

The taxon rhodope Godman and Salvin has also either been lumped with siva or proposed by some (Clench, pers. comm.) as a southwestern United States subspecies of siva. The type specimens in the BMNH indicate it is a separate species.

The taxon siva is sympatric with gryneus Hübner in southern Arizona, New Mexico, and western Texas (see treatment under gryneus).

I dissected seventy-eight specimens of siva, including males and females, for genitalia, legs, and palpi. These were identified by criteria of Johnson (1976a, 1978) and therefore may include actual nelsoni individuals in some areas of California, and western Nevada and Oregon.

Mitoura gryneus (Hübner)

Figs. 361, 362, 509

Papilio damon Cramer, 1784, p. 208, pl. 390, fig. C,D (nec. Papilio damon Schiffermueller, 1775).

Polyommate damon: Godart, 1819, p. 615.

Thecla damon: Hewitson, 1867, p. 37, fig. 100. Scudder, 1872, p. 52. Kirby, 1896, p. 387. Buetenmuller, 1902, p. 52. Smith, Skinner, and Kearfoot, 1903, p. 7. Brehme, 1907, p. 82. Brimley and Sherman, 1907, p. 97. McElhose and Schwarz, 1907, p. 313. Davis, 1909, p. 6. J. Jones, 1909, p. 397. Seitz, 1919, p. 789. Anon., 1920, p. 156. Lutz, 1921, p. 131.

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Davenport and Dethier, 1938, p. 171. Comstock and Huntington, 1943, p. 59. Gillham and Ehrlich, 1954, p. 103.

Mitoura damon: Scudder, 1889, p. 861, pl. 6, 23, 65, 75, 84. Skinner, 1897, p. 156. Dyar, 1902, p. 38. Engel, 1908, p. 34. Barnes and McDunnough, 1912, p. 18; 1917, p. 14. Grossbeck, 1917, p. 24. Barnes and Benjamin, 1926, p. 62 (placed as synonym of gryneus Hübner [1819] through homonymy of damon with Schiffermueller, 1775). Forbes, 1928, p. 679. Brower, 1930, p. 288. Harris, 1931, p. 19. J. A. Comstock, 1940, p. 63. Williams, 1941, p. 218. Freeman, 1950, p. 7; 1951, p. 38. Buchholz, 1951, p. 62.

Mitoura damon = acis Hübner: Grossbeck, 1917, p. 147 (synonymy in error).

species damon: Comstock and Huntington, 1943, p. 59.

Thecla damon var. patersonia Brehme, 1907, p. 82 (and other authors, subspecies synonymies not given here; see below).

Mitoura damon = patersonia: Barnes and Benjamin, 1926, p. 17 (species level synonymy in error).

Lycus gryneus Hübner, [1819], p. 74.

Thecla gryneus: Forbes, 1960, p. 133.

Mitoura gryneus: Dyar, 1902, p. 38. Barnes and McDunnough, 1917, p. 14. Barnes and Benjamin, 1926, p. 62 (replacing damon exclusively). Clark, 1929, p. 115; 1932, p. 282; 1951, p. 84. Harris, 1931, p. 14. Clark and Clark, 1936, p. 68. Field, 1938, p. 151. Richards, 1932, p. 249. Rawson and Ziegler, 1950, p. 69. Buchholz, 1951, p. 78. Klots, 1951, p. 141. Rawson, Ziegler, and Hessel, 1951, p. 123. Hessel, 1953, p. 107. Remington, 1953, p. 102; 1955, p. 77. Martin and Truxel, 1955, p. 22. Remington and Pease, 1955, p. 4. Meiners, 1956, p. 164. Mather and Mather, 1958, p. 82. dos Passos, 1964, p. 54. Shapiro, 1966, p. 31. Covell, 1967, p. 23. Masters, 1967a, p. 207; 1967b, p. 210, 1967c, p. 277; 1969,

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p. 6; 1975, p. 59. O'Byrne, 1970, p. 16. Price, 1970, p. 15. Kuehn and Masters, 1972, p. 4. Shapiro and Shapiro, 1973, p. 92.

Thecla (Mitoura) gryneus: W. Holland, 1931, p. 231.

Callophrys gryneus: Small, 1962, p. 195. Lambremont and Ross, 1965, p. 49. Downey, 1966, p. 164. Huber, 1966, p. 14; 1967, p. 10. Masters, 1972, p. 7. Downey and Irwin, 1973, p. 21. Miliotis, 1970, p. 4.

Callophrys (Mitoura) gryneus: Ziegler, 1960, p. 21. Clench, 1961, p. 207. dos Passos, 1970, p. 32. Riotte, 1967, p. 137. Kendall and and Walker, 1970, p. 3. Badger and Shull, 1972, p. 18. Harris, 1972, p. 213. Johnson, 1972, p. 112; 1976, p. 6; 1977, p. 109; 1978, p. 3. Masters, 1972 (1973), p. 179. S. Miller, 1972, p. 231. Gregory, 1975, p. 34. Howe, 1975, p. 293.

Polyommatus damastus Godart, 1823, p. 640. J. Morris, 1860, p. 12.

Thecla damastus: J. Morris, 1862, p. 100.

Thecla damastus = damon: Kirby, 1896, p. 387. Dyar, 1902, p. 38. Barnes and McDunnough, 1917, p. 14. Barnes and Benjamin, 1926, p. 17. McDunnough, 1938, p. 25. dos Passos, 1964, p. 54; 1970, p. 32.

Mitoura damastus = patersonia: Barnes and Benjamin, 1926, p. 17 (species level synonymy in error).

Thecla damastus = smilacis Boisduval and LeConte: Barnes and McDunnough, 1917, p. 14. Barnes and Benjamin, 1926, p. 17.

Thecla smilacis Boisduval and LeConte, 1833, p. 107, pl. 33. J. Morris, 1862, p. 98. Scudder, 1872, p. 52 (placed as type of Mitoura). W. Edwards, 1877, p. 41; 1881, p. 6. Worthington, 1880, p. 48. Anon., 1882, p. 3. French, 1882, p. 268. H. Edwards, 1889, p. 32. Skinner and Aaron, 1889, p. 146. Blatchley, 1891, p. 393. Smith, 1891, p. 12. Davis, 1895, p. 46. Barnes and McDunnough, 1917, p. 14.

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Thecla smilacis = damon: Dyar, 1902, p. 38. Smith, Skinner, and Kearfoot, 1903, p. 7. Barnes and McDunnough, 1917, p. 14. Anon., 1920, p. 156. Comstock and Huntington, 1943, p. 59.

Thecla smilacis = gryneus Hübner: Morris, 1862, p. 98. Worthington, 1880, p. 48. Barnes and McDunnough, 1917, p. 14.

Mitoura smilacis: Barnes and McDunnough, 1917, p. 14. Britton, 1920, p. 156.

Mitoura gryneus smilacis: Richards, 1932, p. 70. Clench, 1961, p. 20.

Mitoura gryneus smilacis = sweadneri Chermock, 1944: Clench, 1961, p. 20 (synonymy in error).

Mitoura gryneus f. smilacis: Field, 1938, p. 151 (placed as brood form of gryneus). dos Passos, 1964, p. 54.

Polyommatus smilacis: J. Morris, 1860, p. 11.

Lycus smilacis: J. Morris, 1860, p. 11.

Thecla auburniana Harris, 1862, p. 77. J. Morris, 1862, p. 102. Scudder, 1863, p. 165; 1868, p. 378. W. Edwards, 1884, p. 56.

Thecla aubumiana (sic): J. Morris, 1862, p. 101.

Thecla auburnia (sic): Knobel, 1895, p. 25.

Thecla auburniana = smilacis: Dyar, 1902, p. 38. Barnes and McDunnough, 1917, p. 14. McDunnough, 1938, p. 25.

Mitoura auburniana = patersonia: Barnes and Benjamin, 1926, p. 17 (species level synonymy in error).

Thecla castalis W. Edwards, 1871, p. 208; 1877, p. 41; 1884, p. 55. Anon., 1882, p. 3. Smith, 1891, p. 12. Smith, Skinner, and Kearfoot, 1903, p. 7. Williams, 1914, p. 264. Seitz, 1919, p. 772. Brown and Opler, 1970, p. 21.

Mitoura castalis: Barnes and McDunnough, 1916, p. 105.

Thecla castalis = damon: Scudder, 1876, p. 109.

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Mitoura damon castalis: Barnes and McDunnough, 1917, p. 14. Barnes and Benjamin, 1926, p. 17. McDunnough, 1938, p. 25.

Mitoura gryneus castalis: dos Passos, 1964, p. 54 (and other authors, subspecies synonymies not given here).

DIAGNOSIS. This species resembles M. siva and sweadneri. It can be distinguished from siva by the presence of two to three postbasal spots in the basal disc of the hindwing (except in some populations in the extreme southwest United States where these spots are diminished or absent), and by the broken and irregular pattern of the postmedian line (= margin of the basal disc) on the same wing. It can be distinguished from sweadneri by the peculiar limbal markings of the latter's hindwing underside (large black blotches on a gray to blue-suffused ground color) and by the tendency of the postmedian line basad this limbal area on sweadneri to be regular and noticeably jagged toward the anal margin. The male genitalia of gryneus have an indentation caudad the saccus not present on siva, and the female genitalia of gryneus lack sclerotizations where the lamellae join which are present on siva. Male genitalia of sweadneri have extremely shouldered valvae caudad the saccus, and the female genitalia of sweadneri look more like siva than gryneus, exhibiting extreme convolutions ventrad on the lamella postvaginalis.

DESCRIPTION. Head, thorax, abdomen, legs, palpi (Fig. 509) and frons as typical of the genus. Upper Surface of the Wings: Varying distinctly in some populations. Central and northern United States, from completely dark Prouts Brown through increasing amounts of Ochraceous Tawney to Tawney expressed in the discal area of forewing and limbal area of hindwing. In southwestern United States (e.g., Texas, southern Arizona) such areas broad, discal areas of both wings, and Chamois to Honey Yellow. Margins of both wings and apices of

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forewings always deep Raw Umber to fuscous. Tail at vein Cu_2, tuft or slight tail at Cu_1; fringe, both wings, brownish, white basad in limbal area, hindwings. Under Surface of the Wings: Ground color varying distinctly in some geographically. Central and northern United States, green ground color bright deep green (Rheinemann's Green to Winter Green); southwestern United States yellow green (Lime Green to Mignonette Green). Forewing, area basad postmedian line suffused broadly green, more brownish caudad and basad; distad postmedian line, suffused green, upper half of wing, brown, lower half. Postmedian line from costa to vein Cu_1, sometimes spots displace basad in cell Cu_1. Margin dark brown broken by white spots in cell interspaces. Fringe brownish to gray. Hindwing with two to three postbasal white spots, large in central and northern United States, smaller to absent southwest; these bordered slightly distad with red-brown. Edge of basal disc (median line) irregular white crescents and rectangles, bordered thinly black centrad (may be missing in southwest), red-brown basad. Distad mesial line ground color normal; submarginally four black spots in cells Cu_2 to M_1; often hint of fifth along vein 2A anad. "Thecla-spot" emphatic, cell Cu_1 suffused blue distad, orange basad. Rest of limbal areas suffused blue and white with prominent white cell interspace bars entire wing, extending basad along the veins cephalad to vein M_1 or M_2. Dull to obscured brown patch distad in cells Rs to M_2. Extreme margin, deep brown, fringe pale, sometimes black distad. Length of Forewing: $\bar{X}$ of fifteen specimens, AMNH, 13.0 mm., range 12.5 mm. to 14.0 mm. Female: Head, thorax, abdomen, legs, palpi and frons as typical of the genus. Upper Surface of the Wings: Similar to males, but lighter brown colors darker and usually more extensive than respective males. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of fifteen specimens, AMNH, 13.3 mm., range, 12.8 mm. to 14.5 mm. Male Genitalia: Fig. 361. Valvae caudad saccus, clear, narrow-rimmed, shouldered

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and indented; valvae, lateral view, browd-tapered; valvae, caudal extension ; saccus, long, broad cornuti, thin. Female Genitalia: Fig. 362. Lamella postvaginalis hemispherical, lamella antevaginalis about one-fourth to one-third in caudal expanse of former structure with no sclerotizations distad of their juncture. Ductus about one and two-thirds to two times caudal extension of lamellae, not sculptured. Signa absent.

BIOLOGY. Early Stages: Only the larvae and chrysalis have been described. The former by Comstock and Dammers (1935), and the former and latter by Dyar (1893), and Holland (1905, 1931). Foodplant: Oligophagous on Juniperus virginiana L., pinchotti Sudw., ashei Buch., and deppeana Stend.

TYPES. Types of damon and auburniana unknown but unambiguous by description; gryneus and smilacis unknown but also unambiguous (see Remarks under sweadneri); castalis lectotype male, CMNH; patersonia, Brehme Collection; damastus, Paris Museum. Type Locality: damon, "Virginia, U.S.A."; gryneus, unknown; castalis, Waco, Texas; smilacis, "Georgia"; patersonia, Garrett Park, Paterson, New Jersey; auburniana, Sweet Auburn, near Cambridge, Massachusetts; damastus, "Virginia. All United States.

DISTRIBUTION. Spatial: Fig. 549. From southern Chihuahua State, Mexico, northward in disjunct populations in southern Arizona, United States, eastward in contiguous populations from western Texas (Davis Mountains) to Georgia. Northward through eastern areas of plains states of United States to Atlantic coast to Maine eastward, and Wisconsin westward. Sympatric with M. siva in Davis Mountains of Texas, Guadalupe Mountains of west Texas and southern Mew Mexico, and in Baboquivari Mountains, southern Arizona. Temporal: Bivoltine northward to trivoltine southward: late May to early June, late July to early August (northeast United States); April through May, June through July, August into October (Gulf of Mexico states, United States).

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REMARKS. This species is presently divided into two subspecies, considering that the taxon sweadneri Chermock, previously considered conspecific with gryneus (Klots, 1951, Clench, 1961; dos Passos, 1964, Howe, 1976) is actually a valid species (see treatment under sweadneri for reasons for this). The nominate subspecies of gryneus is green beneath with two to three large postbasal spots on the hindwing undersides. Its geographic relation with the other named subspecies of gryneus, castalis Edwards, is uncertain since they are not allopatric and the morph of castalis (underside lighter yellow-green, with reduced to absent postbasal spots) has been used very typologically as a form name, or for populations scattered with those of the naminate. The name castalis is probably best limited to the species' range west of the Mississippi River break in Juniperus distribution, wherein the foodplant shifts from J. virginiana to ashi and pinchotti.

The names discoidalis Skinner (1897, Canadian Ent., 29:156, TL, Round Mountain, Blanco Co., Texas), brehmei Barnes and Benjamin (1923, Contrib. Nat. Hist. Lepid. North America, 5:64, TL, Shovel Mountain and Kerrville, Texas), and octoscripta Buckhole (1951, Bull. Brooklyn Ent. Soc., 46:78, TL, Passaic Co., New Jersey) represent local forms of g. castalis, g. castalis, and g. gryneus respectively.

I dissected forty-six specimens of gryneus including males and females, from across its range.

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Mitoura macguireorum, new species

Figs. 116, 363, 364, 510

DIAGNOSIS. Somewhat resembling gryneus, but found in Coahuila State, Mexico and distinct superficially as follows: upper surface of the male's wings dark fuscous, not bright honey yellow as on Texas and adjacent gryneus; under surface of wings of both sexes brightly contrasted red-brown and rich green, entire area of forewing basad postmedian line bright brown; white post-basal and post-discal spots on hindwing large and extremely widely bordered distad and basad, respectively, with bright red-brown. Pattern of these approaching or exceeding "figure 8" configuration (Figs. 116, 117) uncharacteristic of any gryneus save the aberration octoscripta Buchholz. Black dots distad median spot row of hindwing emphatic, not usually diminutive as on gryneus; bright distinct red-brown patch distad cells Rs, R_1 and M_1, not diminutive or blackened as on gryneus. Male genitalia distinct from gryneus with aedeagus of macguireorum extremely elongate.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 510) and frons as typical of the genus. Upper Surface of the Wings: Ground color Prouts Brown to Mummy Brown, Hazel to Tawney in limbal area between veins 2A and M_3. Scent patch distad in discal area, slightly blacker than ground color. Tail at vein Cu_2, slight tuft at vein Cu_1. Light white bar often basad tail from vein 2A to Cu_1. Fringe, both wings, pale brown. Under Surface of the Wings: Ground color forewing, bright Burnt Sienna basad postmedian line becoming lighter basad, greenish at very base and slightly along base of costa. Postmedian line distinct white rectangular to chevron-shaped spots costa to vein Cu_2, bordered widely basad by Mahogany Red. Postdiscal band of bold broken chevron- to rectangular-shaped white markings bordered widely basad with Mohagany Red,

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borders nearly or touching those of post-basal spots. Postdiscal spots in cells M_1 and Cu_2 deeply displaced basad, border of first often touching that of second postbasal spot, border of second invading postbasal area. Limbal area with five distinct black spots, anal margin to vein M_2. Bold "Thecla-spot" at cell Cu_1, bordered distad orange. Submargin with bold Mohagany Red patch, cells Rs and M_1, rest of interspaces mottled blue, white, and brown suffused. Tufted recurved lobe of hindwing between outer and anal margins black; whitish-yellow marginal line along entire wing; fringe light brown, alternating pale to whitish along limbal area, especially anad. Length of Forewing: 14.0 mm. (holotype). $\bar{X}$ of seven paratypes, 13.5 mm., range 12.8 mm. to 14.2 mm. Female: Head, thorax, abdomen, legs and palpi (Fig. 510) as typical of the genus. Upper Surface of the Wings: Amber Brown over expanse of wing except for deep Prouts Brown along margins and wide areas of apices, both wings, and basad on both wings. Auburn Brown on hindwing sometimes mottled with darker brown overcast; border with Prouts Brown in limbal margin often crennated in shape; prominent white marginal line along limbal area followed by black margin; fringe, forewing light brown, hindwing pale, to whitish in limbal area. Under Surface of the Wings: As on males. Length of Forewing: 14.0 mm. (allotype). $\bar{X}$ of nine paratypes, 14.2 mm., range 13.8 mm. to 15.2 mm.

BIOLOGY. Early Stages: This species has been reared by William W. and Nadine M. McGuire and the early stages will be described by them and this author in a separate paper. Foodplant: Juniperus monosperma Torr. (Little).

TYPES. Holotype male (Fig. 116, left), ex ova collected 29 April 1978, hatched 22 June 1978, from Hwy. 57, 18 mi. SE Saltillo, Coahuila, Mexico, William W. and Nadine M. McGuire. Allotype female (Fig. 116, right), same data as holotype, hatched 24 June 1978. Paratypes. AMNH: same data as holotype, emerged 23 June 1978 (one male), same data as holotype, collected 28 April (two

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males), 19 April (two males), same data as holotype, emerged 22 June 1978 (one female), same data as holotype (three females); LACM: same data as holotype, collected 28 April 1978 (one male), 29 April 1978 (one female); AME: same data as holotype, collected (one male), emerged 24 June 1978 (one female); NMNH: same data as holotype, collected (one male, one female); collection of William W. and Nadine M. McGuire: same data as holotype, both emerged 23 June 1978 (one male, one female); collection of Roy O. Kendall: same locality as holotype, exact data unknown (one female).

DISTRIBUTION. Spatial: Fig. 549. Presently known only from type locality.

REMARKS. Measurement comparison of a series of macguireorum and gryneus from southern Texas and Arizona indicates that the mean of the length of aedeagis versus arc of vinculum is 4.5 mm. on the former and 3.5 mm. on the latter. By X^2 test this difference is significant at 95% confidence level. N = 8, former species, 10, latter. All specimens of macguireorum were dissected for genitalia, some for legs and palpi.

Mitoura nelsoni (Boisuval)

Figs. 365, 366, 511

Thecla nelsoni Boisduval, 1869, p. 43. W. Edwards, 1884, p. 55. Kirby, 1896, p. 399.

Thecla nelsonii (sic): Boisduval, 1869, p. 43.

Thecla nelsoni (in part): W. Edwards, 1877, p. 40. Smith, 1891, p. 124. Smith, Skinner, and Kearfoot, 1903, p. 136. William, 1909, p. 68. Newcomer, 1910, p. 31. W. Comstock, 1914, p. 36. Seitz, 1919, p. 772. Davenport and Dethier, 1938, p. 171.

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Thecla (Mitoura) nelsoni (in part): W. Holland, 1931, p. 230.

Thecla nelsonii (sic) (in part): Anon., 1882, p. 3. Dyar, 1904, p. 37. Skinner, 1907, p. 280. Wood, undated, p. 302.

Mitoura nelsoni (in part): Barnes and McDunnough, 1911, p. 14; 1916, p. 105; 1917, p. 14. Blackmore, 1927, p. 10. J. Comstock, 1927, p. 164; 1940, p. 169. Wright, 1930, p. 24. Garth, 19351, p. 28. McDunnough, 1938, p. 25. Blevins and Blevins, 1945, p. 123. Leighton, 1946, p. 60. J. Jones, 1951, p. 19. Tilden, 1952, p. 95. Guppy, 1954, p. 101. Martin and Truxel, 1955, p. 22. McGugan, 1958, p. 23. Shields, 1966, p. 127.

Callophrys nelsoni (in part): Emmel and Emmel, 1962, p. 33. Garth and Tilden, 1963, p. 47.

Callophrys (Mitoura) nelsoni (in part): Ziegler, 1960, p. 21. Clench, 1961, p. 208. Opler, 1962, p. 193. Garth and Tilden, 1963, p. 37. dos Passos, 1970, p. 32. Gregory, 1975, p. 34. Howe, 1975, p. 292. Johnson, 1976a, p. 6; 1978, p. 3

species nelsoni (in part): Comstock and Huntington, 1961, p. 192.

DIAGNOSIS. Usage of Libocedrus as larval foodplant is the only reliable character for nelsoni. In some areas nelsoni is indistinguishable from siva by wing or genitalic characters because of apparent convergence in local populations. Morphological characters for distinguishing nelsoni and siva (Johnson, 1976a) are more useful for central and westward extremes of range for former, and central and eastward extremes of latter: nelsoni very generally characterized by brown wing undersurface and white line outlining basal disc thinner to obsolescent anad, while siva undersurface green except brown toward russet westward in Great Basin and adjoining areas of Nevada and Utah; siva with wider jagged line outlining basal disc. Male genitalia of siva generally with bilobed configuration parabolic and unindented, nelsoni more widely eliptical and most

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often indented but these characters not always consistent; female genitalia, siva, generally with hemispherical lamellae moderately sclerotized distad and ductus not tapered caudad, more club-ended; nelsoni lamellae hemi-rectangular with extreme sclerotization distad and ductus generally tapered caudad, not club-ended; siva without signa unless as slight trace of sclerotization, nelsoni very occasionally with slight sclerotized dots on either surface of bursae.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 511) and frons as typical of the genus. Upper Surface of the Wings: Ground color Prouts Brown to Mummy Brown, occasionally lighter in discal areas, forewing, and limbal areas, hindwing. Scent patch distad in discal area. Fringe fuscous to lighter distad. Tail at vein Cu_2, extension of vein at Cu_1. Under Surface of the Wings: Ground color, forewing, Sudan Brown to Amber Brown to sometimes grizzled basad. Postmedian line, costa to vein M_3, white centrad variously darker brown distad and basad. Hindwing ground color as above, but more various depending on local populations, can be brown to burgandy, clear in coloration to extensively suffused brown or black. Mesial line across entire hindwing, white centrad, variously brown distad and basad--can be complete, limited to costad only, completely absent, or wide costad and variously thin to obsolescent anad. Limbal area variously suffused blue-gray to brown with orange about dark "Thecla-spot". Length of Forewing: $\bar{X}$ of 15 specimens from areas where L. descurrens is exclusive Cupressaceae occurrence, 14.5 mm., range 13.8 mm. to 16.5 mm. Female: Head, thorax, abdomen, legs, palpi (Fig. 511) and frons as typical of the genus. Upper Surface of the Wings: As on males but with centrad areas, forewing, and limbal areas, hindwing, much lighter and usually more extensive. Under Surface of the Wings: As on males. Length of Forewing: $\bar{X}$ of 15 specimens from areas where L. descurrens is exclusive Cupressaceae occurrence, 14.8 mm., range 13.5 mm. to 16.8 mm. Male Genitalia: Fig. 365a.

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(Example of Sierra Nevada Mountains, California, United States, Libocedrus-feeder, representative of dominant nelsoni morph.). Fig. 365b (type of nelsoni). Former: valvae, caudad saccus, clear, rounded, indented, narrow-rimmed; valvae, lateral view chevron-tapered; valvae, caudal extension tapered; saccus, short; cornuti thin. Latter: valvae, caudad saccus, narrow-rimmed, more parabolic, less indented; lateral view round-tapered, saccus longer, cornuti thin. Female Genitalia: Fig. 366. Lamellae mallet-shaped, ductus gradually tapering to antrum. Signa absent except in occasional specimens and then as only one small sclerotized spot on corpus bursa.

BIOLOGY. Early Stages: The life history, egg, and larva of nelsoni, common usage (not necessarily population of type of nelsoni), have been treated by Comstock and Dammers (1932). Foodplant: This paper limits the name nelsoni to populations feeding on Libocedrus (= Calocedrus) descurrens Torr. (Cupressaceae).

TYPE. Boisduval's type male of nelsoni is in the NMNH. It has no locality data (see below). Type Locality: Unknown; assumed as "America."

DISTRIBUTION. Spatial: Fig. 548. Occurring within the distribution of L. descurrens in the extreme western United States (see Little, 1971): from Cascade Mountains of northern California, Oregon and Washington south in Sierra Nevada Mountains and adjacent coastal ranges of California to northern Baja California, Mexico. Local populations of uncertain relation to siva or nelsoni in numerous outlying occurrences of L. descurrens or where Juniperus occurs with it or replaces it geographically. Temporal: Known from mid-April through June.

REMARKS. Numerous problems are created by the lack of locality data on Boisduval's type. Firstly, it makes it impossible to know the foodplant of the

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species. Secondly, it makes it impossible to know which of the Mitoura species assumed to represent particular foodplant usages should be associated with the name nelsoni. Further, examination of morphological characters from even more populations than those in earlier work (Johnson, 1976a) has convinced me there are no morphological criteria to distinguish this species from siva in some areas. Therefore it is not possible to associate the genitalia of Boisduval's type with those from any known parameter of character states that would indicate association with a particular population. This is probably due to the wide divergence in convergent and parallel character states which result from extreme local isolation characteristic in the geography of populations in this complex.

Considering the characters of the type of nelsoni, it is more resemblant to those I consider within the range of known siva populations than those of populations known or assumed to be utilizing Libocedrus. I have found no population within the range of Libocedrus decurrens which resembles the genitalia of Boisduval's type, but John Lane (pers. comm.) has told me he considers some dissections he has seen to be close to it. There are specimens of siva from northeastern California (e.g., Modoc County, where numerous possible Cupressaceae hosts might be the local foodplant) that resemble those of Boisduval's type. Hence, I nearly preferred to sink the name siva to synonymy with nelsoni and take the name nearest in priority for Librocedrus-feeding populations (exoleta Edwards [form] 1881, Papilio, I:53, TL, Big Trees, Calaveras Co., California) as the name to be used for what had hitherto been called nelsoni. However, not wanting to initiate great confusion among lepidopterists concerning the meaning of the two familiar names nelsoni and siva, and recognizing the fact that it can never be exactly known what nelsoni is, I retain the traditional association in this revision. I am of the opinion that two species exist: nelsoni

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and siva (or call them what you may), defined by the unique autapomorphies of Libocedrus and Juniperus usage respectively (and separating them also as biological species if this is of interest). But these two species have populations representing such constellations of variation that no morphological characters can be used to distinguish them in all cases.

In all I have dissected eighty-three specimens of nelsoni, including males and females. These are included as nelsoni by the characters of Johnson (1976a, 1978) and whatever consideration of larval foodplant possible in particular cases. Therefore, this number may represent some M. siva (see Remarks under that species).

Mitoura rhodope (Godman and Salvin), status revised

Figs. 372b, 498

Thecla rhodope Godman and Salvin, 1887, p. 48, 54, pl. LIV, fig. 3,4. Draudt, 1919, p. 772.

Mitoura siva: Barnes and Benjamin, 1926, p. 17 (placed as synonym of siva W. Edwards). W. Holland, 1931, p. 231. McDunnough, 1938, p. 25. Hoffman, 1940, p. 710. dos Passos, 1964, p. 53.

Callophrys (Mitoura) siva: dos Passos, 1970, p. 32.

Mitoura siva rhodope: Cockerell, 1939, p. 24.

DIAGNOSIS. Since this taxon is little known, the following diagnosis is tentative: type specimen differing from regionally sympatric siva and gryneus as follows: rhodope with gradually rounded and entire median arc, under surface, hindwing, ground color green but arc widely brown basad, black to brown distad

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(not broken as on gryneus, jagged anad as on siva). Limbal area more brightly suffused than siva and gryneus (more as on turkingtoni), marginal markings emphatic along entire margin (more as on loki). Forewing with postmedian line more emphatic and extended caudad than on other Mitoura. Upper surface of hindwing with broad chevrons on lighter (Amber) brown in limbal area. Tails prominent at Cu_1 and Cu_2.

DESCRIPTION. Male: Head, thorax, abdomen, legs, palpi (Fig. 498) and frons as typical of the genus. Upper Surface of the Wings: Completely Prouts Brown to Sanford's Brown with Amber Brown in limbal area between veins 2A and M_3 on the hindwings. Male scent scale on forewing distinct. Under Surface of the Wings: Ground color of the forewings brown basad, greenish distad. Postmedian line, costa to M_3 emphatic. Hindwing Winter to Bice Green sheened to brownish. Mesial line gradually rounded about wing, smoothly curved, not jagged even anad: thinly white centrad, broadly brown basad, black to brown distad. Limbal area birghtly suffused gray-blue; orange widely at "Thecla-spot." Length of Forewing: 14.0 mm. (holotype). Female: Head, thorax, abdomen, legs, palpi (Fig. 498) and frons as typical of the genus. Upper Surface of the Wings: As on males, but lighter browns centrad on the wings. Under Surface of the Wings: As on males. Length of Forewing: 13.5 mm. (Sonora female). Male Genitalia: Fig. 372b. Valvae, caudad saccus, clear, wide-to mid-rimmed, widely parabolic to ovate, unindented; valvae, lateral view, area between cephalad and caudad articulations of the valvae extremely wide with converging contours of the valval articulations nearly at right angles to each other; caudal extension of valvae, broad caudad bilobed configuration, then tapered; saccus, funnel; cornuti as illustrated. Female Genitalia: Fig. 372c. Similar to characters of western populations referred to as nelsoni: lamellae broadly hemi-rectangular,

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sclerotization heavy distad at juncture. Ductus flared cephalad; bursae with signa, each as two sclerotized spots.

TYPES. Holotype male BMNH. Type Locality: Sonora, Mexico.

REMARKS. The characters of the wing and genitalia of the holotype specimen in the BMNH are sufficiently differrent from other congeners to disallow lumping it with one of them as conspecific. More specimens are needed. There are two females from Sonora in the AMNH collecation which I associate with this species at this time, simply by distributional similarity. Their genitalia (see above) are "nelsoni-like" adding to the notion that rhodope cannot be lumped with siva. Collecting in this region should eventually help define the precise status of the taxon rhodope. Only three specimens are known from Sonora; the genitalia of each have been studied.

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ZOOGEOGRAPHICAL DISCUSSION

Methodology.

Platnick and Nelson (1978) distinguished two models of historical biogeographical hypotheses--dispersal and vicariance. Within dispersal models, they separated two kinds of hypotheses. One involves enlargement of a range ("dispersal," Platnick, 1976) followed by disjunction ("vicariance in disguise"). The other includes range expansion across a barrier, implying simultaneous division of a range. Vicariance hypotheses posit the origin of a barrier simultaneous with the disjunction of a population, rather than dispersal across a pre-existing barrier. Both of these hypotheses are attempts at a methodology of "historical" biogeography, in which particular hypotheses are stated and subsequently falsified or corroborated. Vicariance biogeography must be distinguished from "narrative" or "descriptive" biogeography (traditionally familiar as the "scenario" approach to "explaining" patterns by invoking process explanations), since the latter do not imply hypotheses or testing but rely instead on intuitive plausibility.

Platnick and Nelson (1978) and Rosen (1978) have noted that cladistic analysis produces branching diagrams indicating hypothetical kinship relations which may be compared with patterns of spatial splitting contained in distributional data. The taxa of areas included by synapomorphies of greatest generality in a branching diagram indicate an ancestral distribution; subsequent synapomorphies include distribution areas of derived descendant taxa. The papers by Platnick, Nelson, and Rosen develop certain implications of cladistics and the methodology of zoogeography originally proposed by Croizat's (1958, 1964)

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"panbiogeography." Croizat reasoned that long term processes of allopatric speciation acting on the elements of biotas allows identification of "generalized tracks" (or coincident distributions) within a biota's various monophyletic assemblages. These "generalized tracks" represent hypothetical distribution areas of an ancestral biota whose descendant taxa show various patterns of subsequent distribution, or "individual tracks." Croizat's notion of tracks was expanded and clarified by Croizat, Nelson, and Rosen (1974) and Rosen (1975). An apparent weakness in Croizat's method involves the extent to which tracks may involve only two-area or two-taxon relationships. In vicariance analysis, relations of two taxa or two areas cannot (by their nature) be necessarily incongruent or incompatible with any other two-taxon or two-area relationships. Observing that the smallest possible unit of analysis in phylogenetic systematics involves at least three taxa, Platnick and Nelson (1978) and Rosen (1978) conclude that a relationship of three areas is the basic unit needed to test vicariance hypotheses. The method proposed by Platnick and Nelson (1978) and utilized by Rosen (1978) has been called "area cladogram analysis" and is used in the zoogeographical considerations of this study.

Basic Considerations.

Since the zoogeography of a supposedly well-known group like Lepidoptera has been of interest to zoogeographers for some time, it is useful to review the methods and conclusions of previous studies. Axiomatic to this consideration are the following points:

(1). Conclusions of scenario or descriptive zoogeography, especially those invoking a priori dispersal should be viewed with suspicion because such studies seldom contain testable hypotheses.

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(2). Para- and polyphyletic groups obscure zoogeographical considerations and lead to erroneous patterns or congruences. Biogeography without phylogentic analysis should be dismissed.

(3). Coincident patterns, in themselves, yield information of limited value and should not be considered as substitutes for the information available through phylogenetic analysis.

(4). Zoogeographic and phylogenetic analysis gains power proportionate to the number of analyses available, just as Croizat's individual tracks cannot be understood outside their relation to generalized tracks.

(5). Initial phylogenetic and vicariance biogeographic studies of groups should suggest what problems are indicated by their data and what analytical steps can be taken to resolve these.

Following in Table 1 is a list of works concerning the zoogeography of Lepidoptera with comments on their general methodology and inferences. None has a phylogenetic analysis or any phylogeny inferred.

None of the above papers is of significant use to vicariance biogeography except insofar as they provide distributional data. Some are inadvertantly destructive to the aims of biogeography (see the five points above). Clench's notion, in a widely circulated book by Howe (1975), that numerous genera and other groups of Nearctic butterflies have originated from single ancestors crossing the Atlantic Ocean or Pacific Ocean (the latter via the Bering Land Bridge) must be considered untestable, to say the least. It implies a vacuum and "founder theory" (sensu Mayr, 1963) which ignores the probable vicariance of biotas. Clench's (1963) proposition that current Antillean distributions result from waif dispersal to and from islands since the Pleistocene and that South American-African distributions indicate early oceanic dispersals are typical of

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Table 1

Author	Group	Methodology	Process Invoked
Brown, F. M. 1942	Incisalia, Satsuma (Lycaenidae)	Descriptive (scenario)	Expansion from refugia
Brown, K. S. et al.. 1974; 1975 a, b; 1976; 1977 a, b, c	Heliconius, (Nymphalidae)	Descriptive (scenario)	Expansion from refugia ("Quaternary")
Clench, 1963	Neotropical Lycaenidae	Descriptive (scenario)	Vacuum theory[1]; founder species from centers of origin; expansion from refugia; African- South American dispersal; island-mainland dispersal and vice versa; all since Pleistocene
Clench, 1975	various Lycaenidae, including Callophrys sens. lat.	Descriptive (scenario)	Founder species from centers of origin; trans-oceanic dispersal
Emsley, 1964, 1965	Heliconius (Nymphalidae)	Descriptive; coincident distributions	Expansion from refugia ("Quaternary")
Ga, 1971	Palaearctic Lepidoptera	Coincident distributions	Dispersal, subsequent vicariance
Hoffman, undated	Nearctic, Neotropica	Distributions; continental "fits"	Entertains continental drift, sensu Wegener (1929)
Hoffman, 1936	Mexican Lepidoptera	Descriptive (scenario)	Vacuum theory; dispersal from outside areas
Holloway, 1978	Indo-Australian Lepidoptera	Numerical clustering vis-a-vis faunal resemblance	Dispersal

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Table 1 (continued)

Hovanitz, 1958	Neotropical Lepidoptera	Frequency of taxa per latitude	Dispersal
de Lattin, 1952	Palaearctic Lepidoptera	Descriptive (scenario)	Expansion from refugia ("Pleistocene")
Miller, 1968	Worldwide Satyridae	Descriptive (scenario)	Matthew's "Stable Earth" hypothesis accepted; Wegener rejected. Dispersal from centers of origin
Munroe and Mutuura, 1975; Munroe, 1965, 1975	Nearctic, Neotropical Lepidoptera	Descriptive; coincident distributions	None
Povolny, 1962	European Lepidoptera	Descriptive; coincident distributions	Expansion from refugia ("Pleistocene")
Shields and Dvorak, 1979	Neotropical, some African Rhopalocera	Coincident distributions	Plate Tectonics

[1]Vacuum theory refers to explanations of biotas by attributing their elements to various outside areas, inferring that no biota was previously in the initial area and that all elements are variously imported.

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some of the results of descriptive or scenario biogeography coupled with a priori dispersalism. Shields and Dvorak's use of coincident distributions without phylogenetic analysis to point out congruences of distribution within a reconstructed Caribbean drift model has limited implications. Without phylogenetic analysis their groups are of questionable monophyly, and other explanations of their coincident ranges are equally tenable. Because there are no three taxon phylogenetic statements based on cladistic analysis, their claim to perform a "test" of drift models is false. Although their work implies a vicariance model, the works of Croizat or of vicariance biogeography in general are not mentioned in their bibliography. In the end Shields and Dvorak are concerned with questions of centers of origin as regards both butterflies and angiosperms.

The only potentially useful information in the above mentioned studies concerns possible area cladogram relations for endemic taxa. Numerous authors (Emsley, 1964; Haffner, 1969; Vanzolini, 1970a, 1970b; Vanzolini and Williams, 1970; K. Brown, Sheppard, and Turner, 1974; K. Brown, 1975, 1976, 1977a, 1977b, 1977c; 1977; Turner, 1977) have hypothesized "Quaternary refugia" as centers of evolution and subsequent expansion during climatic oscillations of the Quaternary. These hypotheses, based actually on a vicariance observation (areas of endemism) have generally been based on comparative measures of divergence within and between populations of endemic taxa. Since no phylogenetic analyses have accompanied such studies it has been impossible to discern if a pattern of congruence between phylogenetic relations and areas of endemism occurs. Only by testing particular hypotheses of taxonomic and geographic relationships with (at least) three taxon statements from phylogenetic analyses of many groups can a congruent pattern with particular geographic implications be discerned.

I have applied area cladogram analysis to the cladograms available from the Callophryina and these analyses are reviewed in appropriate sections of this

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discussion. Below are listed in detail the geographic areas included by each of the taxonomic groups indicated by the cladogram of Callophryina and the cladistic classification (see Fig. 4).

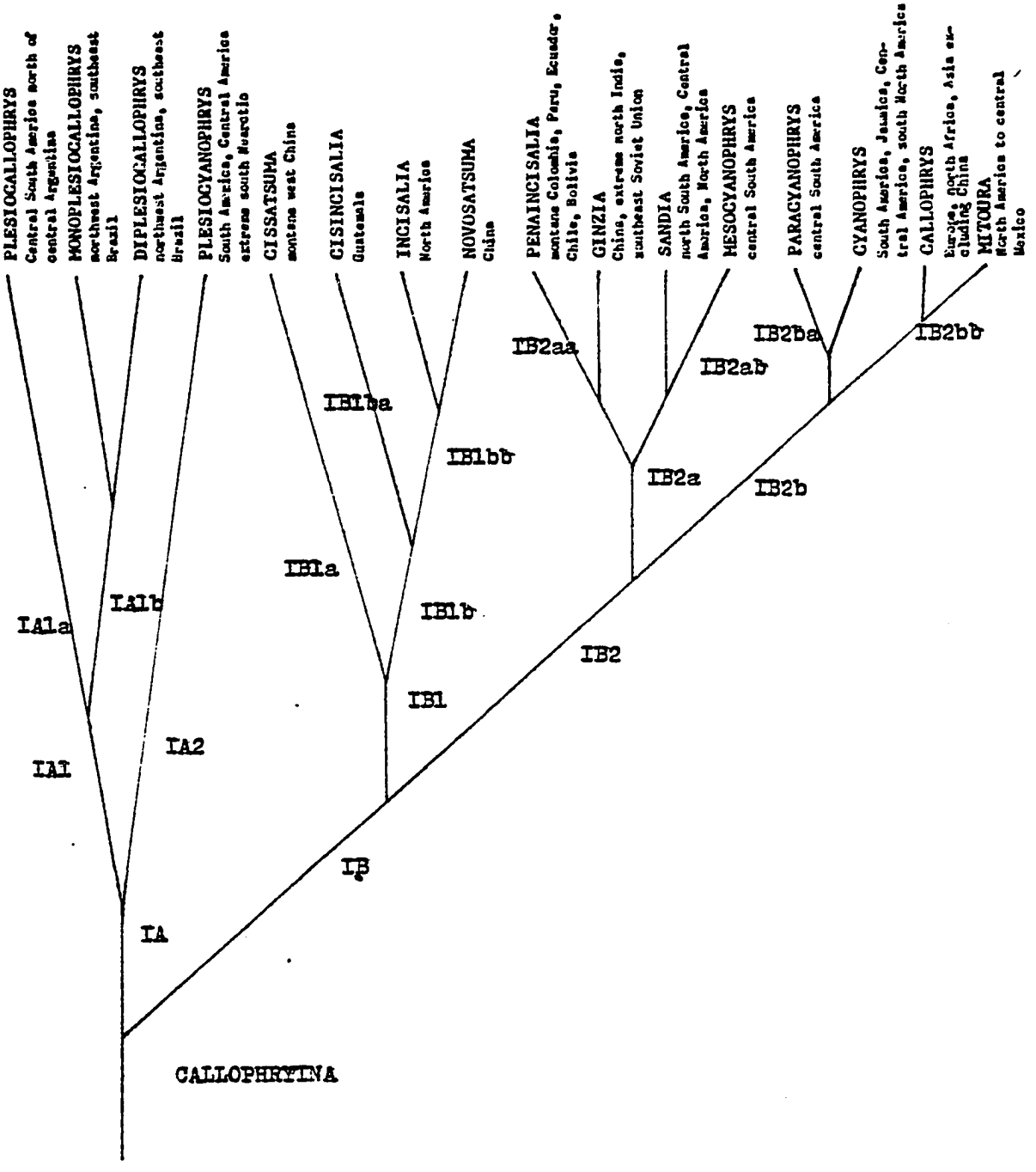


Fig. 4

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Cladistic Hierarchy of Callophryina in Relation to Geographic Distributions[19]

I. Wordwide Callophryina: Entire South America north of central Argentina; Antilles, only in Jamaica, Trinidad-Tobago; entire Central America; entire North America; entire Eurasia; Africa north and west of Sahara.

IA. Entire South America north of central Argentina; entire Central America north to extreme southern North America.

IA1. Northern Argentina; Paraguay, southern Brazil.

IA1a. Two disjunct areas of central South America: east and west of the Silada-Parana delta, the latter in the Andes.

IA1b. As above.

IA2. Entire South America north of central Argentina; entire Central America north to extreme sourthern North America.

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[19]Definitions: "Central America" in this treatment includes all of Mexico and south through Panama. "Eurasia" excludes Indo-Australia (India, southeast Asia, etc.), but includes Europe, Turkey, Syria, Iran, Afghanistan, Iran, north Pakistan, entire Soviet Union, China (including Tibet and Mongolia), Korea and Japan.

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IB. Entire South America north of central Argentina; Antilles, only in Jamaica, Trinidad-Tobago; entire Central America; entire North America; entire Eurasia; Africa north and west of Sahara.

IB1. Central America, Guatemala only; Asia, throughout China (including Tibet); entire North America.

IB1a. Asia, montane western China only.

IB1b. Central America, Guatemala only; Asia, throughout China; entire North America.

IB1ba. Central America, Guatemala only.

IB1bb. Asia, throughout China; entire North America.

Genus Incisalia. Entire North America.

Genus Novosatsuma. Asia, throughout China.

IB2. Entire South America north of central Argentina; Antilles, Jamaica and Trinidad-Tobago only; entire Central America; entire North America; entire Eurasia; Africa north and west of Sahara.

IB2a. Entire South America north of central Argentina; entire Central America; entire North America; Asia,

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throughout China, extreme north India, southeast Soviet Union.

IB2aa. South America, extreme northwest only, Asia, throughout China, extreme north India, southeast Soviet Union.

Genus Penaincisalia. South America, extreme northwest only (montane Colombia, Peru, Ecuador, Bolivia-Chile border).

Genus Ginzia. Asia, throughout China, extreme north India (Assam), southeast Soviet Union (Amur region).

IB2ab. Entire South America north of central Argentina; entire Central America; entire North America.

Genus Sandia. South America, extreme north only; entire Central America; entire North America.

Genus Mesocyanophrys. South America, central Argentina north only to Amazon River and Ecuador.

IB2b. Entire South America north of central Argentina; Antilles, Jamaica and Trinidad-Tobago only; entire Central America; entire North America; Eurasia excluding China; Africa north and west of Sahara.

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IB2ba. Entire South America north of central Argentina; Antilles, Jamaica and Trinidad-Tobago only; entire Central America north to extreme south North America.

Genus Paracyanophrys. South America, north of central Argentina, south of Amazon, northwest to Ecuador.

Genus Cyanophrys. Entire South America north of central Argentina; Antilles, Jamaica and Trinidad-Tobago only; entire Central America north to extreme south North America.

IB2bb. Entire North America; northern Central America south to south-central Mexico only; Eurasia excluding China; Africa north and west of Sahara.

Genus Callophrys. Montane western North America; Eurasia excluding China; Africa north and west of Sahara.

Genus Mitoura. Entire North America; northern Central America south to south-central Mexico only.

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The Ancestral Biota Implied by the Monophyletic Group under Study

An ancestral range is implied by the distribution of Callophryina. Phylogenetic analyses of many groups with contemporaneous distributions similar to Callophryina are necessary to discern if any general pattern exists. A general pattern of area cladogram congruence would imply a similarity of historical events influencing the distributions of all these groups. Knowledge of the cladistic relations of the immediate outgroups of Callophryina will clarify the particular ancestral distribution predicted by these lycaenid butterflies. Below I suggest the possible ancestral distributions which may be implied by the data in this study.

The times when an ancestral distribution could have occurred, relative to meeting the demands of monophyly for the group without trans-oceanic dispersal, are two. Both possibilities can be conjectured from current geological reconstructions of plate tectonic events; one can also be suggested from amphi-American biotic distributions alone.

(1). Considering the plate tectonic models of du Toit (1939), Frakes and Crowell (1968), Dietz and Sproll (1969), Dalziel and Elliot (1970), Dietz and Holden (1970a, 1970b), and Smith and Hallam (1970) the ancestral assemblage of proto-Callophryina could have been in place sometime between the Triassic and mid- to late Cretaceous (80-120 million years) if at least a late Mesozoic connection of North America and South America is postulated (Malfait and Dinkelman, 1972; Rosen, 1975; Tarling, 1971). A Triassic to at least mid-Jurassic ancestral biota could contain African and Antillean elements since there was pre-Triassic to, at the most, mid-Cretaceous connection between Africa and South America, and the Anteilles were displaced in the late Mesocoic. The two

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Primary Series of Callophryina do not contain Antillean or African elements, except for the single three-taxon element of the miserabilis Group (Cyanophrys) in which three species have Brazilian, Jamaican, and western Mexican distributions respectively (see below). However, in the sister group of Callophryina widespread Antillean and African distributions respectively occur. Positing an early (circa mid-Jurassic) ancestral distribution for proto-Callophryina has one possible problem. According to some tectonic scenarios, it could predict the closest relations of the South American elements as African or Indo-Australian (due to connection of these land areas as late as early Tertiary [K. Brown, 1976]), whereas South American Callophryina are more closely related by my cladogram to Holarctic taxa, and African outgroups seem to follow only after a number of outgroup taxa with widespread Antillean elements (see Fig. 575). In models including eustatic considerations, isolation of South America from North America in the Cretaceous, relative to long term former conjunction of South America and Africa, is especially preferred. Hence, from some points of view, the above postulated early ancestral distribution for Callophryina might require significant extinctions to account for the absence of elements within Callophryina from Africa, and the few Callophryina found in the Antilles.

A further possibility, however, is that the ancestral distribution is not earlier than late Upper Jurassic and that a long term North America - South America contact in the Cretaceous is indicated by the biogeographical evidence in Callophryina cladograms. This possibility is suggested by other amphi-American distributions (see Raven and Axelrod, 1974). At any rate, data from Callophryina cladograms suggest ancestral distributions early enough to include Africa but phylogenetic relations indicating stronger amphi-American connections than African-American.

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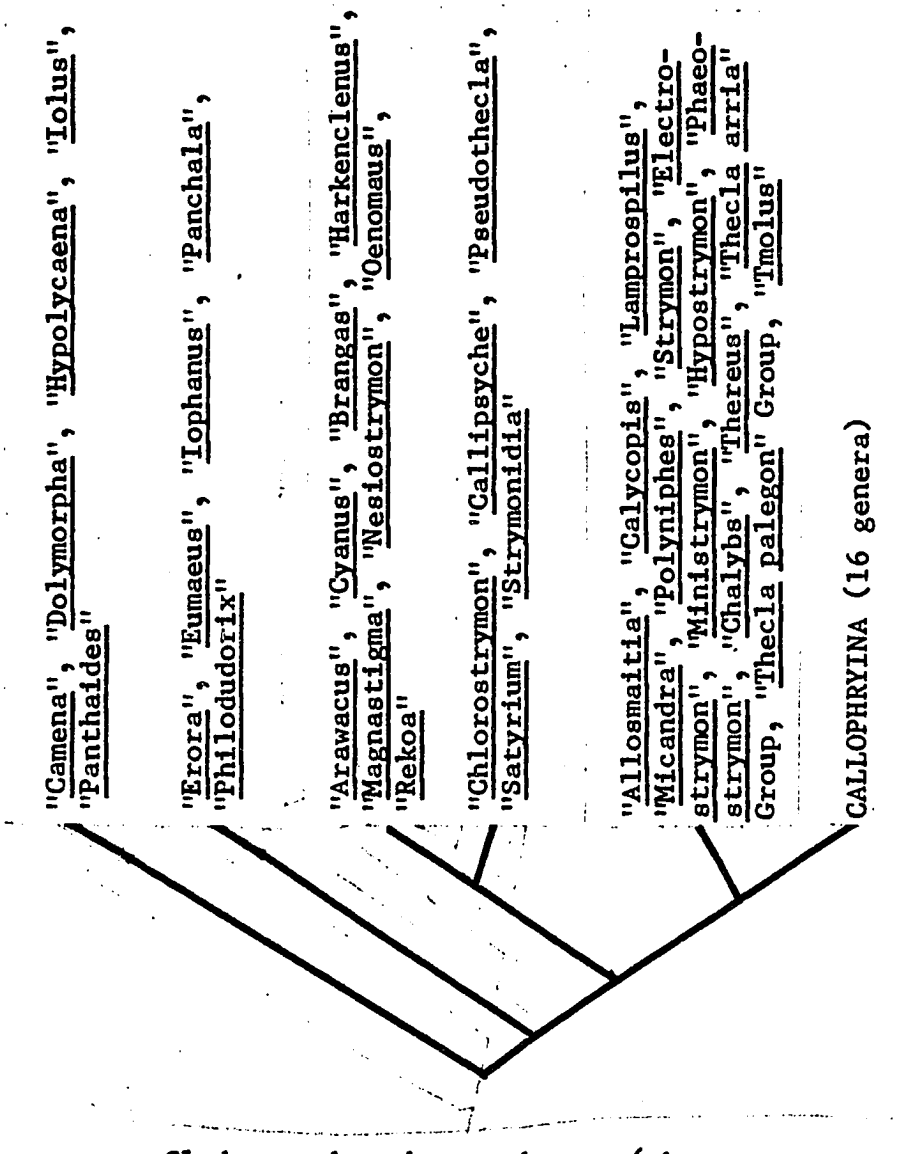


Figure 575. Cladogram of Callophryina with apparent sister groups

(see Cladistic Analysis, I.)

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Consideration of these possible early ancestral distributions for Callophryina is important vis-a-vis the origin and relative age of butterfly taxa. The fossil record of butterflies supposedly dates from Upper Eocene or Lower Oligocene (Handlirsch, 1906-1908, Shields, 1976); the oldest Lepidopteran fossils are late Cretaceous according to MacKay (1970), with recent evidence by Whalley (1978) indicating some Lepidoptera from the Eocene. These fossils all represent the known recent families of butterflies. Zuener (1962) and W. Comstock (1961) do not consider the Oligocene and Miocene specimens as having characters more primitive than recent representatives. There are twenty-four specimens through the Oligocene (Scudder, 1891; Handlirsch, 1906-1908; Cockerell, 1907; Theobold, 1947; Wangrin, 1939; Zuener, 1962; Larsen, 1974) Shields, 1976), then eight specimens from the Miocene (authors above and Zuener, 1962; Nekrutenko, 1965), seven from the Quaternary (Handlirsch, loc. cit; Zuener, loc. cit.; Fujiyama, 1968) and two considered recent (2-3,000 years old Evers, 1907). These fossils mean that all major families of butterflies had developed by the lower Oligocene. The lower Oligocene fauna of Florissant, Colorado (MacGinities, 1953) has been linked with Neotropical and Indo-Malayan forms (Scudder, 1889) and fossils from France show the latter affinities also (Scudder, 1875, 1889). Saporta (1872) notes that the fossil angiosperms of France also show a Neotropical and Indo-Malayan affinity. Fossils of butterflies from Yugoslavia have a subtropical American and African affinity (Scudder, 1875c). The presence of recent butterfly families within the fossil record of the Eocene suggests that major radiations in the butterflies must have occurred before an initial continental splitting prior to Upper Jurassic to early Cretaceous time. No angiosperms are supposedly known before the early Cretaceous (Scott, Barghoorn, and Leopold, 1960). It is a general observation within vicariance and plate tectonics studies that many groups may be older than has been previously

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thought. It may be that the angiosperms, whose earlier fossils show considerable diversity, had an extended pre-Cretaceous existence. This possibility has been suggested by (among others) Croizat (1968), Hawkes and Smith (1965), Melville (1979), and Radforth and Rouse (1956). Regarding similar observations, Shields (1976) concludes that butterfly radiations must have begun sometime before the Upper Jurassic.[20]

There is considerable variance in estimates of time and duration of South American - North American connection in the Cretaceous, with most tectonic reconstructions favoring extensive South American isolation. Malfait and Dinkelmann (1972), however, propose a long term North American - South American connection relative to South American - African contact. Their North-South American contact is broken with eastward displacement of the Antilles in the late Mesozoic. Unless there was an extended Cretaceous connection of North and South America, it is difficult to postulate that Callophryina with relatively primitive elements in northern Argentina - southern Brazil and distributions of apomorph taxa including South America, North America the entire Holartic, could be expected as monophyletic. Therefore, if Callophryina is monophyletic, this does not predict that South American was isolated through most of the Cretaceous and did not attach to North America until the late Pliocene as some authors have suggested. Rather, long term North and South American contact versus long term South American - African contact is indicated. A test of the Malfait and Dinkelmann hypothesis of Antillean displacement relative to the above proposed Upper Jurassic- Cretaceous ancestral distribution of Callophryina is performed below.

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[20]Shields and Dvorak note "a handful" of groups in common, but since their taxonomic analysis is based on regional common usages, without phylogenetic analysis, the number may well be higher.

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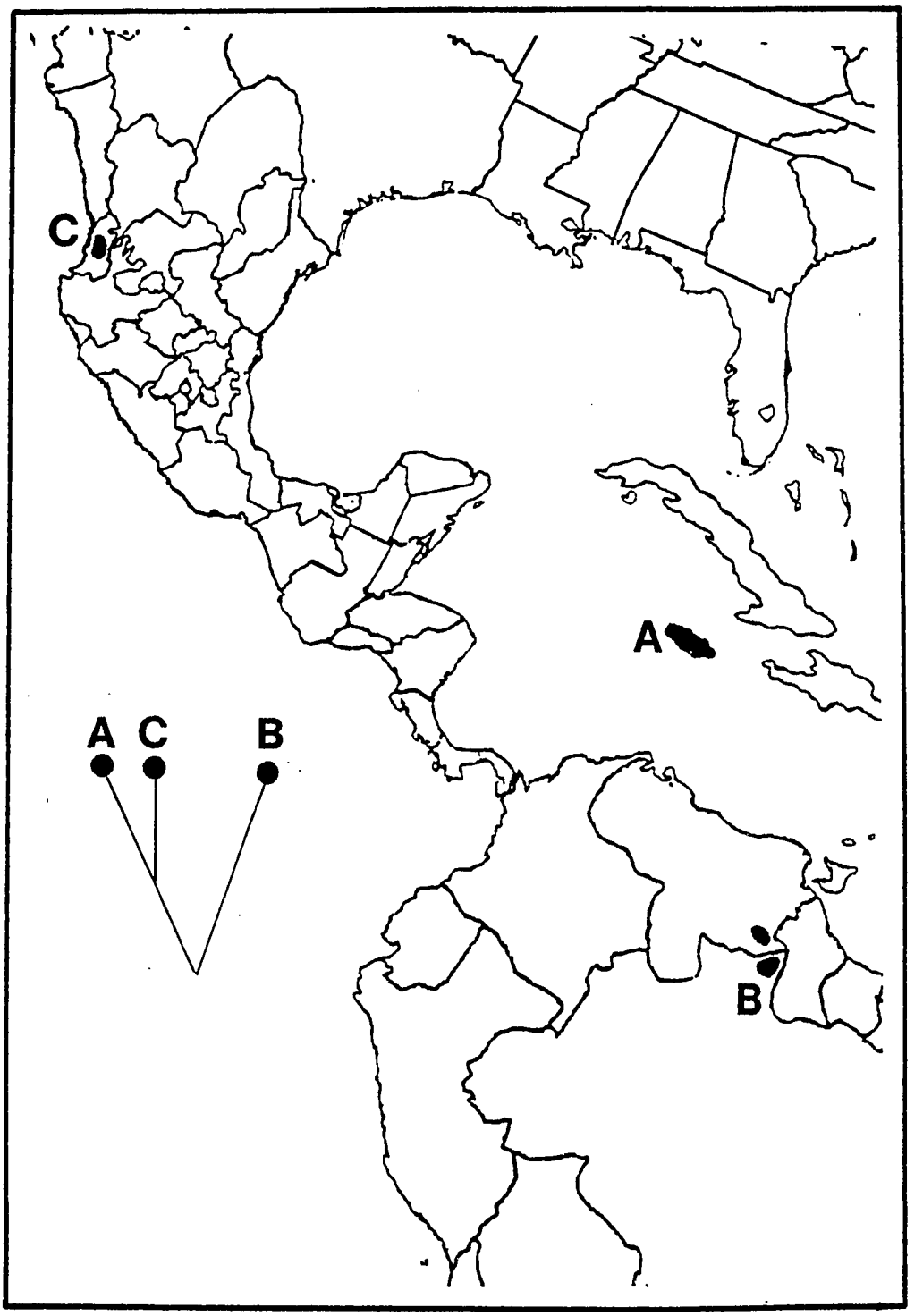


Figure 576. Three taxon statement in Callophrys with Mexican - South American - Antilles distribution (see text for discussion).

A. Cyanophrys crethona. B. C. marianna. C. C. necopinoides.

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There is a single South American - Antillean - Central American three taxon statement in the phylogenetic analysis of Callophryina. Its cladogram illustrated in Figure 576 along with corresponding distributions. Cyanophrys necopinoides and C. marianna are known only from museum specimens, but C. crethona is a familiar montane butterfly known to be isolated in occurrence and rather non-vagile in behavior (Riley, 1975). Nothing is known of the habitat of necopinoides, but marianna is noted as isolated on the high uplifted crustal blocks forming Mt. Roraima in Brazil and Mt. Duida in Venezuela (Comstock and Huntington 1943). If these three Cyanophrys species attained their current distributions by vicariance, if Jamaica was not submerged from middle Eocene to early middle Miocene as has been suggested by Robinson and Lewis (1971), and if a drift rather than uplifting model of Antillean origins is accepted, the vicariance of Central America from South America by the displacement of the "proto-Antilles" (sensu Rosen, 1975) can be used to date this cladogram. An ancestral distribution from western Mexico across the isthmus of Panama and the Guyana shield of South America is indicated, subsequently fractured into the three currently disjunct distributions. This Nayarit-Jamaica- Mt. Roraima/ Duida distribution, if its results from vicariance, corroborates the above early ancestral distribution of the Callophryina. However, to discern if this butterfly distribution is part of a general pattern, phylogenetic analyses of other taxa with distributions similar to these Cyanophrys must be made.

(2.) The ancestral assemblage could be a cosmopolitan distribution embracing South and Central America, the Holarctic following the late Pliocene. Such a cosmopolitan distribution, notwithstanding the thin connection of the North and South American continents could have been made possible by more tropical conditions at that time (Hallam, 1979) and have subsequently undergone

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fragmentation through Quaternary events. Quaternary changes have been characerized as the extinction of tropical elements in North America and Europe and subsequent replacement by cold forms expanding from Quaternary refugia (Clench, 1963; Scott, 1972; Mazel, 1977). Also, various eustatic and themophilic changes in Europe during this period (Mazel, 1977; Hallam, 1979) might account for the meager representation of Callophryina in that area. Difficulties with this concept, however, are several. Firstly, the amount of time involved for sustaining a widespread distribution from which the various elements in this monophyletic assemblage could be derived, seems quite short (2-4 million years). Although the distributions of many of the genera and species groups (e.g., Cyanophrys, Sandia, Plesiocyanophrys) indicate widespread relations across the isthmus of Panama and there are numerous sister species on either side of the isthmus, there is no similar evidence for exchange of Callophryina between Asia and India. India was in contact with the rest of Asia from mid- or late Tertiary and mountain-building did not become a major factor in the disjunction of Asian populations until the Pliocene (Raven and Axelrod, 1974). Further, there is no evidence of an exchange between Chinese elements of the Callophryina and those of the northeast Soviet Union. If indeed Callophryina taxa have attained their present distributions relatively recently, the lack of widespread and complexly inter-connected geographic relations of these taxa across Asia seems unusual. This is because relative to amphi-America, land homogeneity of present-day Asia has existed over a much longer period of time and across a wider perimeter since the Cretaceous. Hence, it seems preferable that complex amphi-American distributions (relative to Callophryina cladograms) are indicative of earlier Cretaceous interactions of North and South American land homogeneities, while limited Asian distributional relations result from comparatively shorter periods for interaction (since late or post-Cretaceous time),

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influenced by effective barriers produced in the Pliocene and Quaternary. The analysis of outgroups of Callophryina will be important in clarifying preference between the two possible times of general ancestral distribution for Callophryina discussed above. If the post-Pliocene hypothesis is preferable, considerations of the proposed "Quaternary refugia" of many authors (see below) become very important. At present the earlier posited ancestral distribution, Upper Jurassic through Cretaceous etc., seems preferred. Phylogenetic and area cladogram analyses of relations between taxa of South America, Africa, the Antilles, and Central America are central to discovering if a general pattern exists.

Regional Considerations.

(1.) Palaearctic. Distributional and taxonomic data indicate two major geographic elements within Palearctic Callophryina. One is a Holarctic element, inhabited by the "relatively apomorph" genus Callophrys. The other is Asian (viz. "nuclear Asia") consisting of China and adjacent Himalayas along with the Amur River Basin and central Japan. It houses several genera of Callophryina with character constellations ranging from relatively primitive to moderately apomorph (see Fig. 2). There has been little exchange between these Holarctic and nuclear Asian elements. Asian genera of Callophryina do not lend themselves to area cladogram analysis because distributions are poorly known. Most of the species diversity is in the Himalayas and current distributional data there indicate sympatry for numerous taxa. Three genera and seven species groups, however, have congruent cladograms.[21] Sympatry limits predictions and testing

[21]Some of the cladograms are more highly corroborated than others since in some taxa only one sex is known. The cladogram of the genus Ginzia has two plesiomorph non-bifurcate branches before it expresses the congruent pattern of the Himalayan groups: a bifurcation of two taxa each.

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of particular hypotheses in these cases. However, congruence suggests a history of similar vicariance influences on these groups followed by subsequent dispersal.

When area cladogram analysis is performed on worldwide Callophryina using the large categories North America, Central America, South America, Antilles, Eurasia and nuclear Asia the only repeating congruence in three taxon statements is nuclear Asia - South America / North America. This congruence with the nuclear Asian element occurs only twice and, obviously, could result from chance alone. The relatively primitive elements in the cladogram of Callophryina include quite disjunct South American, Central America and nuclear Asian distributions that could be explained as disjunct relict populations, regardless of which general hypothesis of former ancestral distribution is preferred. Phylogenetic analysis of groups of organisms within areas of endemism (see below) is the relevant procedure.

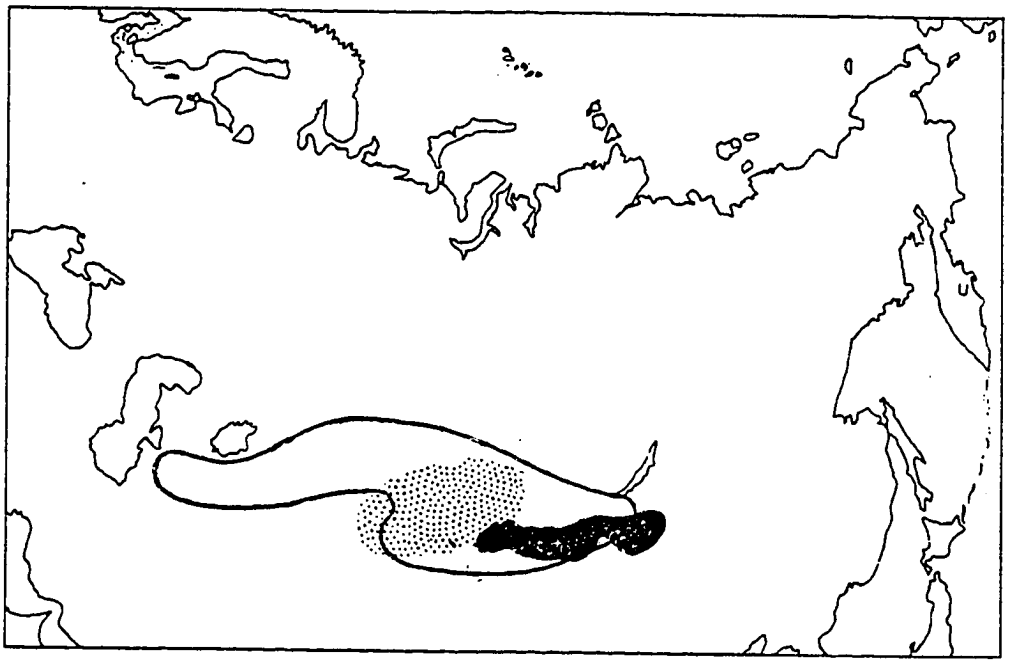
Relative to Asian - South American distributions, the fact that groups with relatively apomorphic constellations of characters occur in distributions northward through North America - Eurasia makes China - South American relations in the Callophryina less interesting. A trans-Pacific connection, as would be invoked by requiring a "Pacifica" sensu Melville (1979) or Nur (1979), or "Expanding Earth" sensu Owen (1976) and Shields (1979), is unnecessary to explain them given the location of the sister groups. Further, searching for a general pattern of cladistic congruence within Eurasia seems more relevant for two reasons: "Expanding Earth" hypotheses have little geologic corroboration at present (McKenna et al., 1979) and the current models available in the literature suggest an early Jurassic vicariance event. If post-Cretaceous events are suggested as most influential on current Palaearctic distributions in Callophryina, lack of exchange of its nuclear Asian elements and the European Callophrys along with the presence of Himalayan-related elements in North and South

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America (but not Europe) is not unexpected vis-a-vis eustatic and climato-geographical histories of the regions. Hallam (1970) has shown an early to late Cretaceous eustatic instrusion between Europe-Africa and nuclear Asia just west of present day Jordan, Syria and western Iraq. According to Hallam the present Europe-Asia connections did not become permanent until the Tertiary. Further, the frequency of time in which parts of Europe remained under water is also emphasized by Hallam (loc. cit.) and Mazel (1977) and there is a subsequent history of climatological, eustatic, and quaternary glacial oscillations. Extinction of boreal flora and fauna is specifically invoked by Mazel (1977) for Europe and could account for the absence of European species of Incisalia sens. lat.

The cladogram of European Callophrys is difficult to accord with Mazel's (1977) idea that the contemporary Lepidopteran fauna of Europe has been in place only since 10,000 B.P. Quaternary (or Pliestocene, depending on the authors) refugia and subsequent expansion have been widely invoked as major causal factors for the biogeography of butterflies in the Palaearctic by several authors (de Lattin, 1952; Povolny, 1962; Mazel, 1977). In Callophrys there is a coincidence between one refugium proposed by de Lattin (southwest of Lake Baikal) and a new taxon of Callophrys, C. cynthia (Fig. 577). C. cynthia is a montane entity occurring in an area of Tertiary and Pliocene uplift (Raven and Axelrod, 1974). Its female genitalia suggest synapomorphy with Eurasian C. rubi; its male genitalia synapomorphy with north African C. neofervidus. As an unresolved trichotomy the above mentioned Callophrys species are the apomorph sister group of C. virgatus, atlasensis and avis for which potential Tertiary vicariance is discussed below. Phylogenetic analysis of other taxa endemic to the trans-Baikal area and their relation to European and North African sister taxa should be pursued. A relevant three taxon statement which may indicate a possible general pattern exemplified by a clade of species in isolated montane

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Distribution of Crepis sp. (Asteraceae) from Croizat, 1964

Quaternary refugia invoked by de Lattin, 1952

Distribution of Callophrys cynthia

Figure 577. Area of central Asia indicating regions of endemism in Callophrys and several other groups of organisms. Phylogenetic analysis of these endemics relative to sister group taxa may be a basic for suggesting general patterns of vicariance in Eurasia. Taxa from the above areas have immediate sister taxa in western Europe and sometimes North Africa, as in Callophrys.

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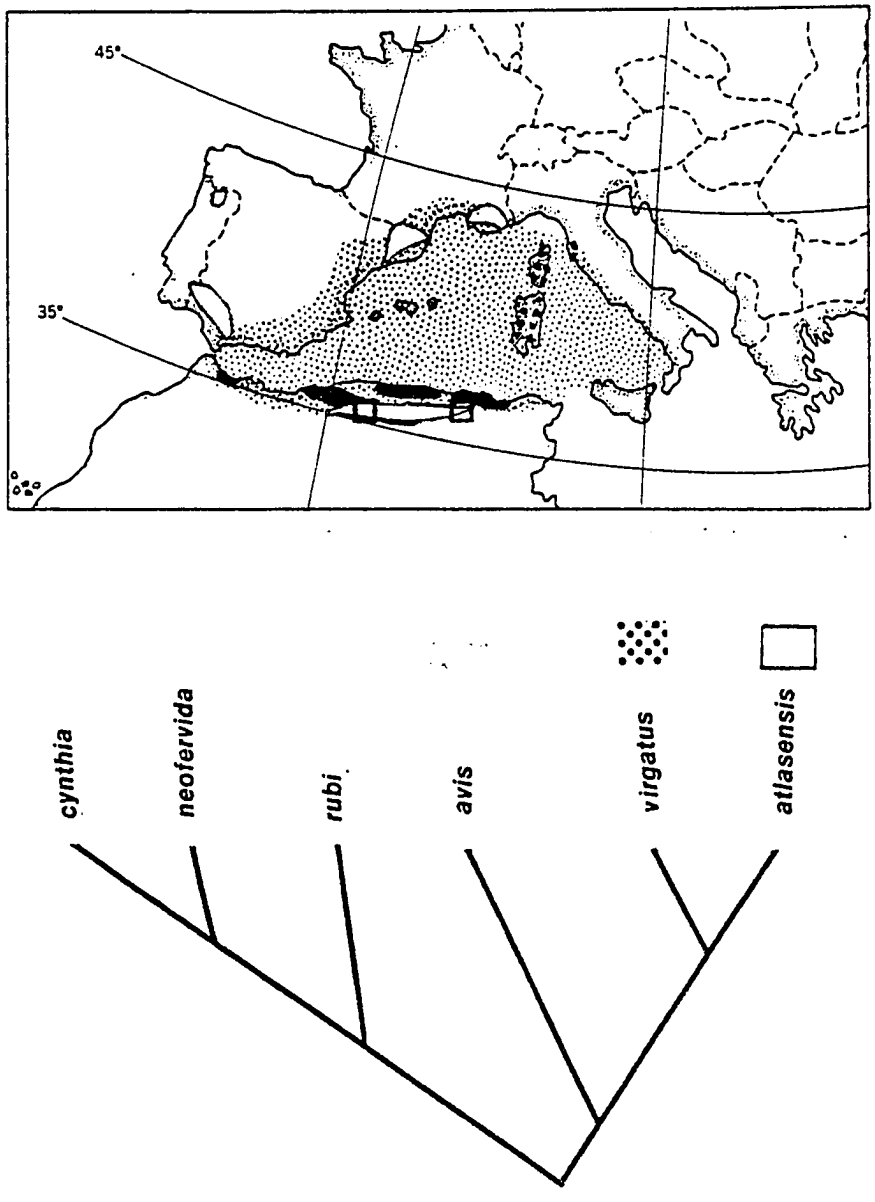


Figure 578. Map showing Croizat's "Tyrrhensis" superimposed over distributions of three locally endemic species of Callophrys (see text for discussion). Relative cladistic position of cosmopolitan sister species also noted (see Appendix 4 for table of characters).

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areas of southern Europe Corsica/Sardinia and the Atlas Mountains of Africa. Their cladogram (Fig.578) and possible pre-Quaternary tectonic explanations for their distributions are interesting.

Hsu's (1971) proposed tectonic breakup of Spain, Italy, and Corsica-Sardinia in the mid-Jurassic is probably too early to be relevant to Callophrys. Callophrys is "relatively apomorphic" within the entire Callophryina, and Callophryina is similarly "apomorph" for all Eumaeini. The cladogram of European Callophrys is not compatible with Hsu's hypothesis. Hsu's model indicates land homogeneity between southeastern Spain, southern France and proto-Corsica/Sardinia while the cladogram indicates the immediate relation of endemic taxa is southeastern Spain / southern France to North Africa and Corsica/Sardinia to Italy.

Croizat (1964) reviewed the idea of a mid- to late Tertiary land area ("Tyrrhensis") spanning elements of the present Mediterranean Sea and separated southward from Africa by an arm of the sea. Tyrrhensis (Fig. 578, stipled) subsequently breaks into an African and European element. The former joins present extreme North Africa (which is thus a part of Europe) and the latter attaches to nuclear Europe. Gibraltar, according to Mazel (1977) became separated at an early Pliocene time. The distributions of the apparently relict Callophyrs (see Revision) in Europe, the Mediterranean and North Africa are superimposed over Croizat's model and their cladistic relations given alongside. The coincidence of the distributions is interesting (though there are major exceptions in western Spain and Portugal). The synapomorphy of the African and European elements, representing a distribution derived from that formerly including Corsica-Sardinia, suggests possible congruence with a geological pattern since the western part of the Mediterranean opened last. Of interest, but of uncertain meaning, is the coincidence of the only distribution area of C.

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virgatus on the European mainland with a gap in Croizat's model. As noted in the description of virgatus, three other endemic butterflies share its distribution. Phylogenetic analysis of these taxa and others with similar distributions seems important to discovering if a general pattern exists, with particular geographic implications.

The example of relatively plesiomorph Callophrys and "Tyrrhensis" may suggest as much reason for considering Tertiary tectonic events relative to speciation in European butterflies as the proposed Quaternary refugia of many authors. Species of Callophrys cannot be considered generally vagile. The cosmopolitan distribution of C. rubi, a species with many derived characters relative to the montane species, is unique. The montane entities concerned in the discussion of "Tyrrhensis" are known to be extremely local (Chapman, 1909a, 1909b; Oberthur, 1917; Riley and Higgins, 1976), not distributed on adjacent lowlands, and (at least in the case of avis) restricted to unique monophagy. Studies of the life histories of virgatus and atlasensis have not been made. Cosmopolitan rubi does not occur in Africa; rather, it has an immediate sister species there, limited to coastal areas. The taxon virgatus, endemic to Corsica, Sardinia and a small area of the Tuscan coast of Italy is evidently very rare. Faunal studies of the aforementioned islands (see Remarks on virgatus) have not listed it. Specimens known to Higgins and Riley (1976) from these localities were lumped with rubi and presumed to indicate waif dispersal. Considering the evidence against vagility in the montane species, the possibility of earlier tectonic-related vicariance seems of interest. Further phylogenetic studies of other European butterflies might yield similar patterns suggesting explanations other than Quaternary refugia.

(2.) Nearctic. The effect of Quaternary oscillations on Nearctic biotas has been a preoccupation with most zoogeographic considerations of contemporary

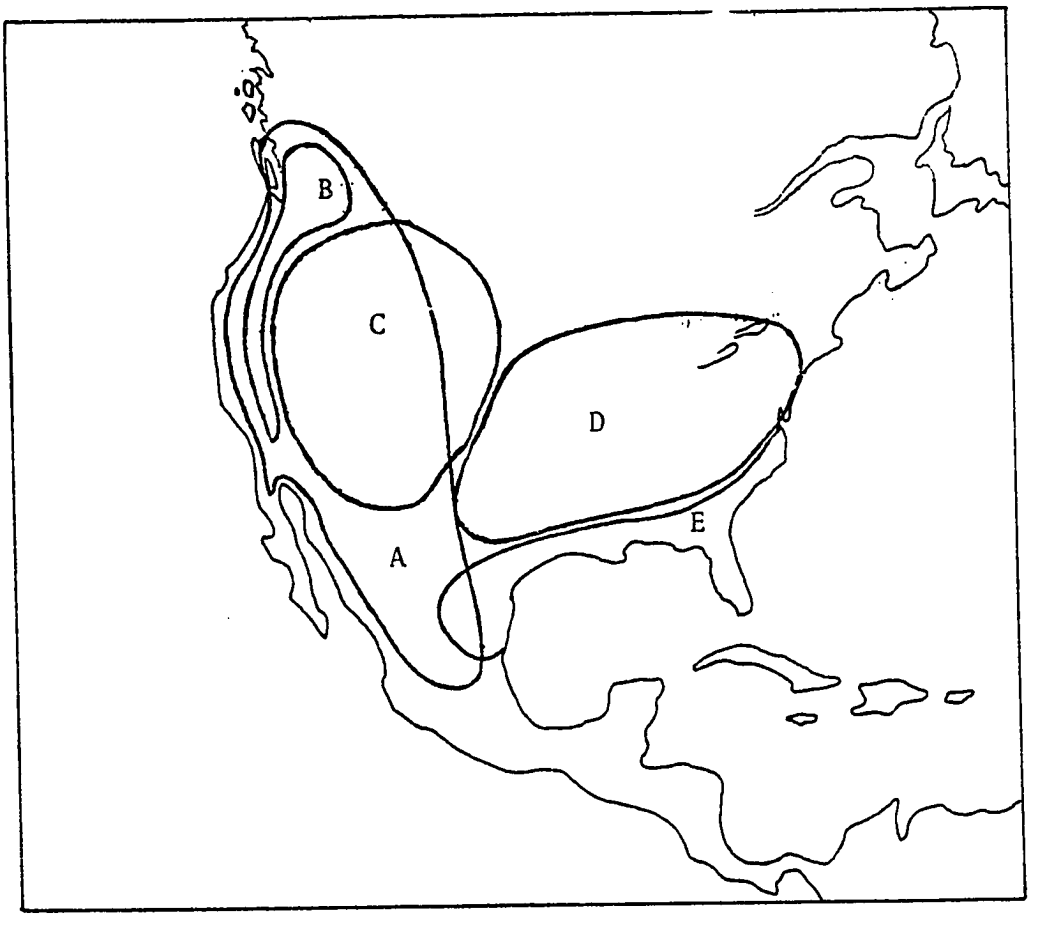
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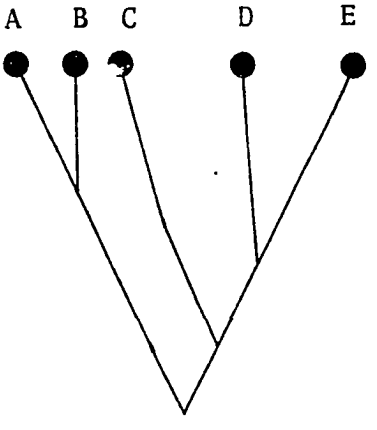
distributions (see, for instance, articles in Dort and Jones, 1970). There are three major groups of Callophryina in the Nearctic: elements of the sister genera Callophrys and Mitoura, taxa of Sandia (formerly placed by other authors with the conifer-feeding Incisalia), and Incisalia. Numerous taxa of all the above groups are sympatric and show apparent dispersal northward into areas once occupied by Quaternary glaciers. Though cladograms of the groups are available in some cases, lack of characters has made it impossible to produce a cladogram for the apomorph Sandia and for Callophrys. In the latter group, genitalia are similar, reducing the number of characters available for consideration. A cladogram is possible for Mitoura, but sympatry makes area cladogram analysis difficult. I have not included such analysis here. However, it is of interest to future considerations to mention a pattern (corroborated by three generally congruent area cladograms) which suggest distributional areas between which phylogenetic analyses of taxa may indicate a pattern.

If one selects as categories a broad Mexican-Western United States element [called here "A."]and superimposes upon it a sympatric Sierras-Canadian Rockies [B.] and central Rockies [C.] pair of elements, along with an eastern deciduous forest element [D.] a circum - Gulf of Mexico - Atlantic coast element [E.] the following relations are indicated (Fig. 579).

The pattern in Figure 579 relative to deciduous forest and circum-Gulf coast taxa coincides with observations of some authors (Van Haverbeke, 1968; Schurz, 1971; Johnson, 1972; 1976b; 1978) that recent east-west movements of deciduous forest and pine-juniper savannah (see Johnson, 1976b) have carried certain butterflies eastward and westward in North America, among these being M. gryneus. Johnson (1976a) and in this study considers the other eastern United States Mitoura (hesseli and sweadneri) as distinct species (and not sister species of gryneus). Formerly, hesseli and sweadneri were considered as a sibling species

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A. Montane Mexico north through Rocky Mountains to southwest Canada

B. Sierra Nevada Mountains and southwestern Canadian Rocky Mountains

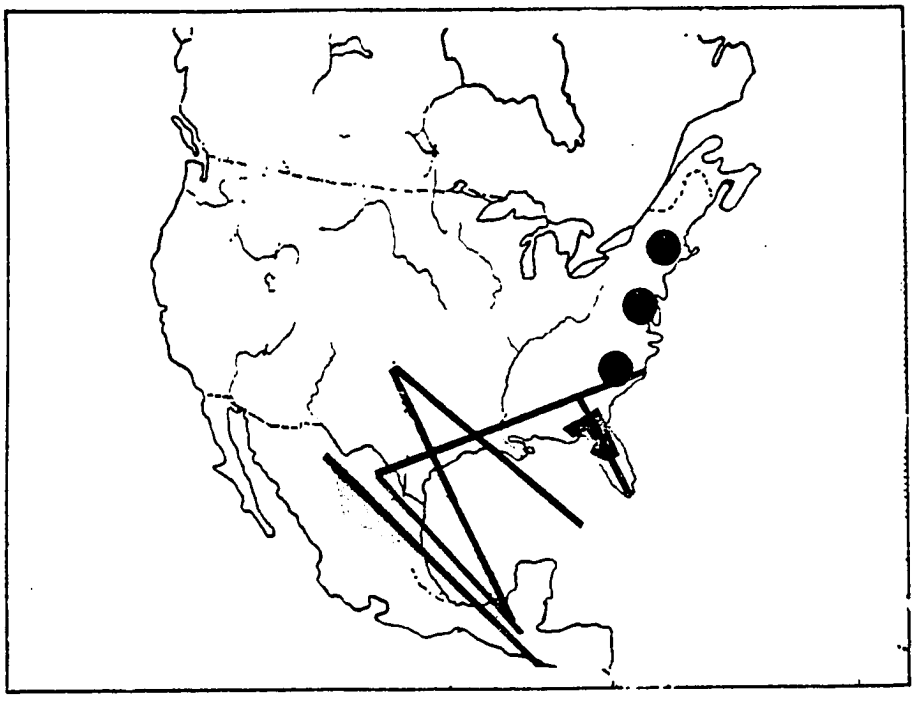
C. Central and Southern Rocky Mountains

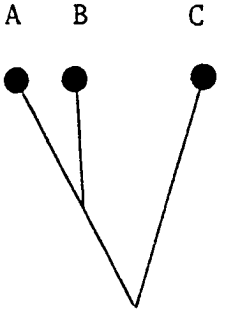
D. Eastern Deciduous Forest

E. Gulf and Atlantic coasts

Figure 579. Five areas of North America suggested as possibly useful for studies of endemic taxa relative to phylogenetic analysis (see text for discussion).

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A. Black dots-- M. hesseli

B. Dark pattern-- M. sweadneri

C. Stiples-- M. dospassosi

Figure 580. Demonstration of apparent dispersal of Mitoura hesseli out of the generalized track of its monophyletic assemblage. Black lines represent generalized tracks from Rosen (1975). Monophyletic group suggests possible Gulf and Atlantic coast component of general pattern.

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and subspecies of gryneus, respectively. The cladogram presented in Figure 574 and the map of distributions superimposed upon generalized tracks from Rosen (1975) corroborate Johnson's hypothesis of relationships. It indicates the monophyly of hesseli and sweadneri with dospassosi and hesseli's range as a probable result of dispersal (see explanation of figure). The demonstration of a three taxon statement supporting the existence of a geogrphic element concordant with generalized tracks suggests that the areas mentioned above may be fruitful for cladistic and vicariance considerations.

(3.) Neotropics. There are nearly seventy-five species within the Callophryina genera which occur in the Neotropics, and as such the most extensive diversity within the group. Most commentators on Neotropical zoogeography consider that contemporary diversity and distribution relate to events of the Quaternary. Some accounts (Clench, 1963, 1965; Scott, 1972) limit present-day consideration to events of the Pleistocene. Quaternary (or Pleistocene) "refugia" postulated by numerous aforementioned authors (see Table 1) are evidently considered as generally simultaneous events. At least in presentations of these areas of endemism, they are plotted on maps as in Fig. 581 and the faunal resemblances or relative degrees of divergence of their taxa compared.

This study has applied area cladogram analysis to various Neotropical geographic categories.[22] There is similarity between areas of endemism in this paper and some of the refugia postulated by various authors. Figure 582 shows

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[22]The areas considered by area cladogram analysis included the following categories: North America, South America, Central America, Antilles, Eurasia/North Africa, nuclear Asia (China); area from Tampico, Mexico northward to North America, Tampico south to the Motoqua Polochic Faults, Polochic Faults to southern end of Panamanian isthmus, South America (see Rosen, 1975); area of post-Pliocene vulcanism (sensu Rosen, 1975) north to North America, area of volcanism south to Colombia adjacent isthmus of Panama, nuclear South America; areas of endemism. Only the latter analysis yielded congruent patterns.

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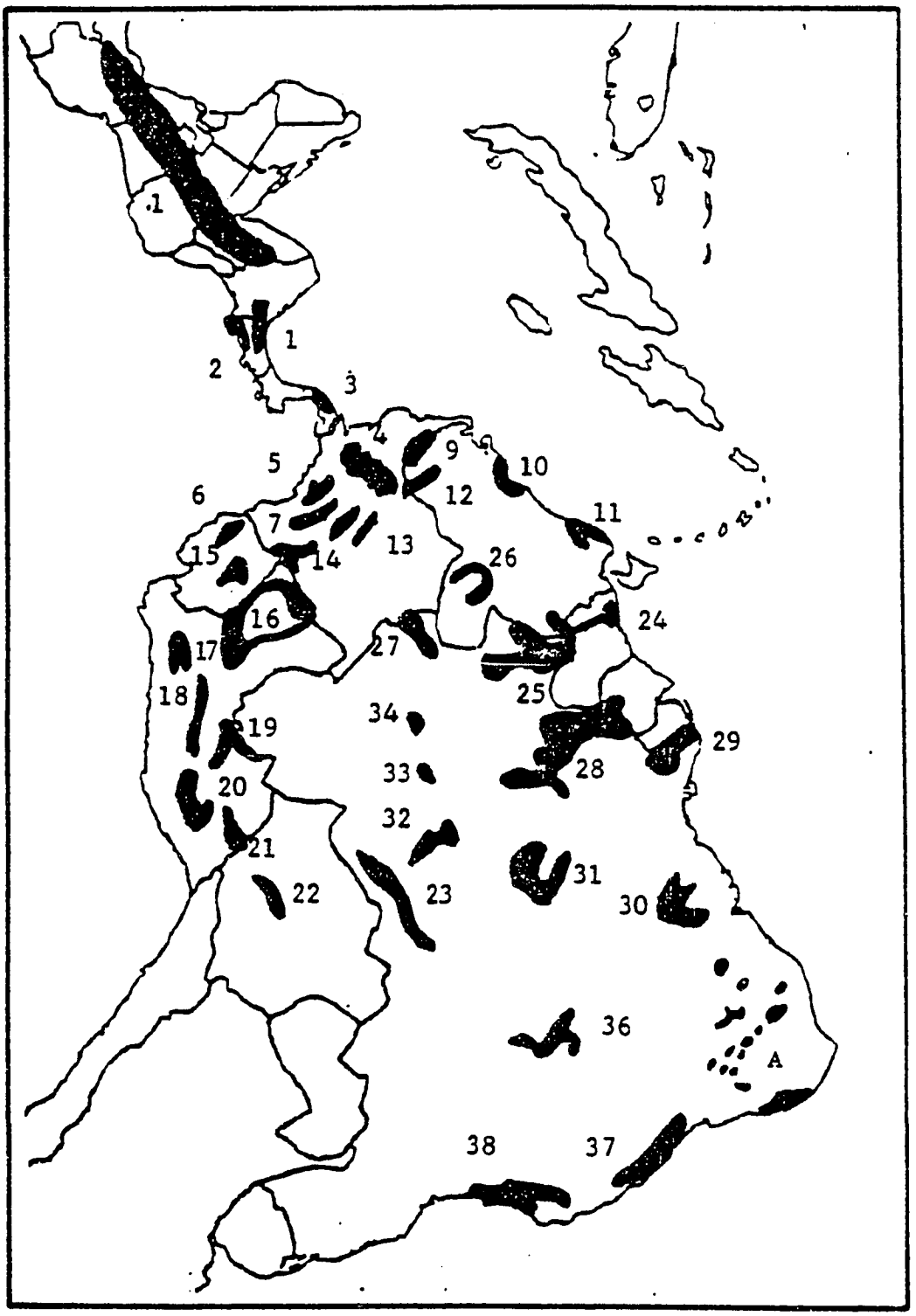


Figure 581. Areas proposed as Quaternary refugia

by Brown and others

(see Appendix 6 for key; see text for discussion).

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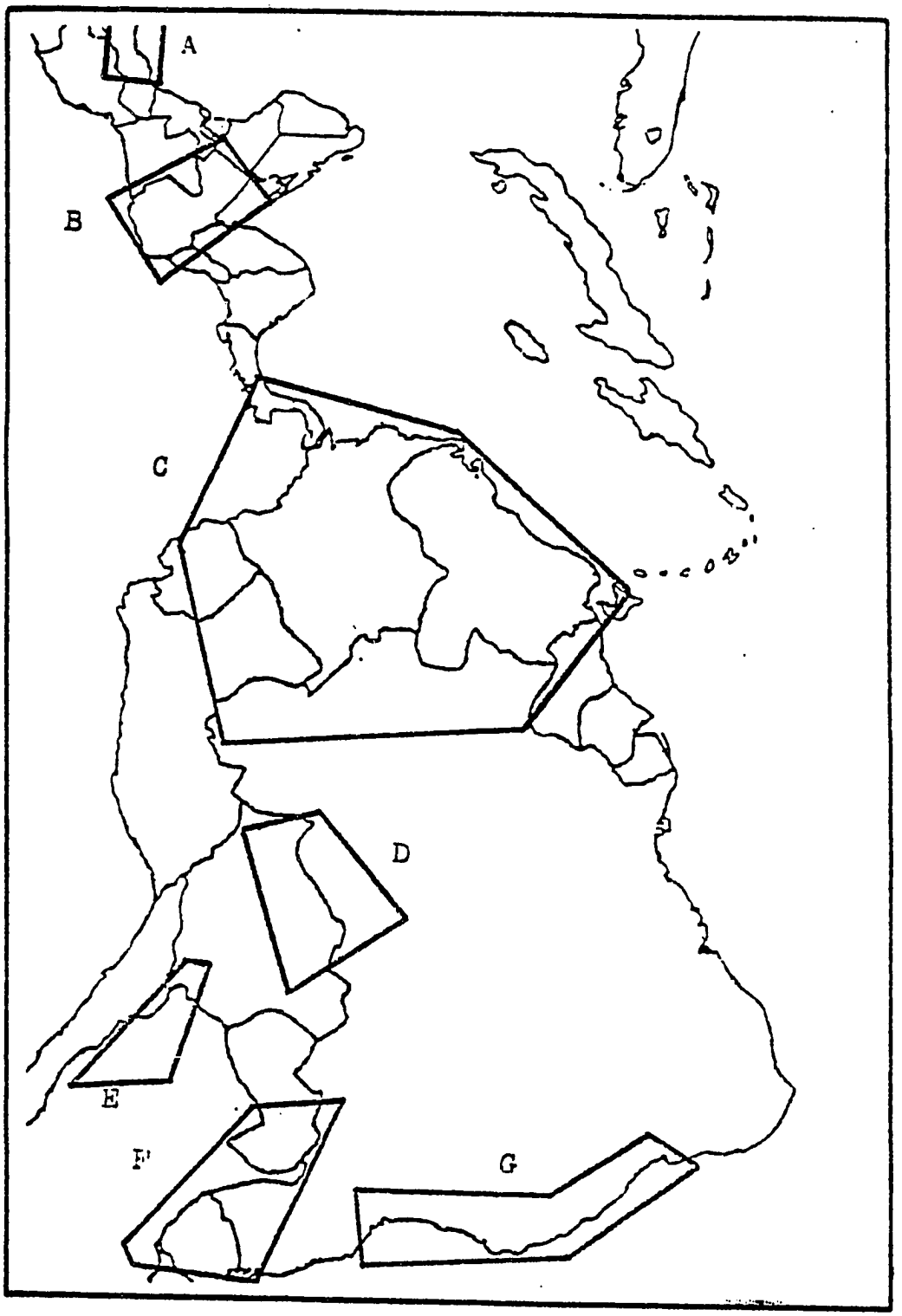


Figure 582. Areas of endemic taxa in Callophryina. See Table 2 for localities, numbers of taxa and relations to "refugia" of Brown and others.

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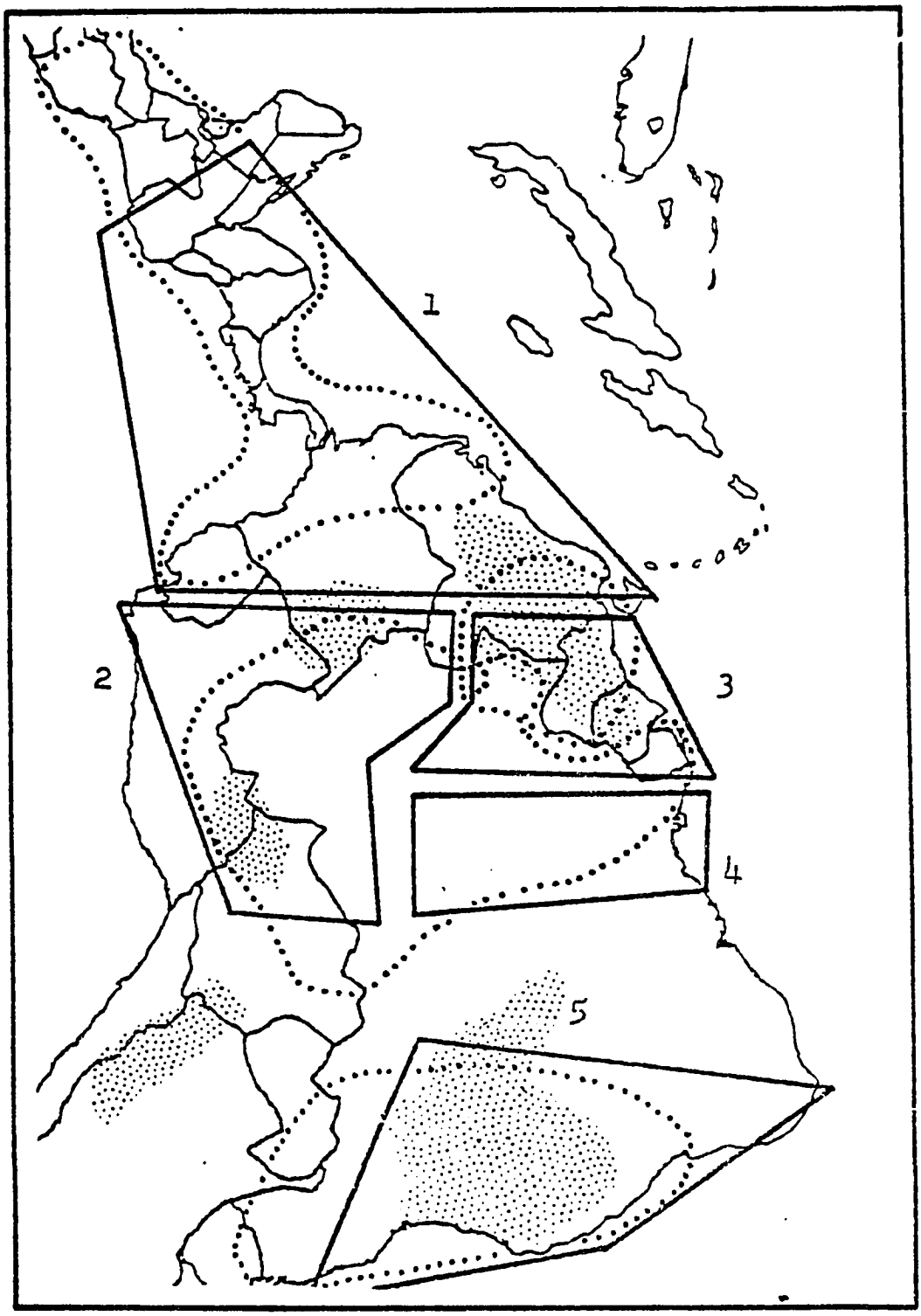


Figure 583. Other areas of general endemism suggested for South America. Numbered enclosures: major groupings of "refugia" by Brown. Dotted enclosures: ranges included by taxa groups as species by Brown from his polymorphic forms and subspecies. Stipled areas: Areas of endemism proposed by Croizat (1965).

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Table 2

Areas of Endemism, Callophrys sens. lat.	Coincidence with Quaternary refugium (Brown)	No. of Endemic Lycaenid taxa
A.	None	1
B.	Guatemala	-
C.	Chiriqui	1
	Nechi	
	Darien	
	Choco	
	Chimborazo	1
	Cauca	1
	Magdalena	
	Catatumbe	
	Rancho Grande	
	Sucre/Trinidad	
	Apure	
	Villavicencio	1
	Putumayo	
	Abitagua	2
	Napo	
	Maranon	
	Huallaga	
	Ucayali	
	Chanchamayo	1

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Table 2 (continued)

	Imataca		
	Roraima	1	
	Ventuari		
	Imeri		
	Loreto		
D.	Yungas		(3)
	Guapore	1	
	Remnants	-	
	Rondonia		
E.	None	0	
F.	None	0	
G.	Rio de Janeiro	10	
	Bahia		

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areas of endemism suggested in this study. The number of taxa occurring within each area and not elsewhere is noted, and Table 2 compares the endemics' distributions to particular refugia named by K. Brown and his associates (see various citations). K. Brown (1976) has already indicated that his areas of endemism (refugia) are of certain congruence with those hypothesized by workers on other organisms (see K. Brown, 1976) and he has presented some analysis of these. At least thirty-one of Brown's "refugia" are included within the areas of endemism of this paper. There are three areas of endemism in the present study which are not included within the distribution areas of Brown's nymphalid butterflies. Brown groups his "refugia" into five larger general categories. These are shown in Figure 583. On this map are also represented five localities which Croizat (1964) refers to as "Rudiments of South American Biogegraphy" (based primarily on monocots); also included are taxa clustered by Brown as "species" from his broadly polymorphic heliconid butterflies. Brown seems less interested in such phylogenetic concerns than in observations of divergence in his many forms and subspecies. When area cladogram analysis is applied to the cladograms of lycaenid taxa from the present study congruences of pattern shown in Figure 584 result.

The congruence indicates:

(a.) Common area of relative plesiomorphy. Of the thirteen cladograms of genera or species groups available from four genera within the region, five yield the same pattern of endemism in the relatively plesiomorphic position (as GF, Bahia, Rio de Janiero/South Paraguay-Uruguay-northeast Argentina). Four others show this general area (as G only) and one as F only. In other words, ten of thirteen cladograms yield the same general geographic area in the relatively plesiomorphic position. Also of interest, four other cladograms (including taxa relatively primitive in characters to the thirteen above) have all of their taxa in

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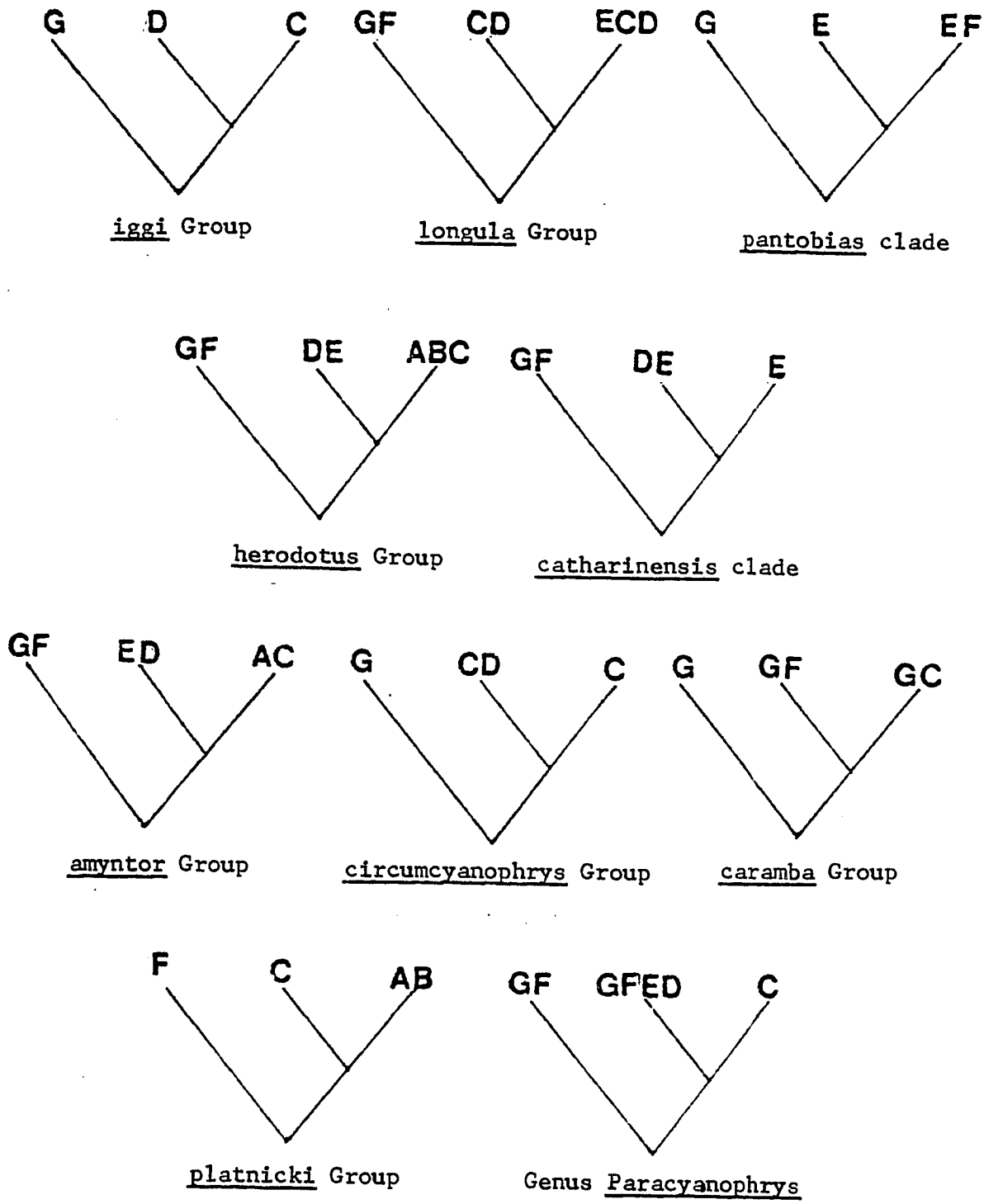


Figure 584. Ten cladograms of Neotropical Callophryina indicating possible pattern of congruence between areas of endemism (see text for discussion).

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either area F or G. Also, another group (Plesiocyanophrys), for which a cladogram of all taxa is not available, shows relatively primitive character states in areas F or G and relative apomorph characters in taxa of the areas mentioned immediately below.

(b.) Common general areas of relative apomorphy. In eight of the above ten cladograms indicating the generally identical plesiomorph area, the immediate descendant area includes combinations of more northward areas A, B, C or D. Six include particularly southern Andean elements (Argentina-south Bolivia) in these derived areas; the two others have the areas of relative apomorphy including the southern Andean areas specifically.

(c.) Nearly identical occurrence of congruencies relative to hierarchical position in larger cladogram of the genera. The six generally congruent area cladograms within Cyanophrys occur at the third hierarchical branching oint across the diagram. The congruence in Paracyanophrys occurs at the same branching point of a larger diagram (or one less depending on resolution of unresolved trichotomies). The two congruencies in Mesocyanophrys occur one branching point above those in Cyanophrys, but again some unresolved relations could alter this. This general consistency in the occurrence of the ten congruencies throughout the cladogram of the general suggest a common vicariance event might have effect them all.

These data indicate that rudiments of a general pattern may be suggested by these ten of thirteen cladogram of neotropical callophryine taxa. If they are indicative of a pattern that can be corroborated though phylogenetic and area cladogram analysis of other groups of organisms endemic to these areas a common history is implied. If an ancestral biota can be hypothesized from such studies and some general pattern of subsequent vicariance corroborated a different explanation than Quaternary refugia may emerge. Specifically in this case, the coincidence of this particular pattern with a Tertiary intrusion of the

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sea isolating the areas in F and G is inviting (Malcolm McKenna, pers. comm.). If an alternative explanation other than Quaternary Refugia can be offered in the Lycaenidae this has great import on the frequency of using the refugia explanation without cladistic analysis in the sister group Nymphalidae. At the least, the data from these Callophryina indicate that instead of there being no pattern relative to phylogenetic relations and endemism in South America (which might be expected of a Quaternary refugia model which implies some general simultaneity) such a pattern is suggested. Since one particular area is consistently indicated as relatively plesiomorph, the comparison of the areas of refugia of many authors as being of relatively equal historical integrity is questioned. Apparently, whatever has been going on in the areas generally referred to as "Rio de Janeiro" and "Bahia" is of a different historical order than those of the other South American "refugia." Evidently, initial vicariance of callophryine taxa in southeastern Brazil has not been followed by subsequent vicariant events in times of vicariance elsewhere in South America. Therefore, there seems to be a major difference in the historical processes affecting Rio de Janiero - Bahia relative to the many other "refugia" with which it has been lumped in discussions of Quaternary oscillations. Whatever these events or processes are they may or may not relate to the Quaternary. Further studies concerning areas of endemism and phylogenetic relations are required to suggest alternative explanations or refinements of the Quaternary refugia model invoked by so many. The lycaenid cladograms predict that phylogenetic analyses of other groups of organisms with a similar pattern of endemism will indicate the most plesiomorph entities in the supposed southeastern Brazilian refugia. In this regard, phylogenetic and area cladogram analyses of the biotas of these areas will have more relevance to evolutionary biology and zoogeography than the demonstrations of coincident distributions produced thus far by several authors.

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CONCLUSIONS

Six major conclusions or recommendations seem warranted from this cladistic analysis and revision:

(1). The methods of phylogenetic systematics (sensu Hennig, et al.) are important for studies of Lepidoptera. The power of the method to yield monophyletic groups allows generation of important information for phylogenetics and zoogeography. The sclerotized morphological structures characteristic of the group provide easy access to large samples of many characters and Lepidoptera are often available in suitable series to allow worldwide consideration of taxonomic groups.

(2). Because only monophyletic groups are useful in reconstructing phylogeny and because they can yield useful zoogeographic data, the cladistic method is demanded for Lepidoptera and the resulting classifications based on monophyletic groups should be preferred.

(3). Most presently available classifications of higher categories in the butterflies (if not all Lepidoptera), except for the families (sensu Kristensen, 1976), are probably non-monophyletic.

(4). The numbers of new taxa discovered in this study suggest several serious problems to current lepidopterological methods. Characters other than those of the wing indicate numerous sibling taxa definable by unique apomorphic characters. The existence of these complexes means that perhaps one-third or more of the Neotropical and Himalayan lycaenids may be undescribed. If this is true, then: (a) all previous biogeographical considerations of Lepidoptera should

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be held highly suspect pending phylogenetic analysis; and (b) future studies of zoogeography in the butterflies (whether using a vicariance model, or others) will demand rigorous character analyses and discrimination of relative apomorphy.

(5). Suspected evidence of reproductive compatibility (often inferred by lepidopterists from phenetic suggestion of intergradation or observation of natural or hand-paired hybridization) may comprise a shared plesiomorphy, and is therefore not a sufficient criterion for species (Rosen, 1979). If inferences concerning hybridization are considered more important than apomorphic characters in applying the species category, important zoogeographical information in the coincidence of nested sets of synapomorphies and probable vicariance events may be obscured. The frequent mixing in lepidopteran systematics of measures of divergence (similarity and difference, e.g., phenetic methods) with conjectures as to probability of interbreeding should be completely reconsidered by lepidopterists, and probably abandoned.

(6). If cladograms are available on worldwide groups of Lepidoptera, they should be analyzed according to the vicariance model of biogeography (sensu Croizat, Rosen, Platnick, Nelson; [see below]) to ascertain if patterns of congruence exist. If such occur, the possibilities of vicariance (e.g., evolution in place) versus dispersal should be entertained since the former are approachable in a testable model with subsequent dispersal secondarily evident. These studies should suggest areas of endemism where other organisms can be studied by phylogenetic analysis to discern if a general pattern exists.

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APPENDIX 1

List of outgroup taxa dissected--in order of Eumaeini according to Eliot, 1973 (authors omitted for convenience; identifications as in museums, all AMNH, except those noted as CMNH; both sexes (*), others, sex that of holotype).

Erora laeta, E. quaderna*

Callipsyche behrii*

Fixsenia herzi*

Nordmannia myrtale*

Strymonidia thalia,* S. pruni,* S. thalia, S. eximia, S. oenone, S. w-album.

Satyrium fulginosa,* S. sylvinus,* S. californica,* S. acadica,* S. edwardsii,* S. calanus,* S. caryaevorus,* S. kingi,* S. liparops,* S. tetra,* S. saepium,* S. auretorum*

Chattendenia sp. (CMNH)

Theclopsis eryx, T. curtina, T. caeus

Pseudothecla lunulata,* P. coveri

Tuttiola spini

Superlua sassanides

Neolycaena sinensis*

Chlorostrymon simaethis,* C. telea*

Electrostrymon denarius,* E. sethon,* E. plusio,* E. persius,* E. joya,* E. ragatus,* E. nubilum, E. fernanda,* E. endymion,* E. cyphara, E. angelia,* E. dowi, E. pantoni,* E. boyeri*

Euristrymon ontario,* favonius,* polingi

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Hypostrymon critola,* H. aderces,* H. margaretae*

Ministrymon leda,* M. clytie*

Phaeostrymon alcestis*

Strymon melinus,* S. acis,* S. albata,* S. martiales, S. limenia, S. columella,* S. cazochii, S. cestri, S. thordessa, S. faunalia, S. hygela, S. crossaea, S. rufofusca,* S. cydia, S. davara, S. yojoa, S. daraba,* S. mulucha, S. avalone, S. bebrycia, S. alea, S. panmelinus

Callicista ocellifera

Calycopis poesis,* C. isobeon,* C. bellera, C. brusilla, C. vitruvia, C. fractuna*

Dolymorpha jada

Eupsyche m-album

Panthiades pelion, punctum,* P. nitor,* P. stigmatos, P. ostia, P. thyrea, P. epytus,* P. arindela, P. echelta,* P. rustan, P. polama, P. phoenissa, P. ortygnus, P. fancia,* P. orgia, P. teleuntes, P. selica,* P. hecates, P. thordesa,* P. vibidia, P. hewitsoni, P. battus,* P. titias, P. hebraeus. P. pelion, P. borwas, P. paphlagon, p. ochus

Polyniphes dumenilii

Iaspis agyrtus

Siderus parvinotus*

Arawacus linus*

Theclopsis labena*

Nesiostrymon sp.* (CMNH)

Allosmatia sp.* (CMNH)

Calystryma sp.* (CMNH)

Symbiopsis sp.* (CMNH)

Argus sp.* (CMNH)

Bakeria sp.* (CMNH)

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Ipidecla sp. (CMNH)

Theritas sp. (CMNH)

Mithras sp. (CMNH)

Atlides halesus,* A. sp. (CMNH)

Evenus sp.* (CMNH)

Chalybs sp.* (CMNH), C. sp. (CMNH), C. sp. (CMNH), C. sp. (CMNH)

Thereus sp. (CMNH)

Arcas iuneta,* A. delphia,* A. splendor,* A. jivaro, A. cypria, A. imperialis, A. ducalis

Lamprospilus genius, L. nicetus

Pseudolycaena sp.,* P. sp.* (CMNH), P. sp. (CMNH)

Molus sp.* (CMNH)

Paiwarria (not examined)

Rekoa sp.* (CMNH), R. sp. (CMNH)

Macusia (not examined)

Heterosmatia (not examined)

Brangas sp.* (CMNH), B. sp.* (CMNH)

Theorema sp. (CMNH)

Eumaeus atala*

Eumaea sp. (CMNH)

Eucharia (not examined)

Harkenclenus titus*

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APPENDIX 2

Additions to the glossary of terms referring to genitalic structures of Callophryina (Johnson, 1976a)

Bevel-rimmed: a condition of the margins of rims on the lobed configuration in which the margin is wavy and the rims of consequent varying width as they arc about the transparent area (Fig. 288).

Blunt-ended: a condition of cornuti such that the tips are not pointed or broadly disc-like, but of even width and simply and roundly terminated at the end (Fig. 309).

Broad-based: in the signa, condition of spine being anchored to wider expansive sclerotized base (Fig. 310).

Bulbous: terminus of the valvae becoming wider instead of tapered to a point and having a rounded club-end (Fig. 316).

Capped: coined first by Clench to refer to terminus of valvae with a dark sclerotized covering at tip (Fig. 141).

Cleft: at bilobed juncture with caudal extension a wide indentation between these two configurations (Fig. 120).

Club-ended: cephalad end of aedeagal trough with obvious knob (Fig. 296).

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Convoluted: lamellae with severe invaginations and foldings (Fig. 325).

Cornered: juncture of bilobed configuration to caudal extension with distinct right-angled margin making obvious change of plane in areas where the structures adjoin (Fig. 337, 339).

Cuplike: antrum so large as to make appearance of goblet-like shape sitting atop the ductus (Fig. 322).

Flared: condition of the vinculum cephalad in which caudad the saccus the vincular arc spreads outward against its usual gradual tapering (Fig. 199).

Hemi-elliptical: lamella postvaginalis not hemispherical (gradually rounded), spade-like (rounded then pointed) or hemi-rectangular (square-like), rather widely parabolic caudad lamella antevaginalis and curved at the caudal margin as an ellipse (Fig. 275).

Hemi-rectangular: lamella postvaginalis not of hemispherical or parabolic shape but with margins angled so as to appear rectangular (Figs. 197, 245).

Hooklike: sclerotizations distad on lamellae appearing dark and hook-shaped (Figs. 297, 336).

Horse-shoe: plates on lamella antevaginalis of horse-shoe shape (Fig. 310).

Lobed: condition of lamella postvaginalis being sculptured so as to appear as more than one lobe (Fig. 331).

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Mallet-shaped: lamella postvaginalis hemi-rectangular but extremely so, breadth usually much more than twice width (Fig. 354).

Recurved (caudal extension): a condition of the caudal extension in which between the juncture to the bilobed configuration and the terminus there is a large convex bulge (Fig. 266).

Recurved (lamellae): distad the juncture of lamellae to ductus, shape of lamellae proceeds cephalad, not caudad (Fig. 241).

Sculptured: lamellae or ductus not of smooth plane but with folds and convolutions so severe as to form unique shape for these structures (Figs. 217, 322).

Spade-shaped: a condition of lamella postvaginalis such that its shape cephalad is tapered roundly and then turns outward to a caudal point (Fig. 296).

Spined: cornuti with prominent spines at terminus; usually on blunt-ended configurations (Fig. 309).

Square-angled: bilobed configuration not rounded cephalad but almost hemi-rectangular, with severe angles giving a quadrant-like appearance (Figs. 219, 220).

Square-cornered: vincular spurs hemi-rectangular, not rounded or pointed (Fig. 300).

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Stair-step: caudal extension proceeding in more than one plane, usually a three-step configuration, but sometimes modified to one or two (Figs. 129, 231, 305, etc.).

Tapered: a condition of the valvae caudal extension such that from the point of juncture with the bilobed configuration to the valval terminus the shape of the valvae is in one smooth tapered plane (Figs. 118, 141).

Three-step: in the valvae, the caudal extension proceeding toward the terminus is in three distinct successively narrower planes (Figs. 307, 309).

Triangular: vincular spurs not pointed spikes but tapered broadly to a less severe point (Fig. 313).

Trilobed: lamella postvaginalis sculptured into three distinct lobes (Fig. 331).

Tubular: often used by me to refer to the primitive state of the ductus (Fig. 130)

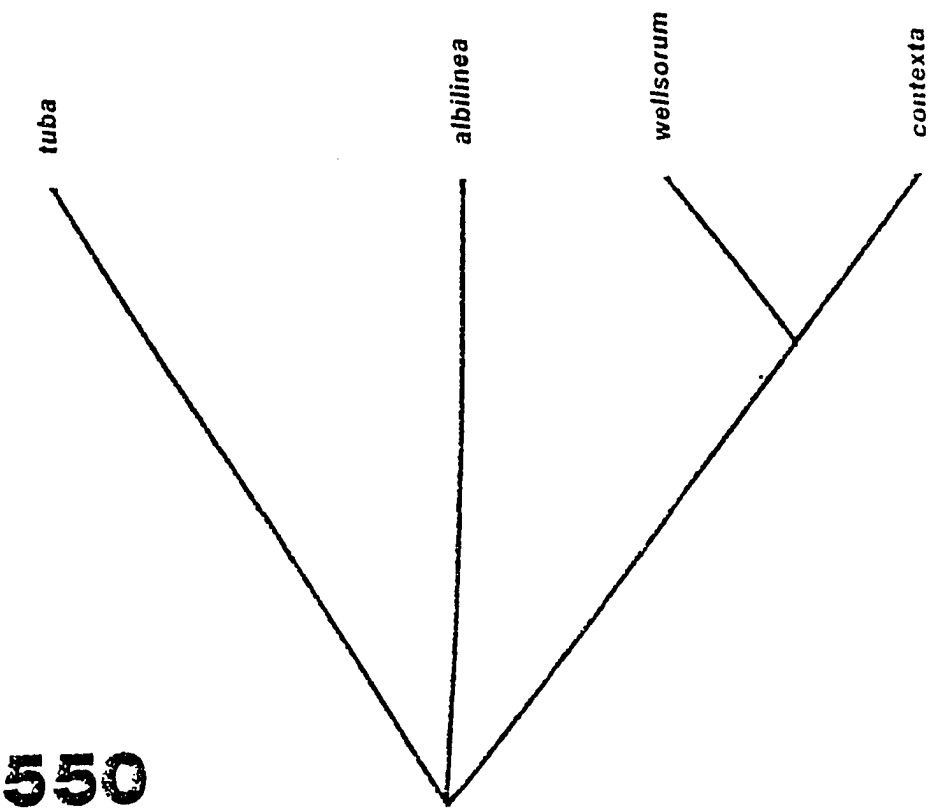
Two-planed: any configuration where the margin is not entire but formed by two contrasting planes as in a chevron or obtuse angle.

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APPENDIX 3

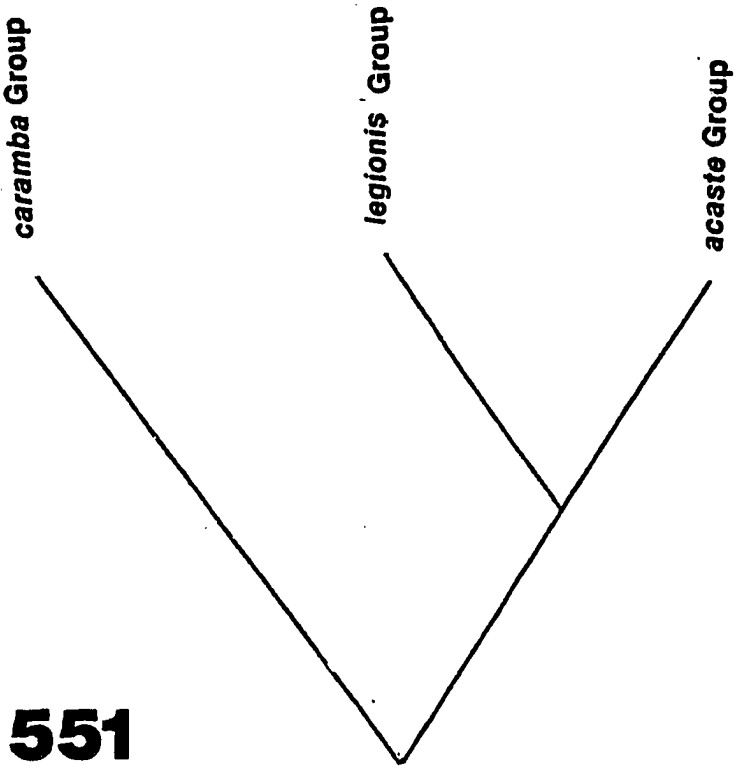
Cladograms of the Genera and Species Groups

Based on Cladistic Analysis of Callophryina presented hitherto (and illustrated as in Figure 1), the following cladograms are judged most parsimonious for the genera and species groups of the infratribe. Consideration of outgroup comparison, internal consistency, and general polarity has particular relationship to arguments already presented (see Cladistic Analysis) or illustrated (see Figure 2).

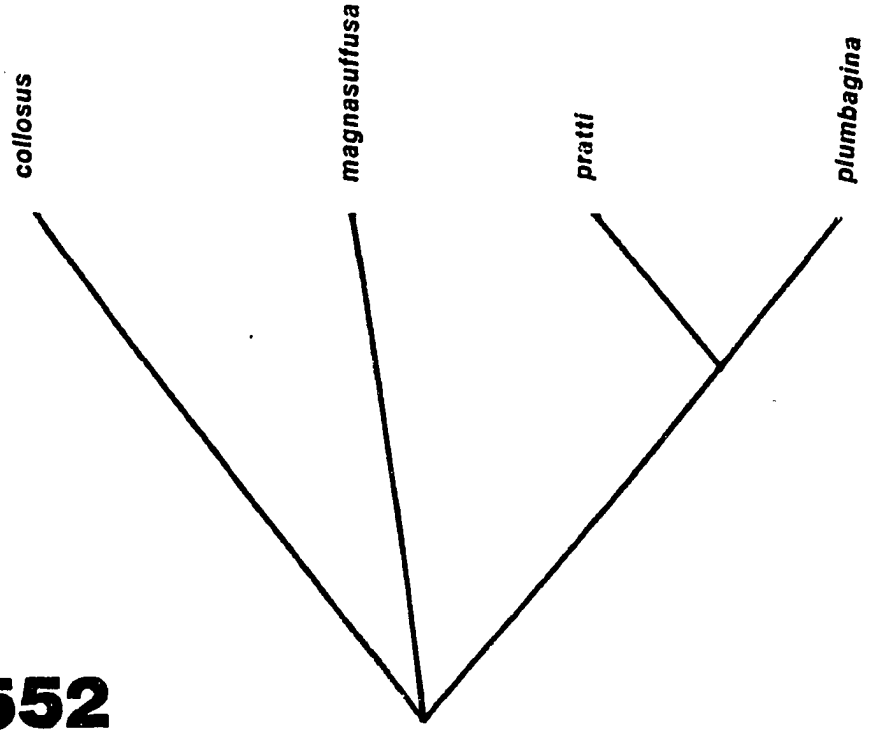


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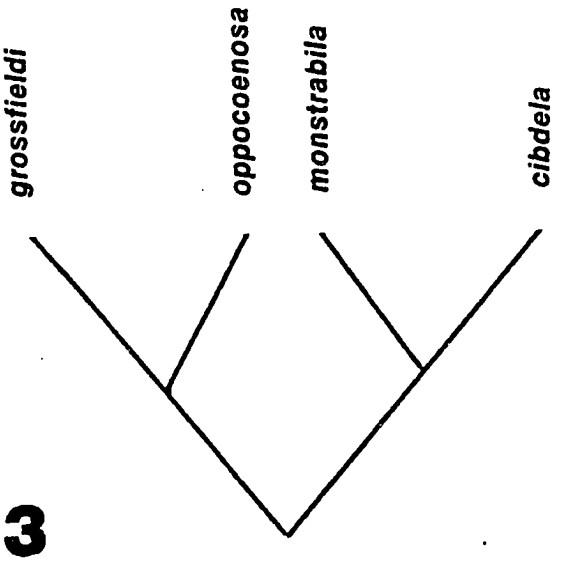


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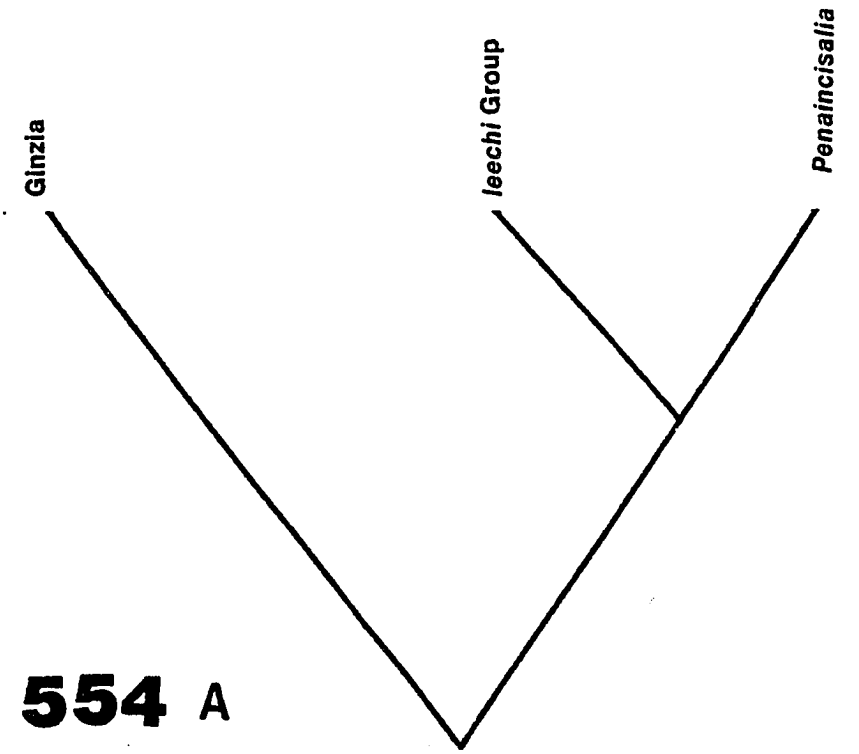


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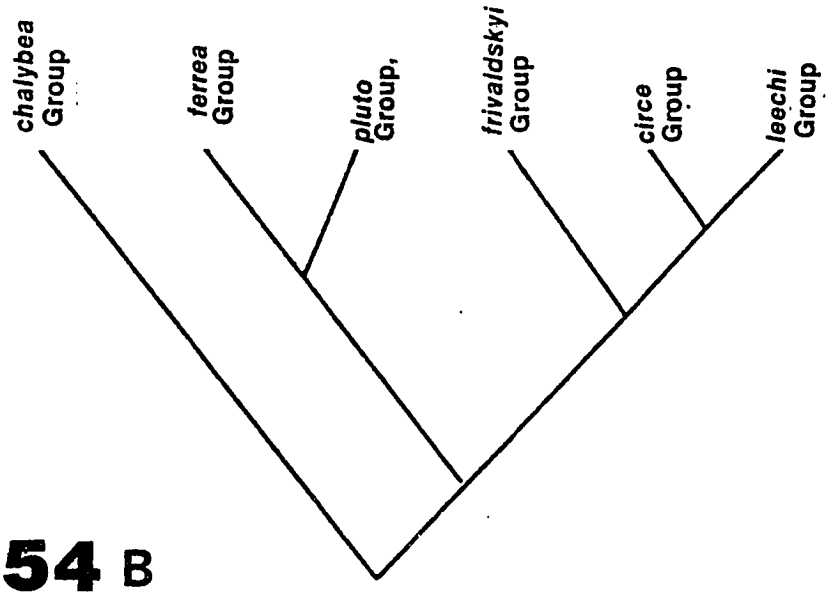


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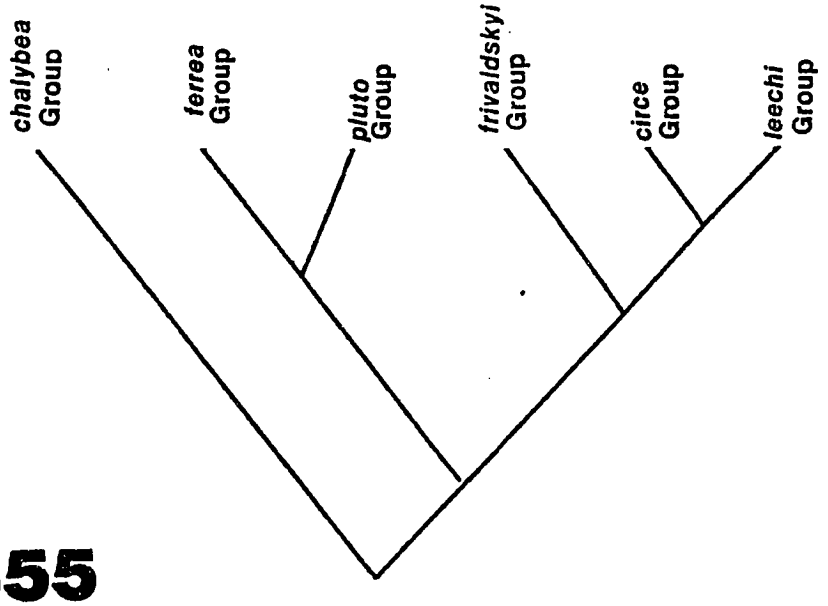


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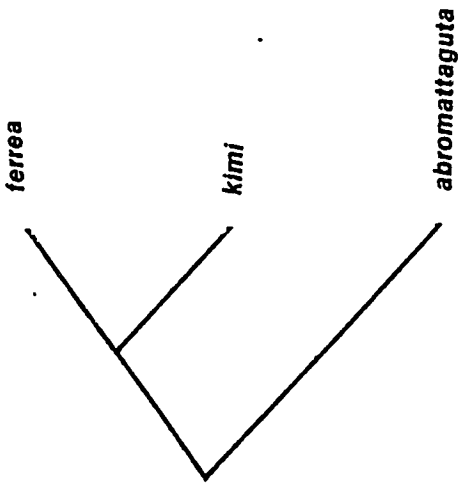


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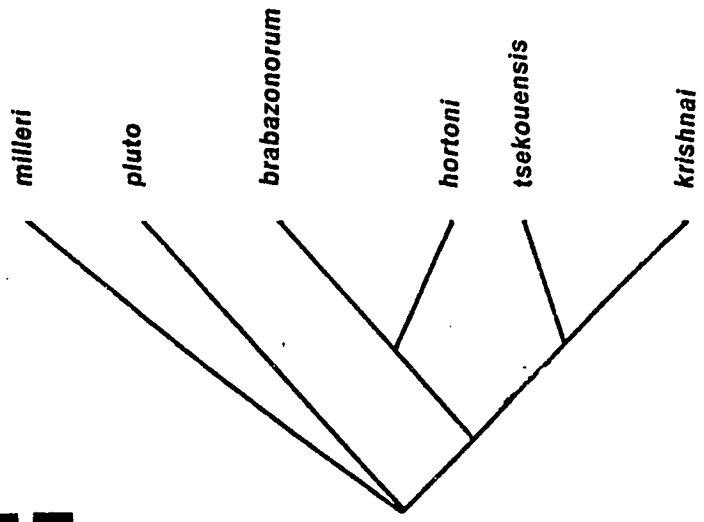


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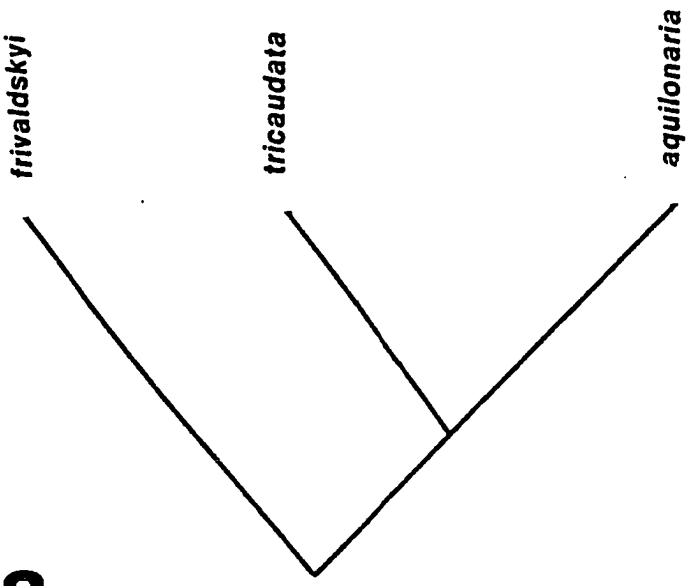


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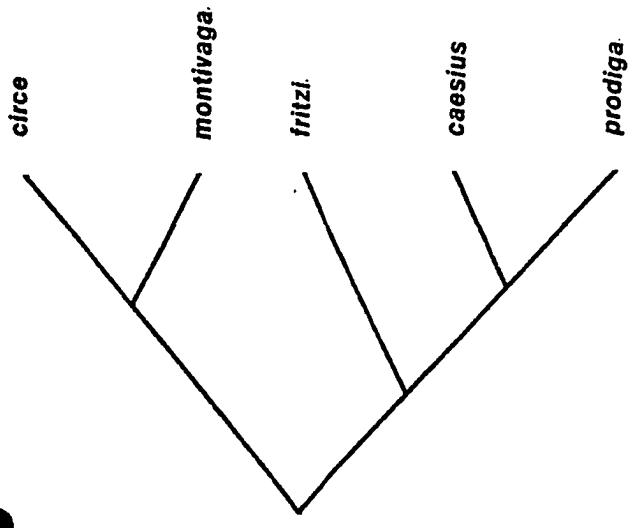


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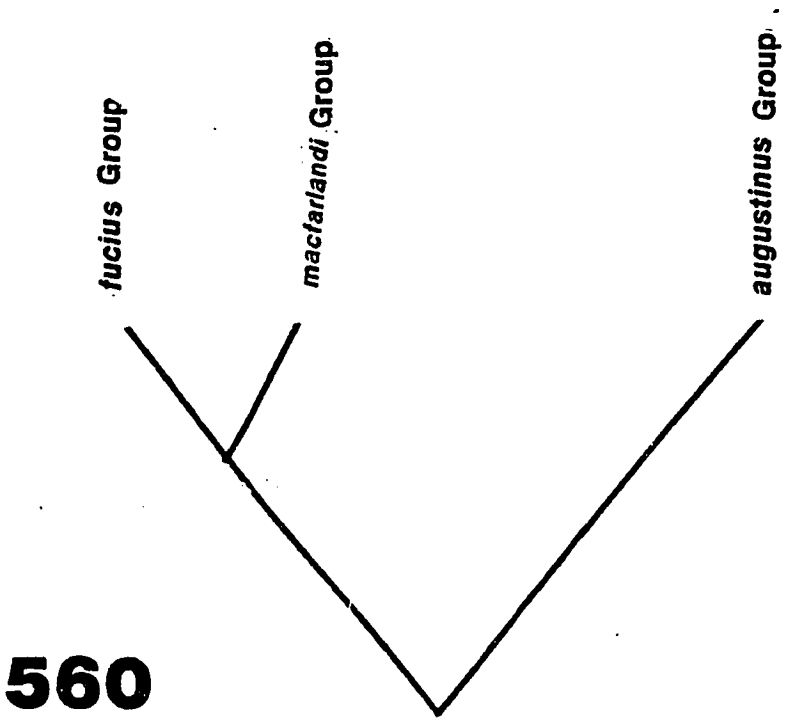


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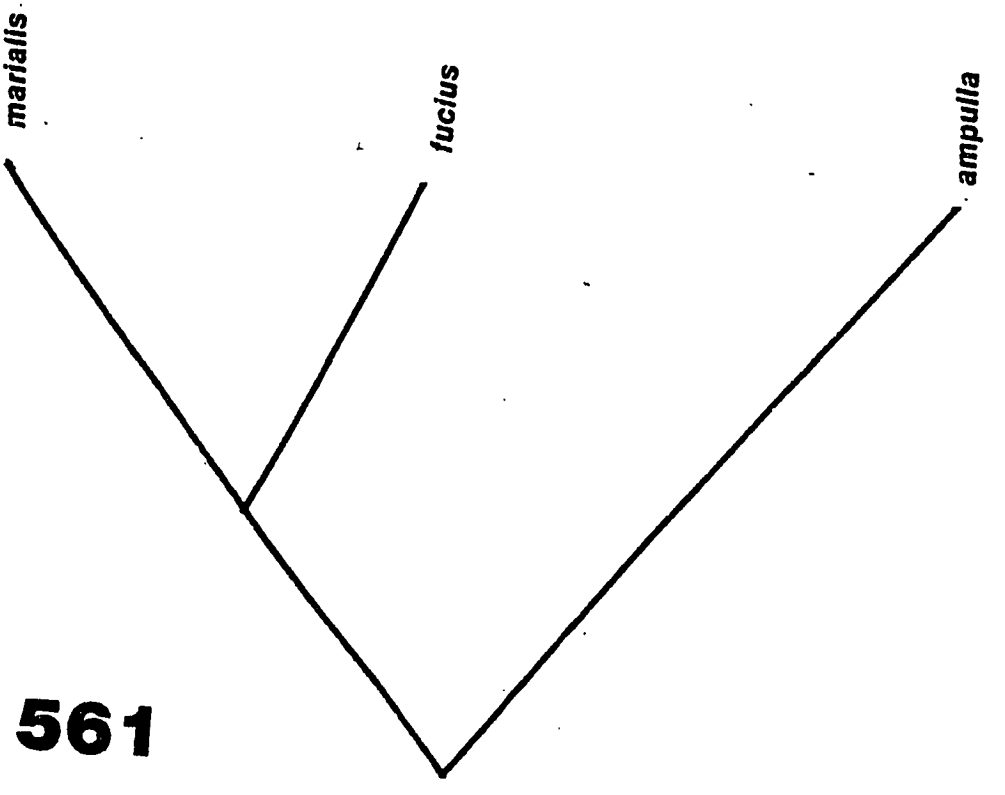


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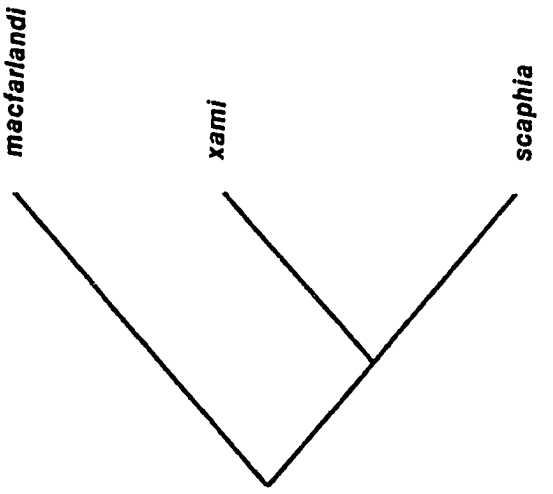


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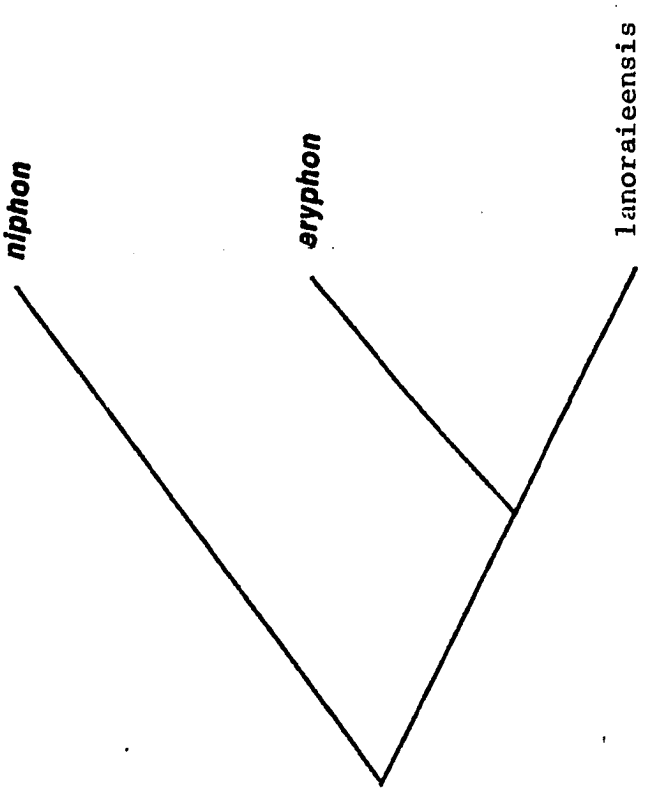


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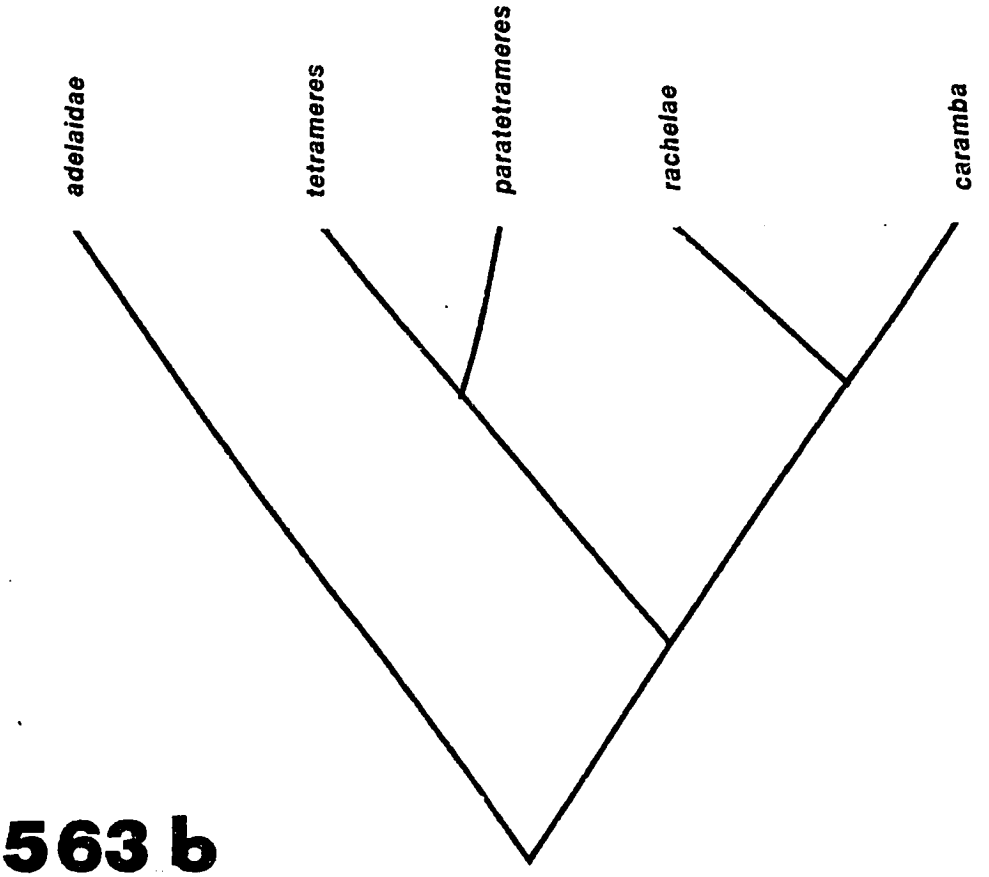


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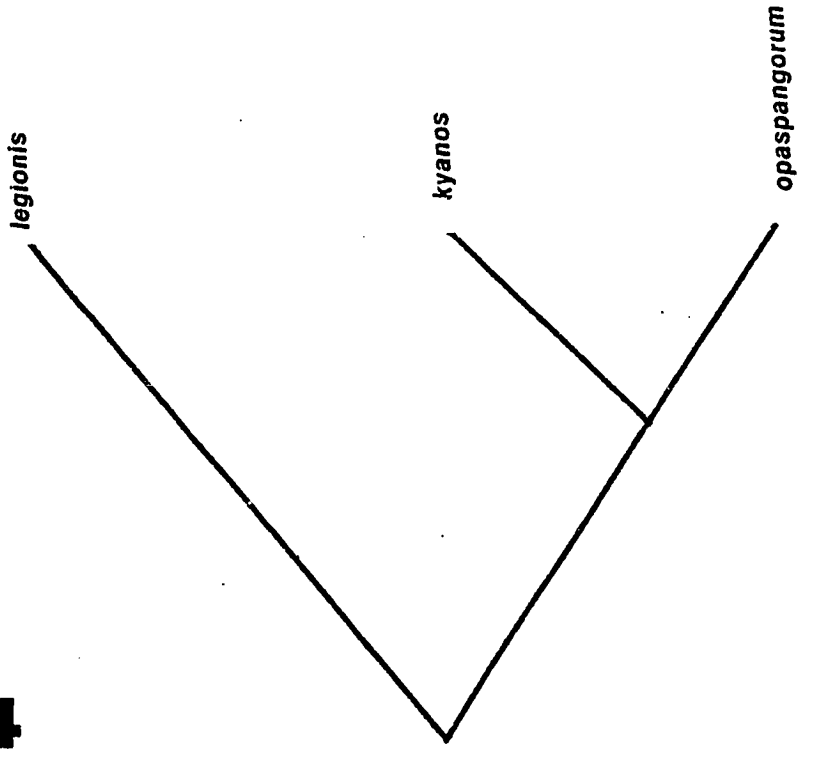


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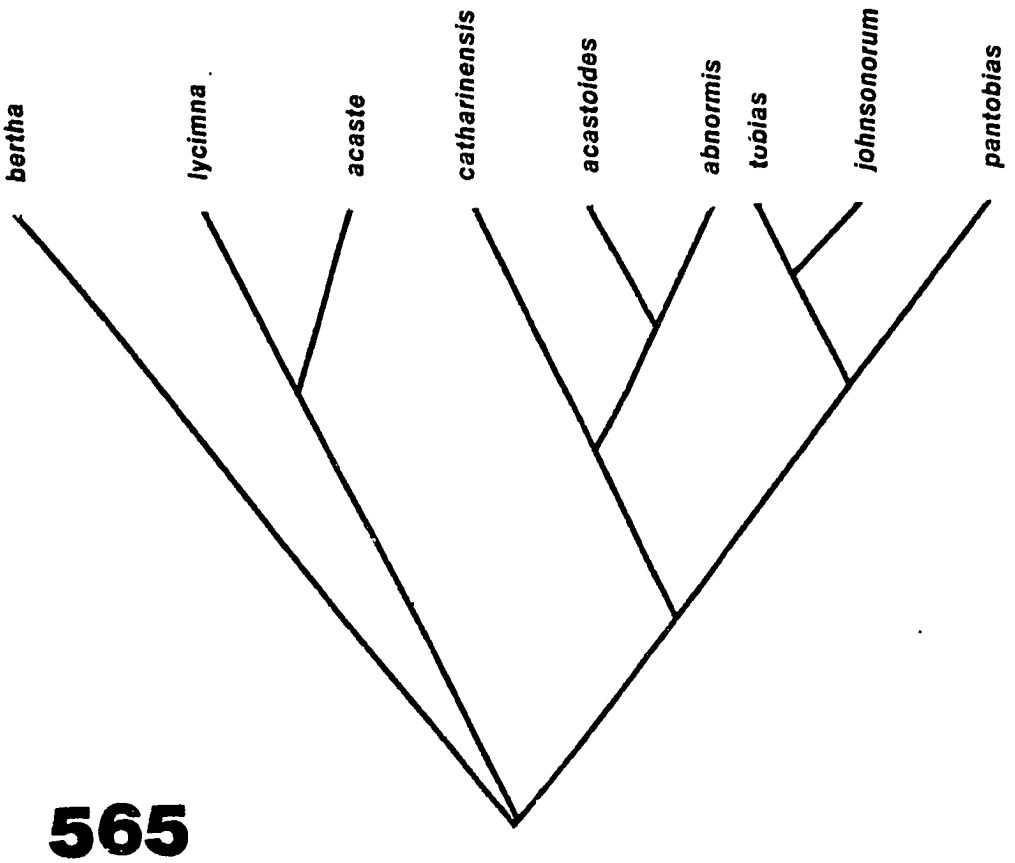


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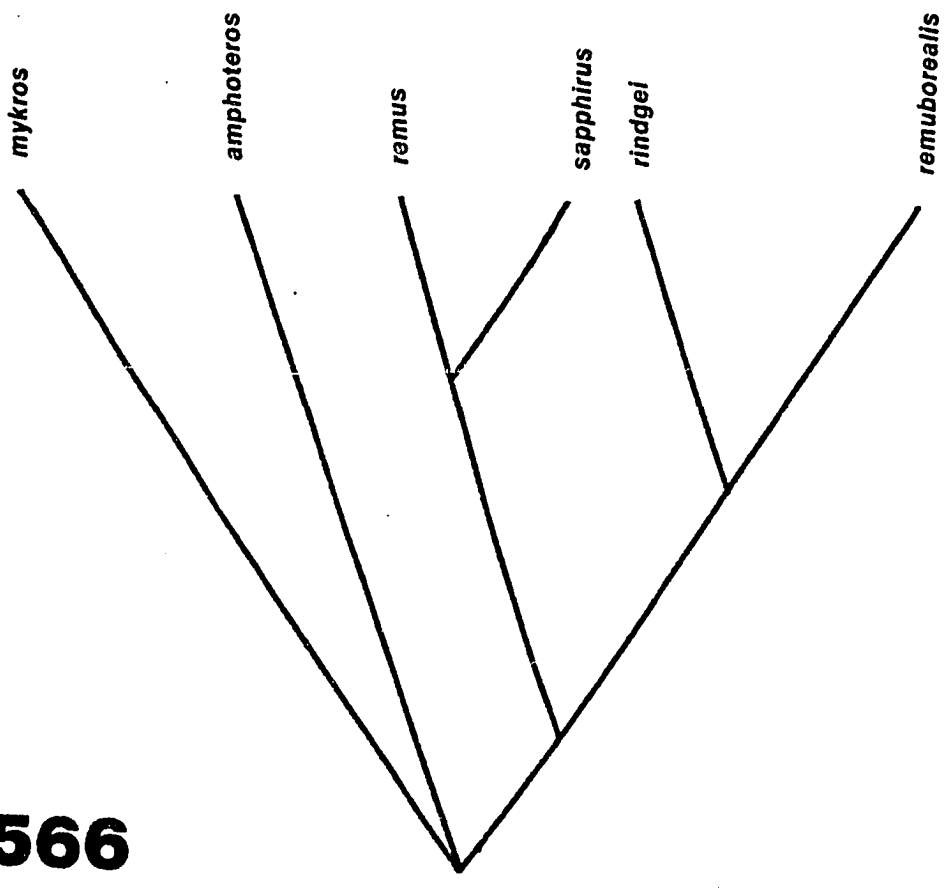


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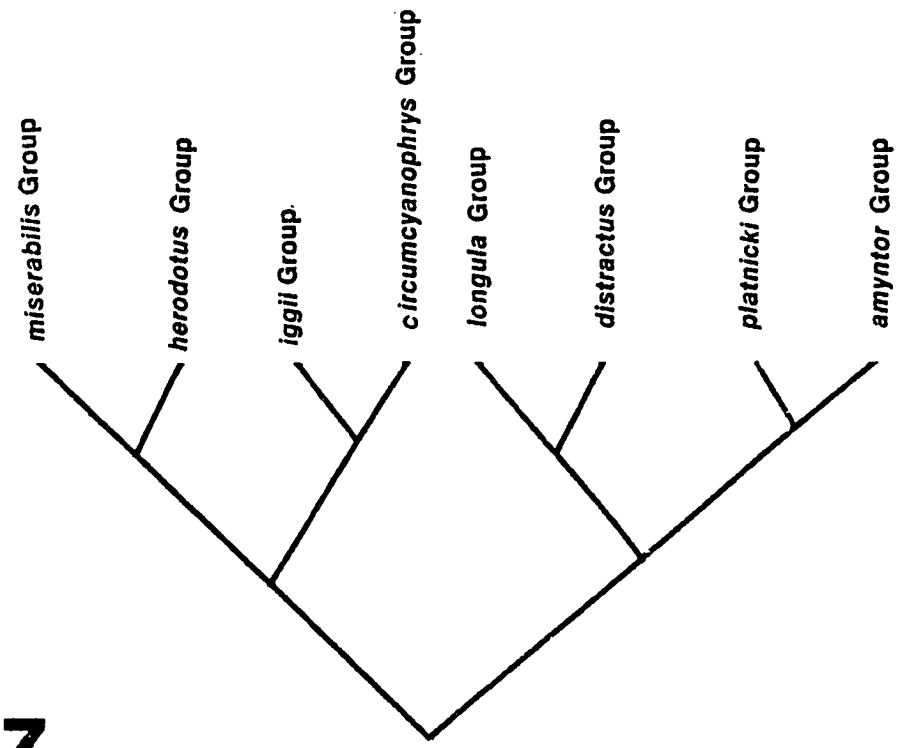


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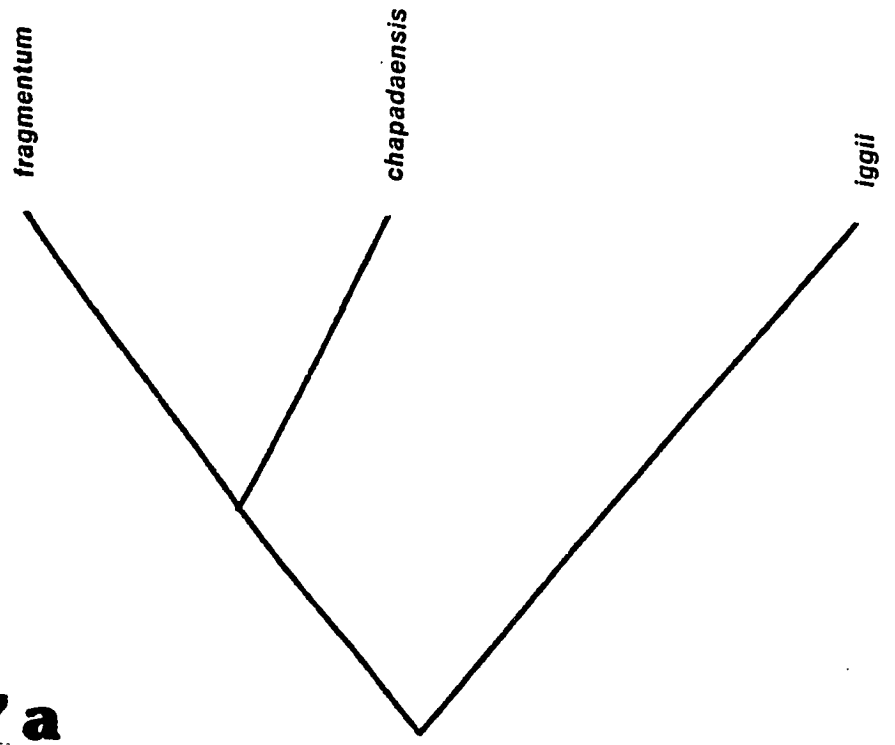


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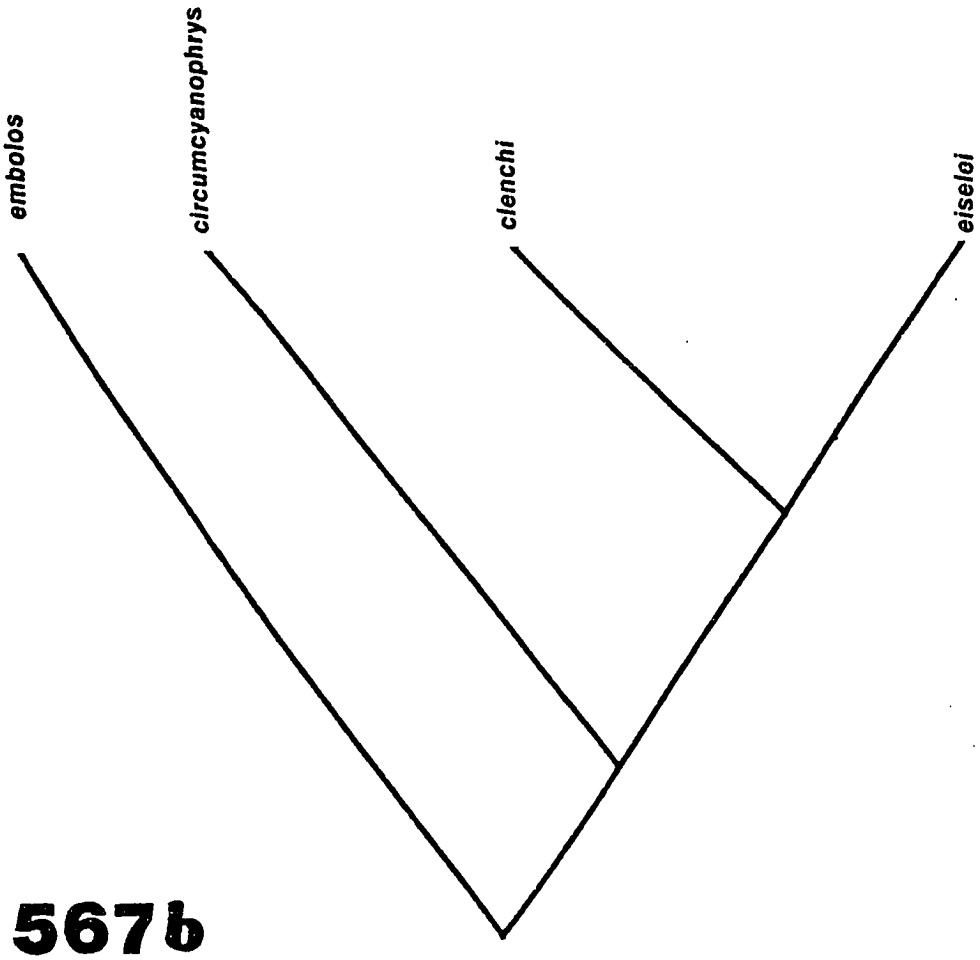


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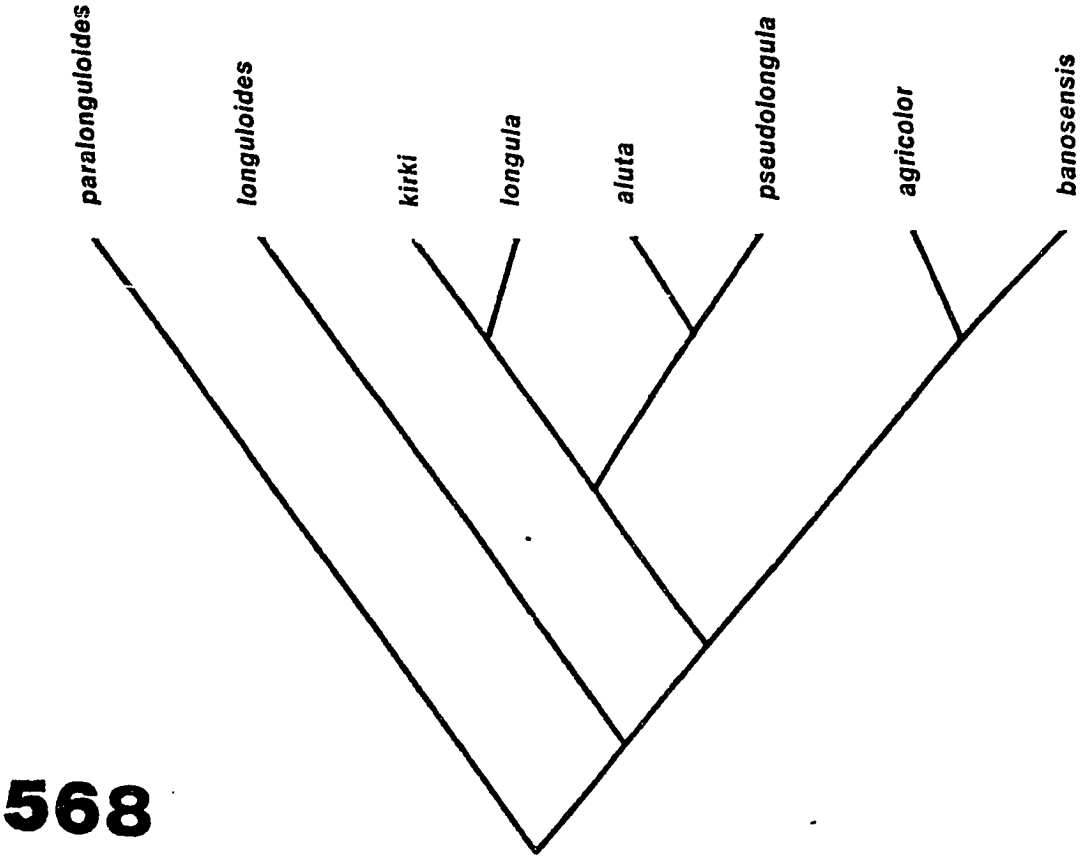


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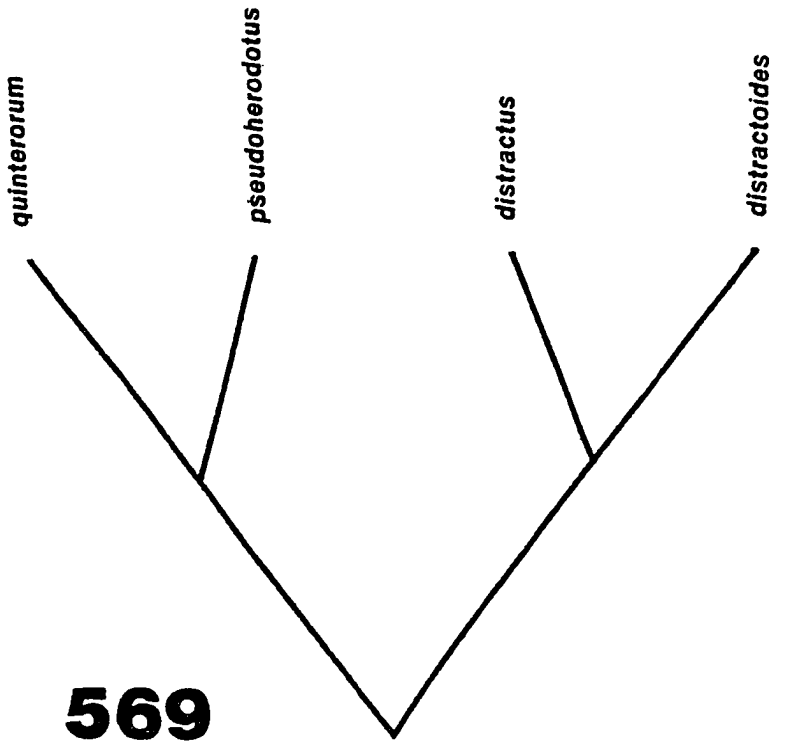


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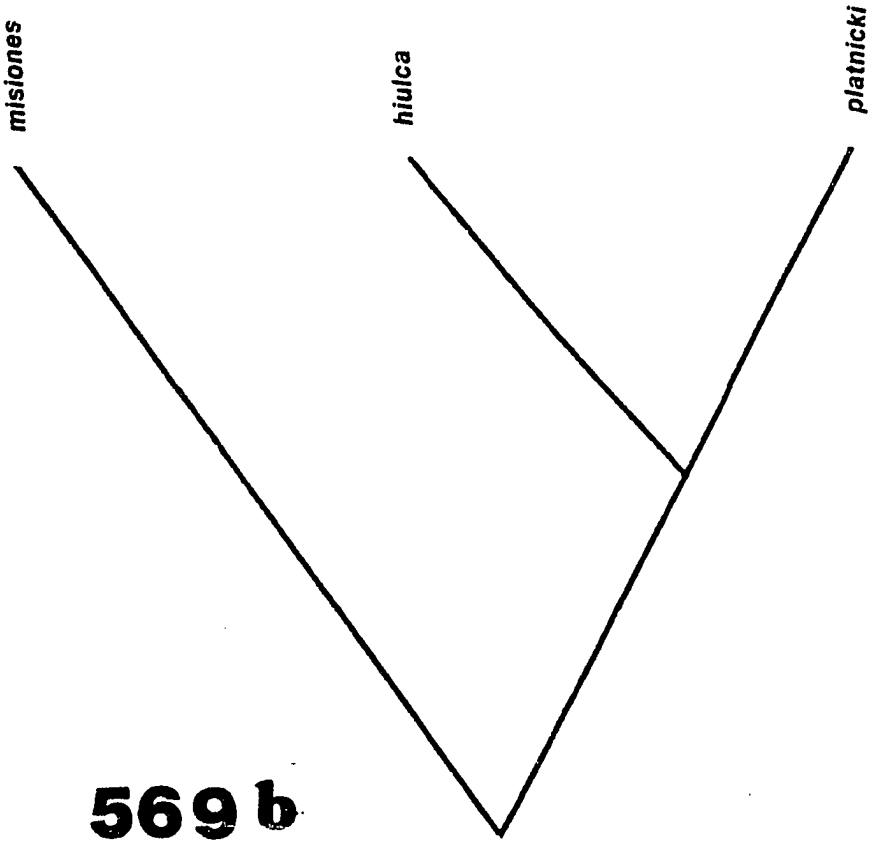


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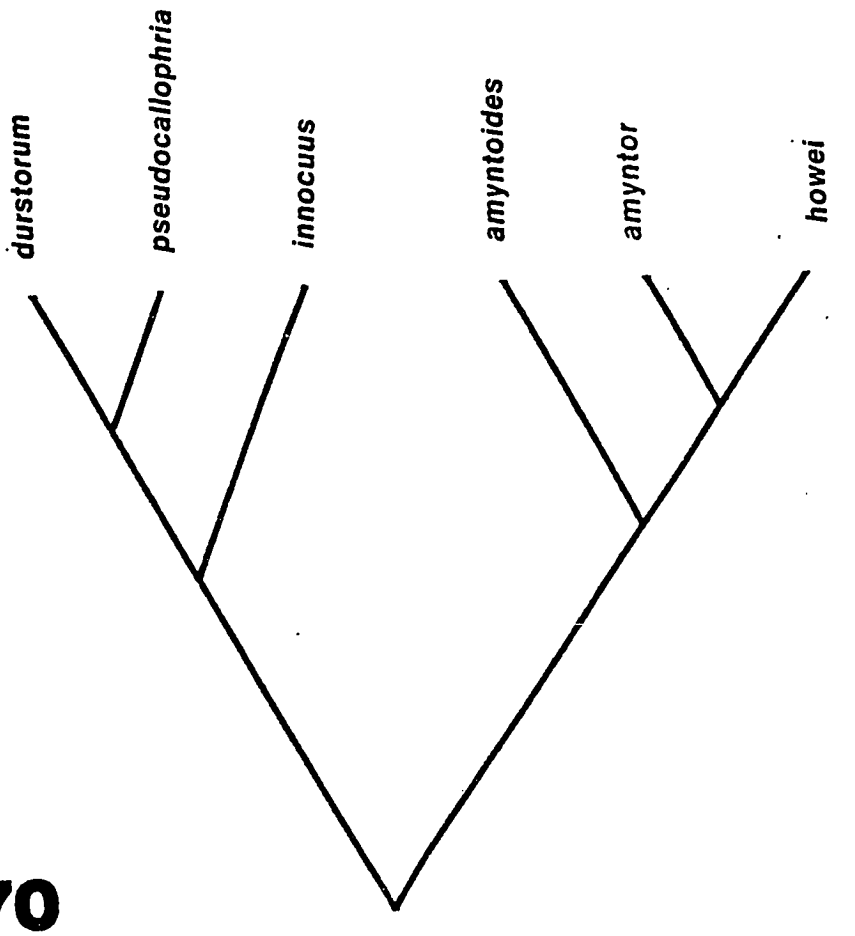


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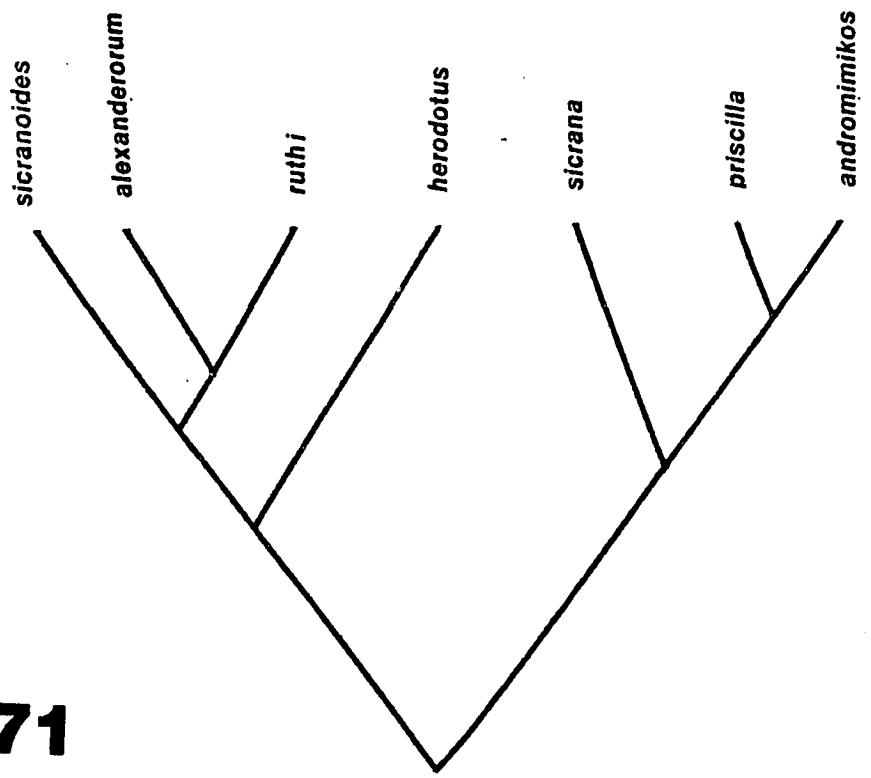


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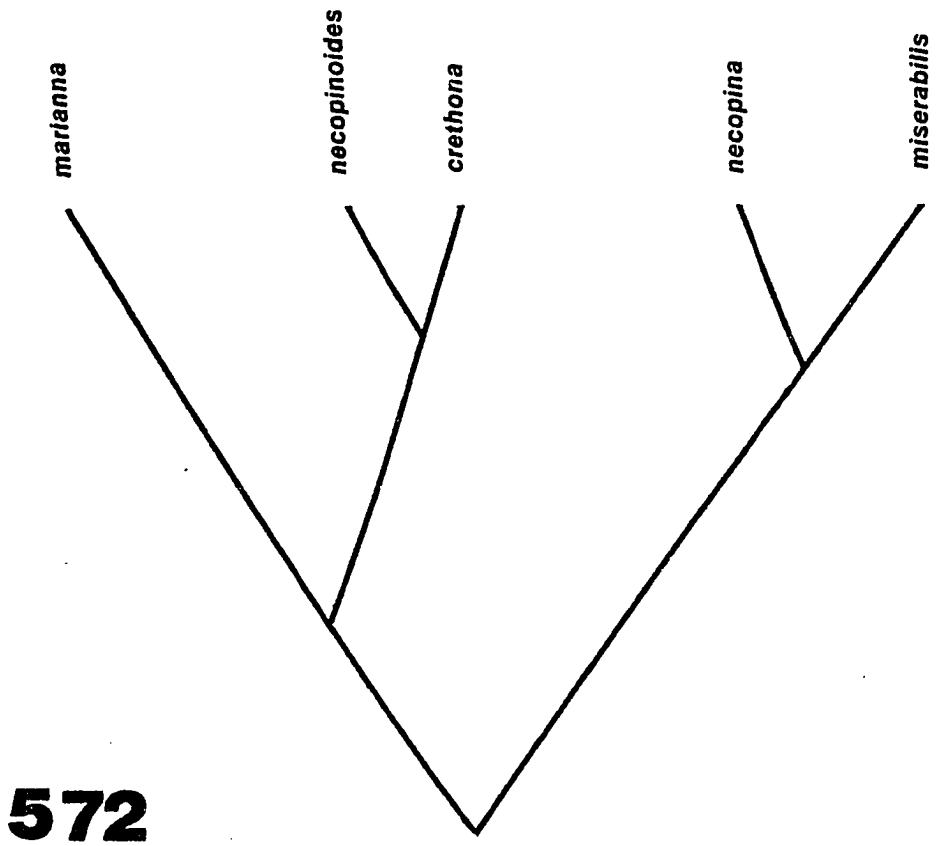


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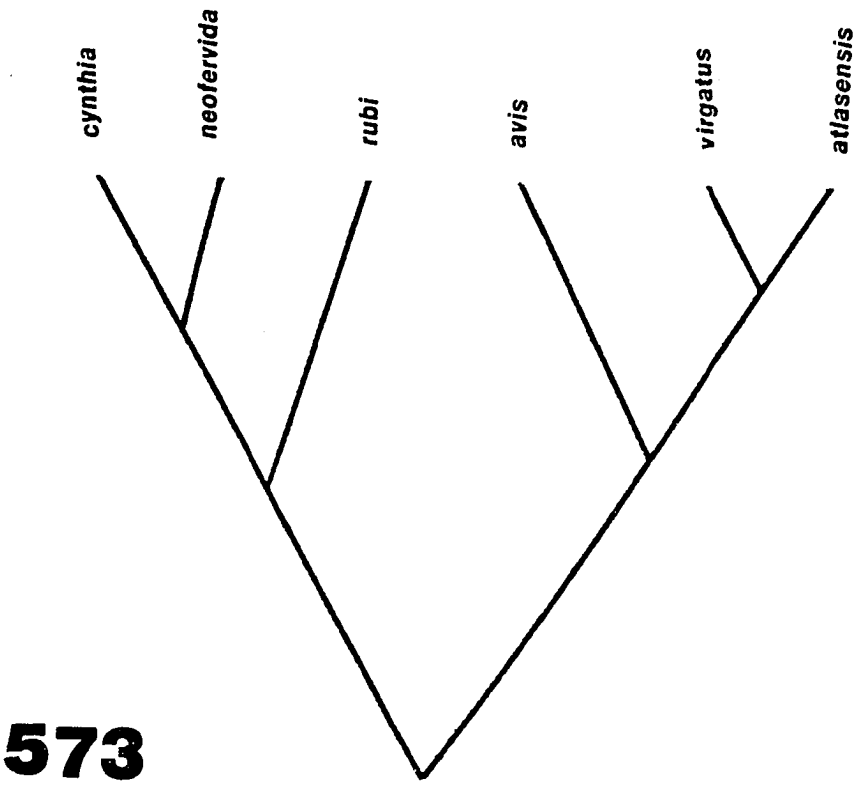


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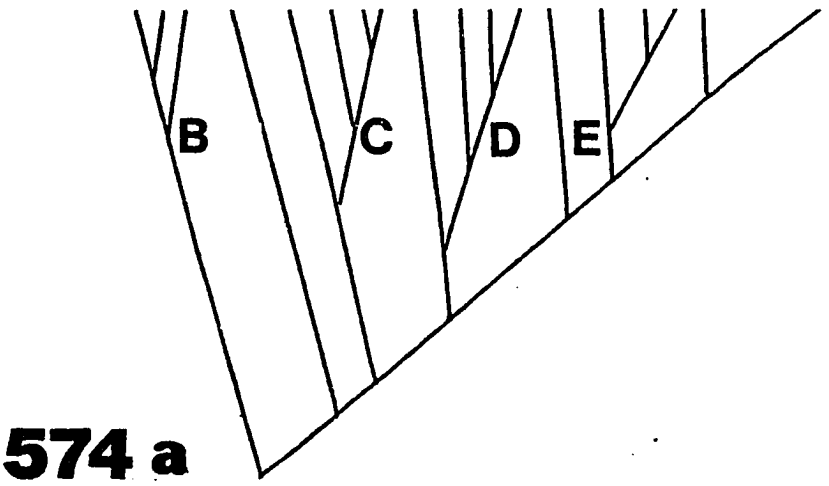


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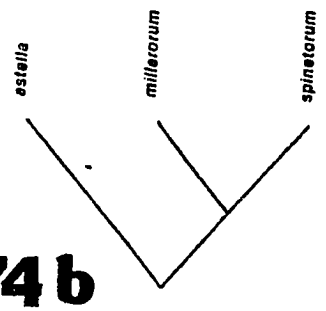


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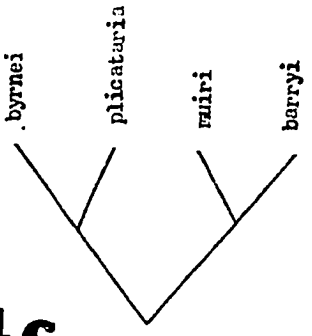
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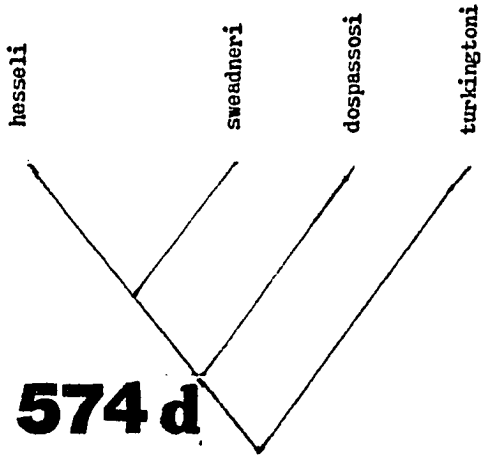
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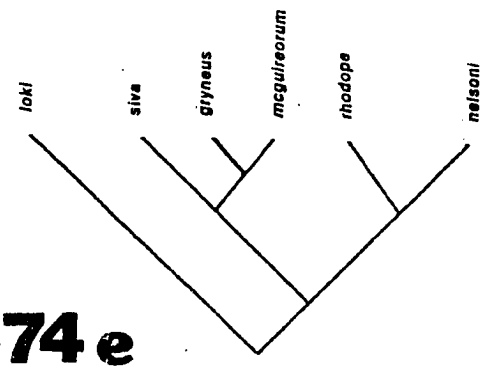
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Figure 550. Cladogram of the genus Cissatsuma. Characters. Monophyly: see Cladistic Analysis. Intragroup Relations--C. wellsorum and contexta as sister taxa with characters assessed as more apomorphic than congeners: sister pair have (1). elongated second palpal segment on both sexes (length circa five to seven times width), judged as apomorph relative to short second segment of congeners (length circa four times width). Polarity corroborated by general transformation series of Callophyrina. Sister pair have (2). ductus narrower than congeners (former with length four times width from lip of lamella antevaginalis distad antrum, latter with width more than twice ductal length and lips not expanded distad) judged as apomorph relative to outgroup taxa and corroborated by general polarities of infratribe.

Figure 551. Cladogram of the genus Incisalia. Characters. Monophyly: see Cladistic Analysis. Intragroup Relations--I. eryphon and niphon as sister taxa with characters assessed as apomorphic relative to congener: sister pair have (1). elongate second segment of palpi on both sexes (length circa five to seven times width) while that of congener is short in both sexes (length circa less than four times width). Polarity corroborated by internal consistency within Callophryina.

Figure 552. Cladogram of the pratti Group, Novosatsuma. Characters. Monophyly: all taxa have characters typical of genus (see Cladistic Analysis)--no structural coloration on wing upper surface; at most with (1). structural color appearing as slight suffusion. Intragroup Relations--N. pratti and plumbagina as sister taxa: (1). structural color appears as patches on upper surface of wing. This is assessed as apomorph relative to immediate outgroup taxa.

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Figure 553. Cladogram of the monstrabilis Group, Novosatsuma. Characters. Monophyly: all taxa have (1). structural color encompassing the entire or at least the majority of wing upper surface. This is assessed as synapomorphic relative to outgroup taxa with structural color only in small patches or in vague suffusion upon the wing. Intragroup Relations--N. grossfieldi and oppocoenosa as sister taxa: (1). upper surface structural color in males is absent broadly along the wing apex. G. monstrabilis and cibdelus as sister taxa: on males (1). bright blue-gray structural color covers the entire wing upper surface except the extreme margin. These assessed as apomorphic characters relative to general polarity of Callophryina and immediate outgroup comparison.

Figure 554. Alternative cladograms for the sister relationship of the leechi Group, Ginzia. Characters. Cladogram A. leechi Group as sister group of Penaincisalia: monophyly with Penaincisalia is supported by these characters if assessed as synapomorphic--(1). Caudal length, valvae, reduced. (2). Genital plate simple in structure: ductus variously narrow and unsculptured, lamellae variously expansive, (requires South American taxa minimally, Asian taxa maximally; character also assessible as synapomorphic with same state in Ginzia, see below). (3). Signa reduced to absent (alternatively assessible as synapomorphic with Ginzia). (4). Saccus reduced with articulation to vinculum thin (requires being not as apparent in Asian taxa). (5). Wings with structural color above, mottled brown-yellow pigmental color beneath, pattern contrasting in basal and postbasal areas (requires exceptions in South America). Cladogram B. leechi Group as sister group of circe Group, Ginzia: monophyly with circe group supported by (1). sclerotized folding of plates ventrad on either lamellae. (2). Signa reduced to small broad-based single-plates ventrad on either lamellae. (2). Signa reduced to small broad-based single-pointed spines. (3). Structural color

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(iridescent blue) over entire wing upper surfaces of males. (4). Caudal length of valvae reduced to less than caudal arch of vinculum ring. (5). Saccus reduced with correspondent narrowing of vinculum caudad. (6). Coloration, hindwing under surface, brown-yellow divided into basal disc and area distad with central mesial extension from disc. (7). Caudal extension of valvae very wide cephalad, then tapering to sharp point. Cladogram B. is accepted as most parsimonious (accepting cladogram A. requires independent derivation of characters of Andean group from outside the Callophryina and an origin of the distributional disjunction more recent than disjunctions of higher groups of the infratribe).

Figure 555. Cladogram of the genus Ginzia. Characters. Monophyly: see Cladistic Analysis. Intragroup Relations--see characterizations of monophyly in individual species groups. Characters are evaluated by outgroup comparison, internal consistency within the genus, and general polarities of Callophryina.

Figure 556. Cladogram of the ferrea Group, Ginzia. Characters. Monophyly: all taxa have (1). female genital plate with ductus moderately narrow (width less than one-fourth breadth of lamellae) and straight. (2). Lamellae hemispherical, lamella antevaginalis rounded and about one-third length of lamella postvaginalis. This is assessed as synapomorphic relative to the genital plate of the immediate outgroup in which the ductus is moderately wide (width one-fourth or more breadth of lamellae). Intragroup Relations--G. kimi and ferrea as sister taxa: taxa exhibit (1). caudal extension of valvae with slope generally continuous from bilobed configuration. This condition is considered apomorph to all taxa of the group (in outgroups juncture of the bilobed configuration with caudal extension is angled). The kimi/ferrea pair also share (2). hindwing with under surface basal disc red-brown suffused black and in which

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there is distinct juncture between basal disc and marginal coloration, sometimes separated by white mesial line. The outgroup has a concolorous condition considered primitive to the above.

Figure 557. Cladogram of the pluto Group, Ginzia. Characters. Monophyly: taxa share (1). under surface of wings with heavy suffusion of red-brown, gray, white, black and bluish judged synapomorphic to outgroup taxa having under surface with patterns lacking heavy over-suffusion of any variously colored scales. Female genital plate of pluto Group taxa with (2). very squarish lamellae. Lamella antevaginalis (when present) is angled squarely distad and (3). junctured to a straight ductus with no tapering. These are assessed as synapomorphic relative to outgroup taxa on which genital plate has lamellae rounded (hemispherical or ellipsoidal) and tapered to ductus. Lamella antevaginalis on these latter is always present and rounded. Intragroup Relations--Monophyly of G. brabazonorum, hortoni, tsekouensis, and krishnai: these share (1). cleft valvae caudad the saccus; (2). bilobed configuration caudad saccus tapered to a point cephalad. These are judged synapomorphic relative to outgroup taxa pluto and milleri which have no cleft and a bilobed configuration rounded or parabolic. G. brabazonorum and hortoni as sister taxa: these have (1). lamella antevaginalis reduced to nearly absent. This is assessed as synapomorphic to outgroup taxa with lamella antevaginalis prominent (usually at least one-fourth the caudal length of the lamella postvaginalis). G. tsekouensis and krishnai as sister taxa: these have (1). coloration on the hindwing under surface dull brown and devoid of bright brown highlights or overcast, assessed as apomorphic to coloration of hindwing in which under surface is bright mottled brown with over-scaling of gray and bluish--occuring in immediate outgroups; (2). ventrally convoluted lamella postvaginalis, assessed as apomorphic to the

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lack of such convolution in other taxa of the species group and corroborated by polarity of this character throughout Callophryina.

Figure 558. Cladogram of the frivaldskyi Group, Ginzia. Characters. Monophyly: taxa share (1). lamellae shaped quite ellipsoidal with ventrad folding or convolutions on lamella postvaginalis generally restricted cephalad. This is assessed as synapomorphic relative to outgroups (e.g., pluto or ferrea groups) with ductus caudad juncture of lamellae not constricted giving ductus straight shape and lamellae appearing square (pluto Group) or hemispherical (ferrea Group). These latter groups have lamella antevaginalis with squared angles, not gently rounded. G. frivaldskyi Group has (2). signa reduced to small single broad-based spines while outgroups listed above have signa as moderately large bifurcate spines, the latter considered primitive. Intragroup Relations--G. frivaldskyi and tricaudata as sister taxa: these have (1). a narrow-rimmed ovate and unindented bilobed configuration with (2). no angled juncture between the bilobed area and the caudal extension. Outgroup taxon aquiloniaria has caudal extension narrower than the bilobed configuration, junctured with a slope or corner. G. aquilonaria as the sister species of taxa in above entry: aquilonaria has (1). structural color over the entire wings of males except the margins while the sister taxa have no structural color except as dull overcast, and (2). rims of the bilobed configuration wide while on sister taxa they are narrow.

Figure 559. Cladogram of the circe Group, Ginzia. Characters. Monophyly: taxa have (1). area caudad juncture of ductus with lamellae constricted, giving very flared appearance cephalad lamellae, latter very ellipsoidal in shape, and (2). lips of lamella antevaginalis rounded, not with square or rectangular angles. These are considered synapomorphic relative to

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the outgroup. Intragroup Relations--G. fritzi, caesius and prodiga as monophyletic group: these taxa share a genital plate typical of the species group but with (1). extreme, often parallel, folding ventrad on lamella postvaginalis. G. caesius and prodiga as sister taxa: these have (1). structural color over the entire wing upper surface on males, less so on females; apparent plesiomorph condition is in fritzi with structural color only in slight patches on females, entirely lacking on males. G. circe and montivaga as sister taxa: sister pair have (1). under surface wing pattern brown-yellow, basically unmottled and confined to dark basal disc with some centrad distal extension into submarginal areas. Wing distad this disc is lighter. Sister species triad has hoary and mottled pattern hued brown and gray.

Figure 560. Cladogram of the Genus Sandia. Characters. Monophyly; see Cladistic Analysis. Intragroup Relations--see characterizations of monophyly in the individual species groups.

Figure 561. Cladogram of the fusius Group, Sandia. Characters. Monophyly: taxa share (1). valvae with narrowing of rims, (2). indentation of saccus basad bilobed configuration and (3). latter nearly separating bilateral lobes basad. These are judged as synapomorphic relative to state of outgroups in which narrowed rims have no indentation at base of bilobed configuration and indentation does not separate the lateral lobes widely. Intragroup Relations--S. fusius and marialis as sister taxa with characters judged apomorph relative to congener ampulla: sister pair share (1). rims of bilobed configuration very wide and (2). juncture with caudal extension much less abruptly tapered caudad.

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Figure 562. Cladogram of the macfarlandi Group, Sandia. Characters. Monophyly: nested sets of characters in successive Sandia species groups seen as proceeding from general generic ground plan (see Cladistic Analysis) as follows: fusius Group with derivation of green frons and green pattern on wing under surfaces, extent of white mesial spots apomorph to outgroup but plesiomorph to general ground plan of sister genus Mesocyanophrys; cornuti of fusius Group from wide-tapered to narrower in more apomorphic states. Relative to above monophyly of macfarlandi Group with augustinus Group determined by (1). configuration of bilobed area parabolic to generally shouldered but with distinct corner to a thick-tapering caudal extension, assessed as apomorphic on general ground plan of genus relative to fusius Group. The macfarlandi and augustinus groups are seen as retaining primitive condition of (1). disclike cornuti (uniquely derived thereafter in some taxa of augustinus Group) (2). roundly "ampulate" configuration of antrum relative to lamella antevaginalis, characteristic of genus, and (3). long single-spined signa, variously bifurcate distad or centrad only. Characters synapomorphic of macfarlandi group seen as derived to (1). full mesial line, under surface, hindwing, assessed as apomorph relative to condition in fusius Group and consistent with polarity of this character in infratribe (some taxa with autapomorphies on this ground plan, see below). Relative to congeners taxa of this group are seen as retaining unsculptured ductus and transparency limited only to area immediately cephalad antrum as primitive characters. Synapomorphies of augustinus Group include: in females (1). transparency within area of juncture between wide antrumal configuration and lamella postvaginalis, and (2). sculpturing of ductus, including transparency cephalad along ductal shaft; in males (3). narrowing or recurvation of caudal extension, and (4). elongation of the palpi in some taxa. Polarity is determined by outgroup comparison and corroboration by general polarity of the charcters in the

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infratribe. Taxa of group are seen as displaying hoary and mottled under surfaces as a primitive character. Intragroup Relations--S. xami and scaphia as the sister species of macfarlandi: based on apparent ground plan of group (see above), former sister pair have (1). tails caudad on hindwing (2). mesial line jagged anad with (3). bright coloration in the limbal area, these assessed as apomorph consistent with outgroup comparison and polarity of these characters throughout the infratribe. Hoary suffusion prominent in under surface limbal are of scaphia taken as autapomorph. Under surface coloration of macfarlandi, along with curved mesial line and terminad markings (see description) taken as autapomorph upon general plan of the group.

Figure 563. Cladogram of the genus Mesocyanophrys. Characters. Monophyly: see Cladistic Analysis. Intragroup Relations--see characterizations of monophyly in individual species groups.

Figure 563b. Cladogram of the caramba Group, Mesocyanophrys. Characters. Monophyly: taxa have (1). markings on under surface of hindwing present as anad white and brown spots, appearing only occasionally costad along mesial area. This is considered synapomorphic to condition of outgroup, but plesiomorph relative to (1). acaste Group with a complete line apparently further derived with various patterns basad on mesial line and supplemental spots, and (2). legionis Group with generally immaculate under surface. Latter is judged as apomorphic, not plesiomorphic to an immaculate under surface precursing spots. Light marginal blotches in the ground color are taken as an apomorph character as are other wing pattern derivations additional to markings on the mesial band. This is corroborated by the genitalic synapomorphies of the species. The caramba Group females also evidence characters of genitalia not present in more

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derived states of Mesocyanophrys but charcteristic of states at the stembase of the sister genus Sandia. Males of the taxon indicated as having the largest array of plesiomorphic characters within the caramba group retain more spatulate and disclike cornuti, a character assessed generally as primitive within Callophryina. The valvae structure is widely parabolic in the bilobed configuration and thickly tapered caudad in the caudal extension. Latter is similar only to characters in the stembase taxa of Sandia, the sister genus. Remaining taxa in the group evidence a valvae configuration apparently derived from the above basic ground plan, but with the bilobed configuration becoming thin and in quadrangular shape in tetrameres and paratetrameres, with an additional apomorphy of a lengthened caudal extension with bulbous ends. Latter taxa have narrowed cornuti, taken as apomorphic throughout Callophryina. The taxon judged as having the most plesiomorph characters (adelaidae) is an exception, indicating plesiomorphy in its wide cornuti. Intragroup Relations--M. rachelae and caramba as the sister group of M. tetrameres and paratetrameres: former two species have (1). lengthened and bulbous-ended valvae and (2). narrow-rimmed bilobed configuration assessed as synapomorphic relative to stembase characters of genus. Latter species pair share (1). quadrangular-shaped bilobed configuration apparently derived from the thicker and parabolic state characteristic of the outgroup taxon adelaidae. All four taxa above have (1). narrow-tapered cornuti. Relative apomorphy of characters of former and latter sister pairs, within entire ground plan of species group, cannot be easily assessed because both pairs have unique apomorphies. M. adelaidae as sister species of the remaining taxa in the group: adelaidae retains primitive characters not present in the other taxa. These are apparently derived from those judged as plesiomorph in the stembase of the sister genus. These indicate adelaidae as a species not assignable in monophyly with the taxa clustered in the tetrad of the previous entry.

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Figure 564. Cladogram of the legionis Group, Mesocyanophrys. Characters. Monophyly: See previous figure entry. The three taxa share (1). reduced to absent markings anad on the hindwing, (2). elongate narrow-tapered cornuti, and (3). mid-to narrowly lobed bilobed configuration (4). tapered in an elongate configuration to the valval terminus and (5). with tapered (not bulbous) ends. Intragroup Relations--M. opaspangorum and kyanos as sister taxa distinctive of M. legionis: relative apomorphy of characters in the three species is not easily assessed. However, opaspangorum and kyanos share the following characters defining them as a sister pair relative to legionis: (1). markings anad along the mesial line, assessed as apomorph to outgroup but plesiomorph to markings of legionis--male genitalia in kyanos and opaspangorum are more similar to each other than to legionis but females of former taxa are unknown. Female genitalia of legionis evidence apparent autapomorphy of smooth hemi-elliptical lamellae with sclerotization distad, but comparison to outgroup or immediate sister taxa not possible because of unknown females.

Figure 565. Cladogram of the acaste Group, Mesocyanophrys. Characters. Monophyly: Taxa share these characters assessed as synapomorphic relative to outgroups: (1). apparent transformation series of gradually increasing ductal length, (2). mesial band present across hindwing under surface gradually derived within group to variously broken or obsolescent, jagged, or complemented by postbasal spots or slashes, (3). submarginal line on under surface of forewing becomes apparent in group. Because of unique characters in a single known specimen, M. bertha cannot be assigned further within the cladogram. Diversity of transformation in structures within many species of the group makes broad generalizations concerning genitalic synapomorphies difficult. Intragroup Relations--M. catharinensis, acastoides, abnormis, tobias, johnsonorum and

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pantobias as apomorph sister group of the rest of the acaste Group: all former taxa have (1). prominent mesial line across under surface of hindwing modified as broken, variously obsolescent, jagged, or variously supplemented by unique autapomorphies of postbasal spots or slashes, or tails. Apparent outgroup taxa acaste and lycimna have complete mesial bands. Character information on latter taxa obscured by apparent plesiomorphy in some characters, resembling stembase taxa of legionis outgroup. M. catharinensis, acastoides and abnormis as a monophyletic group: taxa have (1). bilobed configuration roundly parabolic with (2). juncture to caudal extension distinctly cornered. These are considered derived from the tapered condition of the outgroups and corroborated by general polarity of the Callophryina. Narrowed caudal extension from juncture corner give characteristic shape to valvae of these taxa. Relative length of ductus bursae in taxa cluster remains short, assessed as retention of a primitive condition and consistent with the valuation above. M. tobias, johnsonorum and pantobias as the sister group of M. catharinensis, acastoides and abnormis: former taxa share (1). elongate ductus bursae, judged as most apomorph extremes of apparent transformation series. (2). Wing breadth of distinctly smaller size than congeners and characterized by elongation caudad toward recurved lobe of hindwing. Occurrence in the triad of other wing characters (extreme postbasal patterns and tails) generally considered derived for Callophryina further corroborate above characters as synapomorphic. M. acastoides and abnormis as the sister species of catharinensis: former sister pair have following characters judged as synapomorphic by outgroup comparison and internal consistency: (1). males bilobed configuration with cephalad expanse more than one-third entire length of valvae; (2). caudal extension tapering within same plane from juncture with bilobed configuration; (3). females with antrum as area simply flared from ductus to lamella antevaginalis. M. catharinensis with

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several apparent autapomorphies: (1). females pointed lamella postvaginalis (acastoides and abnormis as hemispherical and hemirectangular, respectively); (2). lamella antevaginalis prominent, nearly as long as lamella postvaginalis (sister pair with lips reduced to slight appearance as lips with minor sclerotizations distad); (3). prominent antrum (sister pair only flared ductus adjoining base of lamellae); (4). males with caudal expanse of bilobed configuration less than one-third entire length of valvae. M. tobias and johnsorum as sister group of M. pantobias: former sister pair with (1). elongate ductus on female genitalia, assessed as synapomorphic relative to apparent transfromation series in group and general polarity for character in Callophryina. C. pantobias male has (1). three-step caudal extension less than one-third entire length of valvae, (2). bilobed configuration less than one-third entire length of valvae, and (3). females with lengthened lamella antevaginalis, all assessable as autopomorphic relative to genus and corroborated by general polarity in Callophryina.

Figure 566. Cladogram of the genus Paracyanophrys. Characters. Monophyly: see Cladistic Analysis. Genus contains six species. In two, mykros and amphoteros, only males are known. Characters of males place these in the genus. With some states generally characterizing apomorphy in Callophryina (thin-tapered cornuti, elongate saccus, flaring of vinculum and unique postbasal spots), mykros and amphoteros are probably immediate sister taxa, but further characters of the sister pair do not allow association with either of the other sister pairs as defined below. Intragroup Relations--P. rindgei and remuborealis as sister taxa with characters apomorphic to P. remus and sapphirus: apparent base ground plan for Paracyanophrys indicates following characters are synapomorphic for the four taxa of this entry relative to outgroups: (1). base of vincular structure and saccal area simple, saccus hardly developed to elongation

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and with wide juncture to the vinculum with little distal flaring. Relative to outgroup taxa in Paracyanophrys cornuti are broader and disclike (remus more so than sapphirus). Female of sapphirus is not known, but female of remus displays several characters typically assessed as plesiomorphic within Callophryina: female with (1). ductus relatively short and wide, (2). flaring to lamellal areas in a simple configuration (less reminiscent of a distinctly sculptured antrum) leading to simple wide lamellal lips with (3). limited transparence beneath the lamellae cephalad, and (4). lobes of lamella postvaginalis vaguely fused with a transparent line centrad. Males with signa large and widely bifurcate. P. rindgei and remuborealis, on other hand, share several apparent synapomorphies relative to remus and sapphirus as a sister pair. These include: females with (1). general derivation of the lamellae to variously sculptured conditions with distinctly sized lamellae and entire configuration caudad an (2). obvious antrum with (3). transparent areas cephalad on the ductus. Ductus is (4). variously elongate and (5). signa are reduced and only vaguely bifurcate. Synapomorphy of amphoteros and mykros with Paracyanophrys based on general tapered configuration of caudal extension relative to bilobed configuration, judged apomorph to outgroup but plesiomorph for genus. Lack of females in above two species makes this placement relatively weak.

Figure 567. Cladogram of the genus Cyanophrys. Characters. see Cladistic Analysis. Monophyly: Intragroup Relations--see stembase characters of individual species groups. Summary: The miserabilis Primary Group as sister group of the longula Primary Group: monophyly of miserabilis Primary Group--taxa have (1). wide disclike cornuti terminad on aedeagus, either both widely disclike, both less widely disclike (one circa one-half former) or each as one of above; (2). All cornuti are serrate edged. (3). Saccus is elongate, length equalling

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at least two times width of vinculum caudad. (4). Bilobed configuration is increasingly ovate, proceding from tearlike shape assessed as relatively primitive to broadly ovate shape taken as derived. Females with apparent transformation toward conditions extreme in miserabilis and herodotus species groups--(5). antrumless juncture between narrow ductus and wide lamellae, (6). lamellae antevaginalis ventrally plated. Exception includes some taxa assessed with other characters primitive and probably precursive to above configuration. (7). Signa with widened base with serrate sclerotizations attaching to bursae. Monophyly of longula Primary Group--taxa have (1). tapered cornuti terminad on aedagus, either broad or narrow-tapered, or combination of these. (2). Cornuti serrate only at the terminus. (3). Saccus short with (4). wide attachment to vinculum basad, saccus usually not exceeding width of vincular area directly above. (5). Caudal extension with apparent transformation series, tapering in primitive state, thereafter characterized by increasing elongation to three-step or slightly recurved conditions. Females with (6). restriction of transparent area cephalad lamellae or antrum to clarity in two distal areas only with a sclerotized line between (some taxa with complete sclerotization and no transparency). (7). Antrum in apparent transformation series from ground plan without noticeable antrum to caudad flaring toward hemispherical lamellae or prominent elliptical antrum with lamella antevaginalis generally diminutive. (8). Signa variously pointed spines mounted directly upon bursae, not sclerotized and dendritic at base. Relations within miserabilis Primary Group--The miserabilis Secondary Group and circumcyanophrys Secondary Group as sister groups: taxa of miserabilis Secondary Group share (1). widely ovate bilobed configuration, narrowed on some taxa in an elongate valvae assessed as relatively more apomorph in apparent transformation series. This condition occurs in combination with (2). antrumless genital plates in females with lamellae characterized

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by broad antevaginalis ventrally plated caudad. (3). Ductus is variously wide to narrow, apparently a transformation series with (4). ductal shapes without noticeable restriction caudad ductus at the transparent area. All these characters are considered synapomorphic relative to outgroup comparison, internal consistency, and general polarity of the infratribe. Taxa of circumcyanophrys Secondary Group share in males (1). cephalad bulbous knob on the aedeagus judged as synapomorphic; (2). teardrop configuration of the valvae bilobed area, taken as precursor to roundly ovate and three-step configurations characteristic of the sister Secondary Group. In females (3). antrumal configuration present only as slight tendency cephalad hemispherical lamellae, latter (4). appear small due to length of ductus and (5). with characteristic constriction cephalad the lamellae. This latter condition supports distinction of this slight antrumal condition from the obvious antrum of the sister Primary Group, a distinction of relationships corroborated by characters of the males. (6). Ventrad area of lamella antevaginalis not sclerotized, some taxa with distad sclerotizations. Relations within the miserabilis Secondary Group--see stembase characters of the species gruops. Relations within the circumcyanophrys Secondary Group--see stembase characters of the species groups.

Relations within the longula Primary Group--The longula Secondary Group and amyntor Secondary Group as sister taxa: longula Secondary Group taxa share (1). generally parabolic and narrow to mid-rimmed bilobed configurations without distinct bevelling distad. This ground plan apparently bifurcates into two transformation series: the longula group with tapered caudal extension and the distractus group with variously elongate three-step conditions. Female genital plate configuration of longula Secondary Group is taken as synapomorphic relative to outgroup and seen as distinct relative to that of sister amyntor Secondary Group. Included are (2). generally widened ductus (judged in its

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stembase ground plan as primitive relative to narrower configurations of more apomorph Cyanophrys in particular and Callophryina in general) and (3). lamellae joined to ductus on generally perpendicular base with ductus at cephalad juncture of lamellae flared elongatedly or alternately with a short antrum when ductus adjoins immediately to base of lamellae. Above configurations, seen in longula and distractus groups respectively, are seen as distinct transformations contrasted to condition in the sister Secondary Group, in which the primitive ground plan is antrumless in one group and discretely elliptical in its sister. Taxa of amyntor secondary group share (1). clearly bevelled bilobed configuration in males and (2). female lamellae with widely spatulate shape in primitive condition (platnicki group) and becoming compacted in apparent transformation series (amyntor group). (3). Antrumal condition in transformation series mentioned above. Autapomorphies in some taxa include sculpturing of the lamellae; this occurs with elliptical antrum characteristic of group and lamellae characteristically in discrete juncture caudad relatively narrow ductus. Conditions are therefore taken as tendencies from the same ground plan. Relations within the longula Secondary Group--see stembase characters of species groups. Relations within the amyntor Secondary Group--see stembase characters of species groups.

Figure 567a. Cladogram of the iggi Group, Cyanophrys. Characters. Monophyly: taxa share (1). elongate saccus and (2). tear-shaped valvae configuration. Saccal shape considered synapomorphic relative to state of saccus former in Cyanophrys Primary Groups, consistent with general polarity of the infratribe. Valvae configuration is assessed synapomorphic relative to former clades of Primary Group and seen as ground plan of eventual derivation to ovate bilobed configuration in herodotus and miserabilis Groups. Only female of chapadaensis is known; apparently autapomorphic are its (1). gradually flared and roundly

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angled juncture between ductus and lamellae and (2). large expanse of lamella antevaginalis relative to lamella postvaginalis. Intragroup Relations--C. chapadaensis and fragmentus as sister taxa: taxa share (1). elongate saccus far in excess of that on outgroup taxon iggii and (2). tear-shaped valvae characterized by elliptical bilobed configuration tapering diminutively caudad to thin caudal extension. These are assessed as synapomorphic relative to thicker and wider saccus of iggii and less gradually sloping caudal extension of latter species making tear-shaped configuration far less extreme. Taxon iggii evidences retention of a character generally assessed as primitive for Callophryina: structural coloration of wing upper surface restricted far basad apical areas on males.

Figure 567b. Cladogram of the circumcyanophrys Group, Cyanophrys. Characters. Monophyly: taxa have (1). cephalad bulbous knob on end of aedeagal trough, unique and synapomorphic for the group, and (2). bilobed configuration vaguely ovate from increasing width relative to caudal extension, taken as further derivation of condition in sister group. Females have (3). signa with slight basad expansion dendritically onto bursae, taken as autapomorphic for group and not synapomorphic with similar condition in species group of sister Secondary Group, viz., general difference in genital plate configuration, and (4). ductus elongate with (5). apparent synapomorphic appearance of sclerotizations distad or ventrad on lamellae postvaginalis. Female of one taxon is unknown. Intragroup Relations--C. embolos as the sister species of remaining taxa of the group: male of embolos is unknown (as noted below, remaining taxa of group show males in apparent transformation series to a fully ovate bilobed configuration). Female genitalia in embolos have these conditions assessed as primitive relative to rest of group: (1). ductus wide, narrowing only caudad transparent

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area, otherwise circa one-third breadth of lamellae; (2). transparent area reduced; (3). signa large and widely bifurcate. Above assessment consistent with general polarities of infratribe. C. circumcyanophrys as sister species of remaining taxa of eiselei and clenchi: eiselei and clenchi share (1). ovate but slightly elliptical bilobed configuration. C. circumcyanophrys has compactly ovate condition in bilobed configuration. C. circumcyanophrys has much less compactly ovate condition in bilobed configuration and thinly tapered caudal extension, these taken as primitive to the former sister pair.

Figure 568. Cladogram of the longula Group, Cyanophrys. Characters. Monophyly: taxa retain some states reminiscent of Paracyanophrys and judged primitive within base ground plan of Cyanophrys. Synapomorphic for the species group: (1). plates on lamellae antevaginalis and (2). sclerotized line in the transparent area of the ductus are assessed as relatively apomorph to the development of transparence in Paracyanophrys. (3). Stembase character of wide-tapered cornuti begin apparent transformation series for longula Primary Group. (4). Variously narrow to mid-rimmed bilobed configurations are apparent transformation series relatively apomorphic to outgroups and representing the tendency in valval derivation characteristic of group and complementing apparent transformation series of bevel rimmed conditions in the sister Secondary group. Relative to sister species group (5). marginal red-gray suffusion of the under surface of the hindwing is considered synapomorphic for taxa of longula group. Intragroup Relations--C. paralonguloides as sister taxon of the remaining taxa of longula Group: all taxa but paralonguloides have these characters assessed as synapomorphic by outgroup comparison and internal consistency: (1). apparent ground plan configuration of male valvae with generally narrow to mid-rimmed in bilobed area and (2). elongation of caudal

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extension increasing with successive derivation of the clade. This is accompanied by (3). adjacent vincular area becoming successively more flared basad (4). with spurs increasing in size along vincular arc caudad and (5). saccus apparently elongated in various parabolic conditions. Females of taxa other than paralonguloides evidence (1). successive diminution of lamella antevaginalis relative to lamella postvaginalis and (2). reduction to loss of ventral plates judged as increasingly apomorphic in a transformation series. C. paralonguloides has (1). mid-rimmed and widely shouldered bilobed configuration and (2). non-flared (3). non-spurred vinculum with (4). thickly parabolic and not extensively developed saccus. (5). Wing under surface pattern is simple vaguely-expressed mesial line of spots with (6). no anal markings (7). reduced blue coloration on the upper surface and (8). no tails. These are assessed as plesiomorph consistent with outgroup comparison and general polarity of the infratribe. Mesial line of variously expressed clear white dots or slashes, various anal markings, gradually mottled patterning in green ground color and mottling in shades of orange and yellow is assessed as extreme for derivation within the group and characteristic in following entries. C. longuloides as sister taxon to remaining taxa of the group: relative to paralonguloides, longuloides has (1). further expression of the spotting pattern on wing under surface, (2). structural color complete but dull (3). caudal extension of male valvae elongate and apparently autapomorphic in three-step pattern (4). vinculum square cephalad and (5). moderately flared, and (6). saccus moderately long. All of these conditions are assessable as more apomorph than in paralonguloides, but plesiomorph to remaining species of the group. C. kirki, longula, pseudolongula and aluta as monophyletic with characters assessed as apomorphic relative to previous entries but plesiomorph to remaining species of the group: males of four taxa have (1). bright structural coloration above (2). mesial line on under surface of hindwing variously expressed

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as distinct white spots or slashes often bordered black or green or brown under surface, mottled distad (3). male valvae with elongate tapered caudal extension (4). elongated saccus, and (6). narrow vincular arc basad. Female with apparent transformation series based on (1). flaring of ductus cephalad to a slight antrum-like condition (2). lamellae with the lamella antevaginalis variously two-thirds to one-fourth expanse of the lamella postvaginalis, and (3). lamellae with variously expressed ventral plates. All of these are considered synapomorphic for the tetrad relative to outgroup comparison, internal consistency, and general corroboration by polarities assessed within Callophryina. C. agricolor and banosensis as apomorph sister group of remaining taxa in the group: taxa pair have (1). under surface of hindwing with mottling expressed in various hues of green, yellow and orange (2). male valvae with caudal extension three-step and/or recurved with (3). enlarged vincular flares and (4). large spurs. Females with (5). lamella antevaginalis reduced (6). ventral plates apparently lost.

Figure 569. Cladogram of the distractus Group, Cyanophrys. Characters. Monophyly: taxa share (1). apparent wide marginal band on upper surface of both wings, distinctive from bright but dark blue ground color. Consistent with assessment of extent of wing structural coloration in Callophryina this is assessed as apomorph to pattern of the longula group but primitive in relation to the thin marginal line and extensive breadth of the structural coloration in more derived Cyanophrys. (2). Genitalia have three-step configuration characteristically elongate and mid-to more wide-rimmed. Consistent with polarity for three-step configurations and elongation throughout Callophryina this is assessed as apomorphic relative to the elongate tapered states of the longula group but plesiomorph to the sculptured, reduced, or recurved condition of the three-step condition as it occurs elsewhere in the genus. These are (3). vincular spurs and

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(4). flares more pronounced than in longula group, these taken as apomorphic consistent with polarity for this character throughout infratribe. Female genitalia have (4). distinct genital plate structure: lamellae diminutive relative to elongate nature of ductus; caudad area of ductus broadly flared. Intragroup Relations--C. quinterorum and pseudoherodotus as the sister group of C. distractus and distractoides: in first taxa pair there is (1). general lack of a clear antrumnal configuration (flaring caudad evident only in quinterorum and pseudoherodotus). In respective males (2). tapered caudal extension becomes elongate (pseudoherodotus and quinterorum) and then slightly recurved in other species. As typical of Callophryina this tapered condition is considered primitive to the three-step configuration but in this case is also relatively apomorph to the stembase characters of the outgroup. C. distractus and distractoides share (1). markedly three-step caudal extension and (2). obvious antrum, with additional sclerotizations and convolutions distad on distractus. Both of the above are considered synapomorphic for this sister pair.

Figure 569b. Cladogram of the platnicki Group, Cyanophrys. Characters. Monophyly: taxa share marked configuration of female genital plate which must be taken as primitive relative to amyntor Group (see below) and as base ground plan not only for derivation characteristic in that group but complementarily in the stembase characters of the sister Secondary Group. Taxa share (1). direct juncture of ductus with lamellae (no antrum or caudad ductal flaring) (2). widely expanded lamellae distad with (3). lamellae simple in structure (not sclerotized distad or with convolutions). Male is known in only one species: characters link it in synapomorphy with this Secondary Group: (1). bilobed configuration mid-rimmed and parabolic and (2). caudal extension thickly tapered. Intragroup Relations--C. hiulca and platnicki as sister taxa: these share (1). bilobed

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structure of lamellae with recognizable lamella antevaginalis and postvaginalis. Caudad structure of genital plate on misiones with indiscriminate flaring of ductus distad lacking distinct lips (see Primary Series Plesiocallophrys) and considered relatively primitive.

Figure 570. Cladogram of the amyntor Group, Cyanophrys. Characters. Monophyly: males of taxa have (1). marginal border narrower than on the outgroup but wider than on species groups assessed as more apomorphic in character (2). bilobed configuration narrow with distad flaring to bevel-rimmed condition, and (3). caudal extension tapered, but slenderly very elongate relative to outgroup. Females have (4). distinct antrum reduced in caudal expanse, making compact configuration with hemispherical lamellae, antevaginalis usually about one-fourth caudal expanse of postvaginalis (5). ductus thin (less than one-fourth lamellal breadth) but (6). short, not exceeding two-times lamellal breadth cephalad transparent area. Autapomorphies of particular taxa make general description of some characters for entire group difficult. Intragroup Relations--C. innocuus, durstorum and pseudocallophria as the sister group of C. amyntoides, amyntor and howei: latter triad taxa have (1). valval configuration with wide bevel rims on bilobed configuration, and (2). caudal extension with caudad elongation of extension tapered in vaguely three-step form. Females have (3). simple hemispherical lamellae caudad small antrum, extended cephalad beyond transparent area of ductus less than one-half breadth of lamellae. Former triad taxa have (1). valval configuration with elongation of shape centered on diminution of bilobed configuration relative to valval caudal extension, and (2). caudal extension of latter tapered or very vaguely three-step but extending at least two-thirds longer than caudal expanse of bilobed expanse itself. Females (3). lack antrumal configuration, instead have simple flaring to

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base of lamellae, and (4). very thin transparent area in ductus relative to sister group. Characters of amyntoides, amyntor and howei are assessed as most apomorphic within the species group and the Secondary Group. Characters of sister triad are taken as apomorph relative to outgroup but plesiomorph for the species and Secondary groups. Above assessments are by outgroup comparison, internal consistency, and general polarity within the Callophryina. C. durstorum and pseudocallophria as the sister group of C. innocuus: former sister taxa have (1). diminutive bilobed configuration relative to caudal expanse of entire valvae. Female of durstorum is unknown but female of pseudocallophria has apparent autapomorphic sculpturing of lamella postvaginalis departing entirely from configuration in innocuus. C. innocuus has (1). diminutive size and (2). immaculate under surface, both taken as autapomorphic. Lamellae are unsculptured and occur without antrum, both assessed as plesiomorphic. C. amyntor and howei as the sister taxa of C. amyntoides: sister taxa have (1). bevel-rimmed bilobed configuration prominent relative to length of valvae caudal extension, being over a third of the total caudal expanse. C. amyntoides has tapered caudal extension from prominent but not bevelled bilobed configuration. Consistent with characters of Callophryina latter is assessed as primitive to former. Sister taxa share also (2). widely hemispherical and unrecurved structure of lamellae, taken as synapomorphic to simpler configuration of amyntoides, consistent with general polarities of Callophryina, outgroup comparison and internal consistency.

Figure 571. Cladogram of the herodotus Group, Cyanophrys. Characters. Monophyly: taxa share (1). marginal black on upper wing surface limited to thin marginal line (2). under surface pattern with mesial line of white spots only, without anal brown of former groups or marginal and submarginal red-gray

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suffusion of miserabilis group (3). widely ovate bilobed configuration on males (4). various three-step configurations of caudal extension. These are judged synapomorphic relative the outgroup. Females of taxa have (5). plates ventrad on lamella antevaginalis (6). ductal width varied from nearly equal to lamellal breadth in taxa judged most primitive to almost two-times lamellal breadth in characters judged more derived, but always flaring gradually cephalad. Ductus not thinly tubular as in apomorph sister group. Intragroup Relations-- C. sicrana, priscilla and andromimikos as sister group remaining species of group: Triad evidences (1). general ground plan of female with ductus short, less than two-times lamellal breadth and (2). valval length in males from apparent short ground plan, barely extending one and one-half caudal expanse of bilobed area. These suggest primitive condition relative to other taxa of the group. Polarity judgment is consistent with transformations of characters in Callophryina in general. Taxa priscilla and andromimikos as a sister pair: these have (1). elongate ductus, considered apomorphic throughout Callophryina. (2). elongation of the caudal extension. Convergence of sexual dimorphism in andromimikos is taken as autapomorphic, consistent with occurrence of this character in the infratribe. Valvae of andromimikos must be considered autapomorph in (1). narrowing of dorsal cornutus. Tapered condition of caudal extension of latter must be taken as primitive, consistent with polarity of this character in the infratribe. Its elongation, however, is assessed as synapomorphic with that in priscilla, the latter which also has a three-step caudal character. Outgroup relation of sister pair with sicrana follows from apparent synapomorphies in the lamella antevaginalis: (1). expanse relative to postvaginalis and (2). structure of the ventral plates. C. herodotus, ruthi, alexanderorum and sicranoides as the sister group of sicrana, priscilla and andromimikos: Former tetrad taxa share general configurations of male and female genitalia based on ground plan

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apparently more apomorph than latter taxa--(1). valvae more elongate (2). genital plate elongate and (3). with diminutive lamella antevaginalis relative to postvaginalis. Within taxa tetrad synapomorphies of ruthi and alexanderorum include (1). generally immaculate under surface pattern on hindwing, judged apomorph consistent with corroboration in characters of the genitalia (2). elongate tapered caudal extension in valvae in transformation series from former species to latter (2). saccus a short funnel relative to outgroup. C. sicranoides is seen as monophyletic with the tetrad, sharing with herodotus the basic ground plan of the group in which sicranoides represents a larger array of more derived states, with above Andean sister group representing successive derivations from the same.

Figure 572. Cladogram of the miserabilis Group, Cyanophrys. Characters. Monophyly: taxa share (1). elongation of tarsus on foreleg (2). terminal red-suffused border on hindwing under surface. These are assessed as synapomorphic relative to conditions in the outgroup, consistent with polarity for extra-mesial patterning in the genus and Callophryina as a whole. (3). Ductus is generally elongate in females, based on apparent ground plan of length at least three-times breadth of lamellae, though usually four or more. (4). Bilobed configuration (parabolic to narrowly parabolic) is elongate relative to caudal extension, former usually constituting less than one third total caudal expanse of valvae. Males of species necopina, consistent with characters in its females, apparently retain condition of the valval bilobed configuration (ovate) relatively primitive for the species group. Intragroup Relations--C. marianna, crethona and necopinoides as sister taxa of necopina and miserabilis. Former taxa triad have (1). female with swollen antrumal configuration cephalad lamellae and caudad transparent area of ductus; (2). males with extremely elongate saccus (3). reduction of cornuti to

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narrow blunt-ended shape and (4). cephalad diminution of bilobed configuration relative to entire shape of valvae, bilobed area equalling only one-fourth of total caudal expanse; (5). both sexes with expansion of terminal red-gray suffusion of hindwing under surface to entire limbal area. Above are assessed as synapomorphic relative to outgroup consistent with general polarity of the infratribe. Males of crethona and necopinoides share (1). diminutive bilobed configuration and (2). extremely long saccus. Male of marianna is unknown. Status of crethona and necopinoides as sister pair based on (1). elongate condition of ductus caudad swollen area, assessed apomorph relative to that on marianna, (2). slight recurved caudad condition of lobes of lamellae and (3). dull blue upper surface structural coloration accented by white marginal line along wing terminus. Upper surface of marianna female is purplish with apical areas of both wings fuscous: latter is taken as primitive condition consistent with this character throughout infratribe. C. miserabilis and necopina as sister taxa is supported by (1). reduced state of red-marginal suffusion terminad on hindwing under surface (limited to patches between the veins or occasionally generally across the outer margin), taken as apomorph relative to herodotus group but primitive relative to other taxa of species group. C. miserabilis and necopina also share (2). elongate and thin ductus in female, but with (3). ductus adjoining flush with lamellae, not swollen in area cephalad. Though female genitalia are nearly identical in these taxa, males differ markedly, with necopina evidently retaining primitive characters of the herodotus sister group including (1). ovate bilobed configuration and (2). sloped three-step caudal extension. In miserabilis the caudal extension is distinctly elongate with bilobed area constituting only about a third of entire caudal length. Caudal extension is broadly elongate three-step: latter is assessed as apomorphic, consistent with this character throughout Callophryina.

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Figure 573. Cladogram of the Palaearctic taxa of genus Callophrys. Characters. Monophyly: see Cladistic Analysis. Intragroup Relations--C. rubi, neofervida and cynthia as sister taxa of avis, virgatus and atlasensis: former triad taxa have (1). green frons (2). variously trilobed sculpturing of female lamella postvaginalis (3). caudal extension with slight corner cephalad juncture with bilobed area, then rounded tapering, first wide, then very narrow (see below). First character above assessed as derived from uncolored primitive state, second as derived from an entire state, third as derived from tapered state (see below)--all consistent with general polarity for infratribe. Latter triad taxa share (1). generally entire lamella postvaginalis, considered primitive state for Palaearctic group, apomorphic relative to the condition of Nearctic congeners (see Cladistic Analysis and text) but with (2). autapomorphic ventral convolutions on lamella postvaginalis (consistent with polarity of this character within infratribe) (3). full mesial line on under surface of hindwing (taken as apomorph to simple mesial spots in Nearctic and sister Palaearctic congeners, consistent with polarity of this character in the infratribe) (4). brown frons, considered derived from uncolored state (see below). C. cynthia and neofervida as a sister pair relative to C. rubi: Former sister pair have (1). recurved caudal extension on male valvae (assessed as synapomorphic relative to outgroup taxon and consistent with polarity of this character in Callophryina) (2). ductus elongate, at least one and one-half times breadth of lamellae (assessed as apomorph to condition in rubi and consistent with polarity of this character in the infratribe). The species neofervida maintains primitive condition of generally entire lamella postvaginalis; cynthia has a relatively apomorphic lobed lamellae and rubi a most autapomorphic fully tri-lobed lamellae structure; cynthia retains primitive partially colored frons. C. virgatus and atlasensis as a sister pair relative to C. avis: former sister pair share (1). lamella postvaginalis vaguely triblobed

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(assessed as apomorphic to entire condition of outgroup taxon and convergent with apomorphy of sister group congeners) (2). caudal extension caudad juncture with bilobed configuration immediately and severly tapered (assessed as derived relative to smoothly tapered condition of outgroup taxon) (3). bilobed configuration long relative to entire caudal length of valvae, bilobe comprising nearly one-half of entire valval length (assessed apomorphic to primitive ground plan above consistent with polarity of this character throughout Callophryina). Taxon virgatus retains uncolored primitive state of frons; ventral convolutions on lamella postvaginalis of avis are seen as autapomorphic, consistent with polarity of this character for infratribe.

Figure 574a. Cladogram of the genus Mitoura and components. Characters. Monophyly: For genus see Caldistic Analysis. Group contains numerous taxa, many very similar in general morphological structure. Cladograms below are accepted by parsimony of all characters previously analyzed within Callophryina. Alternative arrangements are discussed as appropriate. Cupressaceae-utilizing and Loranthaceae-utilizing components (subfigures a, b respectively): see Cladistic Analysis. Synapomorphy of johnsoni Group with remaining Cupressaceae-utilizers (c, d respectively): (1). tawny to rufous pigmental coloration on upper surface of wings (2). narrowing of ductus, especially cephalad juncture of ductus with lamellae (3). constriction of lamellae cephalad lamella antevaginalis, making centrad curved notch in antevaginalis major component of lamellal shape. First character is assessed apomorphic relative to apparent primitive ground plan of non-structural color on upper surface: generally lighter and colored (tawney to yellow) pigment of groups in Mitoura other than spinetorum group is seen as apomorphic to generally dull fuscous pigment of outgroups; second character is assessed apomorphic relative

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to outgroup and is consistent with polarity of this character throughout infratribe; third character above is assessed as synapomorphic of general ground plan for lamellal shape in rest of group. Clustering with Cupressaceae-utilizers is by parsimony of three characters relative to two characters suggesting monophyly with spinetorum group (Loranthaceae-utilization and sclerotization of bilobed configuration). Other similarities with spinetorum Group (general configuration of genital plate and large bifurcate signa in females, disclike cornuti in males) are primitive. Synapomorphy of indented lamellae antevaginalis (see above) may be seen as weak: it could be argued as occurring also in spinetorum; strength of synapomorphy of constriction at juncture of lamellae and ductus might also be seen as weak, making monophagy in Loranthaceae a relatively plesiomorphic condition of johnsoni. Brown pigmental coloration on upper surface (ignoring occurence of lighter shades) might also be considered primitive to the derived structural color of the spinetorum Group, but this argued against by apparent transformation in the Cupressaceae-utilizers. Notched area of saccus caudad bilobed area (in johnsoni and byrnei) can be considered synapomorphic and thereafter lost in taxa of a monophyletic concept including johnsoni with the Cupressaceae-utilizers. Relative position of johnsoni in the cladogram is not entirely important to particular inferences from the diagram: if monophyletic with the spinetorum group or remaining Mitoura, it is still a stembase taxon of relatively primitive character.

Monophyly of dospassosi and loki groups relative to byrnei Group: (1). reduction of signa to single sclerotized point or absence (2). green pigmental coloration on under surface, hindwing, either in entire phene of population or one end of phenetic cline to brown (more inclusive if rhodope is doubted as valid entity) (3). larval foodplant utilization as a Juniperus/Libocedrus subgroup of Cupressaceae, latter considered as apomorph in character to Cupressus/Thuja

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subgroup (more inclusive if barryi is doubted as valid entity or synonymized with siva or nelsoni). Synapomorphies of byrnei group suporting distinction from remaining Cupressaceae-feeders include: (1). irregular lateral configuration of valvae (2). signa as two chevrons or chevron and point (3). tawney to yellow pigmental coloration in discal area, upper surface, limbal area, hindwing (4). utilization of a Cupressus/Thuja subgroup of Cupressaceae. Taxa of byrnei Group, along with nelsoni of the sister group then evidently retain dull brown under surface coloration on the hindwing. M. nelsoni and rhodope in turn retain tendency toward tawny to yellow pigmentation on the wing upper surface. M. nelsoni as included in the loki group must be considered as retaining the largest array of primitive characters within that group and its sister, the dospassosi Group.

Figure 574b. Cladogram of the spinetorum Group, Mitoura. Characters. Monophyly: relations with johnsoni, see previous entry. Taxa share (1). dull blue structural color on wing upper surface (2). fully sclerotized bilobed configuration. These are considered synapomorphic relative to outgroup comparison and are corroborated by general polarity in Callophryina. Group retains certain primitive characters not present in remaining congeners: (1). wide spatulate cornuti in males (see Cladistic Analysis) (2). wide tubular ductus with slight expansion of lamellae distad (see Cladistic Analysis). Intragroup Relations--M. spinetorum and millerorum as sister taxa of estella: taxa pair have (1). limbal area of under surface, hindwing, with prominent marginal black spots in the cell interspaces and moderate to bright blue-gray suffusion and orange coloration about the "Thecla-spot". Latter is taken as a general ground plan apomorphy for genus relative to outgroup (see Cladistic Analysis). As such it is synapomorphic for stembase taxa relative to increasingly derived states in the congeners (see

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below). Apparent primitive states retained by sister pair relative to estella include: (1). wide and tubular ductus (not elongate as in latter) (2). limbal area as in ground plan of genus (autapomorph in estella as below). Autapomorphies of estella include (1). elongation of ductus in females (2). bright red-orange coloration across limbal area and costad of hindwing under surface. Autapomorphies of millerorum include (1). elongation of saccus in males along with (2). extreme distad curviture of the aedeagus cephalad the cornuti (3). postbasal slashes. All autapomorphies are consistent with polarity relative to outgroup and entire Callophryina.

Figure 574c. Cladogram of the byrnei Group, Mitoura. Characters. Monophyly: See characters of component groups of Mitoura, Fig. 574a. Intragroup Relations--M. byrnei and plicataria as sister taxa: taxa have (1). generally narrow-rimmed clear and parabolic bilobed configuration. Clear condition is considered apomorphic relative to outgroup, parabolic configuration assessed as a general ground plan for eventual derivation to wide ovate condition in apomorph sister group (2). utilization of Thuja plicata as larval foodplant assessed as synapomorphic (see Cladistic Analysis). Large spatulate lamellae of byrnei are taken as most primitive condition of a general transformation to distal flaring, proceeding from wide ductal configuration of the outgroup to discrete lamellae shapes within the genus. M. muiri and barryi as sister taxa: taxa share (1). widely ovate bilobed configuration, assessed as autapomorphic consistent with polarity of this character throughout the infratribe. Cupressus utilization by larvae of muiri is taken as autapomorphic. Utilization of Juniperus occidentalis by barryi could represent primitive usage relative to general Juniperus utilization of remaining Mitoura. In such case this would be autapomorphic for the species group. Other possibility is bilobed condition of barryi as

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convergent, and barryi is synonym of M. siva. Elongate palpi in known specimens of barryi are assessed as autapomorph, consistent with polarity of this character in all Callophryina.

Figure 574d. Cladogram of the dospassosi Group, Mitoura. Characters. Monophyly: (1). assumption of a general ground plan for the group, apomorphic relative to condition in outgroup and plesiomorph to that of sister group. Under surface ground color green in the three taxa relatively apomorphic in characters, but all patterns with prominent brown or black terminal spots or blotches in the cell interspaces of the hindwing (condition is considered a primitive continuation of the state evident in the Loranthaceae-feeding outgroup) (2). widely shouldered condition of the bilobed configuration (seen in most primitive state in partially sclerotized condition in turkingtoni, latter taken as retaining this character of the Loranthaceae-feeding outgroup) (3). elongately tapered caudal extension (seen as synapomorphic relative to the outgroups, particularly in its lateral shape) (4). elongate condition of the ductus relative to outgroups and consistent with polarity of this character in the Callophryina in general. Intragroup Relations and Alternative Placement of M. hesseli--M. dospassosi and sweadneri as sister taxa: synapomorphy of these taxa very evident, though association with M. hesseli (preferred by current parsimony of characters) may be weak. M. dospassosi and sweadneri share (1). thinly elongate ductus relative to lamellal breadth, ductus constricting caudad before lamellae (2). broad convolutions ventrad on lamella postvaginalis (3). dull blue structural coloration on upper surface of wings (4). mesial line, entire and distinct jagged anad over a dark green (variously brown ground color) (5). terminal markings in cell interspaces prominent or variously exaggerated (6). single spot-like signa on corpus bursa. These can be assessed as synapomorphic relative to outgroup comparison and

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consistency with polarity of the infratribe. Postbasal spots on under surface of sweadneri are taken as autapomorph. Placement of M. hesseli with the group is dependent on general derived characters of the species group, and interpretation of the unique genital plate of hesseli in relation to character (1). (above) and character (6). (though this does not occur in all populations of hesseli). Also, pattern in under surface limbal area of hesseli can be taken as synapomorphic with that of sweadneri in an apparent transformation series within the species group. Remaining unique characters of hesseli (see description) could be assessed as autapomorph on a general ground plan of the species group. This includes the unique larval foodplant usage of Chamaecyparis. Alternative placement of hesseli: hesseli could be placed as a sister of gryneus/ macguireorum on the basis of superficial resemblances of the wing under surface. This, however, cannot presently outweigh by parsimony character states reviewed above. Genitalia of hesseli markedly depart from those in loki species group. M. turkingtoni included in dospassosi Group based on general derived characters of the group. Autapomorphies of turkingtoni include (1). no male scent patch in discal area of wing upper surface (2). brightly colored limbal area beneath (3). bifurcate cornuti terminad on aedeagus. M. turkingtoni is seen as retaining primitive charcters significant to apparent relationship of stembase Cupressaceae-utilizaers and Loranthaceae utilizers. These include (1). sclerotization of the bilobed area (2). bifurcate cornuti (3). elongate parabolic saccus.

Figure 574e. Cladogram of the loki Group, Mitoura. Characters. Monophyly: (1). assumption of general ground plan for wing characters assessable as relatively apomorph to condition of outgroup. Wing under surface apparently developing from brown to bright green, complementary to transformation series in dospassosi sister group. Limbal area in loki Group with variously

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colored suffusions very apparent, terminad markings in cell interspaces diminutive to absent. In females (2). bursae entirely unsclerotized (3). genital plate on ground plan of short ductal configuration (ductus never more than two-times breadth of lamellae). In males (4). bilobed configuration on ground plan of narrow parabolic shape, differing in extent of indentation cephalad. Intragroup Relations--M. loki as sister taxon of remaining taxa of the group: loki is taken as retaining (1). tendency of dark spots or blotches prominently terminad on hindwing under surface (with ground color ranging from brown to green) (2). simple parabolic and indented configuration of bilobed area. Autapomorph for loki is particular configuration of enlarged mesial spots on hindwing under surface associated with large postbasal spots (assessment consistent with polarity for these characters throughout infratribe). Remaining taxa of the group as monophyletic: taxa share (1). limbal area with suffusion and various colorations prominent, no appearance of terminal markings in all the cell interspaces. This is assessed as synapomorphic to condition in the outgroup. (2). General ground plan of wing pattern seen as dividing into two tendencies--(a). brown with heavy suffusion and reduced limbal or other variously colored markings (b). brown to bright green with discrete markings of various colorations in limbal area (clinal transitions in these characters within species corroborate above assumption). (3). General characters of group relative to loki (see above). M. nelsoni and rhodope as sister taxa of the remaining taxa of the group: females of taxa share generally hemirectangular shape of lamellae with (2). prominent sclerotizations distad. There is (3). prominent development of tawny to yellow patches on upper surface of the wing (may be considered weak). In males (4). widely parabolic bilobed configuration. These characters must be seen as synapomorphic relative to general concept of polarity and character transformation within the group. Further, the species are seen as retaining a number

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of primitive character states of the outgroup. These include brown and/or heavily dark-suffused under surface of wings. Characters of rhodope may be considered convergent and the validity of the taxon doubted. M. siva, gryneus and macguireorum as sister taxa relative to above group: taxa share (1). narrow-rimmed and parabolic bilobed configuration in males differing only in general degree of width and indentation of lobes caudad saccus (2). under surface pattern variously brown to green, with entire or broken mesial band of prominent spots colored basad and distad with or without postbasal spots (3). lamellae in females of hemispherical shape and with antevaginalis comparatively diminutive, taxa differing only in presence of slight sclerotizations distad or sclerotization to eighth sternite. Alternate placement of M. hesseli: see previous entry 574d.

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APPENDIX 4

MATERIAL EXAMINED[23]

PLESIOCALLOPHRYS

P. pseudoargentinensis: BRAZIL. Iguacu, Paraná. PARAGUAY. Asuncion, Santisima, Sapucay, Villaracia.

P. roberti: ARGENTINA. Pichanal, San Pedro.

P. runa: ARGENTINA. Catamarca Province.

MONOPLESIOCALLOPHRYS

M. argentinensis: ARGENTINA. Tucuman, Catamarca.

DIPLESIOCALLOPHRYS

D. paranensis: BRAZIL. Caviuna.

D. maccourtorum: ARGENTINA. Pichanal, San Pedro.

PLESIOCYANOPHRYS

P. goodsoni: COSTA RICA. Irazu. GUATEMALA. HONDURAS. Tegucigalpa. MEXICO. Chichen Itza, Hidalgo. San Luis Potosi, Tapalapa; Yucatan; Atoyac, Veracruz; Catemaco, Vera Cruz, Piste,

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[23]Localities are listed exactly as on labels. Genitalia, legs or palpi studied are variously summarized as total numbers (or some according to localities) within the text of the revision. Because of variance in time and publication of studies on the Mitoura (Johnson, 1976a) versus taxa of this work (including that all available specimens of most Neotropical and eastern Palaearctic groups were dissected) special notation of dissections of Nearctic taxa by locality are not noted here; rather, these lists are on file at the AMNH.

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Yucatan. UNITED STATES. ARIZONA; NEW MEXICO: Pharr, Santa Ana Refuge.

P. brazilensis: BRAZIL. Rio Pardo.

P. lamellalatus: COLOMBIA. Casabe, Hacienda Garcia. ECUADOR. Bahaheye Province, La Chima, Los Rios, Rio de las Juntas. PERU.

CISSATSUMA

C. tuba: CHINA. Tzeku.

C. albilinea: CHINA. Chauloo, Frontier Tibet, Hong Kong, Tatsienlu, Tzeku, Weisi, Wushi.

C. wellsorum: CHINA. Bahand, Ta-Ho, Tatsienlu, Tienshui.

C. contexta: CHINA. Bahand.

CISINCISALIA

C. guatemalena: GUATEMALA. Balen, Municipio San Cristobal, Verapaz.

INCISALIA

I. niphon: CANADA. ALBERTA: Banff, Calgary, Edmonton, Ft. Chippengmum. MANITOBA: Big White Shell Lake, Brokenhead, Red Rock Lake, Riding Mts., Sandylands Prov. Forest. NEWFOUNDLAND. ONTARIO: Constance Bay, Geraldton, Naking. UNITED STATES. ARKANSAS: Faulkner Co. Unknown: Lake Wedington Park. CONNECTICUT: Hartford Co.: Avon, Avon Old Farms. Tolland Co.: Mansfield. Windham Co.: Putnam. DIST. OF COLUMBIA: Potomac Valley, Washington. GEORGIA: Chatham Co.: Wilmington. MAINE: Penobscot Co.: Lincoln, Passadumkeag.

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MASSACHUSETTS: Barnstable Co.: Barnstable. Plymouth Co.: Plymouth. Suffolk Co.: Stoneham. Worcester Co.: Milford, Winchendon. MIGHIGAN: Cheboygan Co. Crawford Co. Luzerne. MISSISSIPPI: Hinds Co.: Cayuga, Clinton, Raymond. Webster Co.: Cumberland. MISSOURI: Franklin Co. NEW HAMPSHIRE: Belnap Co.: Laconia. Grafton Co.: Franconia, Lebanon, West Canaan. Sullivan Co.: Claremont. Unknown: Benton Glencliffe, Reservoir Rd., Surprise Mt., White Mountains. NEW JERSEY: Burlington Co. Middlesex Co.: Jamesburg. Ocean Co.: Lakehurst. NEW YORK: Albany Co.: Albany. Essex Co.: Deene Valley. Fulton Co.: Johnstown. New York Co.: Central Park, New York. Richmond Co.: Staten Island. Suffolk Co.: Coram, Wyandanch, Yaphank. Tompkins Co.: Ithaca. Unknown: Wolfhill, el. 1600. NORTH CAROLINA: Polk Co.: Tryon. PENNSYLVANIA: County unknown: Arcola. VERMONT: Bennington Co.: Mt. Equinox. Lamoille Co.: Stowe. Unknown: Craftsbury. VIRGINIA: Fairfax Co.: Rocky Run. Frederick Co.: Hayfield. Unknown: Difficult Run. WEST VIRGINIA: Unknown: Bloomcru, Ice Mountain.

I. eryphon: CANADA. BRITISH COLUMBIA: Beaverfoot Range. Goldstream, Kaslo, Kelowna, Michel, Nelson, Robson, Wellington. NEW BRUNSWICK: Edmundston. QUEBEC: Fallen Leaf Lodge. McGill. UNITED STATES. ARIZONA: Apache Co.: Alpine, Meadows. Cochise Co.: Chiricahua Mts., Ramsay Canyon. Coconino Co.: Flagstaff. Gila Co.: Globe, White Mt. Graham Co.: Graham Mt. Pima Co.: Mud Springs, Santa Rita Mts. Yavapai Co.: Prescott. Unknown: Hilton, Laeta, Madera Canyon, Rustin Peak, Shannon, Stewart Camp. CALIFORNIA: Madera Co.: Bass Lake. Mendocino

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Co.: Mendocino. Modoc Co.: Warner Mountains, Willow Ranch. Mono Co.: Mono Creek. Nevada Co.: Truckee. Placer Co.: Cisco, Lake Tahoe. Plumas Co. San Bernardino Co.: Barton Flats San Bernardino. San Diego Co.: San Diego. San Francisco Co.: San Francisco. Shasta Co.: Viol, Shasta. Siskiyou Co.: Weed. Sonoma Co. Tulare Co.: Mineral King, Monachee Meadows. Tuolumne Co. Unknown: Big Meadows, Gold Lake, Mt. Sanhedron, Nr. Pohono Trail, Sentinel, Sierra Nevada, Sierra City, Stewart Springs. COLORADO: Boulder Co. Denver Co.: Chimney Gulch. Douglas Co.: Platte Canyon. El Paso Co.: Black Forest, Cascade, Manitou. Jefferson Co.: Golden. Laramie Co.: Cheyenne Canon. Larimer Co.: 6 Mi. east of Drake. Rocky Mountain National Park. Unknown: Black Canyon, Camp Creek Station, Edward, Eldoro, Four Mile Canyon, Grahams Park, Gregory Canyon, Lake Isabel, Packers Gulch, Ralston Creed Canyon, San Isabel National Forest, Soda Springs, Storm Pass Trail, Sunshine Canyon, Two Mile Canyon, West Fork Camp. IDAHO: Bonner Co.: Priest River. Latah Co.: Moscow Mts. Shoshone Co.: Wallace. Unknown: Scurvy Saddle. MAINE: Oxford Co.: Wilson Hills. MICHIGAN: Chippewa Co. MONTANA: Flat Head Co.: Flat Head River at West Glacier. Unknown: Belton. Nevada: Carson City Co.: Lake Tahoe. White Pine Co.: Mt. Wheeler. NEW MEXICO: Catron Co.: 2-3 mi. east Mogollon. Grant Co.: McMillan Camp. Sandoval Co.: Jemez Mts., Jemez Springs. OREGON: Baker Co.: Baker, Spring Creek. Grant Co.: Sumpter. Jackson Co.: Prospect. Klamath Co.: Durkee, Fort Klamath, Klamath. Unknown: Newbridge, Pine Credk 4000 ft. SOUTH DAKOTA: Lawrence Co.: Lead, Spearfish, Spearfish Canyon.

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Pennington Co.: Spring Creek Camp. UTAH: Garfield Co.: Blue Spruce Camp. Iron Co. Toole Co.: Stockton. VERMONT: Bennington Co.: Mt. Equinox. Rutland Co.: Sherburne Mt. Unknown: Beartown. WASHINGTON: Mason Co.: Belfair. Okanogan Co.: Brewster. Yakima Co.: Satus Creek. WYOMING: Albany Co.: Foxpark. Crook Co.: 5-6 Mi. N. Sundance Reuter Canyon Camp. Teton Co.: Jenny Lake, Teton Mts. Unknown: Spring Lake.

I. lanoraiensis: UNITED STATES. MAINE: Penobscot Co.: Lincoln, Passadumkeag. Co. Unknown: Dead Stream Bog.

NOVOSATSUMA

N. collosa: CHINA. Siao-Lou.

N. magnasuffusa: CHINA. Chow-pin-za.

N. plumbagina: CHINA. Chia-Kou-Ho.

N. pratti: CHINA. Chang-Yang, Ichang, Frontier Tibet, Loutsechiang, Tatsienlu, Yachow, Yunna.

N. grossfieldi: CHINA. Yatsuo Yalung River.

N. cibdela: CHINA. Chang Yang.

N. monstrabila: CHINA. Nooa Hills, Chindwin.

N. oppocoenosa: CHINA. Taho.

PENAINCISALIA

P. alatus: ECUADOR. PERU. Oroya, Cordillera Blanca, Cajamarca Prov.

P. oribata: BOLIVIA. Tacora. CHILE. PERU.

P. culminicola: BOLIVIA. ECUADOR. Cuicocha, Hda Tullahua, Paramo-Tinpulla, Rio San Pedro. PERU. Cuzco.

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P. anosma: Not examined.

P. bimediana: ECUADOR. Cuicocha.

GINZIA

G. chaiybeia: CHINA. Chang Yang, Tatsienlu.

G. casinorum: CHINA. Tzeku.

G. ferrea: JAPAN. Hakodate, Kioto, Kobe, Mejiro, Miyajima, Mt. Machikane, Mt. Takao, Nikko, Oyama, Sagami, Tokyo, Xone-Mzuzo, Yesso, Yokahama.

G. kimi: CHINA. MONGOLIA. Sajan. KOREA: Najin, Seishin. SOVIET UNION. Amour, Amourland, Kranka.

G. abromadogutta: CHINA. SOVIET UNION. Amourland.

G. krishnai: CHINA. Lutien.

G. tsekouensis: CHINA. Kangting, Lutien, Tse-kou.

G. hortoni: CHINA. Hong Kong, Kido, Kichange-kou, Kungbung, Pompejekna, Tibet, Weishi, Yu-tong.

G. brabazonorum: CHINA. Lutien, Tibet.

G. pluto: CHINA. Chipa, Chow-Pin-sa, Pu-tsu-Fone, Rinthau, Siao-Lou Ta-Ho, Tatsienlu, Vallee du Tong Ho, Wa-su-Kow, Yare Gong.

G. milleri: CHINA. Saio-Lou.

G. aquilonaria: CHINA. Manchuria.

G. tricaudata: CHINA. SOVIET UNION. Irkutsk, Tunkinsk, Weissbg (sic).

G. frivaldskyi: CHINA. Altai, S.E., Manchuria. SOVIET UNION. Apfelgebirge, Irkat Leder, Khanka, Lang, Nikolajewsk, Ist-Sajan, Pompejetka, Sutschan, Tehuja Valley, Tjutgu-Lo.

G. prodiga: CHINA. Bahand.

G. caesius: CHINA. Tatsienlu.

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G. fritzi: CHINA. Tatsienlu.

G. montivaga: CHINA. Kopadi, Tibet.

G. circe: CHINA. Frontier Tibet, Tatsienlu, Tzeku.

G. nicevillei: CHINA. Yunnan, Yaregong.

G. leechi: INDIA. Jaintia Hills, Shillong.

SANDIA

S. fusius: GUATEMALA. Chisey Valley, Polochic Valley. MEXICO. Concordia, Cuesta de Misantha, Jalapa, Tamancipas, Victoria. PANAMA. Chiriqui, Volcan de Chiriqui.

S. marialis: COLOMBIA. Novelle Granada. GUATEMALA. Perrula. HONDURAS. MEXICO. Victoria. VENEZUELA.

S. ampulla: MEXICO. Cordoba, Rio Cazones.

S. scaphia: MEXICO. Chiapas, San Cristobal. GUATEMALA. Lake Atitlan.

S. xami: MEXICO. Prov. of Chiapas, Mexico City, Lagos de Montabello, San Cristobal. UNITED STATES. ARIZONA: Cochise Co.: South Fork of Cave Creek, 5 Mi. W. of Portal. Pima Co.: Sabino Canyon, Tucson. Pinal Co.: Oracle, Mt. Lemmon, 15 Mi. N. of Peppersauce. Santa Cruz Co.: Madera Canyon, Santa Rita Mts. TEXAS: Arkansas Co.: Rockport. Cameron Co.: Boca Chico, Brownsville, Las Fresnos, San Benito. Hidalgo Co.: Pharr. Nueces Co.: Corpus Christi.

S. macfarlandi: MEXICO. Cuerva, Rancho Campana. UNITED STATES. NEW MEXICO: Bernalillo Co.: Rita Canyon, West Slope Sandia Mts., Sandia Mts., La Cueva. TEXAS: Jeff Davis Co.: 10 Mi. N. of Fort Davis.

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S. augustinus: CANADA. ALBERTA: Jasper. BRITISH COLUMBIA: Duncan, Fasio, Kelowna, Coldstream, Kaslo, Malakat, Okanagan Falls, Robin, Robson, Sidney, Vernon, Victoria, Wellington. MANITOBA: Red Rock Lake, Sandilands Prov. Forest, Winnipeg. NEWFOUNDLAND: Doyle Station. NOVA SCOTIA: Aldershot, Armdale, Digby, Imfield, Halifax, McNutt Island, Mt. Uniuke. NORTHWEST TERRITORIES: Fort Smith. ONTARIA: Constance Bay, Geraldton, Hymers, Ottawa, Thaida Bay, White River. QUEBEC: Belle Riviere, Cadillac, Lanoraic. Unknown: Kamlack, Duneans Vane, Kamsick Butte, Hudson Bay. UNITED STATES. ARIZONA: Cochise Co.: Chiricahua Mts., Cochise Strata, Huachuca Mts., Paradise, Portal. Coconino Co.: Sedona. Pima Co.: Redington, Todd's Lodge, Tucson. Yavapai Co.: Bagdad, Jerome, Mayer. Unknown: Arizona Territory, Cherry, Dewey, Ramsay Canyon, Turkey Creek, White Mountains. CALIFORNIA: Alameda Co.: Mission Jose. Calaveras Co.: Dorrington. Kern Co.: Mount Pinos. Lassen Co. Los Angeles Co.: Azusa, Glendora, Little Rock, Los Angeles, Pasadena, San Gabriel. Madera Co.: Bass Lake. Mendocino Co.: Hopland. Modoc Co.: Cedarville, Davis Creek, Willow Ranch. Monterey Co.: Big Sur. Nevada Co.: Grass Valley. Placer Co.: Cisco. Plumas Co. San Bernadino Co.: Morongo Valley, Providence Mts., Uplands. Riverside Co.: Chino Canyon, White Water Canyon. San Diego Co.: Alpine Creek, Cuyamaca, Doble, Dubzura, Mt. Palomar, Pine Valley, San Diego. San Francisco Co.: San Francisco. San Luis Obispo Co.: Atascadero, San Luis. San Mateo Co.: San Bruno Hills. Santa Barbara Co.: San Marcas Pass, Santa Barbara. Santa Clara Co.: Gilroy Canyon. Santa Cruz Co.

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Shasta Co.: Viola. Siskiyou Co. McCloud, Shasti Retreat, Weed. Sonoma Co. Trinity Co.: Trinity. Tulare Co.: Mineral King, Monache Meadows. Tuolumne Co.: Glen Rulen. Yosemite National Park: Glacier Point, Glenrulen. Unknown: Angeles Forest, Arroyo Seco, Big Crook, Cherry Gap, Chrystal Spring Reservoir, Folanda, Gold Lake, Hayulara, Havisah, Jaspar Ridge, King's Mountain, Mount Saint Helena, Mt. Nopaco, Mount Sanhedron, Pinnacles National Monument, Pohono Trail, Sierra City, Temescal Canyon, Two Rock, Yuba Pass. COLORADO: Boulder Co.: Boulder Canyon. Denver Co.: Chimney Gulch, Denver. Douglas Co.: Oslar. Jefferson Co.: Golden Gate Canyon. Unknown: Clear Creek, Cool Creek Canyon, Upper Cement. CONNECTICUT: Hartford Co.: Avon. Tolland Co.: Mansfield. Windham Co.: Putnam. Unknown: Patehang. DISTRICT OF COLOMBIA: Washington. GEORGIA: Unknown. Black Jack Mountain, Port Mountain. IDAHO: Latah Co.: Moscow Mountain, Wallace. Unknown: Kelly Creek Ranger. ILLINOIS: Illinois Beach. MAINE: Hancock Co.: Mount Desert Island. Kennebec Co.: Gardiner. Oxford Co. Penobscot Co.: Enfield, Lincoln, Passadumkeag Bog. MARYLAND: Cecil Co. Unknown: Paint Branch, Yellow Springs. MASSACHUSETTS: Middlesex Co.: Bedford. Nantucket Co. Norfolk Co.: Foxboro. Plymouth Co.: Plymouth. Worcester Co.: Southboro. Unknown: Massach, Stanchom, Watertower. MICHIGAN: Cheboygan Co. Schoolcraft Co.: Manistique. MONTANA: Flathead Co.: Flathead River. NEBRASKA: Unknown: Bareda. NEVADA: White Pine Co.: Mt. Wheeler. NEW HAMPSHIRE: Unknown: Meadows. NEW JERSEY: Atlantic Co.: Atlantic City. Burlington Co.: Brown Mills. Essex

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Co.: Orange Mountain. Middlesex Co.: Jamesburg, Kendall, Milltown, Old Bridge, Spotswood. Morris Co.: Ocean Co.: Lakehurst, Lakewood, Waretown. Passaic Co.: Greenwood Lake, Paterson. Sussex Co.: Ogdensburg. Warren Co.: Blairstown. Unknown: Elementon, Evram, Great Notch, Haskell, Hemlock Falls, Lake Absegami, Mt. Minery, Orange Mt., Shoteword. NEW MEXICO: McKinley Co.: Ft. Wingate. NEW YORK: Albany Co.: Albany. New York Co.: Central Park, New York City. Rockland Co.: Suffern. Suffolk Co.: Coram, Wyandanch. Unknown: McLean Bogs, Scudder. NORTH CAROLINA: Moore Co.: Southern Pines. Unknown: Tryon. OREGON: Baker Co.: Durkee, Pine Creek. Jackson Co: Medford. Josephine Co.: Saddle Mt. Unknown: Kane Creek, North Timber, Squaw Lake Road. PENNSYLVANIA: Beaver Co.: New Brighton. Berks Co.: Reading. Unknown: Baldy Point. UTAH: Juab Co.: Dividend, Eureka. Tooele Co.: Stockton. Utah Co.: Payson, Provo. Unknown: Lookout Pass. VERMONT: Lamoille Co.: Stowe. VIRGINIA: Fairfax Co.: Rock Run. Montgomery Co. Unknown: Difficult Run, Mons. Old Rag Mountain. WASHINGTON: Chelan Co.: Wenatchee. King Co.: Bellevue. Mason Co.: Hoodsport. Thruston Co.: Tenino. Wahicom Co.: Bellingham. Yakima Co.: Satus Creek. Unknown: Duvall. WEST VIRGINIA: Unknown: Logan Hill, N. Lee Mountain, River Falls, Rumsford River, Union Flat, Wyandanen.

S. henrici: CANADA. MANITOBA: Sandilands Prov. Forest. NEWFOUNDLAND. ONTARIO: Constance Bay. UNITED STATES. CONNECTICUT: Windham Co.: Putnam. DIST. OF COLUMBIA: Washington. FLORIDA: Volusia Co.: E. of DeLand. ILLINOIS: Adams Co.: Quincy. IOWA: Fremont Co.: Belfair. KANSAS:

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Cowley Co. Douglas Co.: Lawrence. Franklin Co.: Ottawa. Greenwood Co.: Eureka. Johnson Co.: S. of Prairie Village. Unknown: Baldwin Hill. MAINE. MARYLAND: Unknown: Centerville, Point Branch. MASSACHUSETTS: Middlesex Co.: Concord. MICHIGAN. Allegan Co. MINNESOTA: Pine Co. MISSISSIPPI: Hancock Co.: DeSoto National Forest, Bosworth, Holly Bluff. Hinds Co.: Brownsville, Clinton. Tishomingo Co.: SW of Iuka, Tishomingo State Park. Unknown: Lake Adams, Rocky Springs. MISSOURI: Jackson Co.: Kansas City. Pike Co.: Louisiana. Platte Co.: Platte City. St. Louis Co.: Meramec, Meramec Highlands, St. Louis. NEW JERSEY: Passaic Co.: Greenwood Lake. Sussex Co.: Ogdensburg. Unknown: Angelsea. NEW MEXICO: Eddy Co.: Carlsbad. NEW YORK: Albany Co.: Albany. Rensselaer Co.: Karner. Rockland Co.: Ramapo. Schenectady Co.: Schenectady. Unknown: Centre. NORTH CAROLINA: Moore Co.: Southern Pines. OHIO. TEXAS: Bexar Co.: San Antonio. Blanco Co.: Round Mountain. Carson Co.: White Deer. Dallas Co.: Dallas, Lancaster. Johnson Co.: Cleburn State Park. Kerr Co.: Kerrville. Travis Co.: Austin. Tyler Co.: Tyler State Park. UTAH: Tooele Co.: Stockton. VIRGINIA: Frederick Co.: W of Cross. Montgomery Co. Prince William Co.: Quantico. WEST VIRGINIA: Unknown: Nr. Forks of Cacapun, Nr. Ice Mountain. WISCONSIN: Unknown: St. Croix.

S. irus: UNITED STATES. CONNECTICUT: Tolland Co.: Mansfield. Windham Co.: Windham. DISTRICT OF COLUMBIA: Washington. GEORGIA: Unknown: Old Fort Mountain. INDIANA. Clark Co. MAINE. NEW JERSEY: Atlantic Co.: Egg Harbor. Burlington Co.: Brown Mills. Camden Co.: Clementon. Middlesex Co.: Jamesburg,

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Old Bridge, Spotswood. Ocean Co.: Lakehurst, Lakewood, Waretown. Passaic Co.: Greenwood. Sussex Co. Warren Co.: Blairstown, Washington. Unknown: Great Notch, New Lisbon, Runyon. NEW YORK: Albany Co.: Albany. New York Co.: Central Park, New York City. Rensselaer Co.: Karner. Richmond Co.: Staten Island. Suffolk Co.: Coram, Yaphank. Unknown: Centre, Toad Hill, Wood Hill. NORTH CAROLINA: Polk Co.: Tryon. OHIO: Wood Co.: Holland. PENNSYLVANIA: Berks Co.: Reading. Lackawanna Co.: Houston. Leon Co. Smith Co.: Tyler, Tyler State Park. VIRGINIA: Fairfax Co.: Rachel Run. Unknown: Baldy point, Difficult Run, Globe, Skyline Drive. Unknown: Middlesex Hills.

S. polios: CANADA. ALBERTA: Athabasca Landing, Banff, Calgary, Carbon, Didsbury, Red Lodge Park, Strathona. BRITISH COLUMBIA: Chelietoy Park, Cranbrook, Crows Nest, Kelowna, Galloway, Robson, Spuzzum, Vavenby. MANITOBA: Aweme, Winnipeg. NORTHWEST TERRITORIES: Fort Smith. NOVA SCOTIA: Digby. YUKON TERRITORY: Dawson, Whitehorse. UNITED STATES. ALASKA: Fort Yukon. CALIFORNIA (erroneous?). COLORADO: Denver Co.: Chimney Gulch. Douglas Co.: Platte Canon. El Paso Co.: Rock Creek. Gunnison Co. Cement Creek. Jefferson Co.: Golden, Plainview. Teller Co.: Woodland Park. Rocky Mountain National Park. Unknown: Grahams Park, Gregory Canyon, Red Lodge Park, Nr. Sugarloaf, Two Mile Canyon. IDAHO: Bonner Co.: Priest River. Shoshone Co.: Kellogg. ILLINOIS: Lake Co.: Chicago. INDIANA: Clark Co. Warren Co.: Pine. MICHIGAN: Cheboygan Co. Huron Co. Oscoda Co.: Luzerne. Presque Isle Co. MINNESOTA: Beltrami Co.: Bemidji. MONTANA. NEW HAMPSHIRE: Unknown: Surprise

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Mt. NEW JERSEY: Burlington Co.: Brown Mills. Middlesex Co.: Jamesburg, Milltown. Ocean Co.: Lakehurst, Lakewood. Waren Co.: Blairstown. Unknown: Mashipaeng. NEW YORK: Unknown: Clarkville, Wolfhill. PENNSYLVANIA: Berks Co.: Reading. Luzerne Co.: Hazelton. VIRGINIA: Unknown: Orphanage Falls. TEXAS. WASHINGTON: Thurston Co.: Tenino. Unknown: Camp Spelman.

MESOCYANOPHRYS

M. adelaidae: BRAZIL. Itabuna Bahia. PARAGUAY. Sapucay.

M. tetrameres: BRAZIL. Sabara-Bello-Horizonte, Rio del Velhao.

M. paratetrameres: ARGENTINA. Misiones. BRAZIL. Curitiba, Castro, Iguazu, Rio de Janeiro. PARAGUAY. Santisima Trinidad.

M. rachelae: ECUADOR. La Chima.

M. caramba: BRAZIL. Masaranduba, Blumeneu.

M. legionis: ARGENTINA. Cordoba. BRAZIL. Bahia, Cordoba, E. Santo Linhares, Minas Gerais, Pelotas, Rio Corcovado, Rio de Janiero, Santa Catarina.

M. opaspangorum: BRAZIL. Santa Catarina.

M. pantobias: ARGENTINA. Buenos Aires, Cordoba, Condonga, Misiones Salladillo, Salta Tucuman, Villa Nougues. BRAZIL. Pelotas.

M. tobias: ARGENTINA. Belgrano, Buenos Aires, Cordoba, Entre Rios de Roajo, La Plata, La Rioja. BRAZIL. Pelotas. URUGUAY: Montevideo.

M. acastoides: ARGENTINA. Baranos Ayres, Buenos Aires, Cadillae, Cartadenas, Cerrillas, Cordoba, Cosquin, La Quena, La Rioja, Irazu,

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Los Questos, Salta, San Pedro, San P. de Colalao, Tanate, Tucuman, Villa Nougues. BOLIVIA. Coroicco, Cussilumi.

M. catharinensis: BRAZIL. Castro Parana, Caviuna Parana.

M. acaste: ARGENTINA: Buenos Aires, La Plata. BRAZIL. Castro Parana, Erexim, Massaranduba Blumenau, Pelotas, Rio de Janeiro, Rosario, Santa Catarina State, Sao Paulo, Urinos. URUGUAY. Montevideo, Negro.

M. lycimna: ARGENTINA. Misiones. BRAZIL. Campo Grande, Esperanca, Penapolis, Ponta Pora, Prate, Rio Campo, Santa Catarina State. PARAGUAY. Rosario, Sapucay, Villarrica.

M. bertha: BRAZIL. Castro.

M. kyanos: BRAZIL. Borhumi, Sao Paulo.

M. abnormis: ARGENTINA. Cordoba, Esquires, Salto, Tucuman.

M. johnsonorum: ARGENTINA. San Pedro, Tucuman.

PARACYANOPHRYS

P. remuborealis: ECUADOR. Loja, Pinchincha, Vilcabamba.

P. remus: ARGENTINA: Buenos Aires, Isla Los Cisnes, Misiones, Panambi, Posados. BRAZIL. Blumenau, Brasilia, Brusque, Castro, E. Santo, Iguassus Parana, Itayopolis, Massaranduba-Blumenau, Nova Friburgo, Nova Teutonia, Pelotas, Pinheiro, Rio do Janeiro, Sao Paulo. PARAGUAY. Sapucay. URUGUAY.

P. rindgei: ARGENTINA. Tucuman. BOLIVIA. Balzapamba. BRAZIL. Blumenau, Caviana, Nova Trento, Rio de Janeiro, Sao Paulo, Castro, Igaussa. PERU. San Ramon, Dos de Mayo.

P. sapphirus: ARGENTINA. Buenos Aires.

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P. mykros: ARGENTINA. Cerrillos, Tucuman.

P. amphoteros: BRAZIL. Pelotas.

CYANOPHRYS

C. paralonguloides: PARAGUAY. Santissima Trinidad.

C. longuloides: BOLIVIA. Chulumans, Coroico. COLOMBIA. Corcorna. PARAGUAY. Sapucay. PERU. San Ramon.

C. kirki: ARGENTINA. San Pedro, Tucuman.

C. longula: COLOMBIA. Vic. Bogota, Vichada. COSTA RICA. Cartago, Cauche, Mt. Poas, Puntarenas, San Jose, Sitio. EL SALVADOR. Cerro El Boqueron. GUATEMALA. Gauzacapan, Polochic Valley, Retallenten, San Cristobal, San Sebastian, Volcan Santa Maria. MEXICO. Acapulco, Catemaco, Chilpanango, Coatepec, Colima, Cordoba, Cuernavaca, Cuesta de Misantla, Duenas, Galope, Gomez, Guadalajara, Jalapa, Jalisco, Juchitán, Lagos Tiscon, Naolinco, New Granada, Oaxaca, Orizaba, Ochuc, Potverillos, Presidio, San Antonio, San Carlos, San Cristobal, San Felipe, San Quintin, Tehuacan, Uruapai, Ventanas, Yalafia, Zimapan. PANAMA. Volcan de Chiriqui. UNKNOWN. Acahizotla, Balev, C. Santa Maco, Central Valleys, Hall Jalafia, Irazu, Paruta, Pedregosa, San Francisco, San Juan, Santa Rosa, Taxperillo.

C. pseudolongula: BOLIVIA. Balzapamba, Rio Surutu. COLOMBIA. Bogatá, Cauca Valley, Choachi, Cordillera, Coreato Cauca, El Palma, Farallonos, Mapoto, Periera, Pescador, Popayan, Quadite, Rio Ovejas, San Pedro, Viota. ECUADOR. Banos, Cashaunicre, Chimbo, Cuenca, D'Ambato, Huigre, Imbabura, Mapota, Mirada, Napo Latas, Pinas. PERU. Chanchamayo, R. Tabaconas. VENEZUELA. Cucuta. UN-

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KNOWN. Corosita, de Lojal, Hasienda Cavandeied-Rio Bamba, Manizales, Pedgregosa.

C. aluta: GUATEMALA: Acatenango, Beleu, Quisache, San Cristobal, Verapaz, Alta Verapaz.

C. agricolor: COSTA RICA. Cartago, La Boncanos, Mt. Poas, Fort Limon, R. Sacio, San Jose. EL SALVADOR. GUATEMALA. Chiso Valley, San Sebastian, Volcan Santa Maria. HONDURAS. MEXICO. Cerro Prieto, Cordoba, Cuesta de Misantla, El Nogal, Jacala, Jalapa, Jalisco, Oxala, Morelos, Salto Grande, San Carlos, San Cristobal, Yucatan. NICARAGUA. PANAMA: Bugava, Chiriquicito.

C. bañosensis: ECUADOR. San Pablo.

C. fragmentus: BRAZIL. Parecis Mts.

C. distractus: COLOMBIA. Bogota, Rio Minero, Rio Magdalena. ECUADOR. Chimbo. VENEZUELA. Pt. Cabello.

C. distractoides: EL SALVADOR. Acajutla, La Libertad. GUATEMALA. Gualan, Polochic Valley. NICARAGUA. Achoyapa. PANAMA. Chiriiquii.

C. pseudoherodotus: MEXICO. Catemaco, San Luis Potosi, Veracruz.

C. quinterorum: COLOMBIA. El Centro. PANAMA. Ancon, Cartago, Colon, La Boca, Los Rios, Madden Dam.

C. platnicki: EL SALVADOR. GUATEMALA. Polochic Valley. HONDURAS. MEXICO. Qaxaca, San Geronimo, Vera Cruz. PANAMA. La Boca.

C. misiones: ARGENTINA. Misiones.

C. hiulcus: PERU. Achinamiza.

C. amyntor: BRAZIL. Amapa, Amazonas, Breu Branco, Rio Branco, Tapajos. GUYANA. W. Bank Essequiba River. SURINAM. Pava.

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TRINIDAD. Fowdes Amendes Road, Hololo Mountain Road, St. Ann's. VENEZUELA. Las Quiques, Merecural. UNKNOWN. Fort George, St. Georges, Lake Sapatoza, Perambucco.

C. amyntoides: ARGENTINA. Cadillae, Catamarca, Jujuy, San Pedro. BOLIVIA. Baizapamba, Benyes, Buena Vista, Cuatro Ojos, La Junta, Puerto Guerta, Puso de Sara, Santa Cruz, Yapacani. BRAZIL. Acre State. PERU. Chaquimayo, Sani Beni, Yahaus.

C. howei: MEXICO. Presidio, Dos Amatos, Veracruz.

C. durstorum: BRAZIL. Pelotas.

C. pseudocallophria: ARGENTINA. Calilegua. BRAZIL. Menotoas, Riodas Velhao. PARAGUAY. S. Paraguay.

C. embolos: BRAZIL. Linhares.

C. innocuus: BRAZIL. Pelotas.

C. iggii: BRAZIL. Petropolis.

C. chapadaensis: BRAZIL. Chapada.

C. eiselei: BRAZIL. Obidos, Tefe. COLOMBIA. Caldaz, Rio Prio, Payonde, Vieja, Tolima. PERU. Latigo, Rio Maranon.

C. clenchi: BOLIVIA. Rio Mamore.

C. circumcyanophrys: PANAMA. Colon, Pina.

C. herodotus: CANAL ZONE. Barro Colorado. COLOMBIA. Bogota, Cauca, Magdalena, Manawe, Muzo, Purweo, San Antonio. COSTA RICA. Cartage, Guapiles, Pejivalle, Post Limon, San Jose, San Mateo. ECUADOR. Chimbo Pavamba, Sarafaen. FRENCH GUIANA. Cayenne, Kartabo, St. George, St. Laurent. GUATEMALA. Barbaren, Cayuga, Centr. Valley, Chejel, Chisoy Valley, Guazacapan Morales, Polochic Valley, Sayache, San Sebastian. HONDURAS. La combue, San Pedro Sula. MEXICO. Acapulco,

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Altamíra, Atoyac, Cacaquolito, Catemaco, Chilapa, Coatepec, Colima, 19 Mi. E. Concordia, Cordoba, Chuminapolis, Huatuxco, Jacala, Jalapa, Merida, Mizantha, Nayarit, Pisté, Presidio, San Jéronimo, San José, Santa Lucevia, San Luis Potosi, 27 Km. S.E. Santa Rosa, Soyolapan, El Bajo, Takasso, Galena Canyon, Tampico, Tapijulapa, Teapa, Topajos Tuxpango. NICARAGUA. Camoapo, Chontales, Ivazu, Matagaulpa, Pantalon. PANAMA. Bugaba, Calobre, Chiriqui, El Valle, Varaquas. PARAGUAY. Hamilton, Nambuco. TRINIDAD-TOBAGO. Mt. Hololo, Pabadie, Port of Spain, St. Ann's, St. Augustine, Tacarique, Tucpuna. VENEZUELA. Avipas, Caracas, Covosita, Las Quigues, Marguerita, Merida, Pto. Cabello, San Esteran, Suapure. UNKNOWN. Canache, Espejuelo-Cauca, La Palma, Lion Hill, Maraval, Rio Maranon, Santa Maria, Suapure, Tierra Colorada, Tapalapan.

C. sicranoides: ARGENTINA. Jujuy, Las Juntas, Pinochal, Salto, San Pedro, Tucumán. BOLIVIA. Chulumani, Cuatro Ojos, Santa Cruz. BRAZIL. Guanabara, Rio Suruta. ECUADOR. Napo, Rio Shinquipino. PERU. Campo, Chanchamayo, Huanuco, Iquitos, La Merced, Perene R., Satipo, Vina, Yahuarmajo.

C. priscilla: BRAZIL. Curitaba.

C. alexanderorum: ARGENTINA. Jujuy.

C. sicrana: ARGENTINA. Agua Blanca, Buenos Aires, Marchala, Saladillo, San Pedro. BRAZIL. Castro, Chapada, Curitiba, Espirito Santo, Iguazu, Minas Gerais, Pelotas, Rio de Janeiro, Sao Paulo, Sunion. PARAGUAY. Asuncion, Perrona, Sapucay, Villarica. URUGUAY.

C. miserabilis: COSTA RICA. Alaguela, Avanguarz, San Mateo. MEXICO. Acahuab, X-Can Q. Roo, Chichen Itza, Colima, Concordia, El Salto,

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Guerrero, Hidalgo, Jalapa, Merida, Mexico City, Piste, Puebla, San Luis Potosi, Uruapan, Veracruz, Victoria, Xicotepec, Zimapan. UNITED STATES. TEXAS: vic. Brownsville, Brownsville.

C. necopina: MEXICO. Acohuata, Catemaco, Mendez, Rincon, Vanegas. UNITED STATES. TEXAS: Brownsville.

C. marianna: BRAZIL. Mt. Roraima.

C. necopinoides: MEXICO. Maria del Oro.

C. crethona: JAMAICA. Belmore Castro, Bull Head, Clarendon, Cave River, Christiana, Colyville, Joinville, Mount Pick.

C. andromimikos: ARGENTINA. Pichanal. BRAZIL. Pelotas.

C. ruthi: ARGENTINA. Jujuy.

CALLOPHRYS

C. cynthia: U.S.S.R. Altai Mtns., Chadan, Irkutsk, Ongodai, S.E. Altai, Tehuja Valley, Tunkinsck, Ursk.

C. virgatus: FRANCE. Sardinia. ITALY. Corsica, Tuscan Coast.

C. avis: ALGERIA. Algiers, Ben aknoun, Bermandreus, Berrouaghia, Bon Saada, El Biar, El Kantara, Guell-es-Shel, Hammam R'irha, Kenchela, Sebdon, Senalbo, Souk-Ahras, Tiemcen. FRANCE. Cavaliem. ITALY. Cap. Nigue, Monte Fasce-Genoa, Verona. MOROCCO. Tangiers. SPAIN. Barcelona. TUNISIA. Aghbalu Barbi, Azrou, Mazir, Tarsett Pass. COUNTRIES UNKNOWN. Alguebeda, Amielie-les-Bains, Angouleme, Barmes, Cap Negre, Mts. Capiz, Carnoules, Cavalaire, Cavena, Chiclana, Digne, Gavarnia, Grecia, Hyeres, La Grave, La Ste. Baume, Laziv, Martigay, Martigny, Moux, Pyrenees, Valesenze.

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C. neofervida: ALGERIA. Alger, Ben Aknoun, Bon saada, Berroughia, Bouzarea, Djebel-Aures, El Biar, El Kantara, Geryville, Guelt-es-Stel, Hammam R'irha, Meecheria, Sebdon, Senalba, Souk Ahras, Tiemcan, Zeralda. MAURETANIA. TUNISIA. Air-Draham Faroult, Constantine, Tunisi-Faroult, Tangi-Gharuh am Kabuifas.

C. atlasensis: ALGERIA. Aflou, Sud-Oranaiz. MOROCCO. Agouti m'jouru.

C. rubi: AFGHANISTAN. Paghman, Kabul. DENMARK. Jutland, Vaile. ENGLAND. Hopton, Mid-Durham, Snodland. FINLAND. Krickelbort, Nr. Kanes Birch Forest, Finmark, Kroulkinsky, Lapland, Pallas, Patfamokn. FRANCE. Chasseurs de Digne, Corse, de Lavandau, Eau de Vernet, Foret de Montangis, Hjeres, Karsthange, Rennes, Sarlar, Sewen. GERMANY. Berlin, Darmestedt, Freedland, Munchen. GREECE. Athens, Attica Daphne, Hercules Baths, Lunistau. HUNGARY. Budapest. IRAN. Macedonia. ITALY. Arquata, Monte Fasce-Genoa, Mt. Volki, Toscana. Burnabad. LEBANON. Barduk. MOROCCO. NORWAY. Bergun, Bulken, Christiania, Voss. PAKISTAN. Baluchistan. PORTUGAL. Alemtejo. ROMANIA. Bucharest. SOVIET UNION. Aehowicho, Amax River, Apdelgebinge, Dubulti, Elabanga, Gunther, Irhoutsk, Jbi Dist., 35 Km. NE of Moscow, Novarossisk, Pompejetkam, Petropolis, Ural, Yukanski. SPAIN. Iberia. SWEDEN. Asserbo, Eke Vakrda, Fennia, Uddevalla. SWITZERLAND. Geneva. SYRIA. Akbes, Alemdagh For., Bendan, Chamlija, Erenkaui, Katlavo, Mt. Vitosh, Pyle, Shakkuh, Taurus, Techetfer, Vorbuse, Zebdani. TURKEY. Amasya, Amesia, Armelit, Asia Minor, Belgarde For., Broussa, Burnabat, E. of Constantinople, Meshiak, 40 Km. N. of Eski Shehir, Gumusane,

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Gryoksu, Hadjin, Izmir, Karkal, Kedos, Kiat-Hane, Prinkipo, 40 Mi. fm. Salonica, Salonica, Samsun, Tokat, Trepia, Zebil Taurus. YUGOSLAVIA. Predota. COUNTRIES UNKNOWN. Biharfured, Bishopsbad, Csehlelek, Fiamenda, Fincklov, Gada des Dkrissa, Giarz, Greben, Herculesbad, Isazwig, Ifranc, Karsthange, Kutaiato Alium, Jaice, Kazu Nullah, Krania, Saeterstoev, Scorcola, Seealpen, Serepta, Suffresa, Tin Tin Rock, Valvail, Vicze.

C. dumetorum: UNITED STATES. ARIZONA: Maricopa Co.: Phoenix. CALIFORNIA. Alameda Co.: Berkeley, Oakland. Inyo Co. Kern Co.: Buena Vista. Los Angeles Co.: Altadena, Azusa, Coquellette, Dunnetana, Glendora, Little Rock, Los Angeles, Mint Canyon, Pasadena, Redondo Beach, San Fernando. Marin Co.: Point Reyes. Mendocino Co.: Albion. Orange Co.: Dana Point. Placer Co.: Lake Tahoe. Plumas Co. Riverside Co.: Corona, Palm Springs, Riverside, Whitewater Canyon. San Bernardino Co.: Mojave Desert, Perris Phelan, Sheep Creek. San Diego Co.: Alpine Creek, Alpine Creek Road, Balboa, Pine Valley, Witch Creek. San Francisco Co.: Daly City, Lone Mountain, San Francisco. Santa Clara Co.: Alma, Gilroy, Hamilton. Santa Cruz Co.: Saratoga, Santa Cruz. San Mateo Co.: San Bruno Hills. Shasta Co.: Summit, Twin Peaks. Siskiyou Co.: Mount Shasta, Shasta Retreat. Sonoma Co. Tulare Co.: Mineral King, Monachee Meadows. Tuolumne Co.: Meadows. Yosemite National Park. Unknown: Alum Rock Park, Cajun Pass, Dimona, Elmstone, Fort Klamasti, Mt. Pochakka, Senuke Valley, Swan Creek, The Geysers, Unas River. COLORADO: Animas Co.: Animas Valley. MONTANA: Polaris. NEVADA: Humboldt Co. Klamath Co.: Fort Klamath. OREGON: Polk Co.: 1 Mi. S. Black Rock. Washington

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Co.: N. Timber. Unknown: Camp Sherman-Metolius, Reed. UTAH: Juab Co.: Eureka. Millard Co.: Silver Lake. Unknown: City Creek Canyon. WASHINGTON: Klikitat Co. Mason Co.: Hoodsport. Okanogan Co.: Brewster. Yakima Co.: Kusshi Creek, Satus Creek. Unknown: Great Falls. WYOMING: Albany Co.: Foxpark. Teton Co.: Grand Teton, Jenny Lake, Moose, Teton Mountains.

C. apama: MEXICO: Madera, 10 MI. E. Namiquipa. UNITED STATES. ARIZONA. Apache Co.: White Mts. Cochise Co.: Chiricahua Mts., Huachucca Mts. Coconino Co.: Jacob Lake. Graham Co.: Mt. Graham. Pima Co.: Baboquavaria Mts., Mud Springs, Santa Catalina Mts., Redington, Santa Catalina Mts. Yavapai Co.: Prescott. Unknown: Bear Wallow Trail, Navajo Mountain, Palmerlee, San E. Ples., White River. COLORADO: Boulder Co. Custer Co.: Davenport Camp. Denver Co.: Chimney Gulch, Indian Hills nr. Denver. Dolores Co.: West Fork Camp. Douglas Co.: Platte Canon. El Paso Co.: Husted. Gunnison Co.: Almont. Jefferson Co.: Clear Creek Canyon, Golden, Plainview. La Plata Co.: Durango. Morrison Co.: Bear Creek. Rocky Mountain National Park. Unknown: Clear Lake, Flagstaff Mountain, Four Mi. Canyon, Graham's Park, Gregory Canyon, Left Hand Canyon, Magnolia Road, One Mile Camp, Red Rocks Park, Star Ranch, Sugar Loaf Road, Turkey Creek Canon. NEW MEXICO: Catron Co.: 2-3 Mi. E. Mogollon. Grant Co.: Cherry Creek Camp, McMillan Camp. Lincoln Co.: Cedar Creek Camp. McKinley Co.: Fort Wingate. Sandoval Co.: Jemez Springs. San Miguel Co.: Las Vegas. Unknown: Cloudcroft, Highrolls, Hyde State Park, Sangre de Cristos. TEXAS: Brewster Co.: Alpine. WYOMING: Teton Co.: Jenny Lake, Teton Mts.

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C. sheridanii: UNITED STATES. ARIZONA: Apache Co.: White Mtns. Cochise Co.: Huachuca Mts., Palmerlee. Coconino Co. Pima Co.: Baboquavaria Mts., Redington, Santa Catalina Mts. Yavapai Co.: Prescott. CALIFORNIA: Kern Co.: Havilah. Modoc Co.: Cedarville. Orange Co.: San Juan Capistrano. Placer Co. San Benito Co.: Pinnacles National Monument. San Bernardino Co.: Providence Mts. San Luis Obispo Co.: Atascadero. Santa Barbara Co.: Santa Barbara. Siskiyou Co.: Weed. COLORADO: Boulder Co.: Boulder. Denver Co.: Chimney Gulch, Denver. Gunnison Co.: Cement Creek. Jefferson Co. Rocky Mountain National Park. Routt Co.: Rabbit Ears Pass. Unknown: Bear Creek, Camp Creek, Cemetery, Cool Creek Canyon, Flagstaff Mt., Four Mile Canyon, Larkspur, Lookout Mt., East slope of Mt. Santee, North St. Vrain, Ravine Meadow, Red Rocks, Sunshine Canyon, Two Mile Canyon. IDAHO: Unknown: Johnson Bar-Snake River. MONTANA: Beaverhead Co.: Dillon. Madison Co.: R. Canyon. Unknown: Poleris, Taylor Creek. NEVADA: Clark Co. NEW MEXICO: Lincoln Co.: La Blanca. Otero Co.: Cloudcroft. OREGON: Klamath Co.: Fort Klamath. Unknown: Greater Lake-Arent Pt. UTAH: Juab Co.: Eureka. Tooele Co.: Silver Lake, Stockton. Trinity Co.: Trinity. Unknown: Ashland, Figueroa Mt., Sentinel, Timber Line, Ventucopa. WASHINGTON: Columbia Co.: Blue Mt. Okanogan Co.: Brewster. Spokane Co.: Mt. Spokane. Yakima Co.: Satus Creek, Yakima. Unknown: Ft. Simcoe, Mill Creek. WYOMING: Teton Co.: Jenny Lake. Unknown: Burnett, Jackson Hole.

C. affinis: UNITED STATES. COLORADO. Denver Co.: Chimney Gulch. Gunnison Co.: Almont. NEVADA: White Pine Co.: Mt. Wheeler.

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UTAH: Juab Co.: Eureka, Eureka Mtn. WYOMING: Albany Co.: Foxpark. Grand Teton National Park: Moose, Teton Mtns. Laramie Co.: Pine Bluffs. Teton Co.: Jackson.

MITOURA

M. spinetorum: CANADA. BRITISH COLUMBIA: Cranbrook. UNITED STATES. ARIZONA: Apache Co.: 2 mi. s. Alpine, White Mtns. Cochise Co.: Rustler Park. Greenlee Co.: Rt. 666. CALIFORNIA: Imperial Co.: Brawley. Inyo Co.: Telescope Peak. Lassen Co.: Black Mtn. Mount Shasta National Park. Orange Co.: Laguna. San Bernadino Co.: Bonanza King Mine, Providence Mtns. San Diego Co.: Laguna Mtns. Yosemite National Park. COLORADO: Custer Co.: San Isabel National Forest. Grand Co.: St. Louis Creek Camp. Rocky Mountain National Park. Summit Co.: Breckenridge. IDAHO: Latah Co.: Moscow Mtns. MONTANA: Missoula Co.: Lee Creek Camp. NEVADA: White Pine Co.: Mt. Wheeler. NEW MEXICO: Catron Co.: 2.3 mi. E. Mogullon, Willow Creek Ranger Station. Grant Co: McMillan Camp. McKinley Co.: Fort Wingate. Sandoval Co: Jemez Springs. Santa Fe Co.: Hyde State Park. Socorro Co.: Bear Trap Camp. OREGON: Baker Co.: Blue Mtn., Pine Creek. Powder Mtns. Jefferson Co.: Metolius. Wallowa Co.: Joseph.

M. millerorum: MEXICO. Bolanos, Palos Colorados.

M. estella: MEXICO. East Salto.

M. johnsoni: UNITED STATES. CALIFORNIA: Mariposa Co.: Jerseydale. Plumas Co.: Gold Lake. San Diego Co.: Laguna Mtns. Sierra Co.: Gold Lake. WASHINGTON.

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M. byrnei: UNITED STATES. IDAHO: Benewah Co.: S. Enida. Latah Co.: 8.9 m. SW Clarkia. Wallace Co.: Wallace.

M. plicatarii (including rosneri): CANADA. BRITISH COLUMBIA: Cameron Lake, Cranbrook, Goldstream, Kaslo, Lilooet, 1 m. N Balfour, 2 m. S Daslo nr. Kootenary Lake, Sicamous, Spuzzum, Vancouver, Victoria, Wellington. UNITED STATES. WASHINGTON: Stevens Co.: Cedar Lake. Wahicom Co.: Bellingham. Unknown: Ovington.

M. muiri: (type locality listed here only, see Distribution): UNITED STATES. CALIFORNIA: "Mendocino Co." (sic).

M. barryi: (including "acuminata", see Remarks): CANADA. BRITISH COLUMBIA: Victoria. UNITED STATES. IDAHO: Latah Co.: Moscow Mtn. OREGON: Crook Co.: 3 m. E Culver, Ochoco Pass, 16 m. E Prineville. Jackson Co.: Butte Falls. Union Co. Unknown: Austin Hot Springs, Eagle Fern Park.

M. dospassosi: MEXICO. Cuitico, Madera, Tecora, Zimapan.

M. hesseli: UNITED STATES. NEW JERSEY: Ocean Co.: Lakehurst, Oyster Creek, Waretown.

M. sweadneri: UNITED STATES. FLORIDA: St. John's Co.: St. Augustine. Levy Co.: Ozello. Volusia Co.: New Smyrna Beach, Port Orange. Unknown: Guantown. GEORGIA: Glynn Co.: Jekyll Island. Unknown: Wilmington Island.

M. turkingtoni: MEXICO. Chihuahua, Namiquipa.

M. loki: UNITED STATES. CALIFORNIA: Los Angeles Co.: San Gabriel. Riverside Co.: Chino Canyon, Gavilan Park, Gavilan Hills, Palms to Pines Hwy., Perris, Pinon Flat, San Jacinto Mts. San Bernardino Co.:

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Morongo Valley, San Bernardino Mts. San Diego Co.: Cuyamaca, Jacumba, Mt. Springs.

M. siva: UNITED STATES. ARIZONA: Apache Co.: Alpine Divide Camp, 4 Mi. N of Alpine, 5 Mi. N of Rose Park Saddle-Route 666, White Mts., 3 Mi. S of Alpine, 6 Mi. S of Wide Ruin. Cochise Co.: Chiricahua Mts., Huachuca Mts., Onion Saddle, Onion Saddle-Road to Portal, SWRS-5 Mi. W of Portal, Ramsey Canyon, Huachuca Mts., Sycamore, Chiricahua Mts., Road above E. Turkey Creek. Coconino Co.: Sedona. Gila Co.: Fort Apache, Globe. Grahan Co.: Graham Mts., Shannon Peak. Grand Canyon National Monument. Peach Spring. Navajo Co.: Snowflake, Reservation E. of McNary, White Mts. Pima Co.: 5 Mi. E of Continental, Santa Rita Mts., Madera Canyon, Mud Springs, Santa Catalina Mts., Sycamore Canyon, Santa Catalina Mts. Pinal Co.: Oracle. CALIFORNIA: Kern Co.: Cedar Canyon, Greenhorn Mts., Polonia Pass. Kings Co.: Route 46, Twissleman Ranch. Los Angeles Co.: Mint Canyon, San Gabriel. Marin Co.: 5 Mi. NE of Fairfax. Modoc Co.: Willow Ranch, Duck Creek. Riverside Co.: Idyllwild. San Benito Co.: Nr. Bitterwater, Hollister, Nr. Panoche. San Bernardino Co.: Bananza King Mine-Providence Mts., Nr. Cajon Pass-Mojave Desert, Crestline, Doble, Littlerock, 39 Mi. W 5 Mi. S of San Luis Obispo, Route 178, 21 Mi. E 40 Mi. N of San Luis Obispo. Santa Cruz Co.: McKinley Grove. COLORADO: Archuleta Co.: Arboles. Boulder Co.: Magnolia Road. Custer Co.: San Isabel Natl. Forest. Dolores Co.: Rico. Garfield Co.: Glenwood Springs. Grand Co.: St. Louis Creek Camp--1 Mi. S of Lolo Hot Spring. Gunnison Co.: Jack's Cabin, One Mile Camp--8 Mi. NE of Almont. Jefferson Co.: Golden. La Piata Co.: Grahams

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Park, Rio de los Pinos. Moffat Co. Montezuma Co.: Mancos. Rocky Mountain National Park: Trailridge. IDAHO: Latah Co.: Moscow Mts. MONTANA: Missoula Co.: Lee Creek Camp. NEBRASKA: Brown Co.: Long Pine Recreation Area. Keith Co.: Kingsley Dam. NEVADA: Carson City Co.: 4 1/2 Mi. WSW of Carson City, Kings Canon--4 1/2 Mi. SW of Carson City. Clark Co.: 5 Mi. S of Lee Canyon--Charleston Park. Storey Co.: 5 Mi. W of reservoir--Virginia City. Washoe Co.: 5 Mi. W of Virginia City. White Pine Co.: Mount Wheeler. Unknown: Antelope Spring, Harrison Pass. NEW MEXICO: Catron Co.: 2-3 Mi. E of Mogollon, Willow Creek Ranger Station--25 Mi. E of Alma. Grant Co.: Cherry Creek Camp--13 Mi. N of Silver City, McMillan Camp--13 Mi. N of Silver City. Lincoln Co.: 20 Mi. N of Carrizozo, Cedar Creek Camp--2 Mi. N of Ruidoso. McKinley Co.: Fort Wingate. Sandoval Co.: Jemez Springs. Santa Fe Co.: Hyde State Park--8 Mi. NE of Magdalena. Union Co.: Capulin Mt. National Monument. OREGON: Baker Co.: Burnt River Canyon--W of Durkee, Durkee. Clackamas Co.: Near Big Eddy, Clackamas River, Eagle Fern Park, Vic Firwood Rd.--4 Mi. W of Oregon City. Crook Co.: 16 Mi. E of Prineville. Deschutes Co.: Big Falls. Douglas Co.: Yoncalla. Harney Co.: 10 Mi. N of Burns, 13 Mi. NW of Burns, Divine Canyon--10 Mi. N of Burns off U.S. Hwy. 395, Divine Canyon, Hwy. 395 12 Mi. NNE of Burns, Jackass Mountain. Jackson Co.: Butte Falls, Roxy Ann--6 Mi. NE of Medford, Siskiyou Pass, 0.5-0.7 Mi. S of Siskiyou Pass 4350', 0.2 Mi. S of Hyatt Lake 4950'. Jefferson Co.: Camp Sherman--Metolius River, Metolius River, 17 Mi. E of Modras, Pelton Dam, Warm Springs. Lake Co.: Christmas Valley Crater area, Quartz Mts.--25 Mi. WNW of

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Lakeview. Lane Co.: Oakridge. Linn Co.: Lost Prairie--Williamette National Forest--7.7 Mi. Hwy. 20-22 Junction. Wasco Co.: Juniper Flat--10 Mi. W of Maupin, 2 Mi. Se of Tygh Valley. Wheeler Co.: Mitchell. Unknown: Blitzer River. TEXAS: Bexar Co. UTAH: Beaver Co.: Beaver Canyon, Dent Lake--16 Mi. E of Beaver. Carbon Co.: Rock Creek--37 Mi. S 22 Mi. W of Duray. Garfield Co.: Blue Spruce Camp--18 Mi. N of Escalante. Juab Co.: Dividend, Eureka. Millard Co.: Nevada border. Tooele Co.: Loop Camp--13 Mi. SW of Grantsville, Stockton. Uintah Co.: Kaler Hollow Camp--22 Mi. NNW of Vernal. Utah Co.: Eureka, Provo. Washington Co.: Bellevue. Unknown: La Sal Mt. VIRGINIA: Columbia Co.: Dayton. WASHINGTON: Franklin Co.: Juniper Forest--Pasco, Juniper Forest--30 Mi. NE of Pasco. Unknown: Cedar Lake, Ovington. WYOMING: Albany Co.: Centennial. Big Horn Co.: 13-15 Mi. SW of Big Horn, 12-16 Mi. SW of Big Horn. Fremont Co.: Louis Lake--28 Mi. SW of Lander. Sheridan Co.: 12-16 Mi. SW Big Horn Mts., Long Park--20 Mi. SW of Big Horn. Teton Co.: Jenney Lake. Yellowstone National Park. Unknown: Lone Park.

M. gryneus: MEXICO. Cuiteco, El Puerto de los Frijales, Tecora, Zimapan. UNITED STATES. ALABAMA: Madison Co.: Monte Sano State Pard. ARKANSAS: Carroll Co.: Eureka Springs. Cleburne Co.: Quitman. Washington Co.: S. Fayetteville. CONNECTICUT: Fairfield Co.: Danbury, New Canaan, Southbury. Litchfield Co.: Washington. New London Co.: Clover Hill. Tolland Co.: Mansfield. Unknown: Patchang. KANSAS: Franklin Co.: Mears Park. MASSACHUSETTS: Bristol Co.: Fall River. MISSISSIPPI: Claiborne Co.: Rocky Springs. Hinds Co.: Bolton, Brownsville, Clinton,

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Edwards, Raymond. Lafayette Co.: Oxford. Lee Co.: Tupelo. Lowndes Co.: Lake Lowndes. Oktibbeha Co.: Clayton Village, Craig Springs, Mississippi State University. Tishomingo Co.: SW of Iuka, Mt. Woodall. Warren Co.: Bovina, Vicksburg. Webster Co.: Cumberland. Yalobusha Co.: Coffeeville. MISSOURI: Benton Co.: 4 Mil NW of Warsaw. Camden Co.: Camdenton. Hickory Co.: Hermitage, Hwy. 54, N of Hermitage. Unknown: Nr. Preston. NEW JERSEY: Bergen Co.: Oakland, Ramsey. Burlington Co.: New Gretna. Gloucester Co.: Harrisville. Passaic Co.: Paterson. Union Co.: Summit. Warren Co.: Blairstown. Unknown: Orange Mts. NEW YORK: Albany Co.: S. Bethlehem. Broome Co.: New Windsor. Greene Co.: Catskill. Jefferson Co.: Clayton. New York Co.: Van Courtland Park, New York City. Rockland Co.: Suffern. Steuben Co.: Greenwood. Suffolk Co.: Coram, Hampton Bays, Noyack, 5 Mi. W of Sag Harbor. Westchester Co.: Banksville, Bedford Village, Mt. Kisco, North Castle. Unknown: Glenmont. PENNSYLVANIA: Berks Co. Unknown: Adalia. RHODE ISLAND: Providence Co.: N. Scituate. TENNESSEE: Wayne Co.: Waynesboro. TEXAS: Bexar Co. Blanco Co.: Round Mountain. Brazoria Co.: Damon Creek. Big Bend National Park: Boot Springs Trail, Chisos Basin. Carson Co.: White Deer. Dallas Co.: Dallas, Lancaster. Harris Co. Kerr Co.: Kerrville. Leon Co. Palo Pinto Co.: Palo Pinto. Somervell Co.: Glen Rose. Unknown: Palo Duro Canyon. VIRGINIA. WEST VIRGINIA: Unknown: North Ice Mountain.

M. macguireorum: MEXICO. Coahuila.

M. nelsoni: UNITED STATES. CALIFORNIA: Amador Co.: 28 Mi. ENE of Jackson. Calaveras Co.: Dorrington. Contra Costa Co.: Mt. Diablo

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Park, Russelman Park, Russelman Park SE of Clanton. El Dorado Co.: Blodgett Forest--13 Mi. E of Georgetown, Lake Tahoe, 14 Mi. SE of Lake Tahoe, Pilot Creek, Pino Grande--SW of Lake Edson, Pollock Pines--14 Mi. SE of Tahoe. Fresno Co.: 34 Mi. NE of Fresno, Shaver Lake Heights. Inyo Co.: Surprise Canyon--Panamint Mts., 3 Mi. W of Westgard. Kern Co.: Greenhorn Mts., 3 Mi. NE of Havilah, 8 Mi. NE of Havilah. Lake Co.: Hobergs, 5 Mi. N of Hobergs, Mt. St. Helena. Lassen Co.: Desert Springs, Chink's Meadow, W Side of Eagle Lake, Susanville. Los Angeles Co.: Desert Springs, Devils Punchbowl, Little Rock, 1 Mi. E of Mint Canyon Summit, Mint Canyon, Valyermo. Marin Co.: Carson Ridge, 3 Mi. WSW of Fairfax. Mariposa Co.: Devils Gulch, Wawona. Modoc Co.: Adin Summit VII, 8 Mi. E of Junction of Hwy. 395 and 299 along Hwy. 299 NE of Alturas, Buck Creek Ranger Station, Buck Creek, Cedarville, Davis Creek, Fandango Pass, Electric Plant Vic. Modoc National Forest, 3.0 road miles E of Pine Creek, Warner Mountains, Cedar Pass Campground 5700' just W of Cedar Pass--Warner Mts., Willow Ranch. Monterey Co.: Near Cottonwood Pass, 30 Mi. ENE of Paso Robles. Nevada Co.: Grass Valley. Placer Co.: Cisco. Plumas Co.: Clio, 2 Mi. W of Greenville, Keddie, Mohawk, Mt. Elwell Camp, Portola, Warner Valley--Camp Lassen. Riverside Co.: Idyllwild. San Benito Co.: 7 Mi. MW of Betterwater, 34 Mi. SExS of Hollister, 2 Mi. NE of New Idria. San Bernardino Co.: Black Canyon 16 Mi. SW of Cima, Cedar Canyon--Providence Mts., Crestline, Doble, Forest Home, New York Mts.--6 Air Mi. Ivanpah, Canyon above Bonanza King Mine--Providence Mts., Nr. Lake Arrowhead. San Diego Co.: Anza Desert--Box Canyon, Boiling Springs--17 Mi. SW of Viola, 4 Mi. W of

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Viola. Sierra Co.: Bassets, 2 Mi. S. of Calpine, 4 Mi. of Comptonville, 5 Mi. NE of Comptonville, 10 Mi. Downieville, East Bassetts, Sardine Creek, Sierra City. Siskiyou Co.: Hebron Pass--10 Mi. S. of Dorris, McCloud, Nr. Mt. Shasta, 11 Mi. SW of Mt. Shasta, Sierra Nevada. Sonoma Co.: 3 Mi. NE of Occidental. Stanislaus Co.: Del Puerto Canyon--22 Mi. E. of Patterson, Del Puerto Canyon--21 Mi. W of Patterson, Del Puerto Canyon--15 Mi. W of Patterson. Tulare Co.: Nr. Mineral King. Tuolumne Co.: Cow Creek--16 Mi. W of Dardenelle, Dodge Ridge Ski Area, 4-6 Mi. S of Mathes, Strawberry, 1 Mi. E of Twain Harte. Ventura Co.: Hungry Valley--5 Mi. S of Gorman, Quatal Canyon, NW Crnr. Yosemite National Park: Mirror Lake; Yosemite National Forest, Yosemite Valley. Unknown: Lookout, Morgan Springs, N. Fork Castle Creek, Salt Creek.

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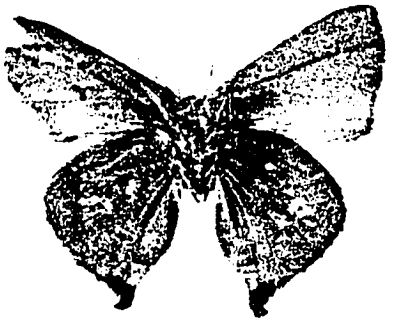
APPENDIX 5

Photographs of Type[24]

and Representative Specimens

[24]Photographs divided by vertical black line indicate under surface on right and upper surface on left.

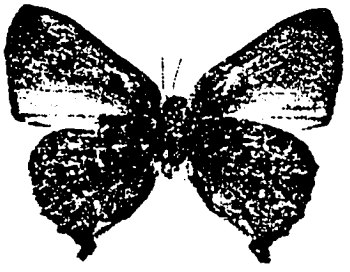
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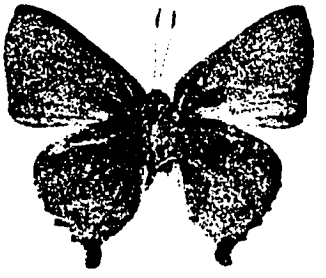
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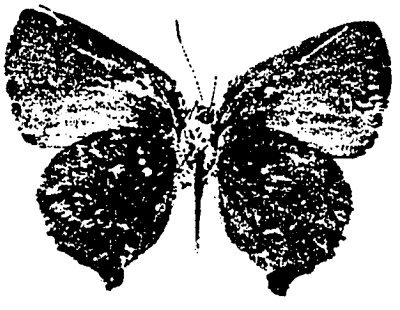
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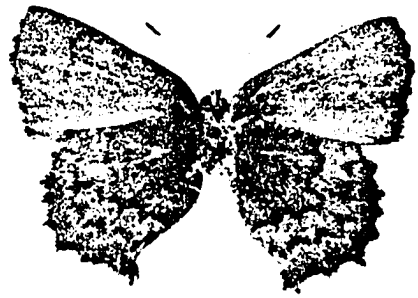


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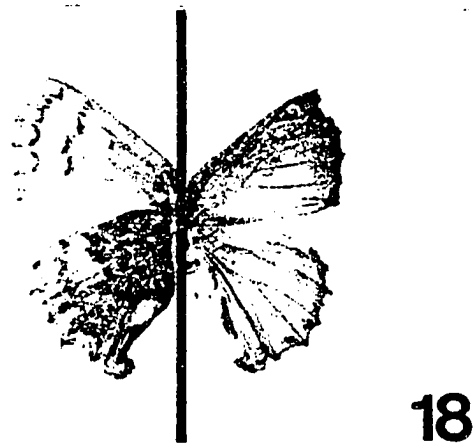
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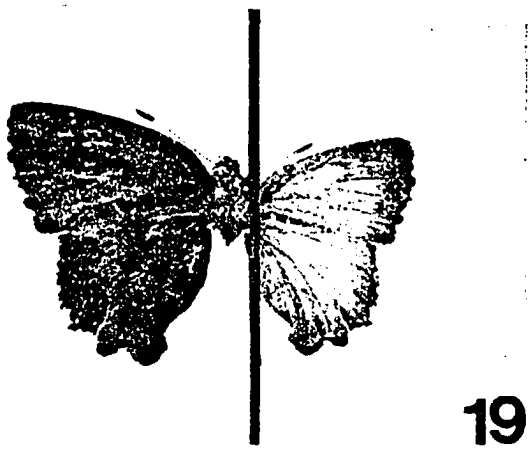
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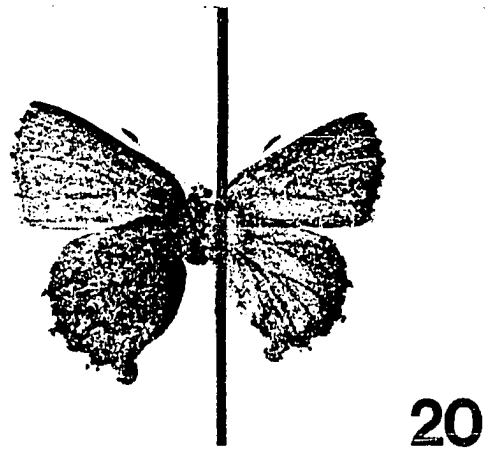
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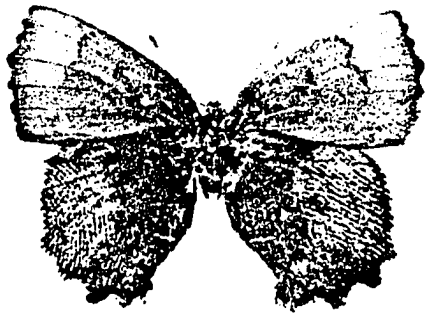
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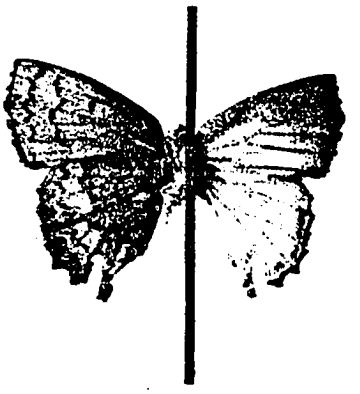


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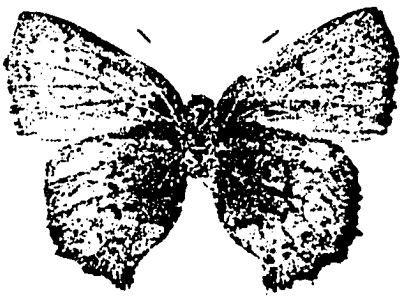


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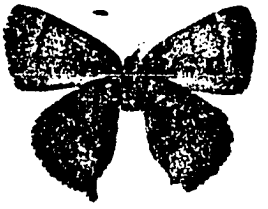
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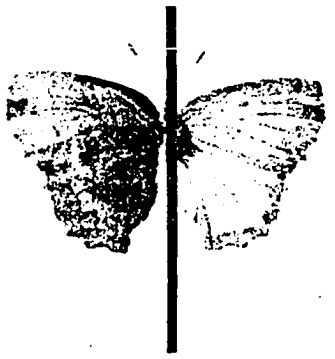


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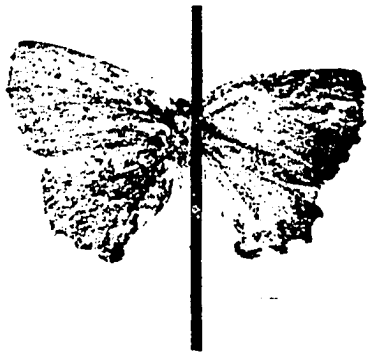


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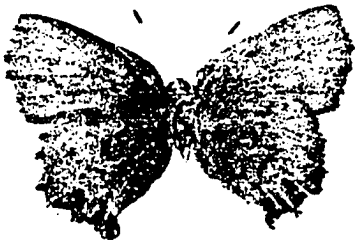
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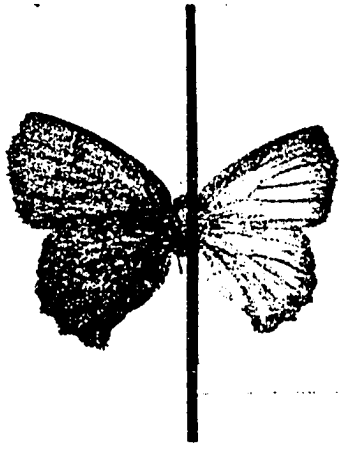
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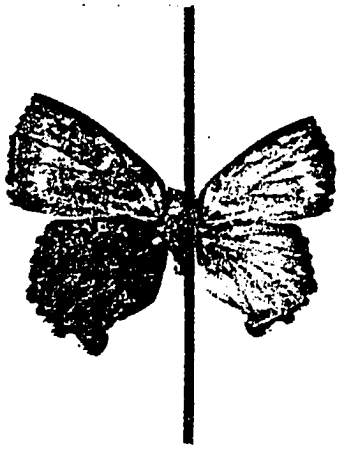
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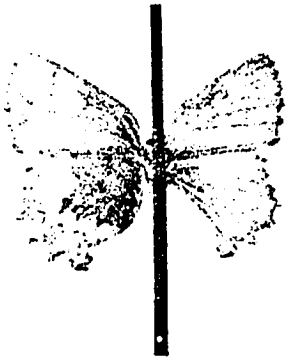


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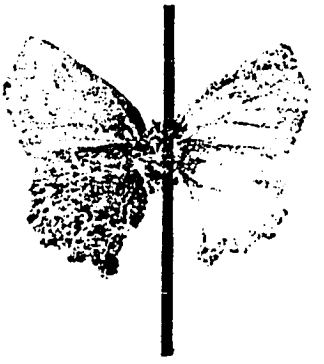


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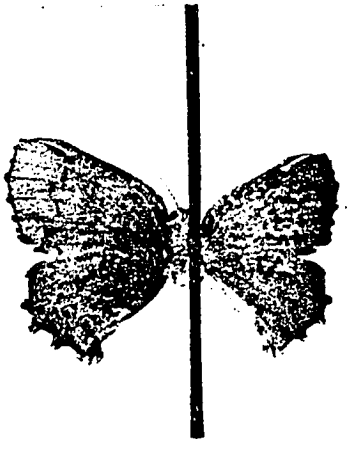
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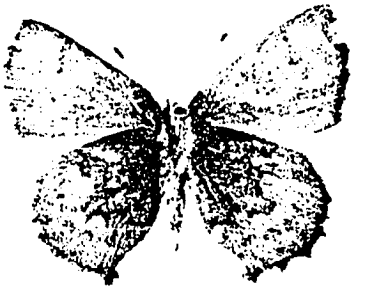
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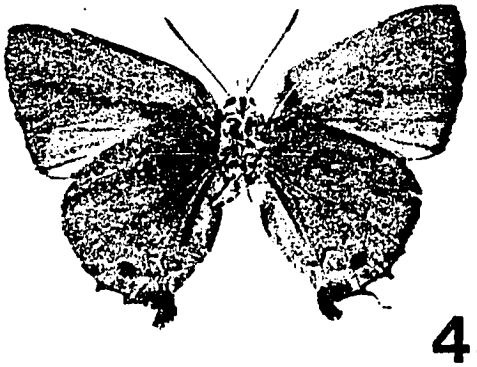
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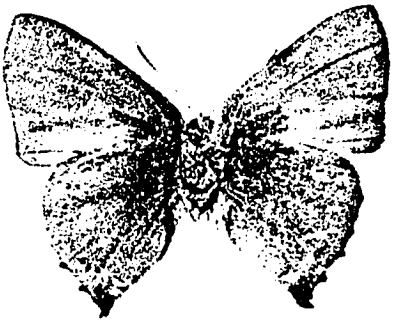
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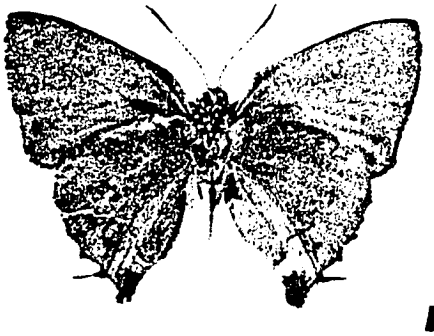
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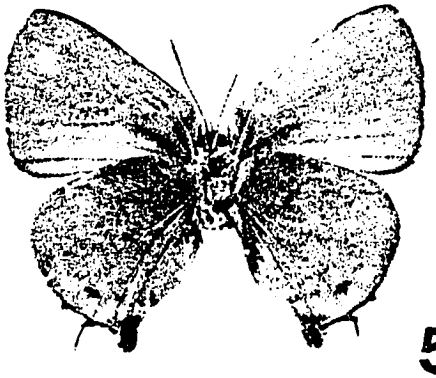
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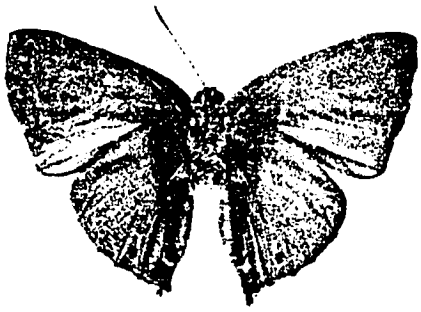


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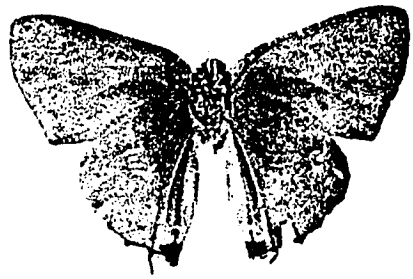


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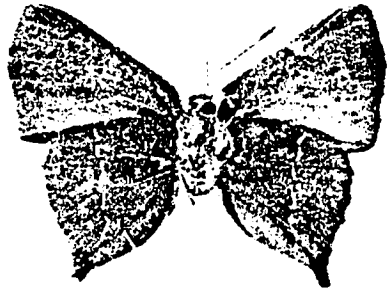
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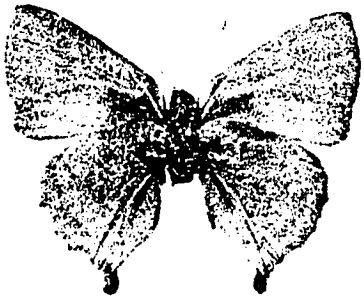
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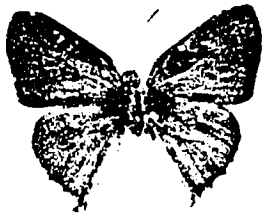
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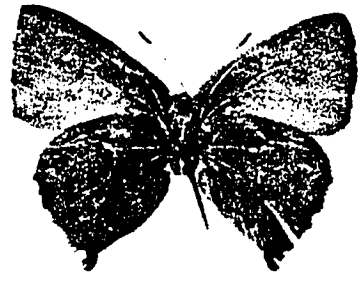
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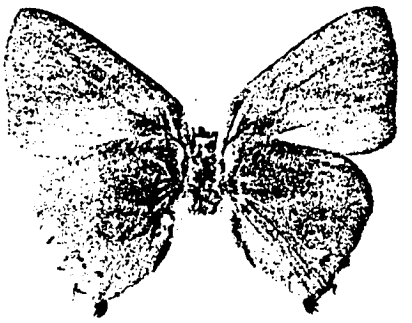


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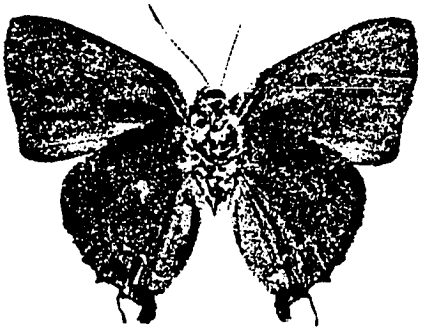
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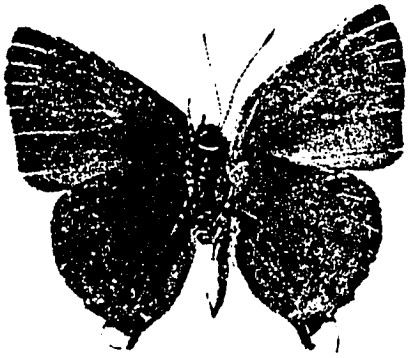
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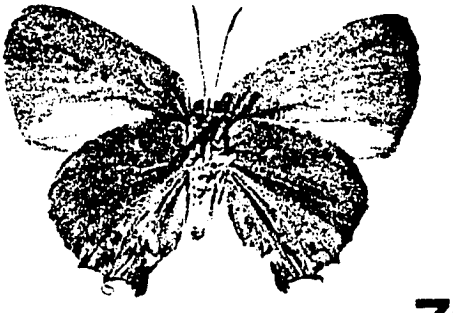
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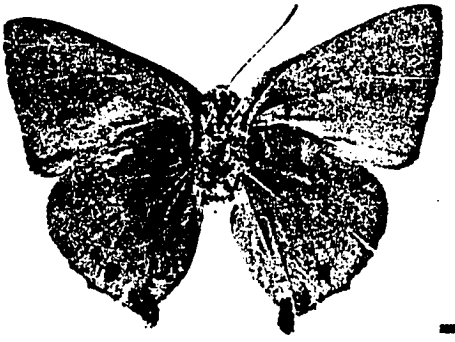
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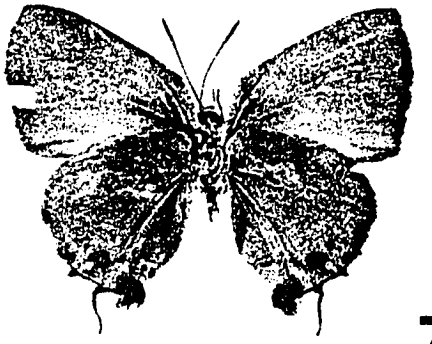
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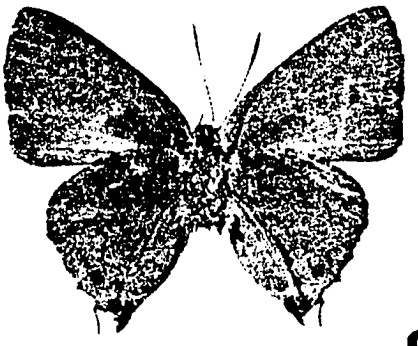
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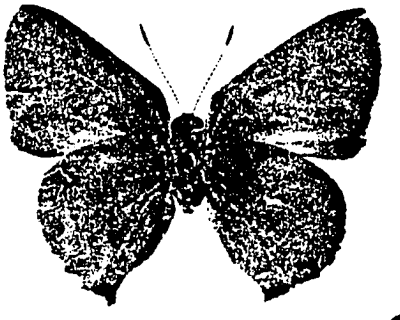
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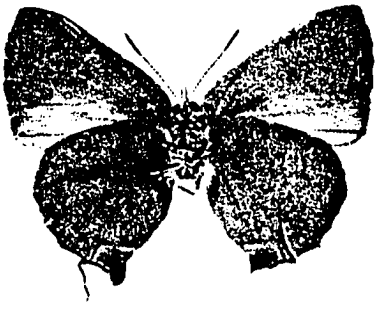
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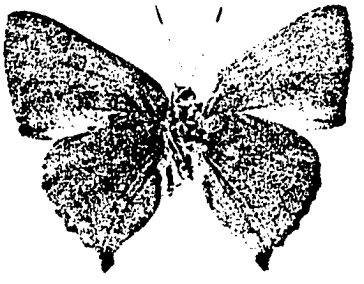
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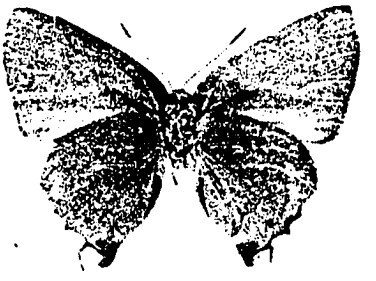
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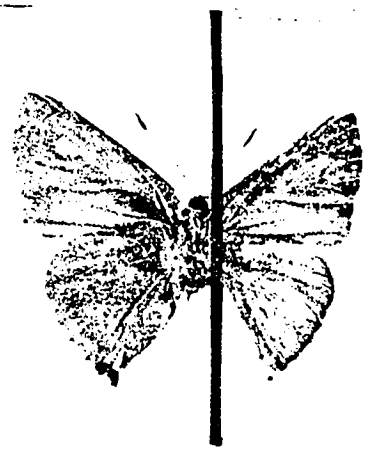
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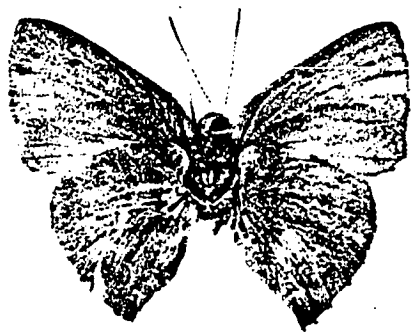
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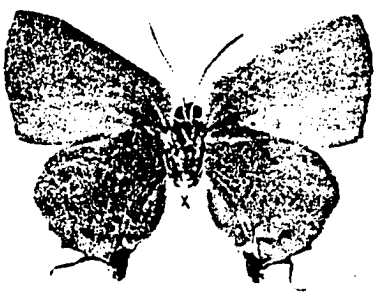


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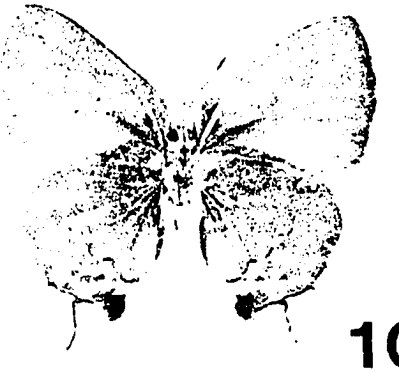
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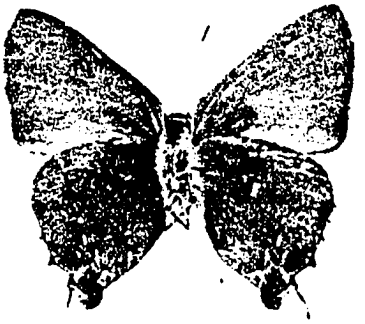
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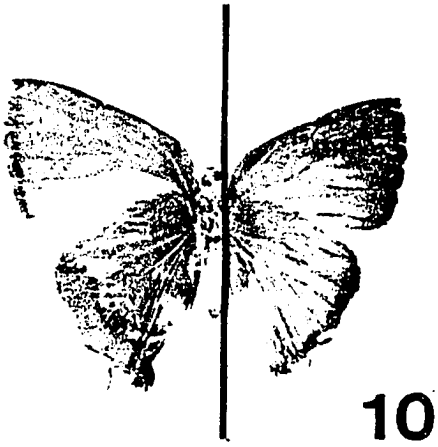
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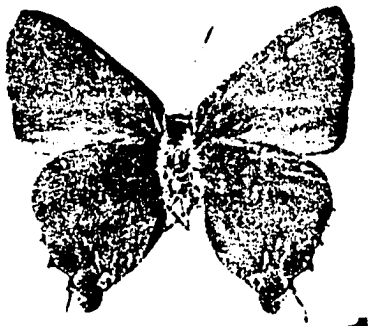


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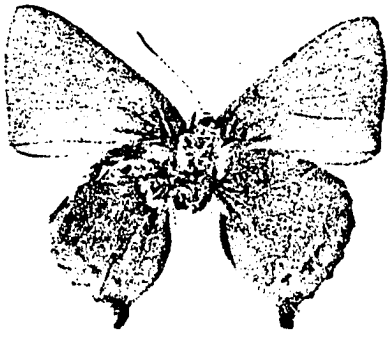
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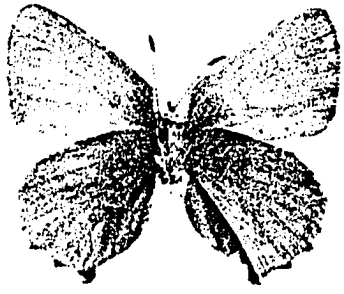
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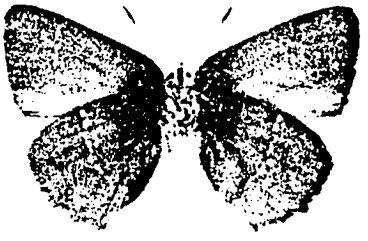
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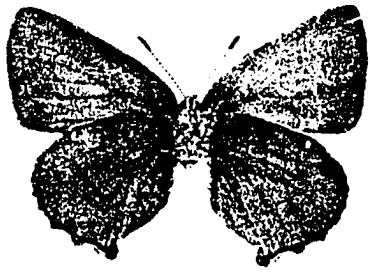


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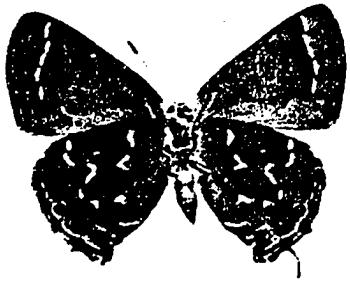
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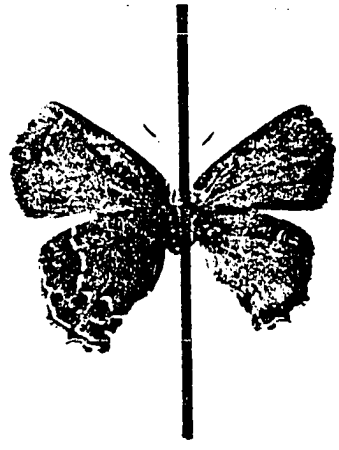
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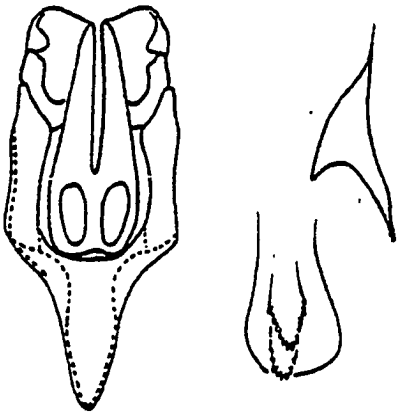
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APPENDIX 6

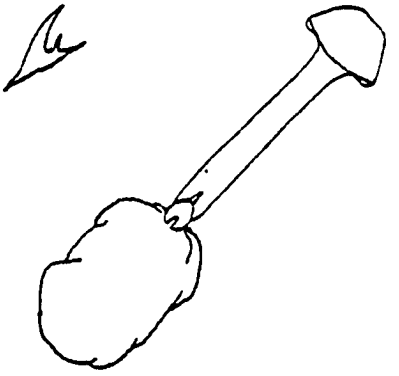
Male and Female Genitalia[25]

[25]Genitalia are figured schematically for emphasis on most obvious characters. Setae are not figured except as particularly diagnostic (e.g., some Mitoura). Male structures figured include (left) ventral view of genital structure without aedeagus; (far right) lateral view, valvae; (immediate lower right) ventral view, terminus of aedeagus. Aedeagus is shown only when particularly diagnostic. Female structures figured include (diagonal from left to right) ventral view corpus bursae on left to genital plate (ductus bursae and lamellae) on right; (immediate upper right) lateral view, signum.

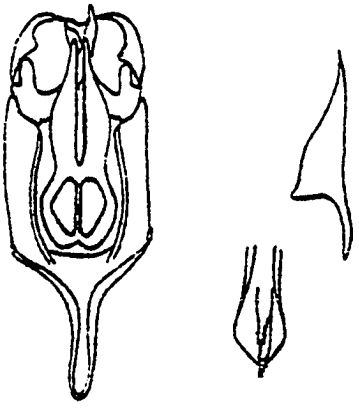
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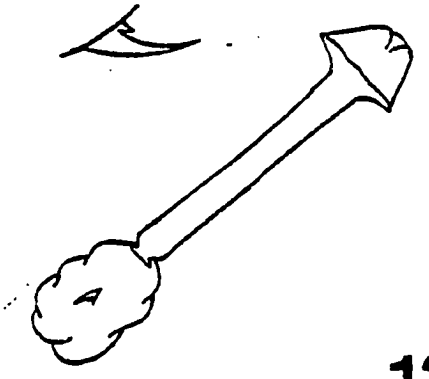
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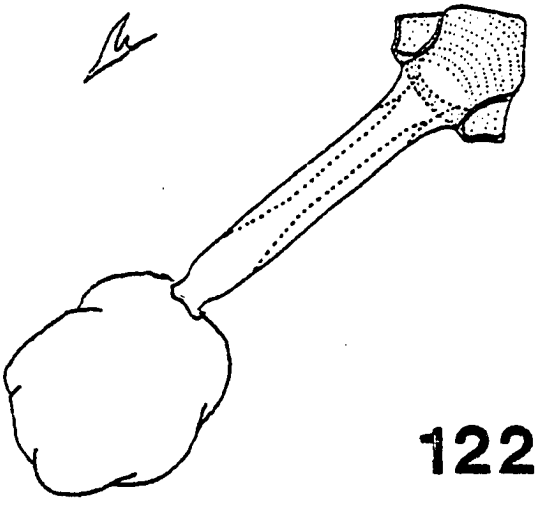
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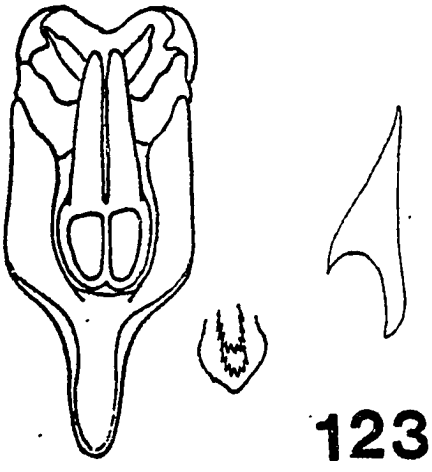
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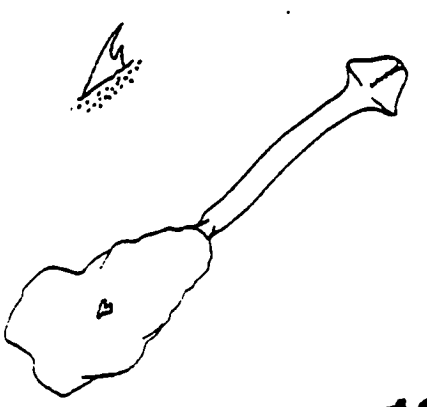


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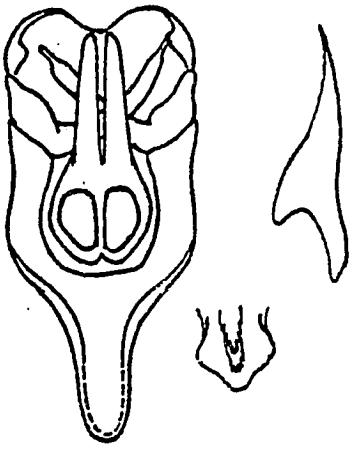


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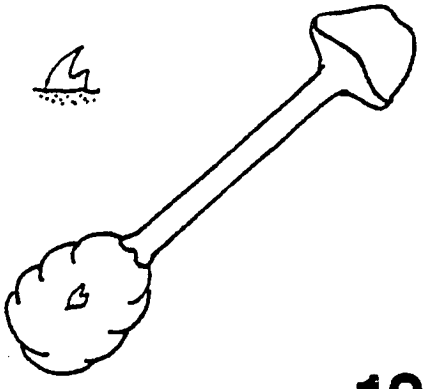
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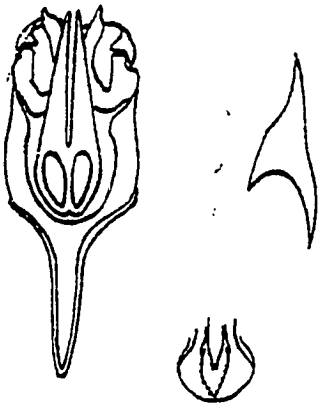
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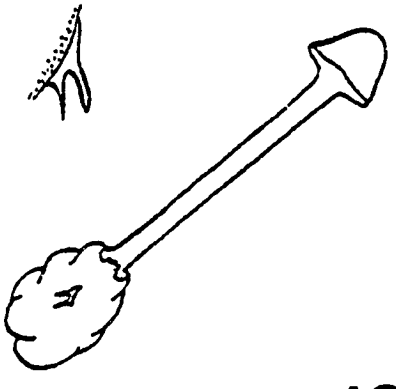
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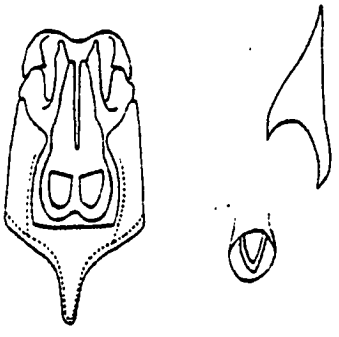
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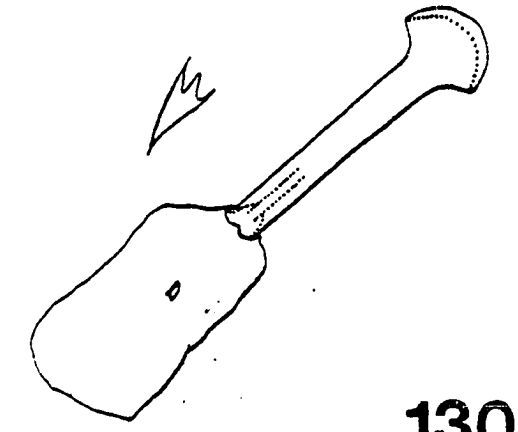


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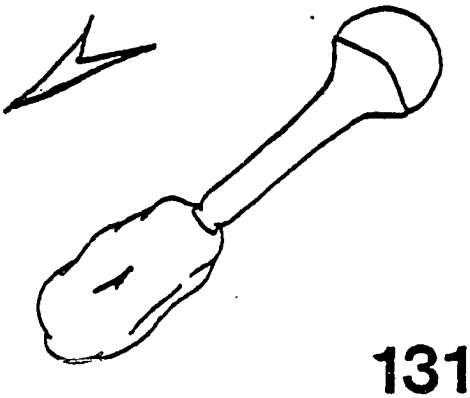


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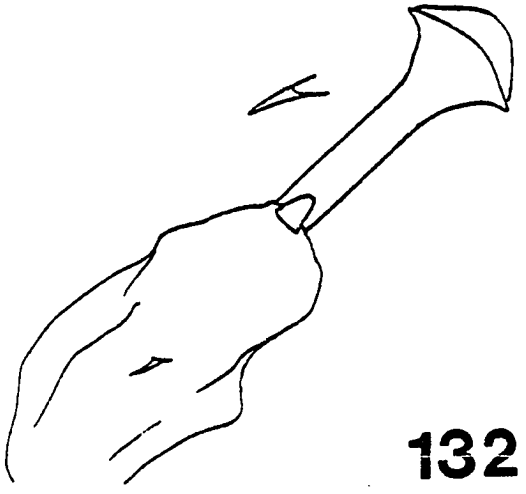
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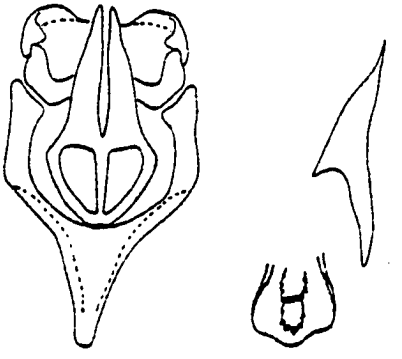
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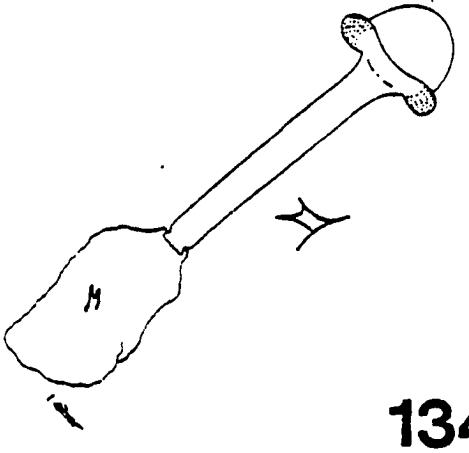
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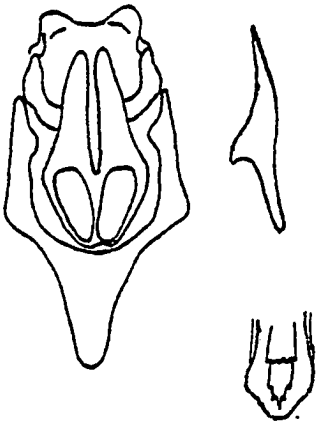
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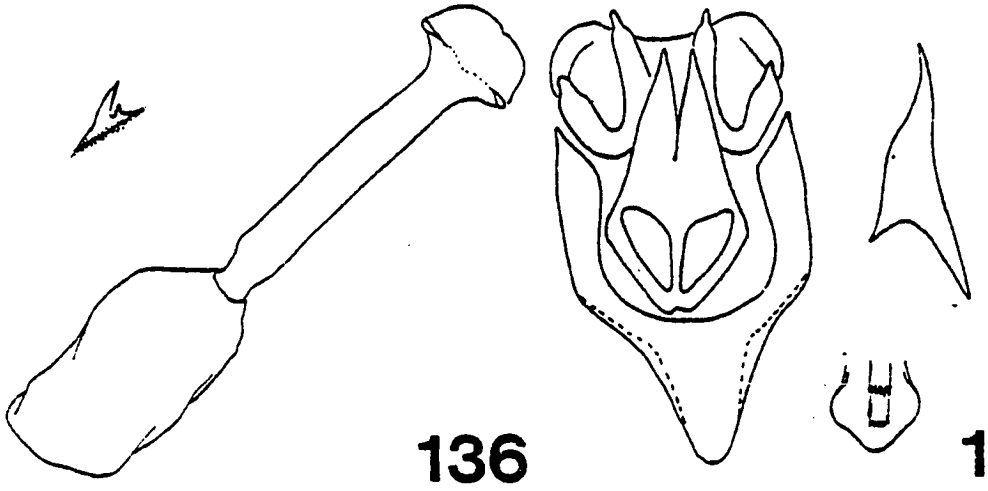


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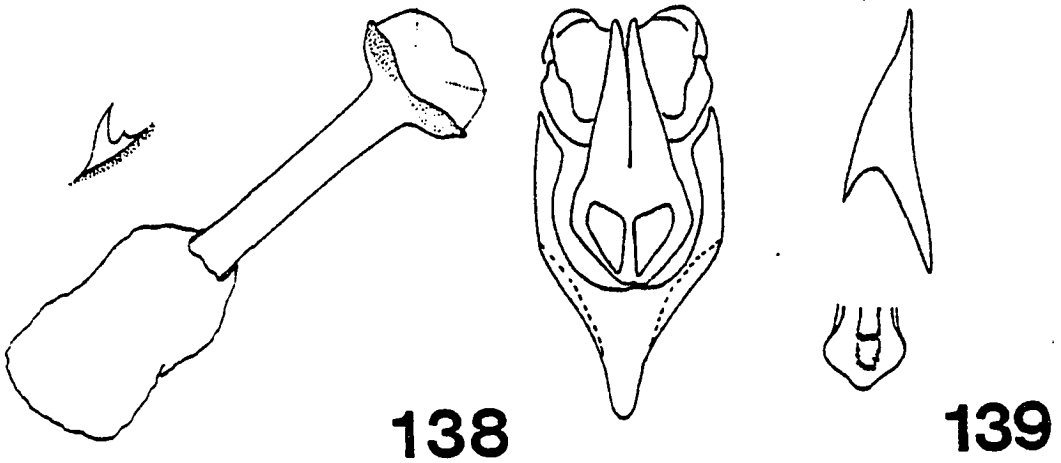


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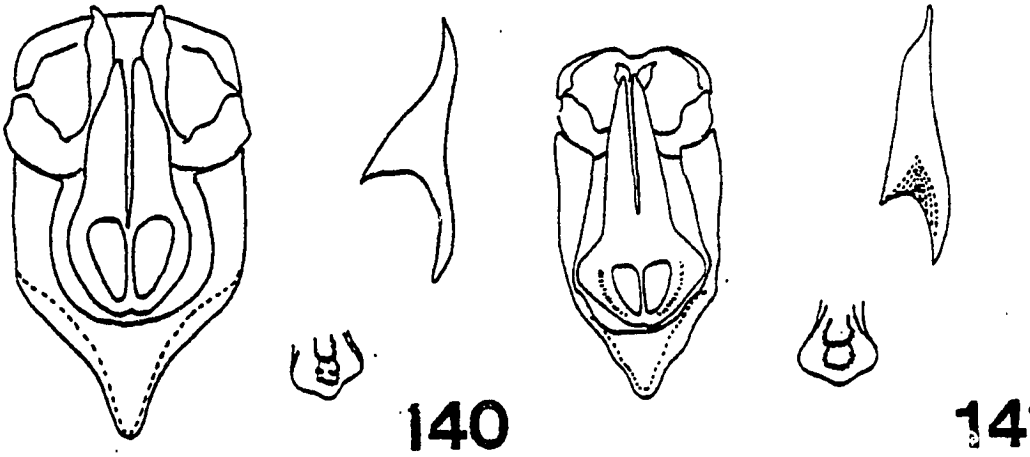
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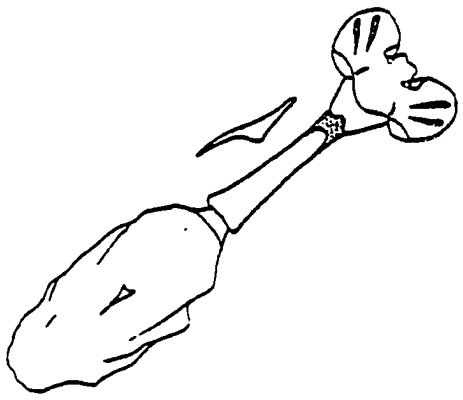


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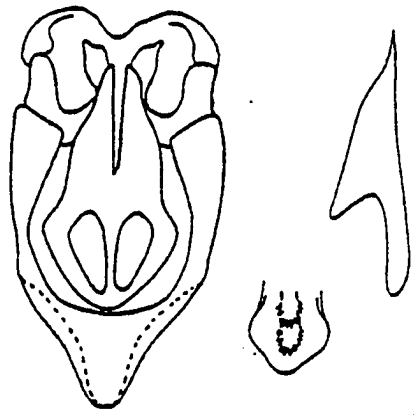


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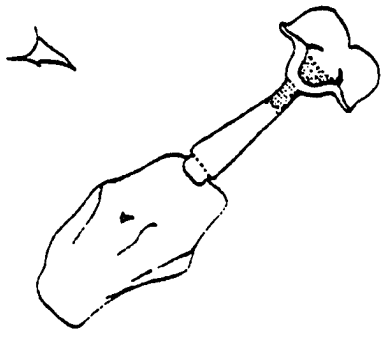
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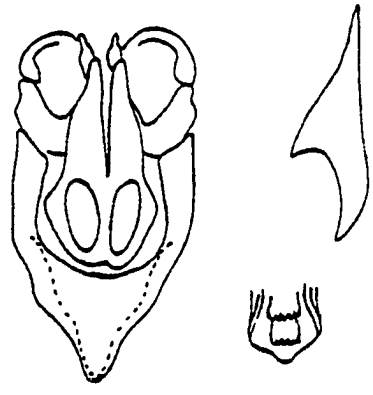
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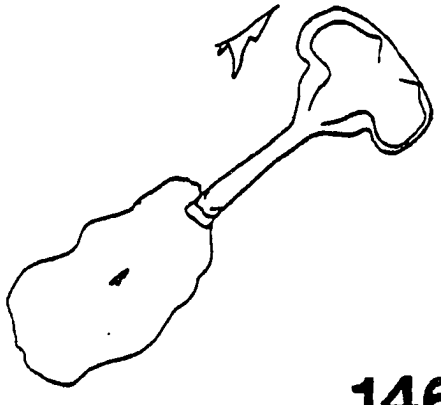
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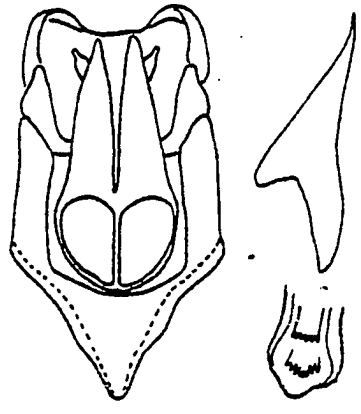
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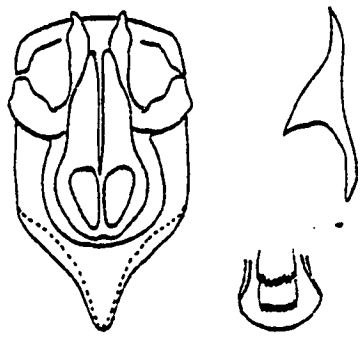


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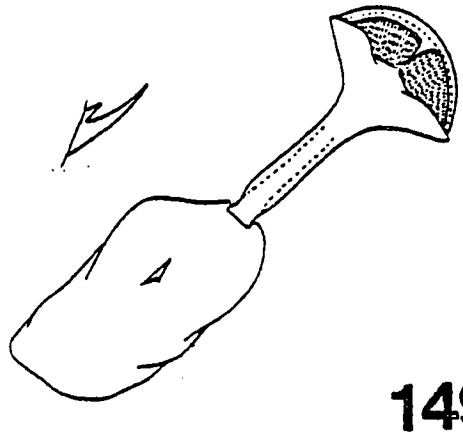


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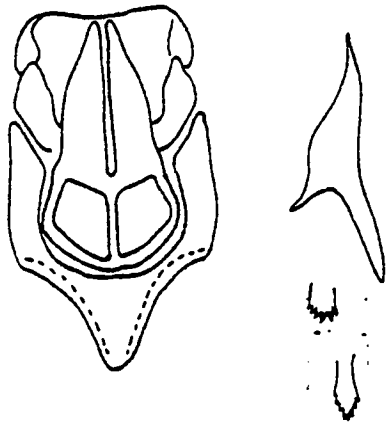
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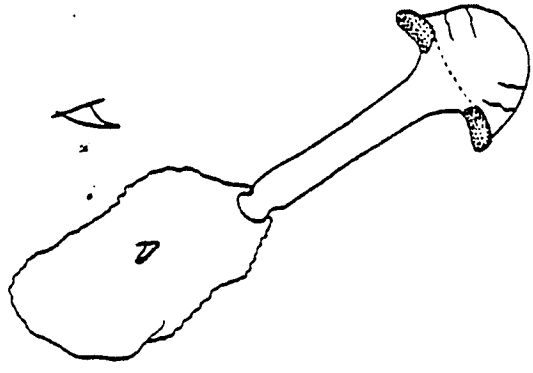
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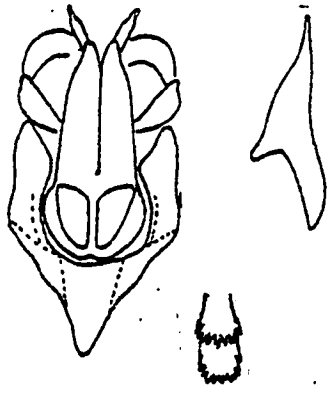
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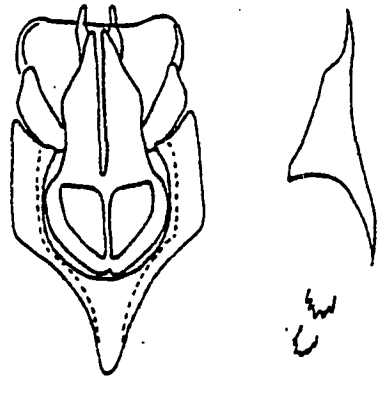
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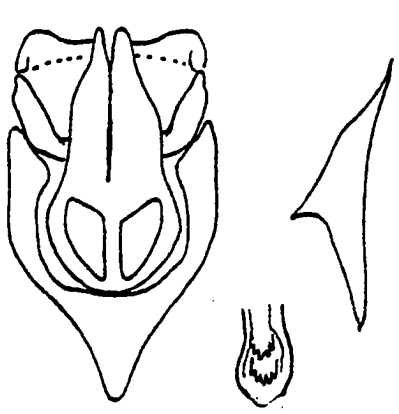


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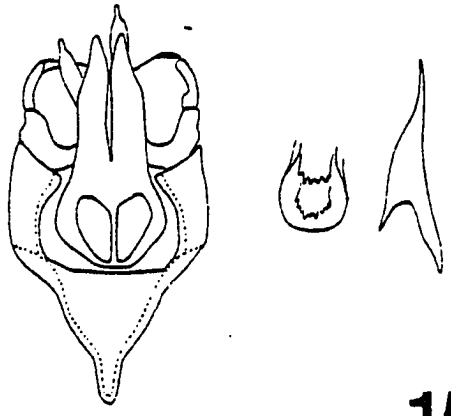


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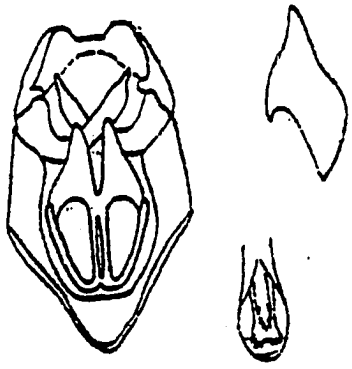
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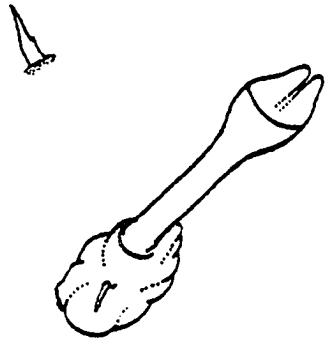
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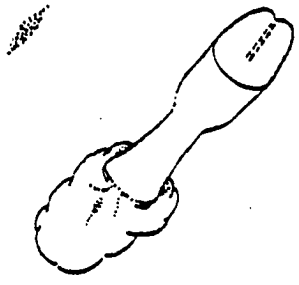
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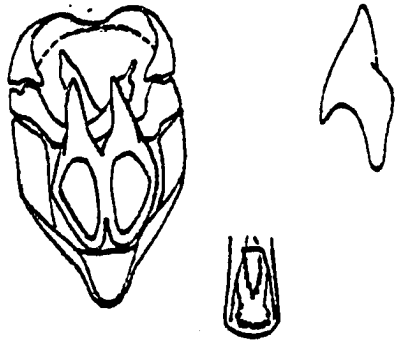
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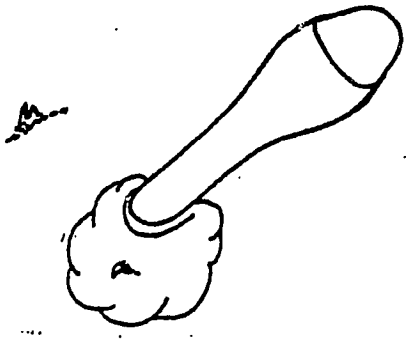


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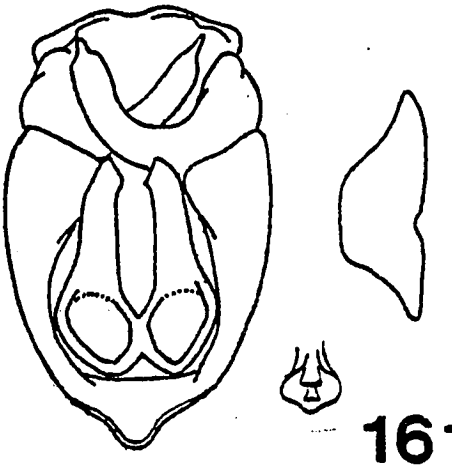


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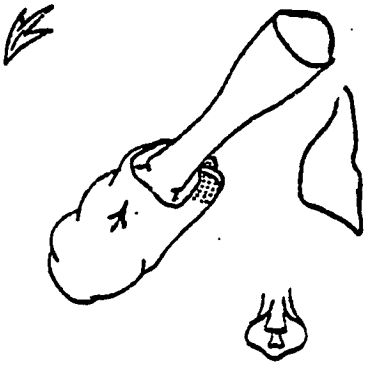
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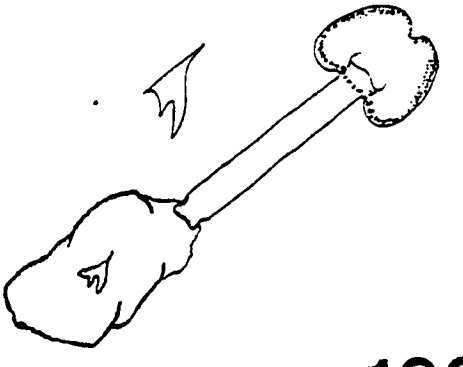
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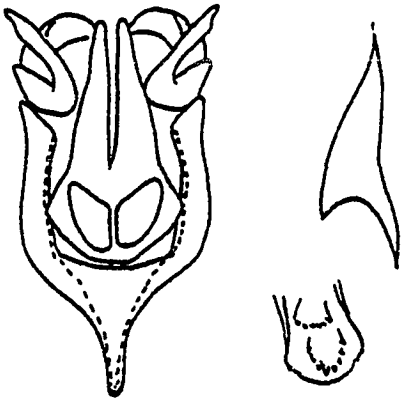
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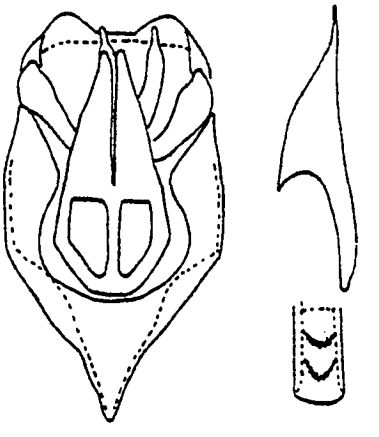
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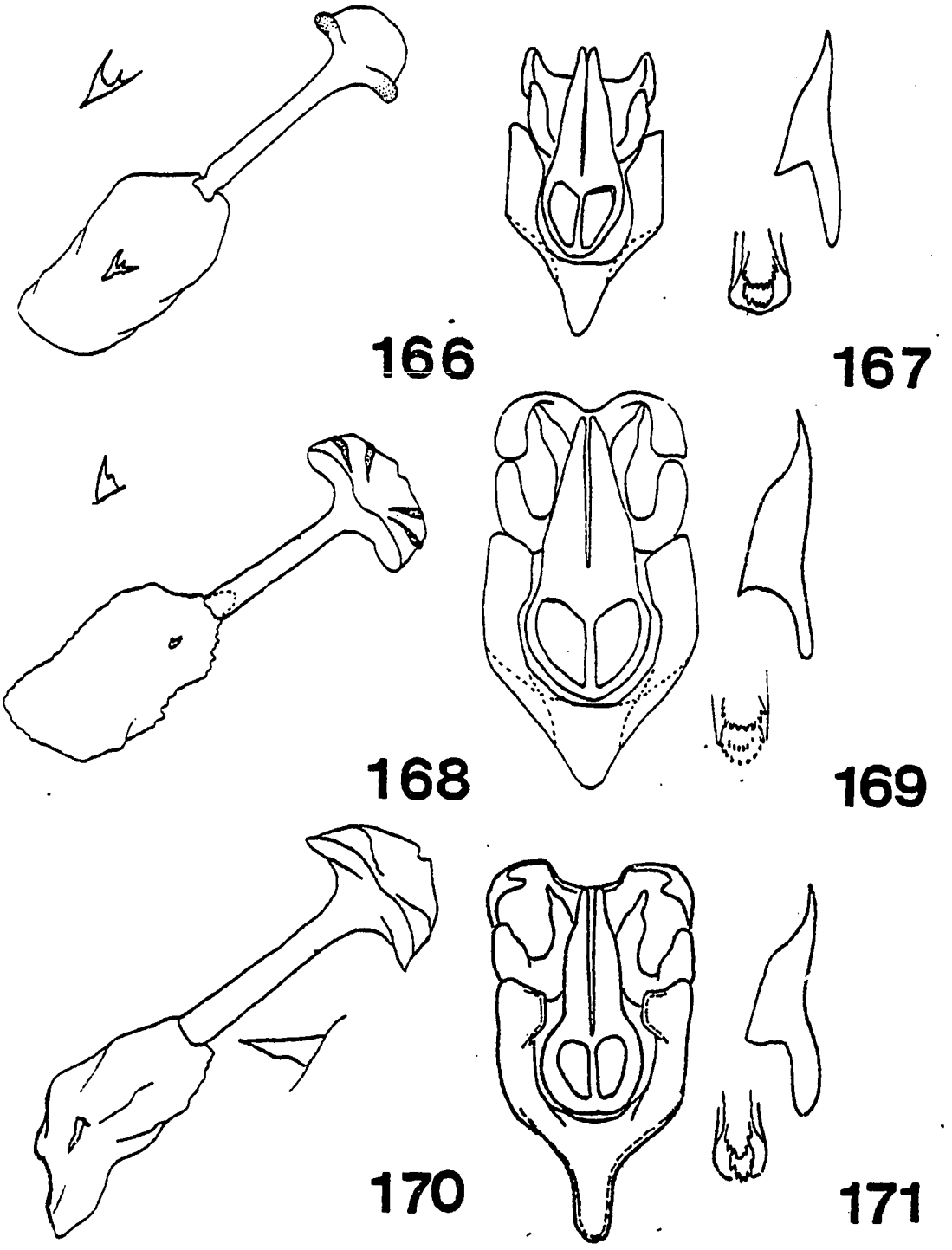


164



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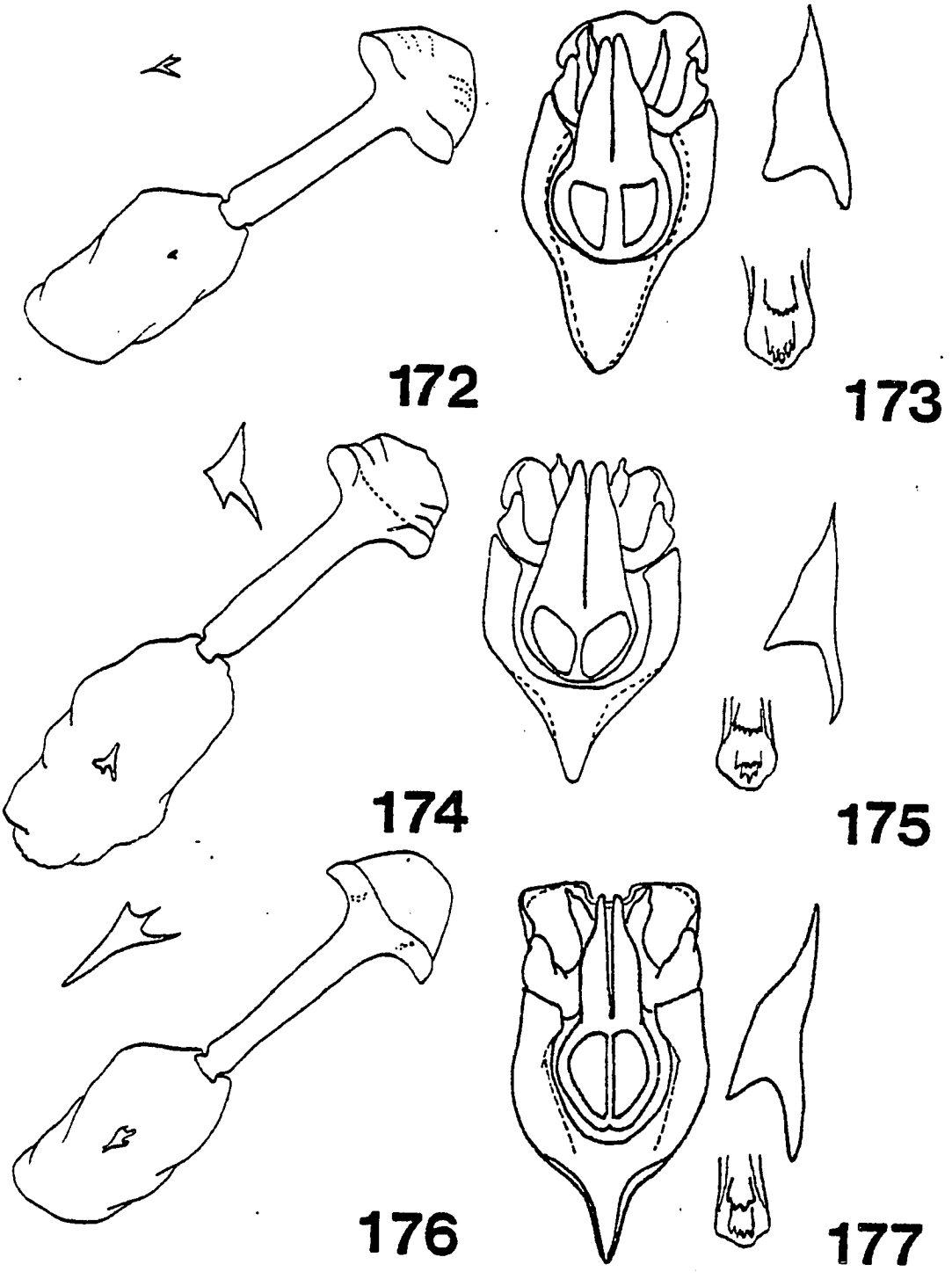


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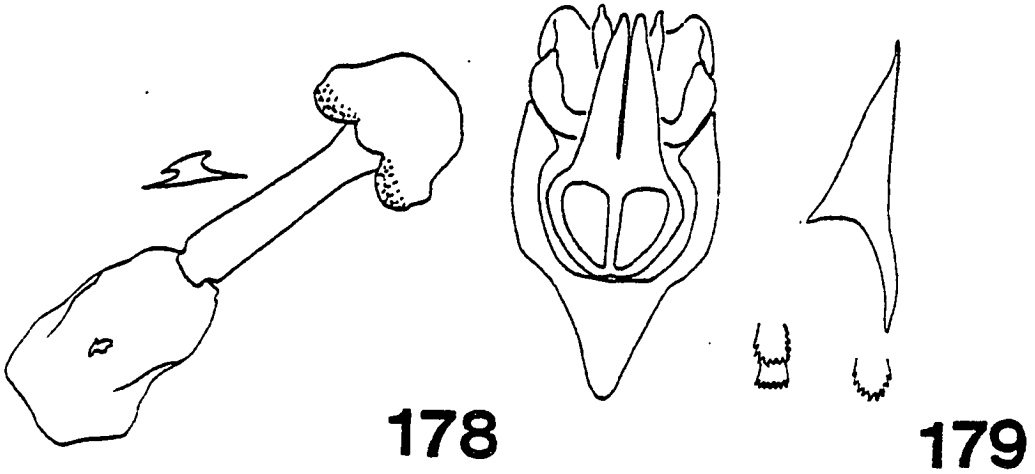
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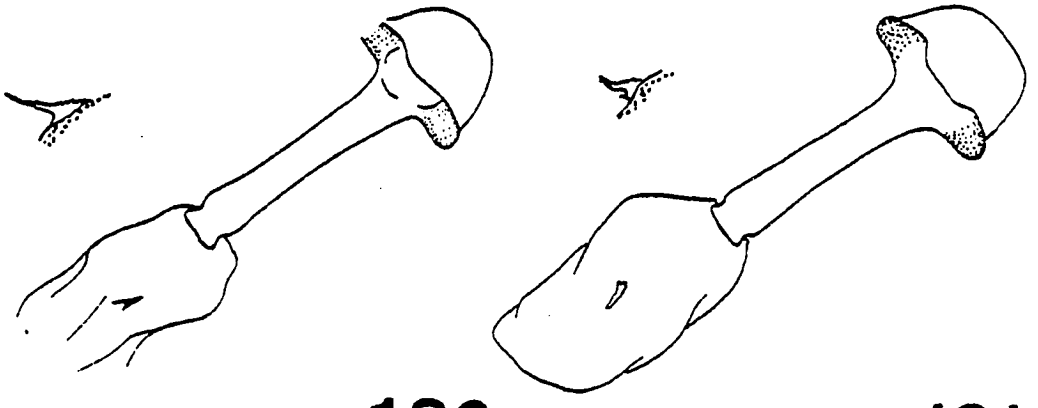
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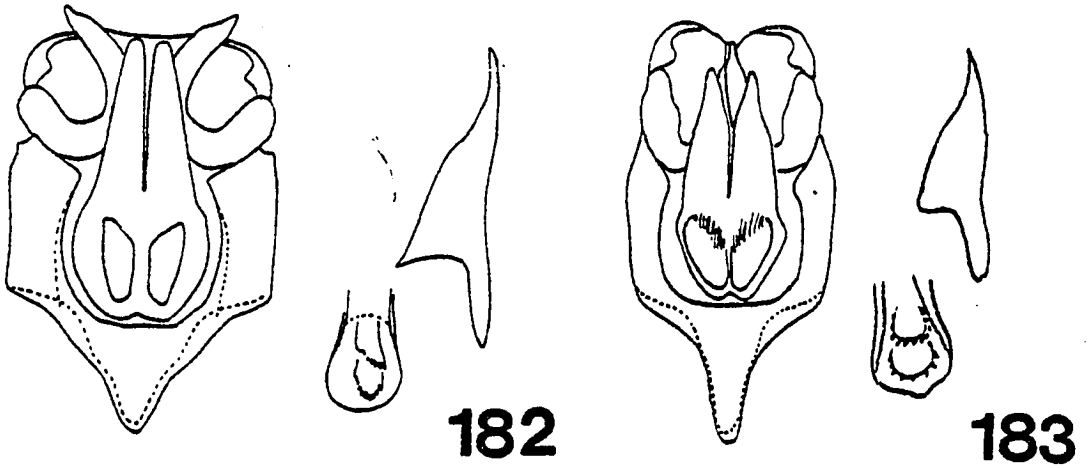
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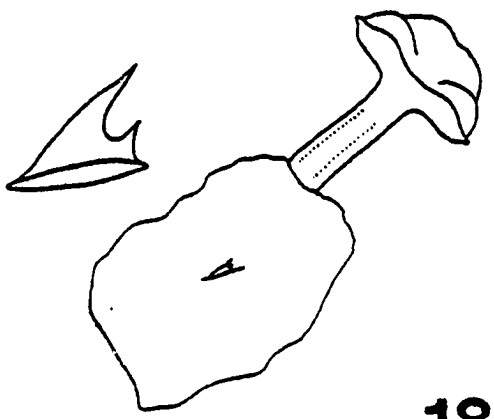


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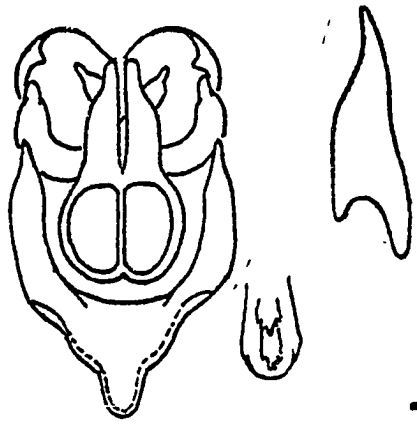


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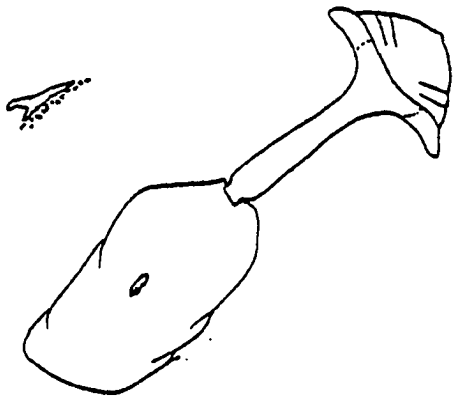
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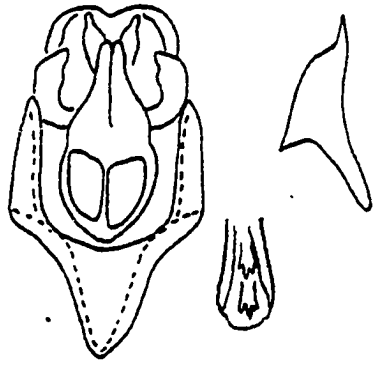
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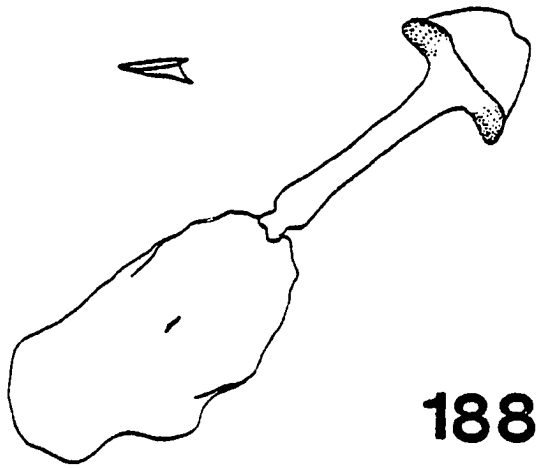
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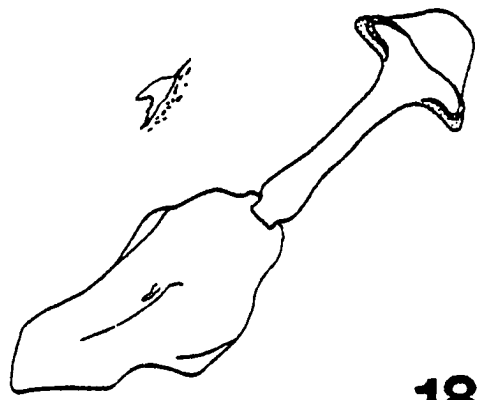
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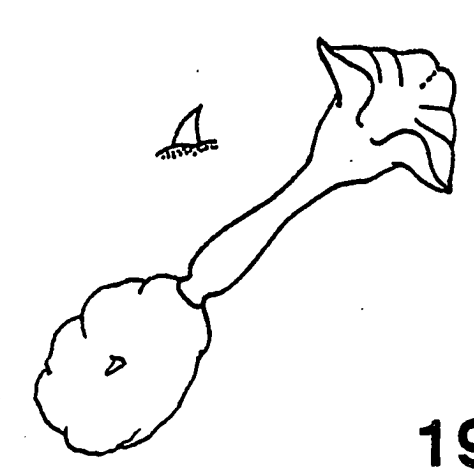


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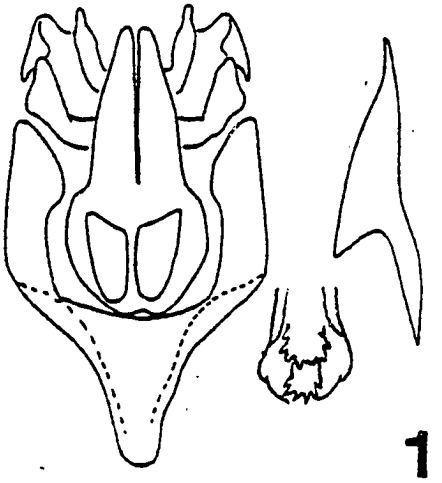


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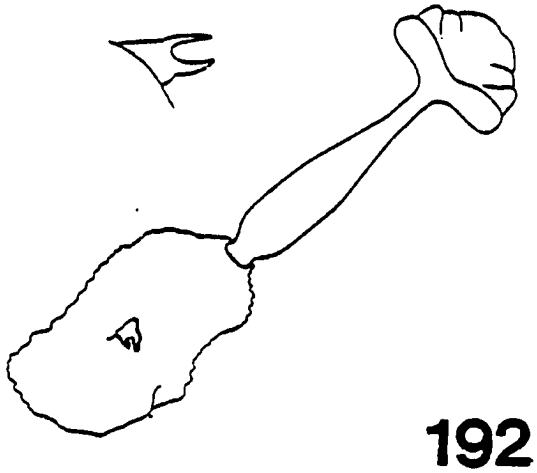
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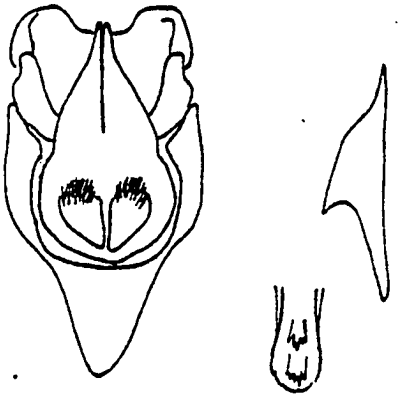
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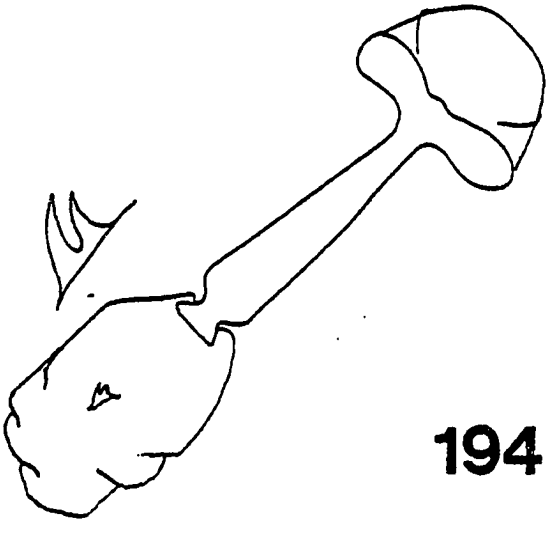
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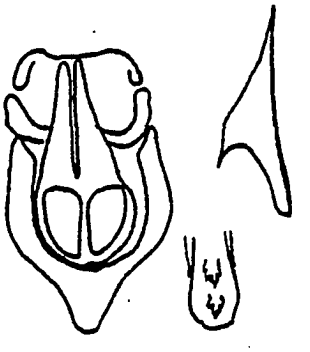
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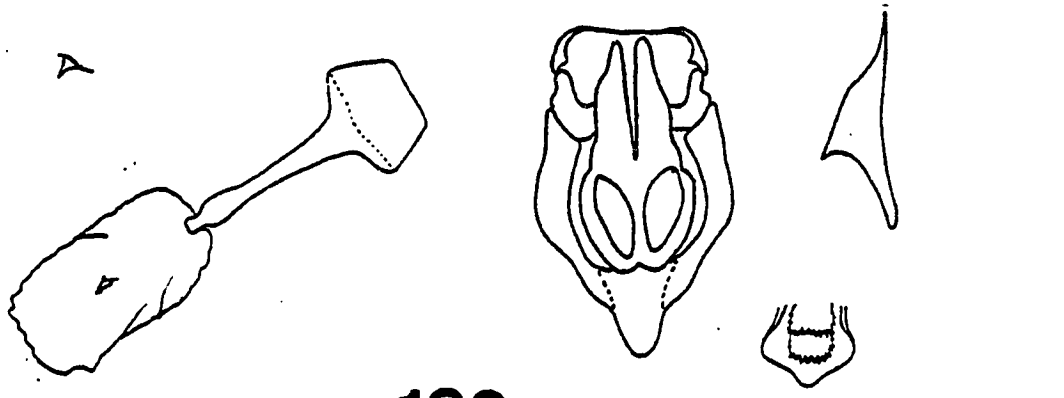


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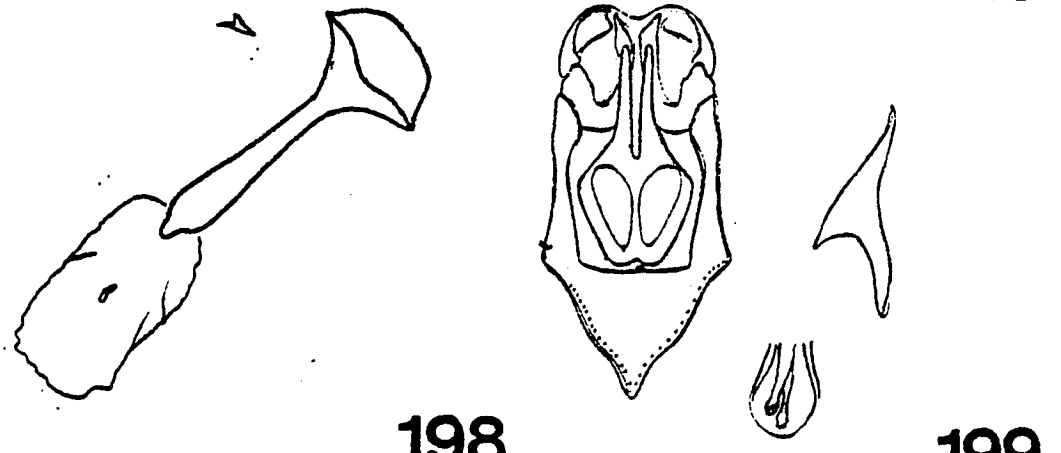


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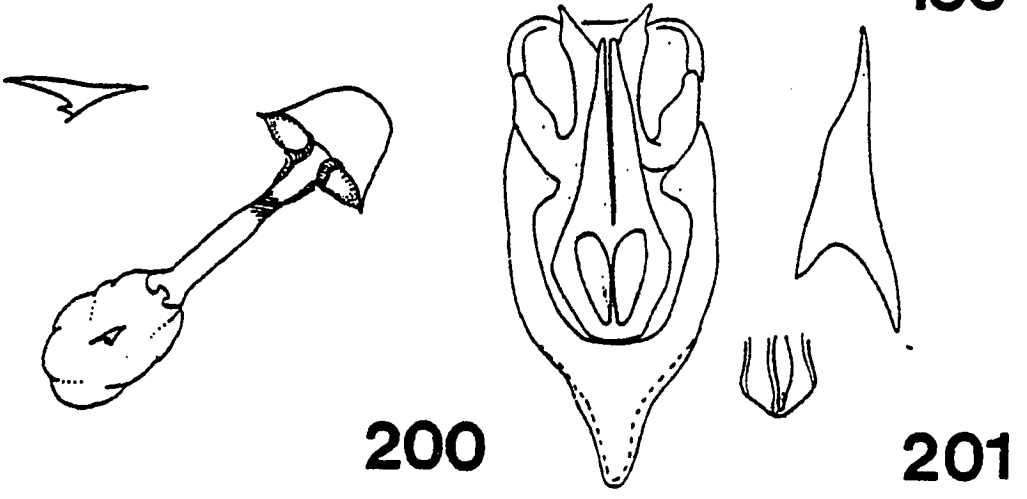
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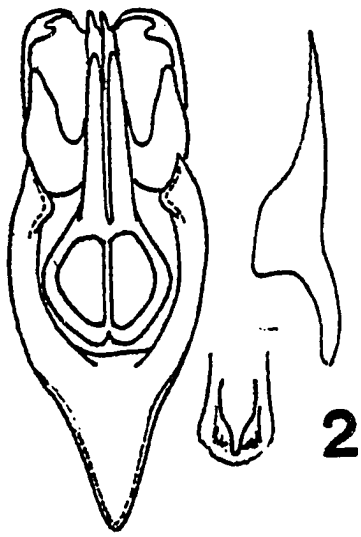


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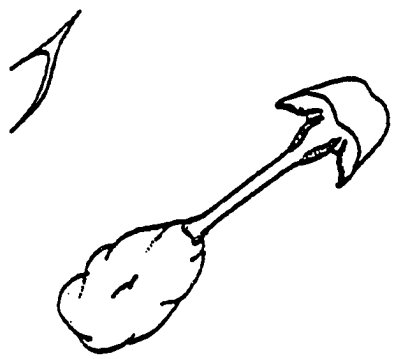


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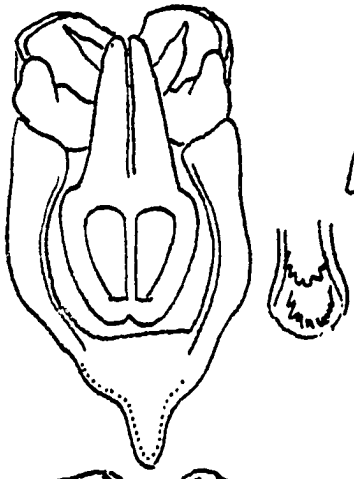
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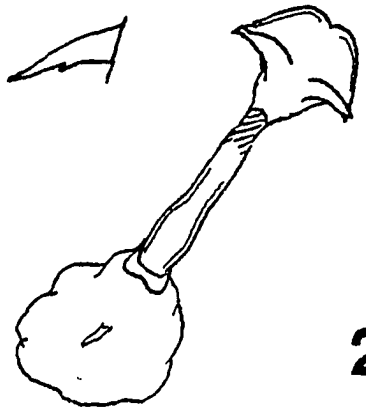
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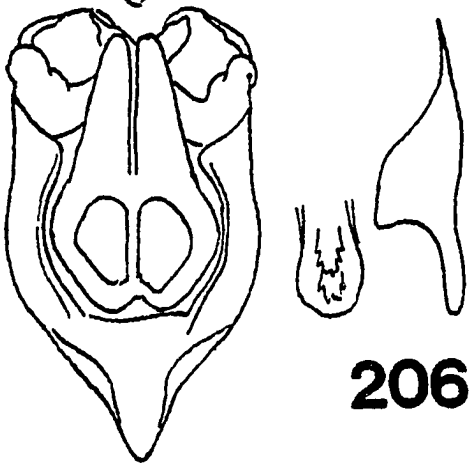
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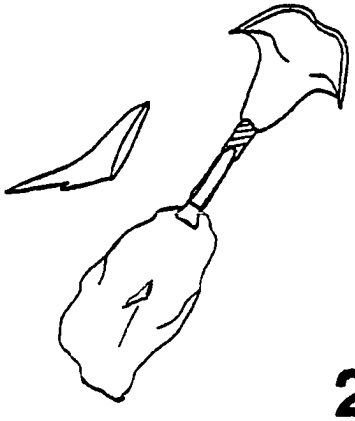
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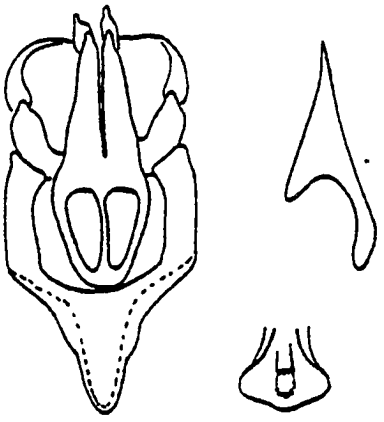


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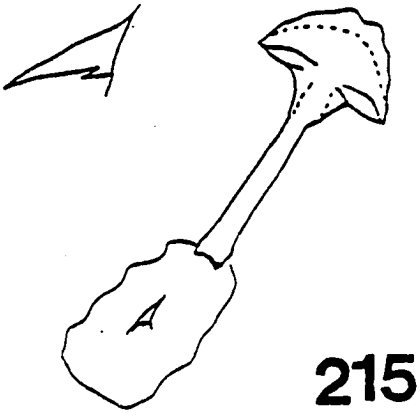


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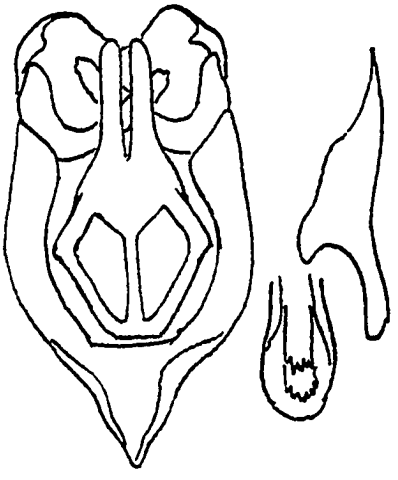
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214



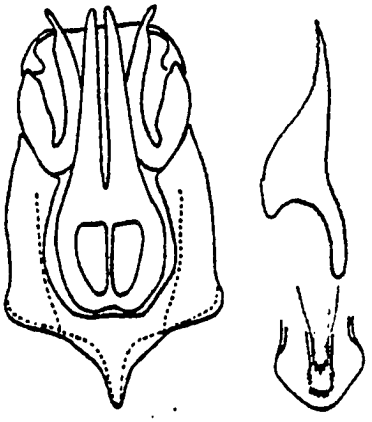
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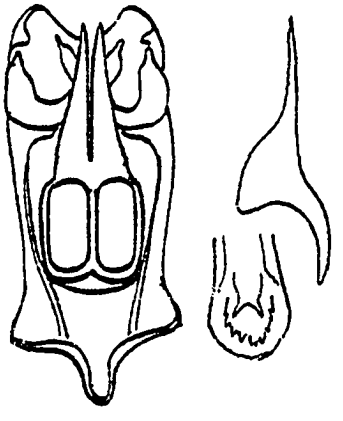
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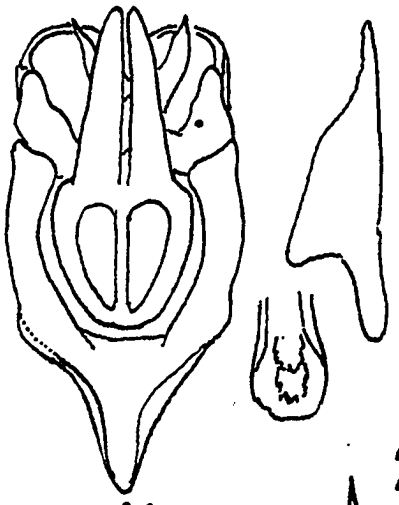


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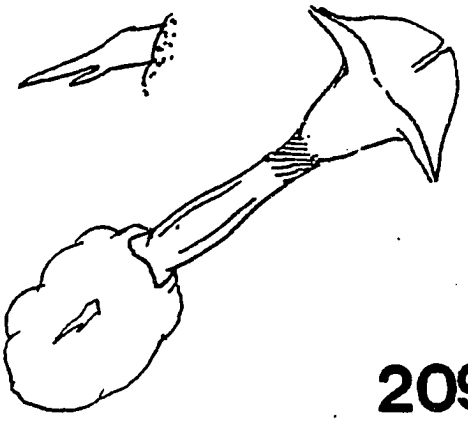


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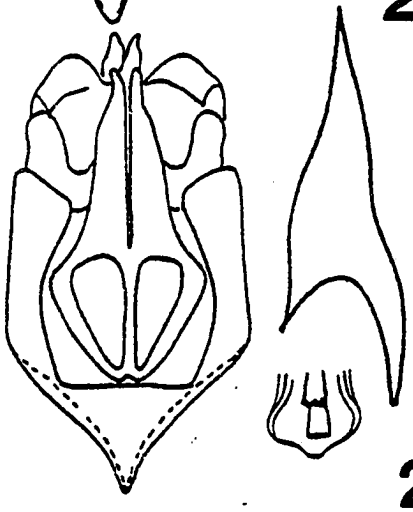
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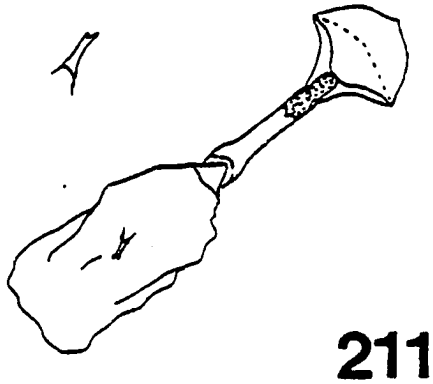
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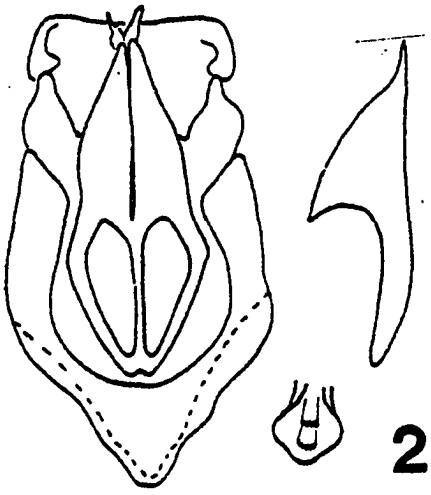
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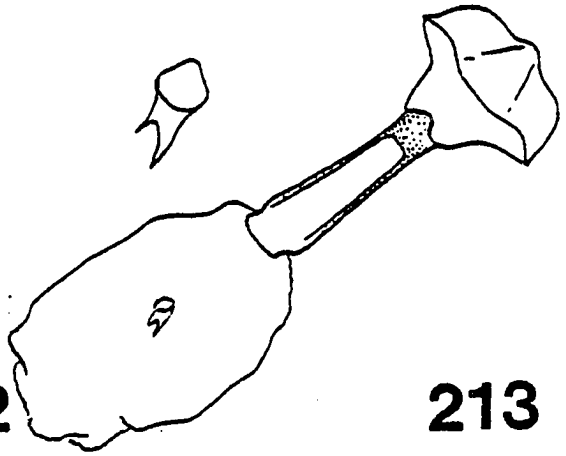
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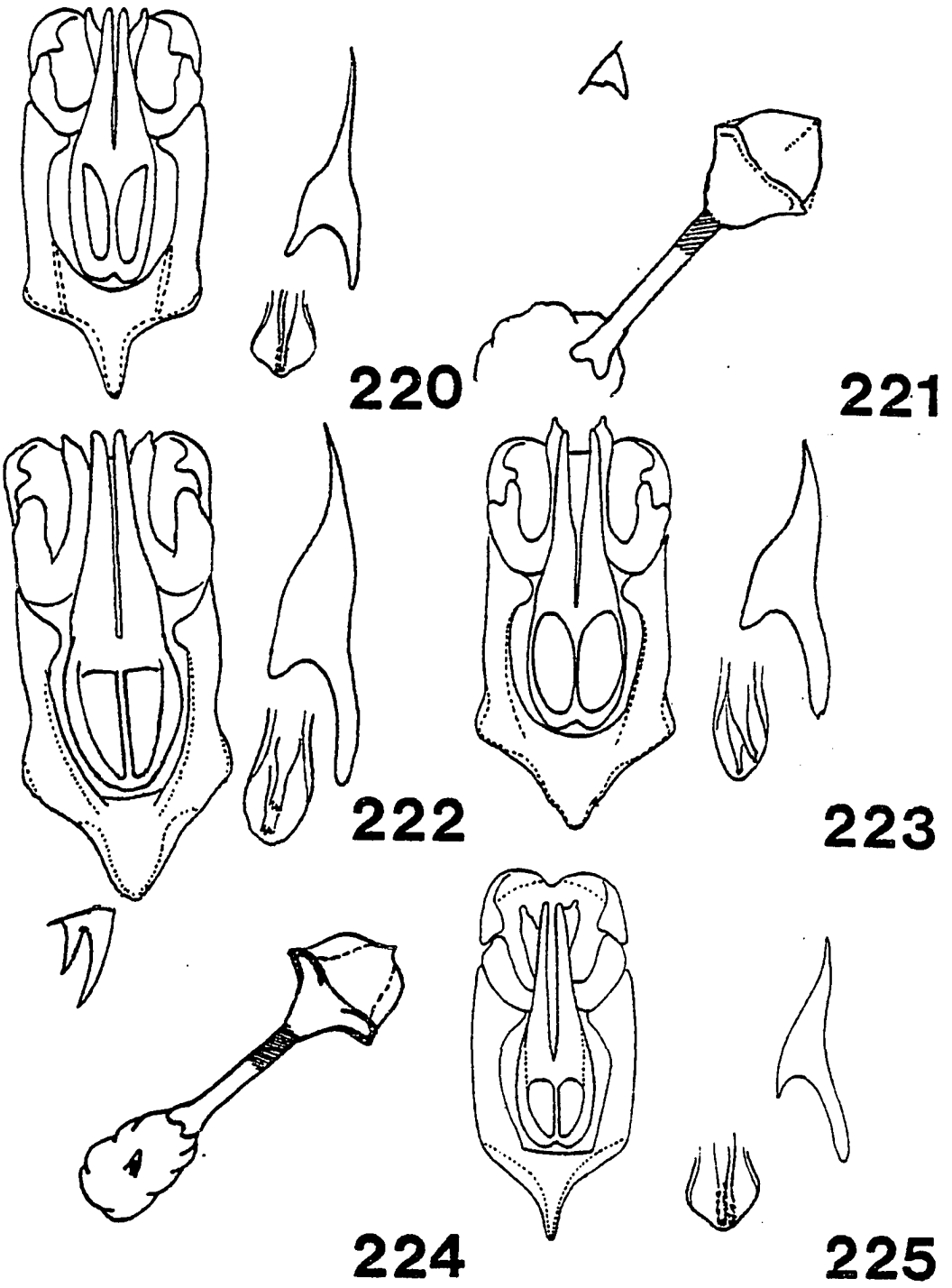


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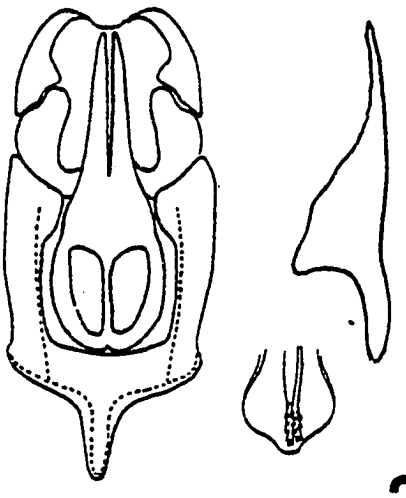
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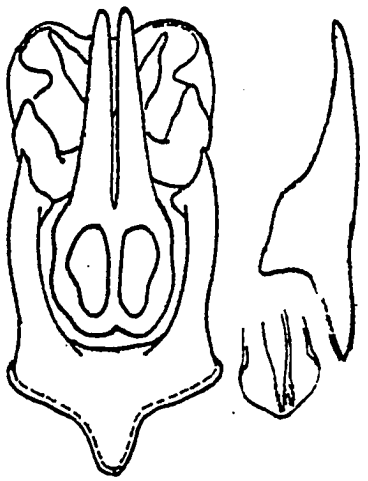
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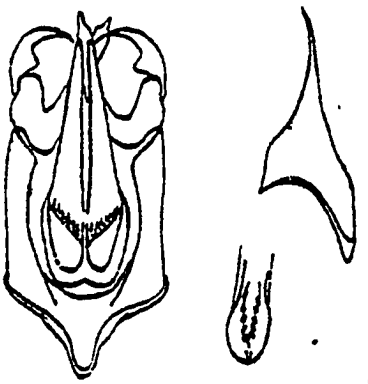
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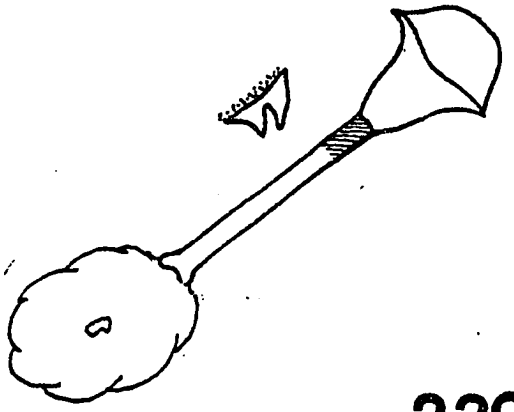
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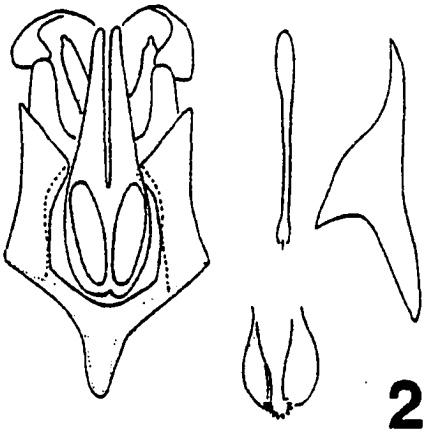
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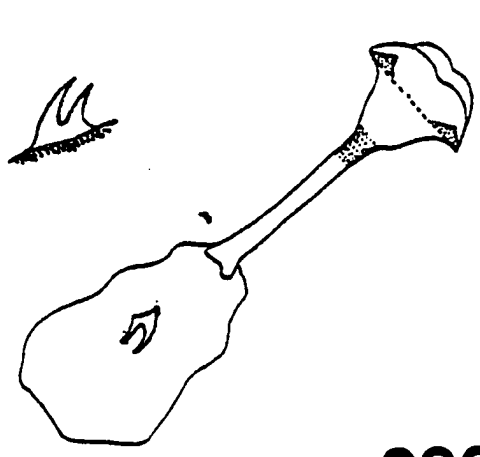


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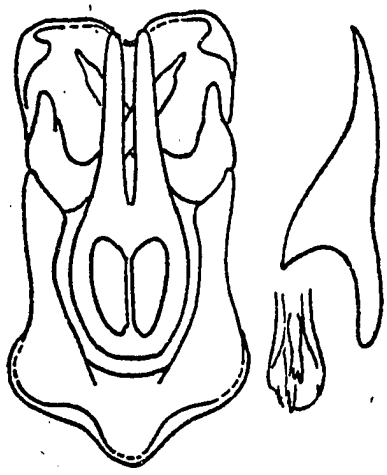


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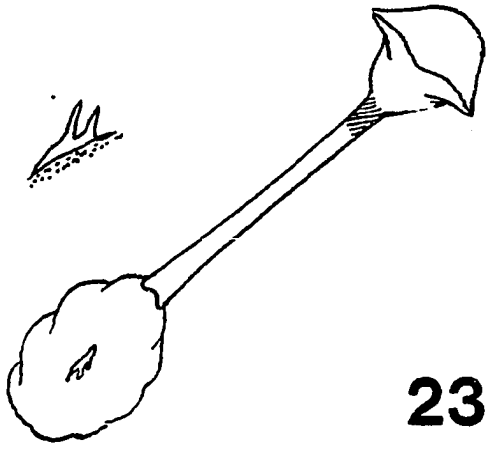
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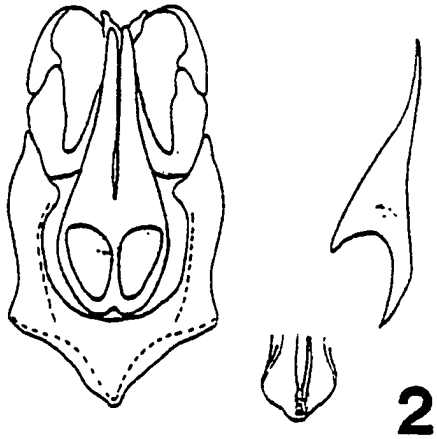
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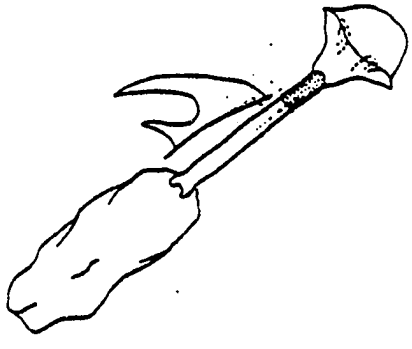
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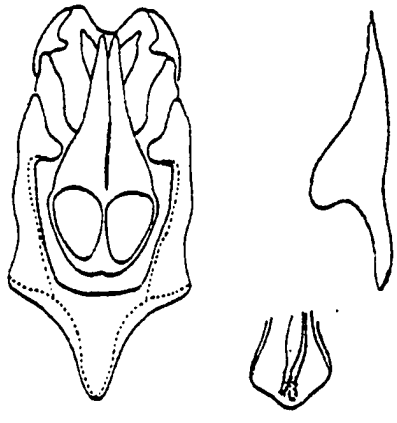
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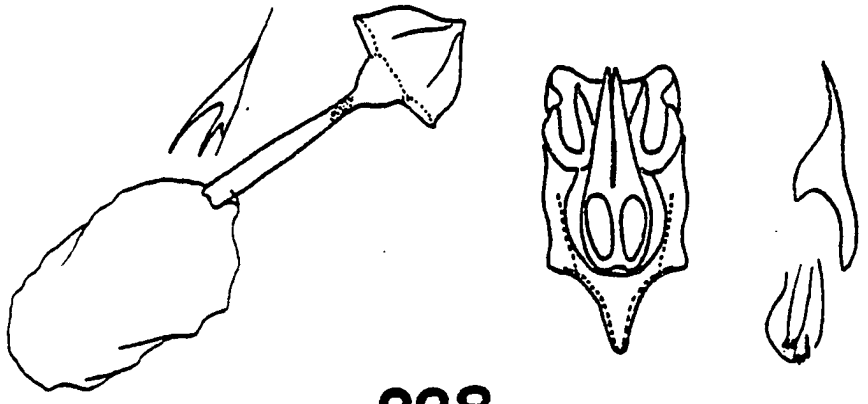


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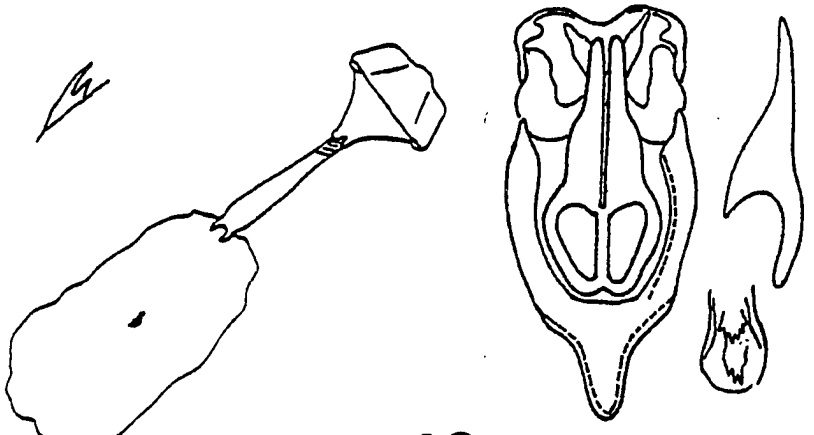


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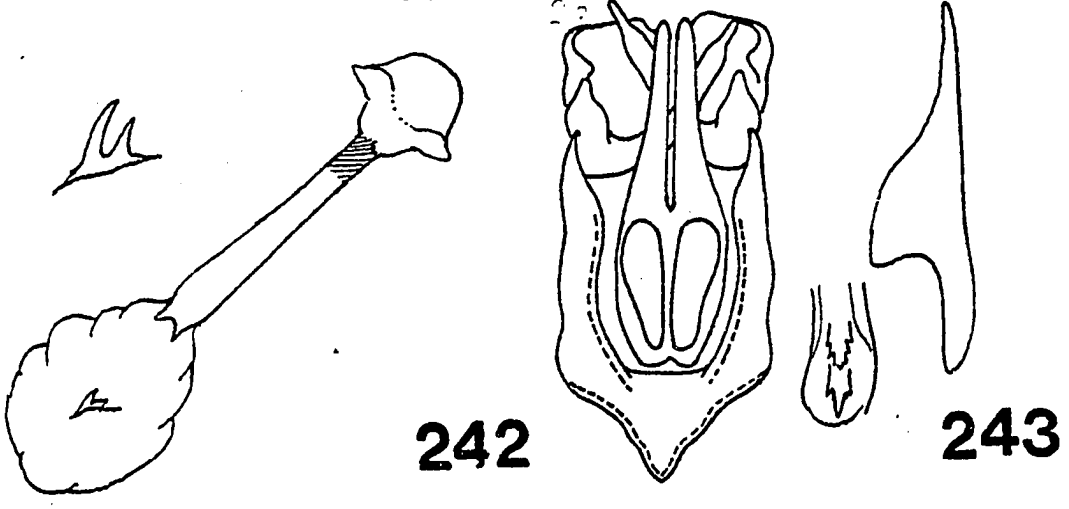
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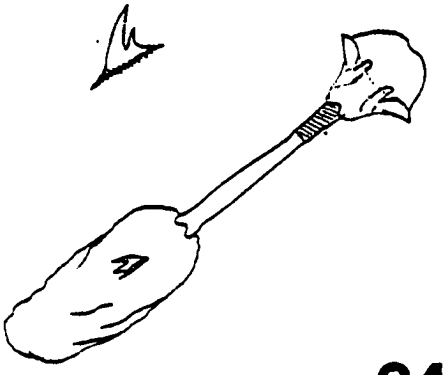


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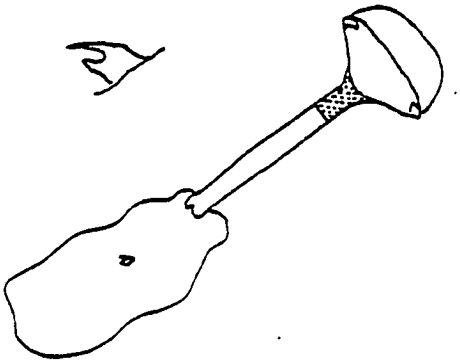


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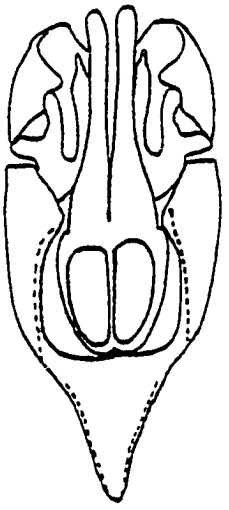
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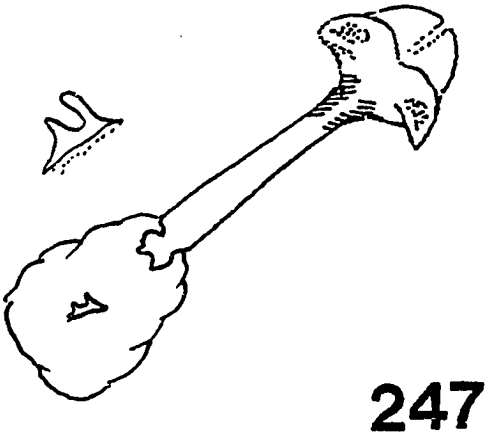


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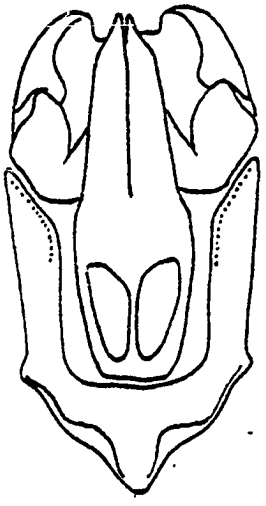




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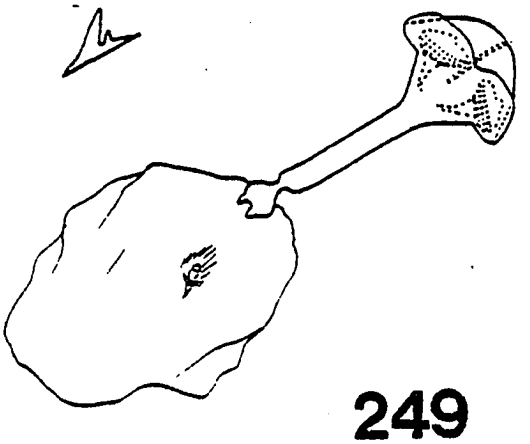


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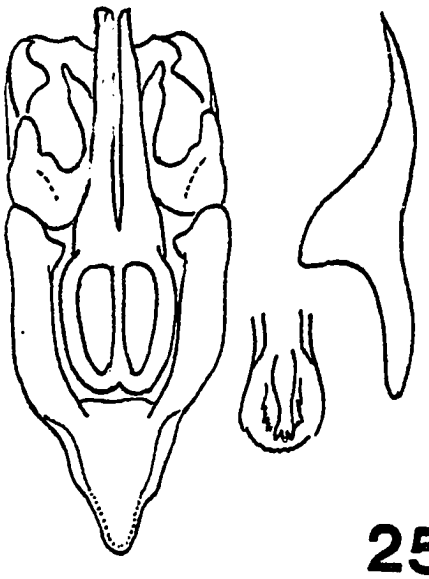


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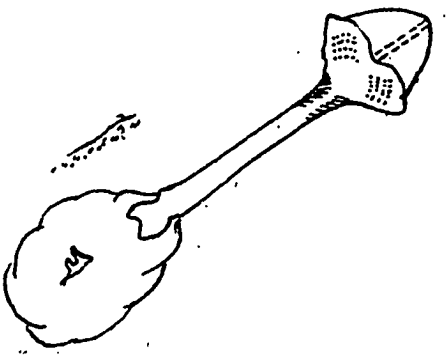


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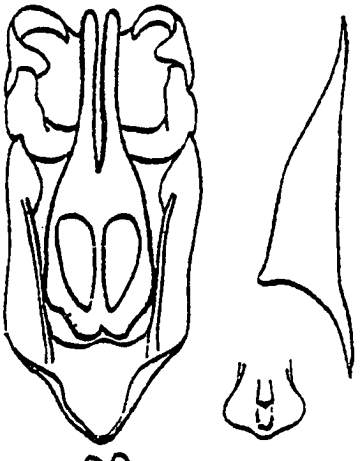
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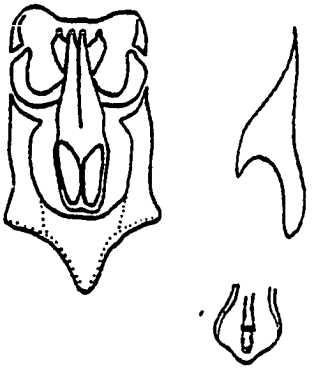
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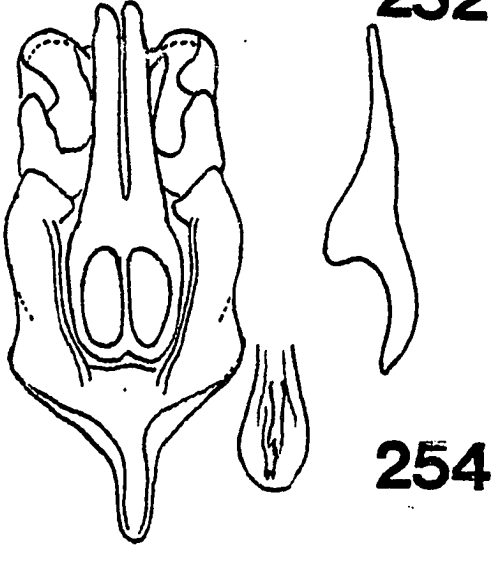
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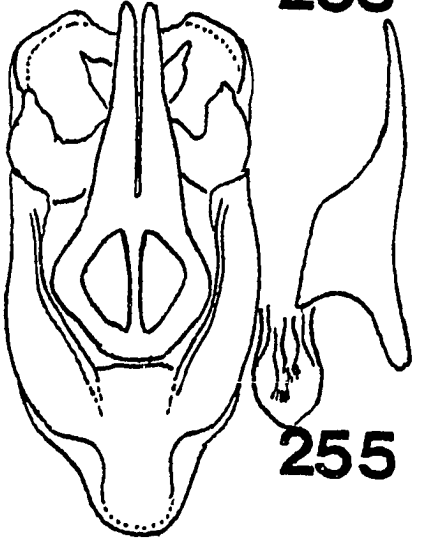
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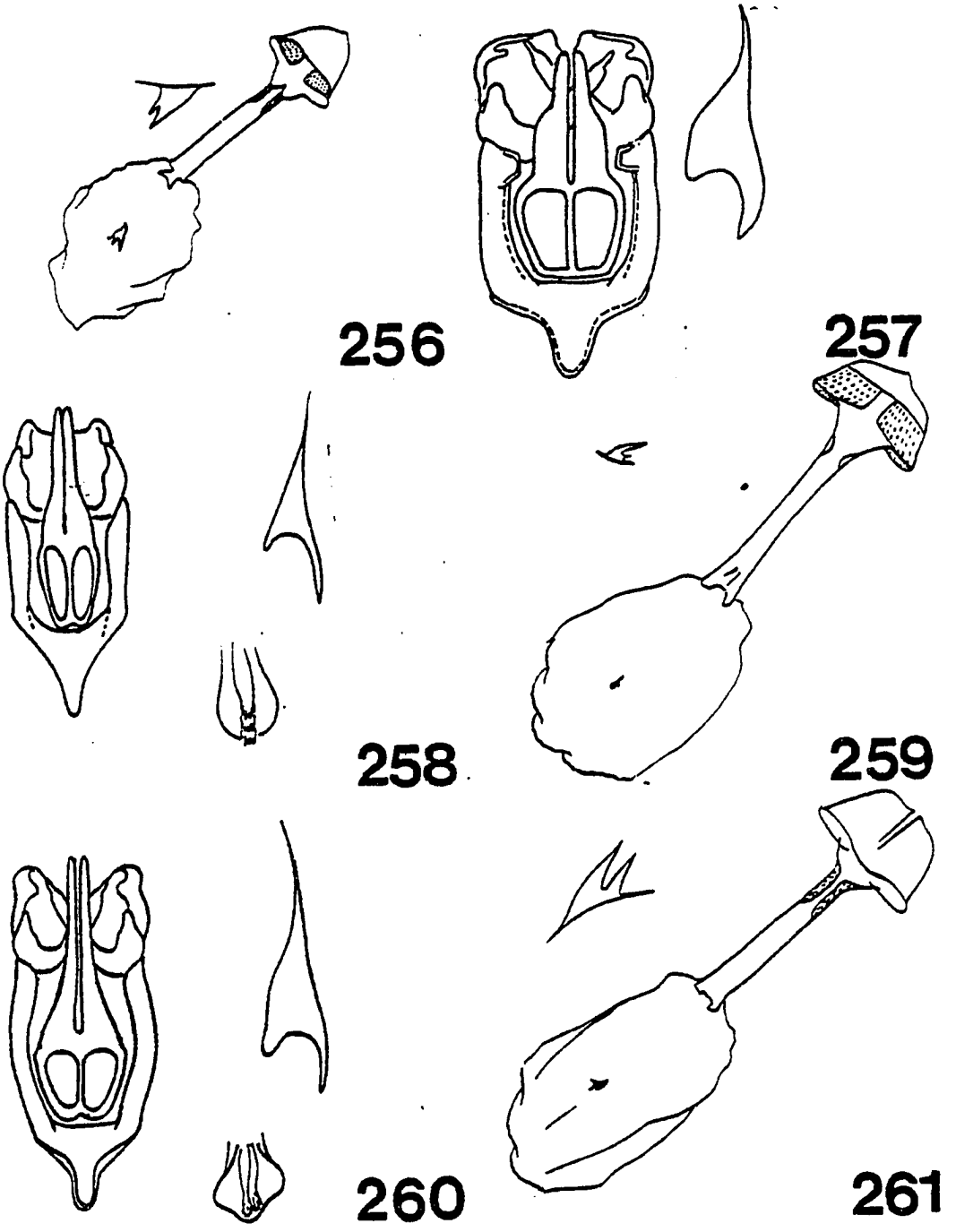


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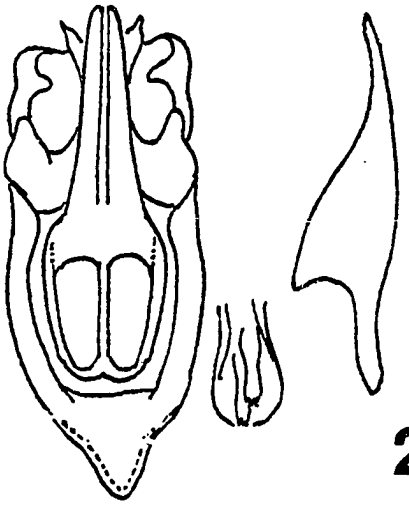


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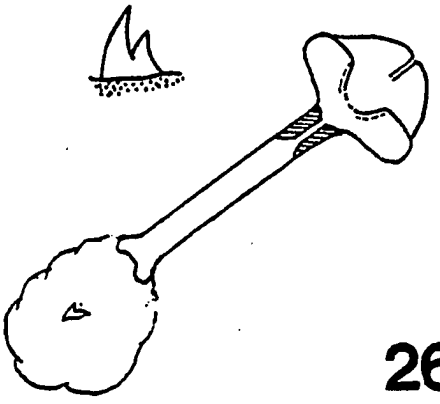
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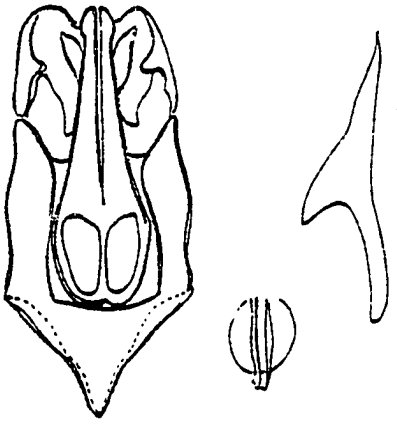
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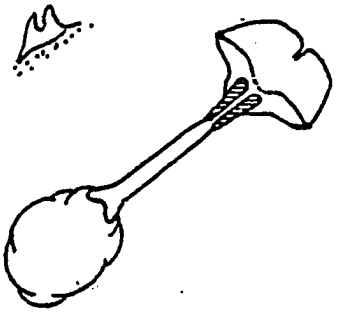
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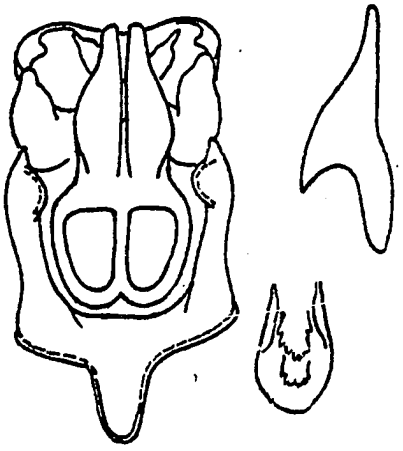
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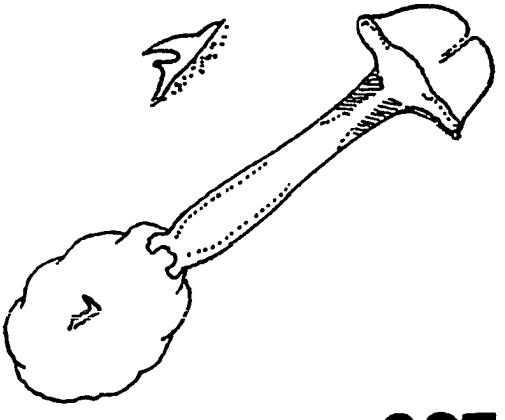
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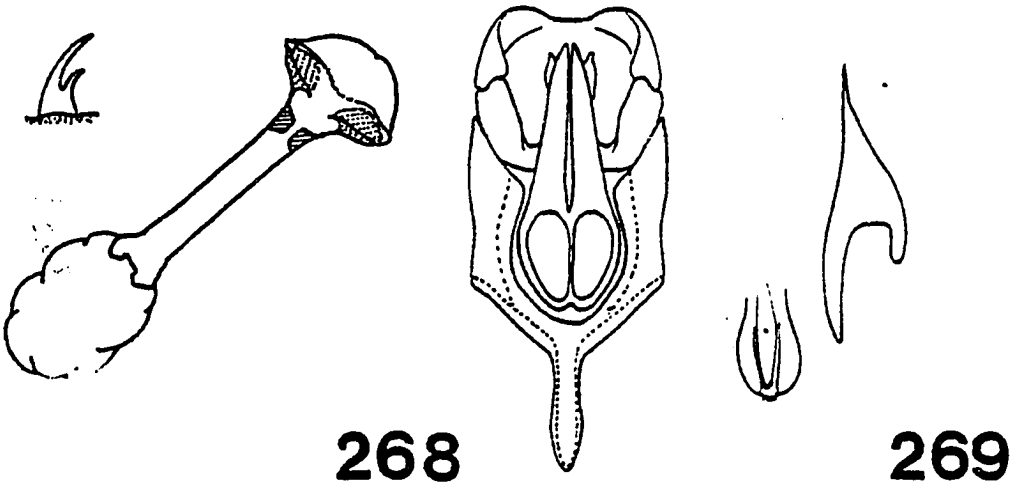


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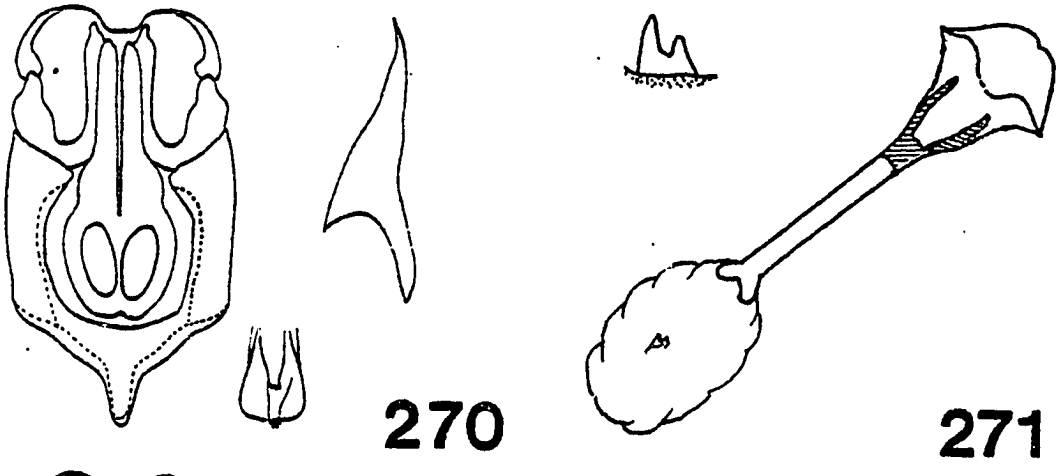


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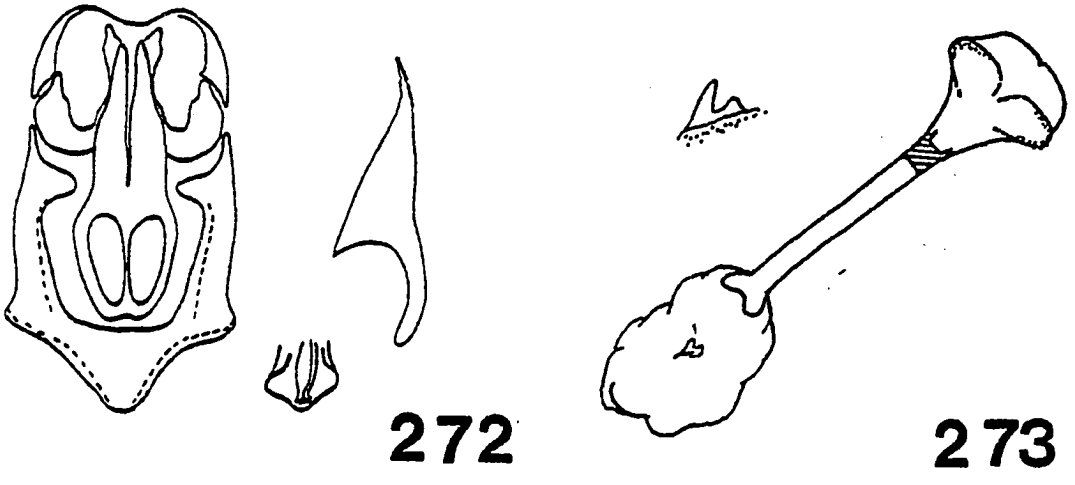
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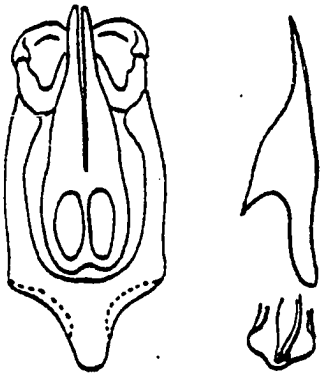


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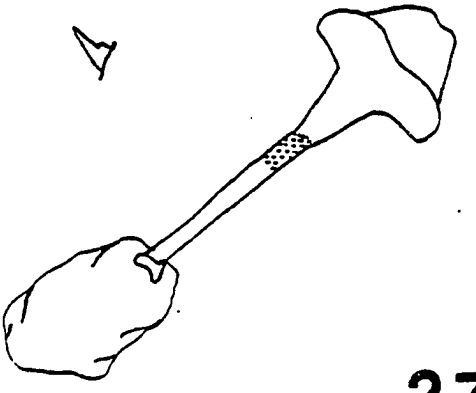


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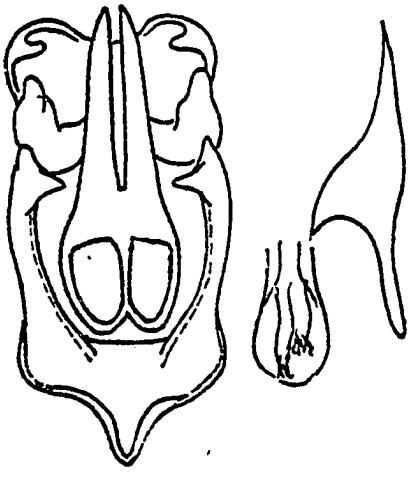
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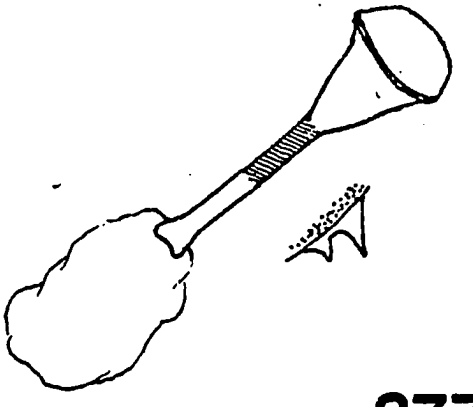
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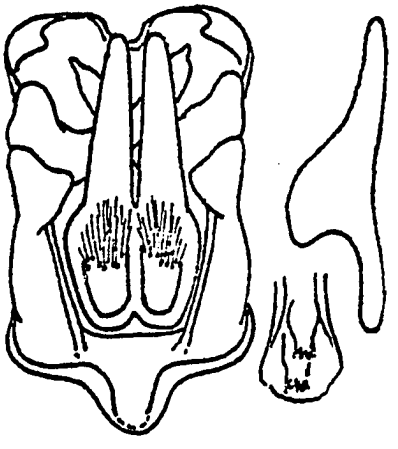
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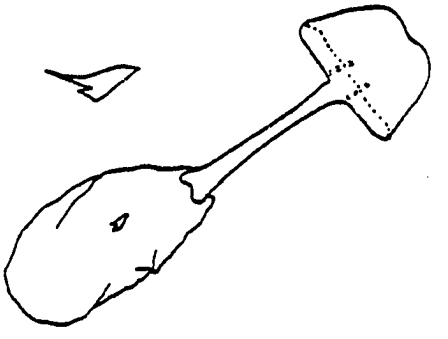
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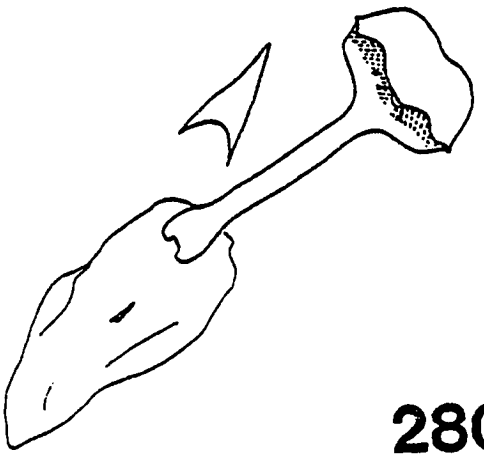


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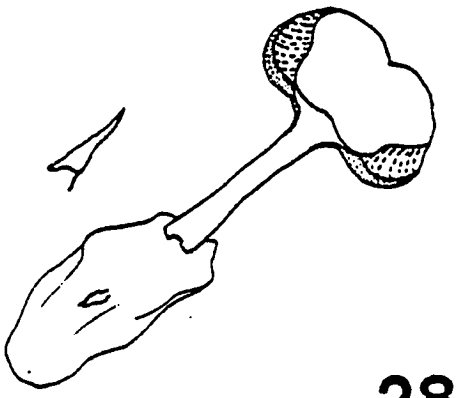


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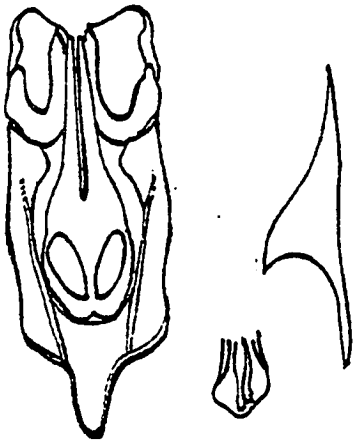
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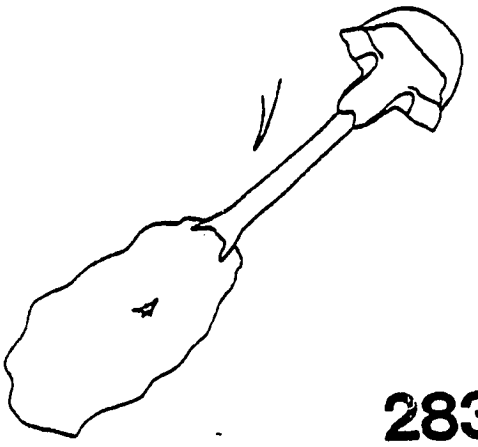
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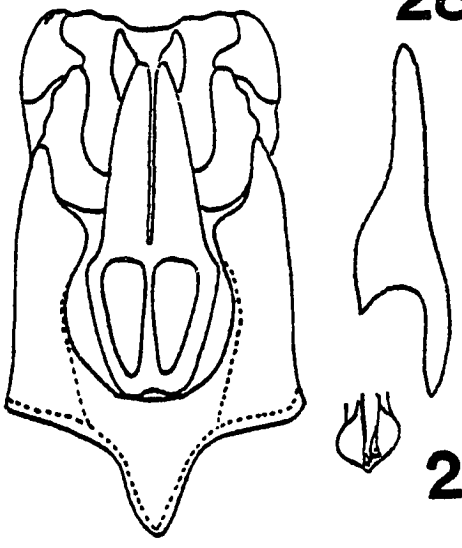
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282



283

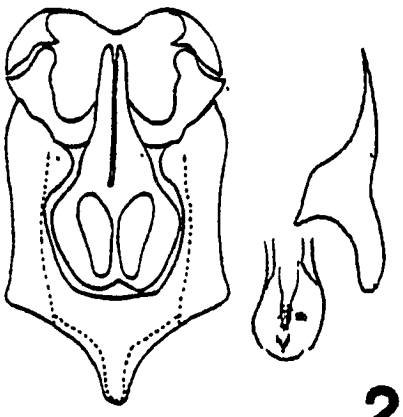


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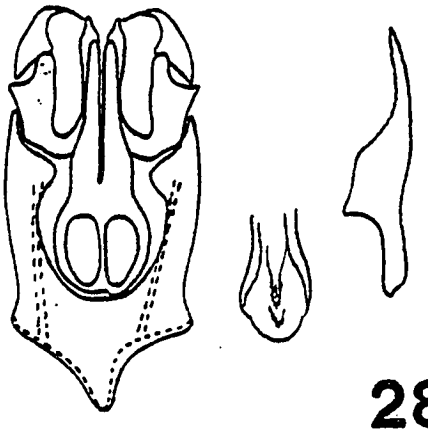


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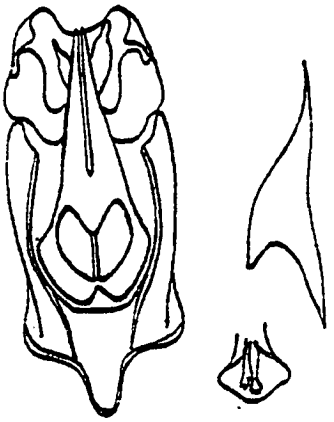
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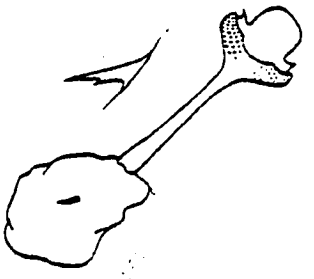
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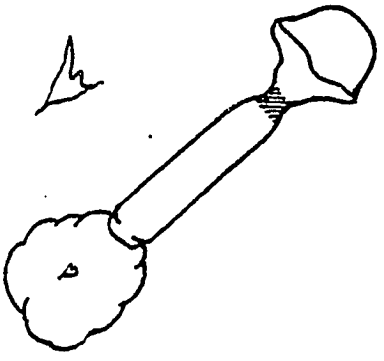
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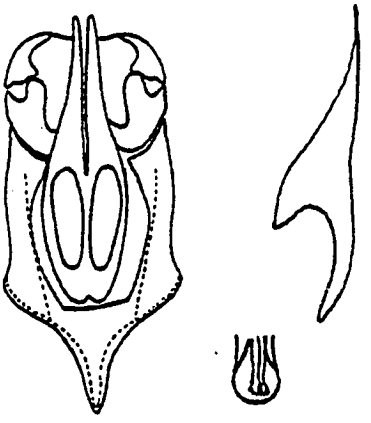
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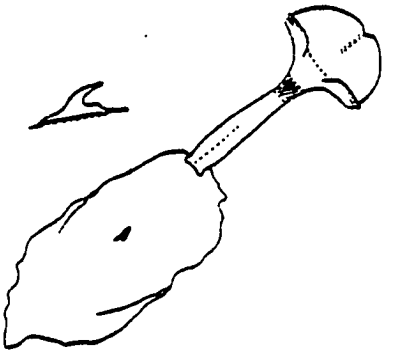


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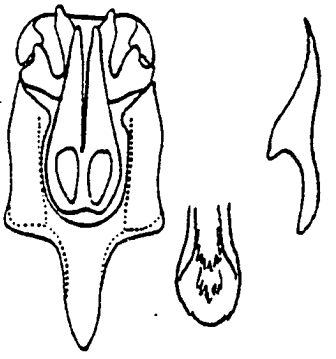


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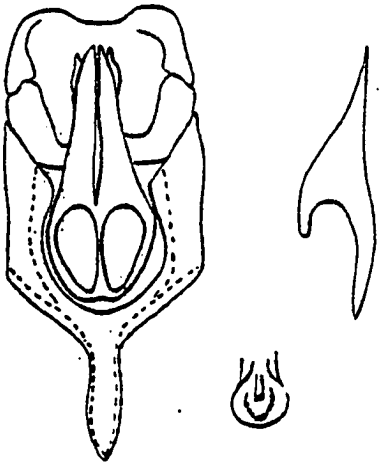
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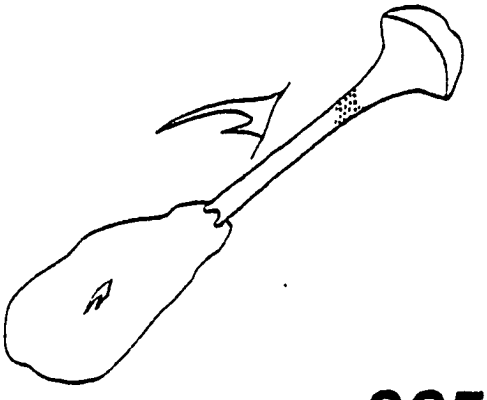
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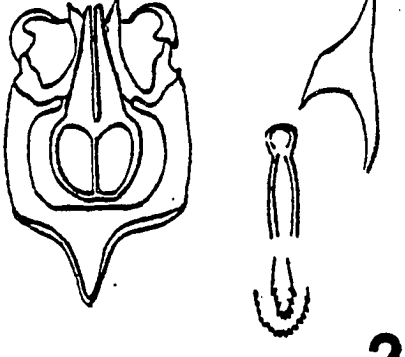
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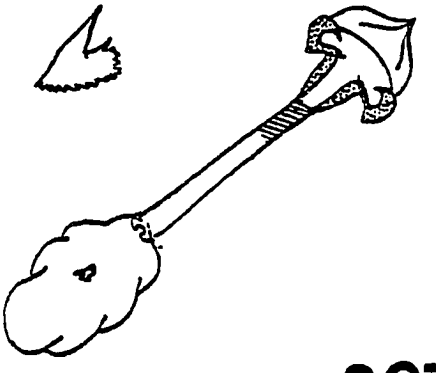
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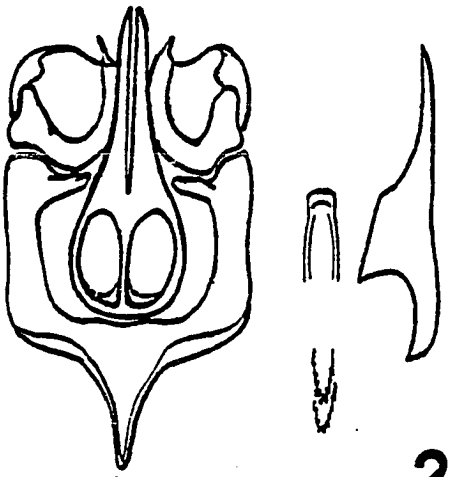


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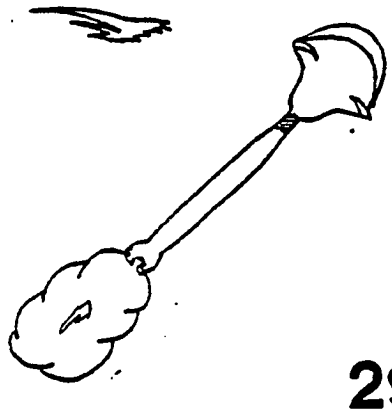


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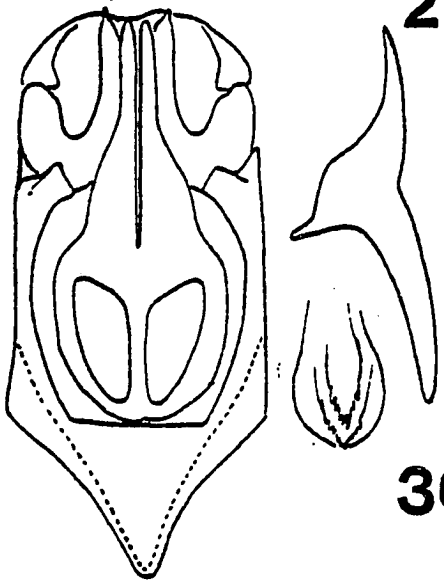
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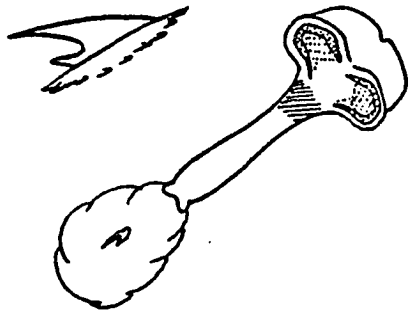
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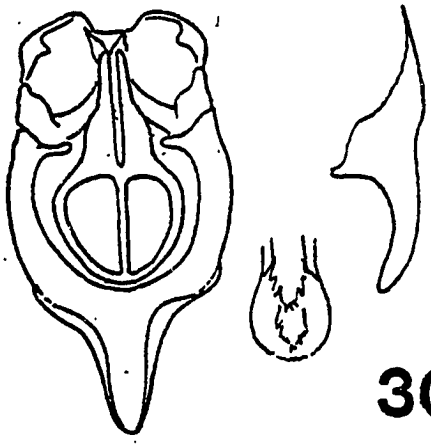
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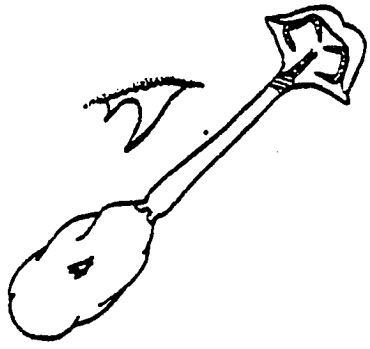
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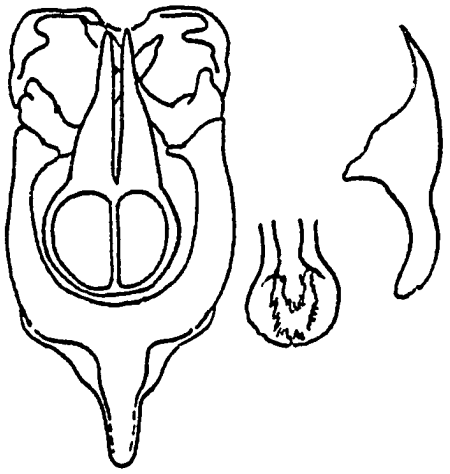


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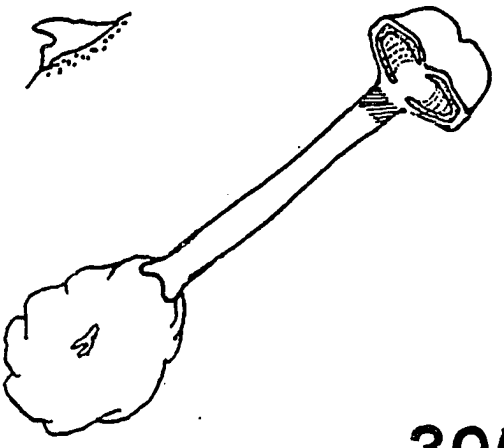


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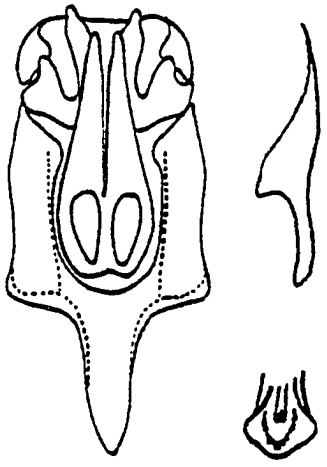
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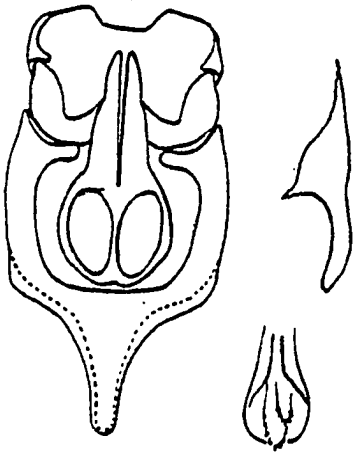
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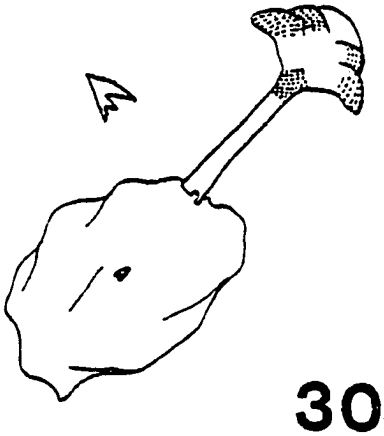
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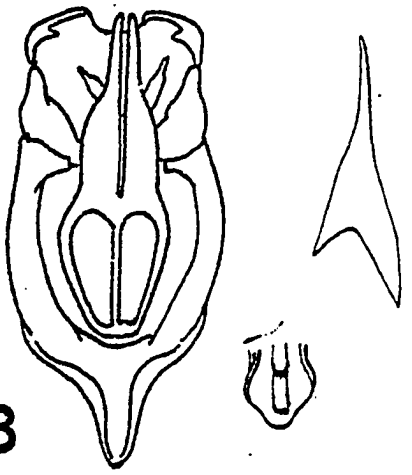
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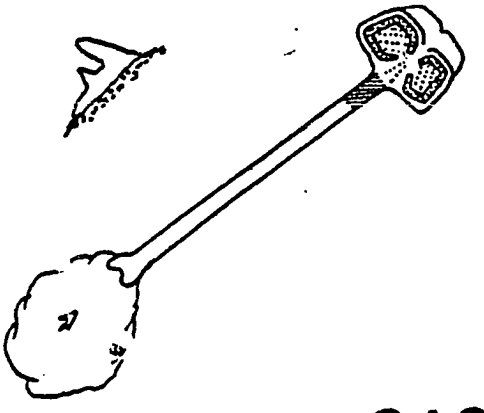


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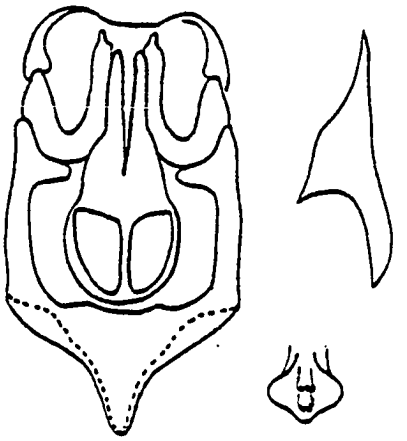


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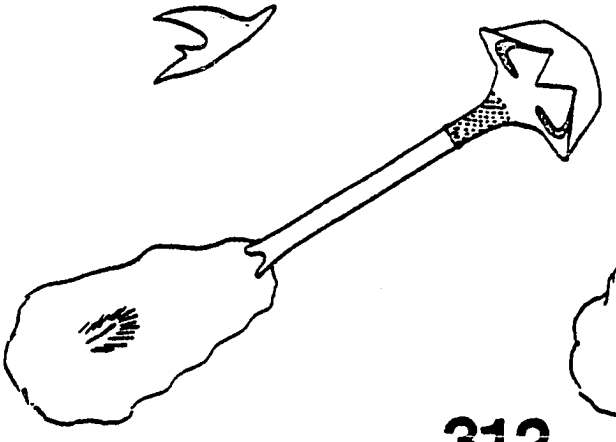
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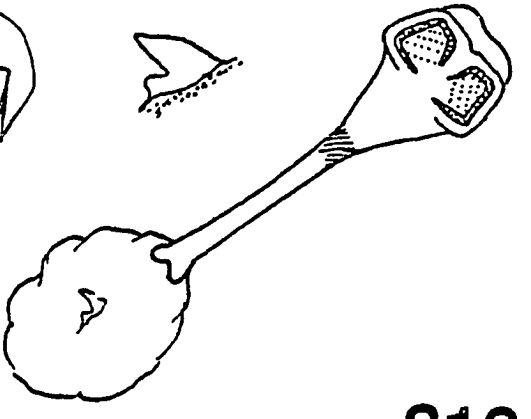
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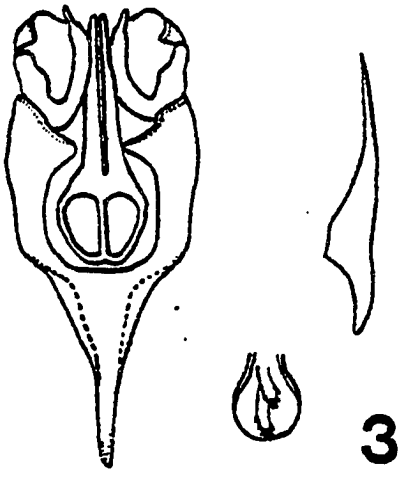
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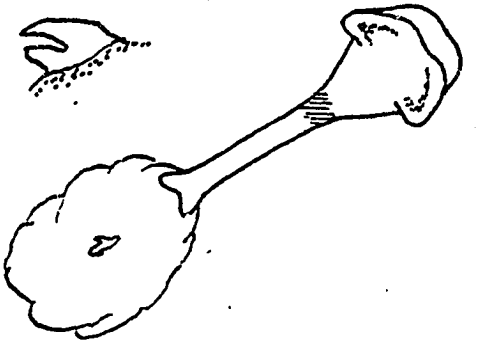
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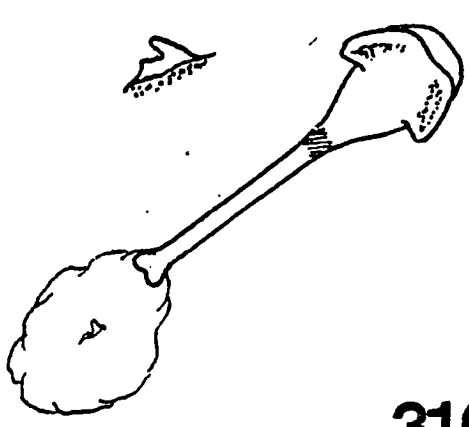


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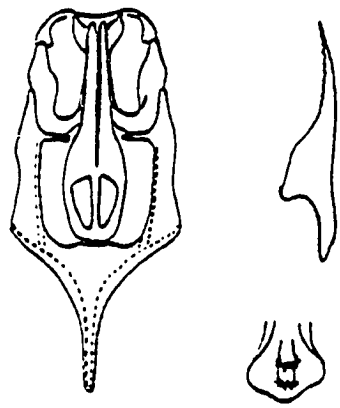


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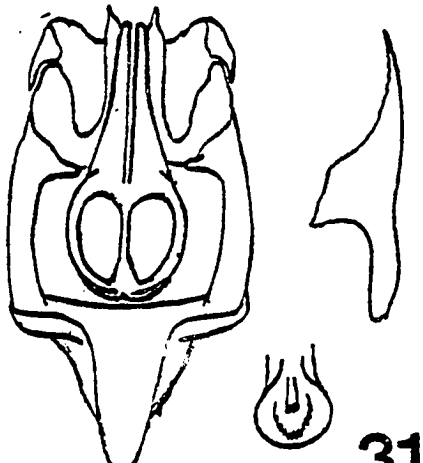
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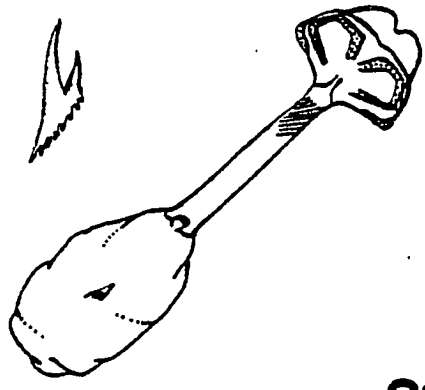
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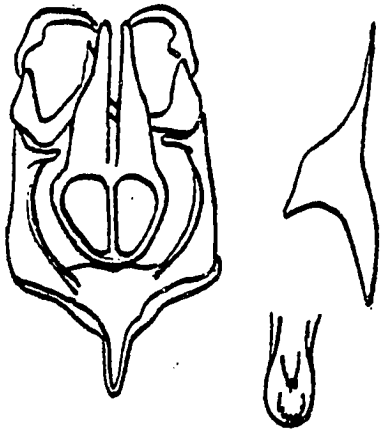
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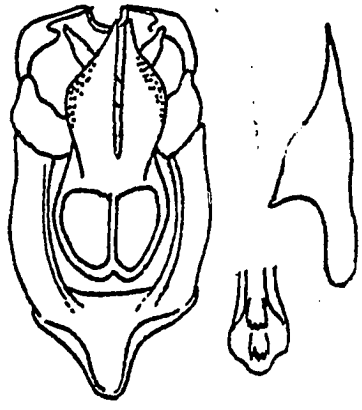
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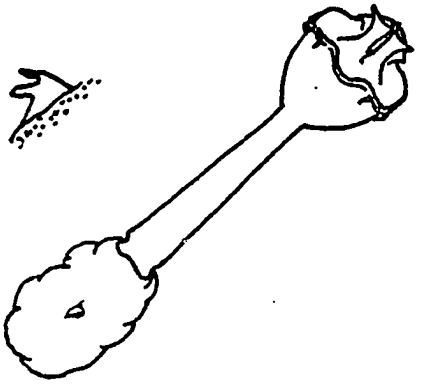


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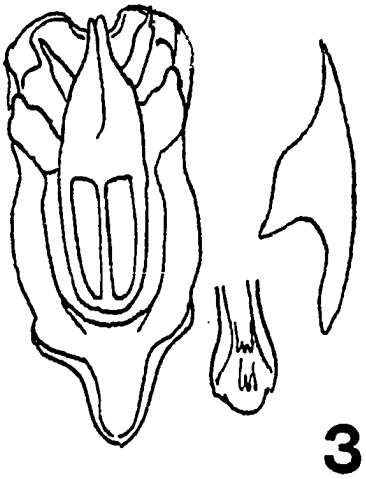


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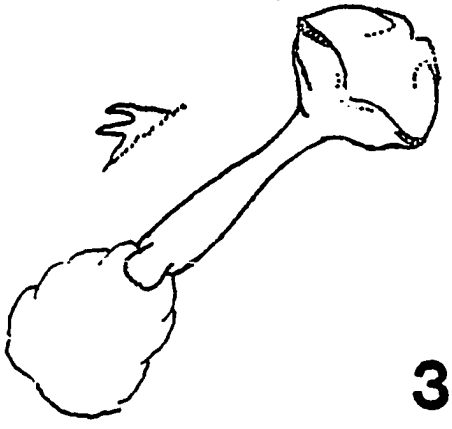
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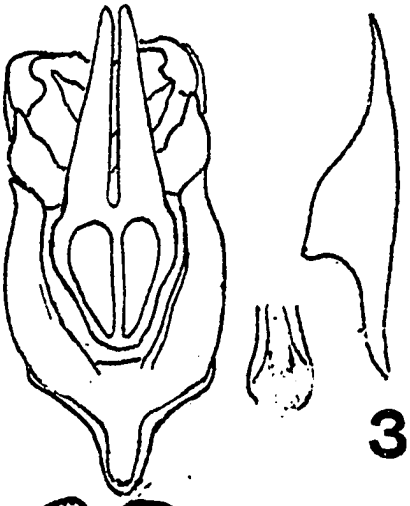
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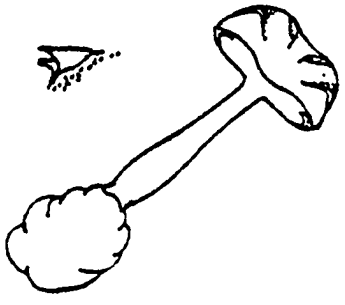
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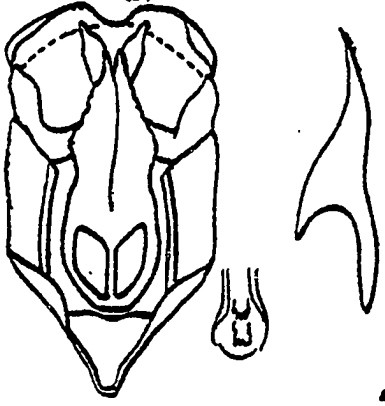
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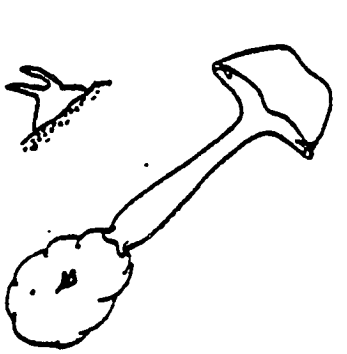


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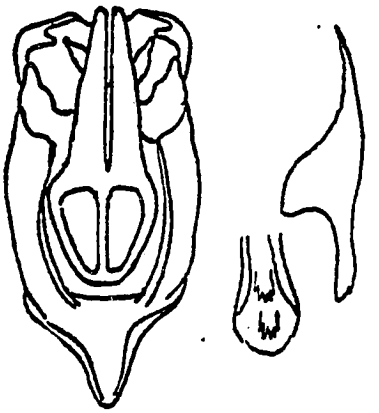


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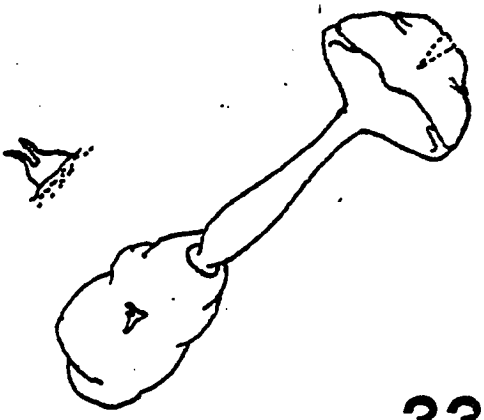
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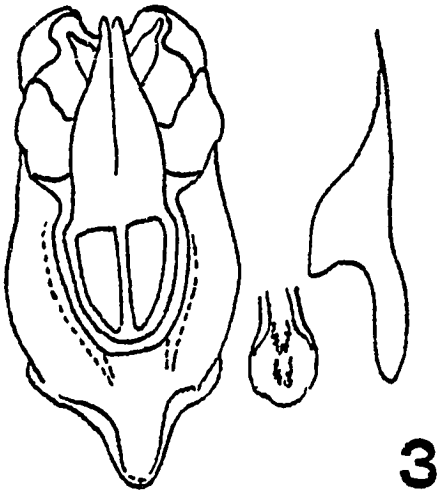
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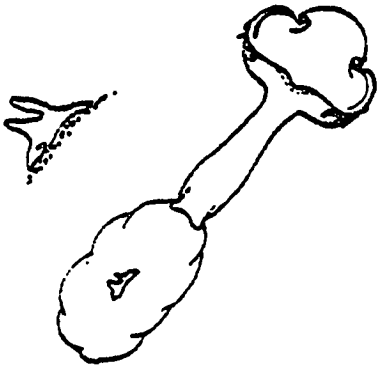
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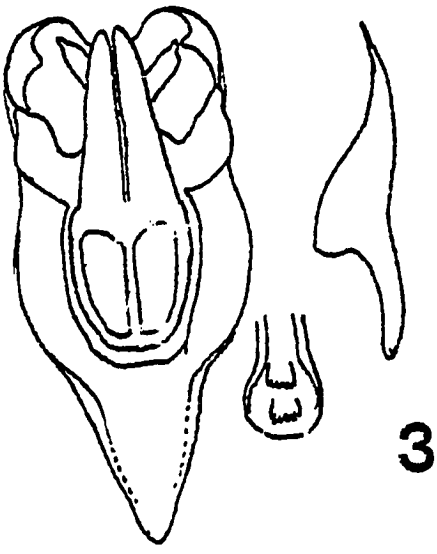
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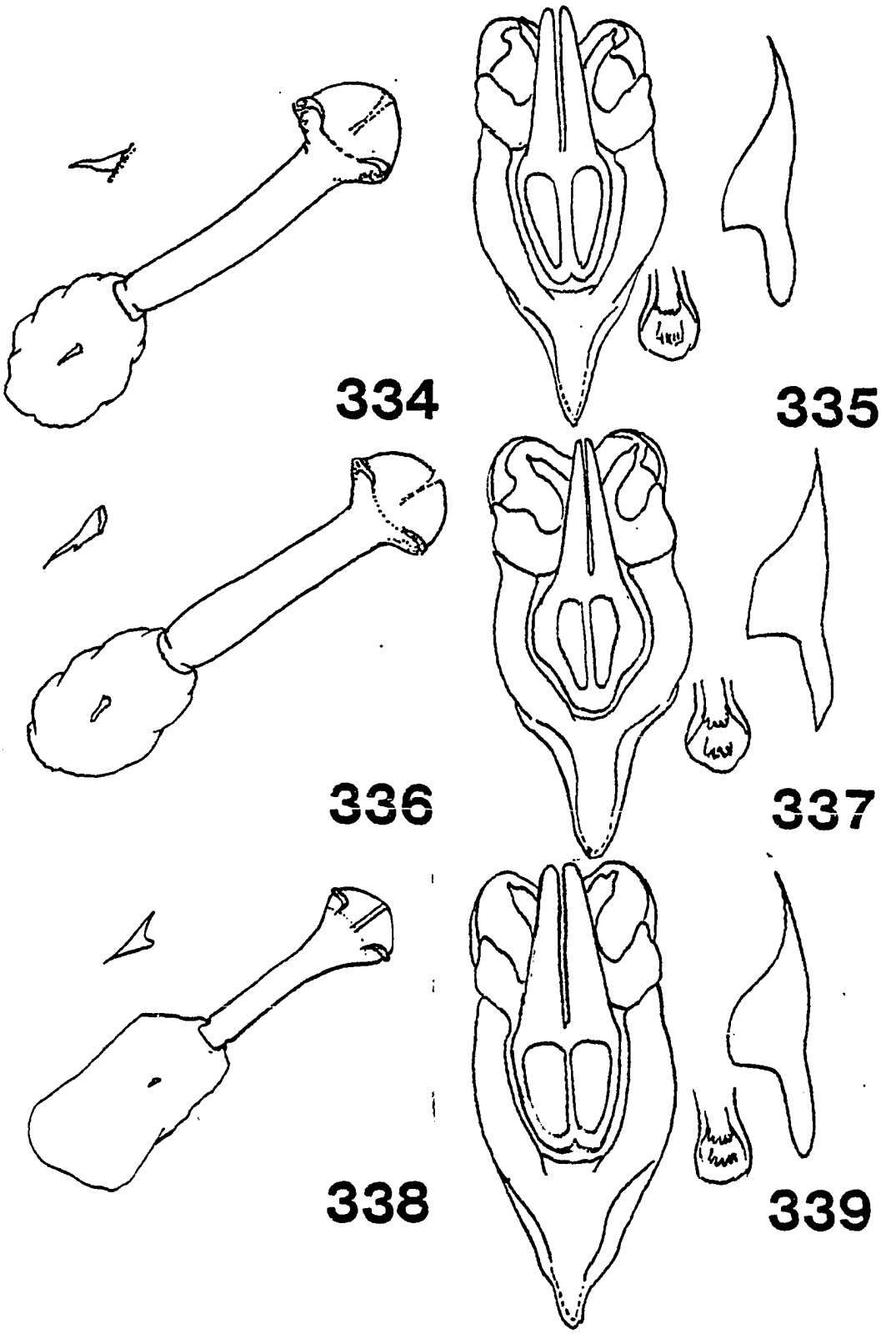


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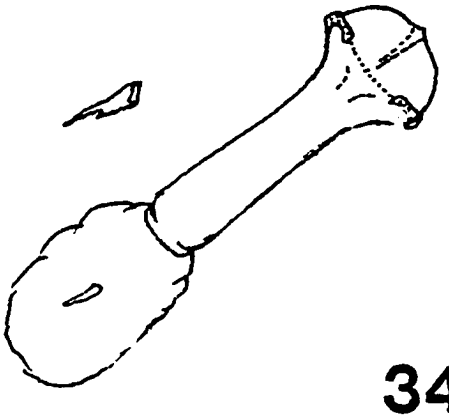


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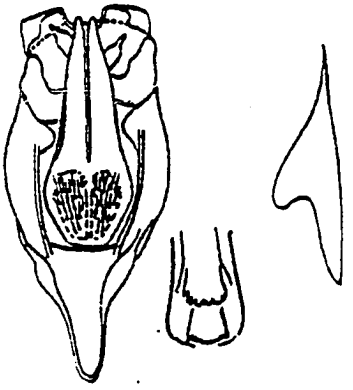
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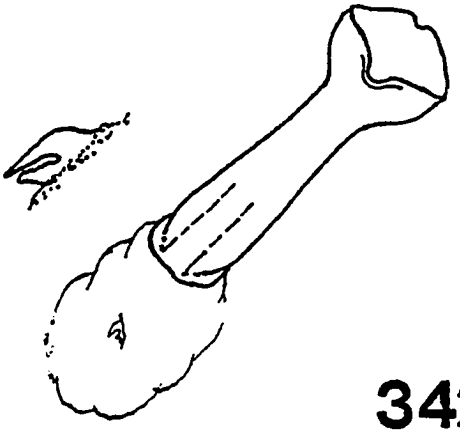
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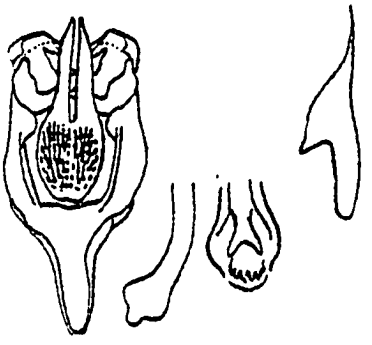
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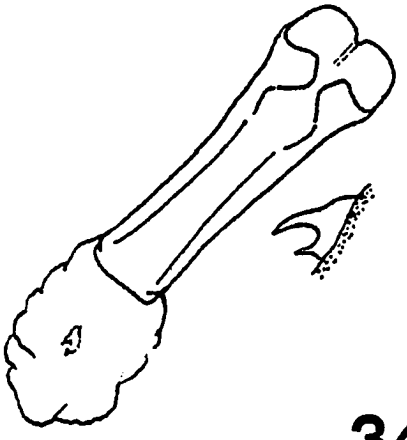
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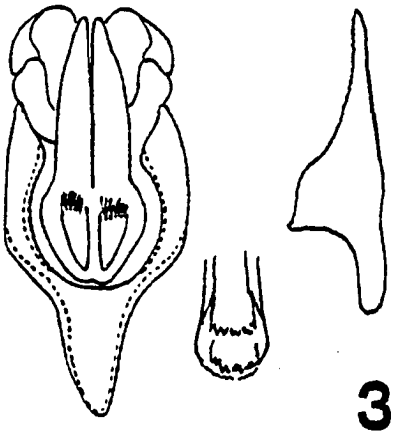
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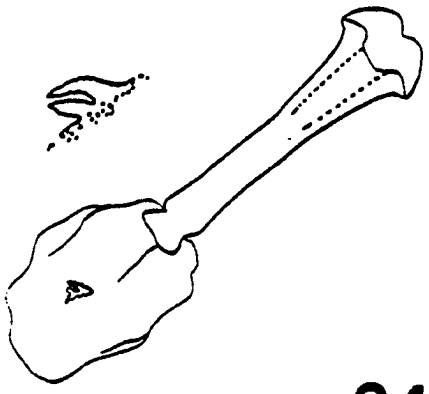


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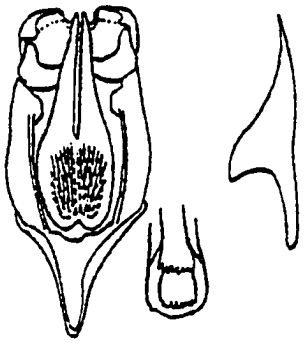


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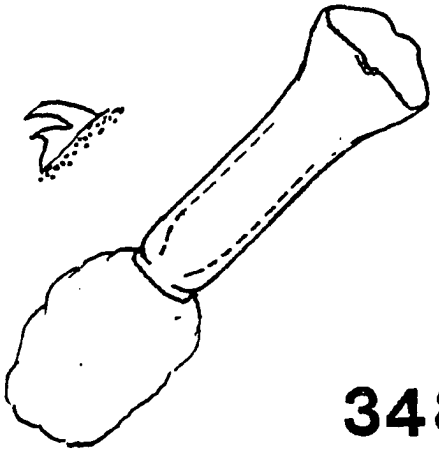
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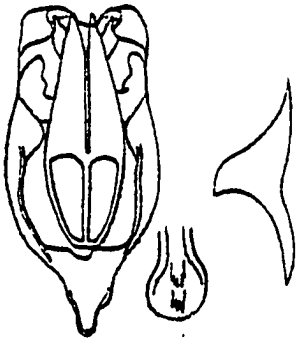
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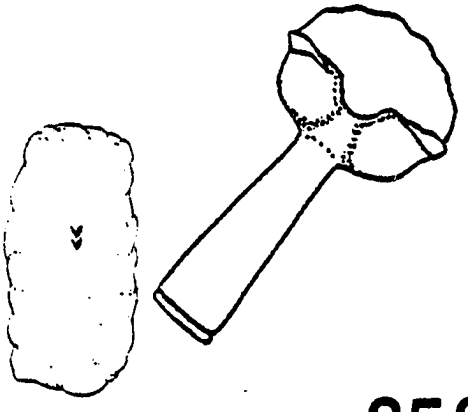
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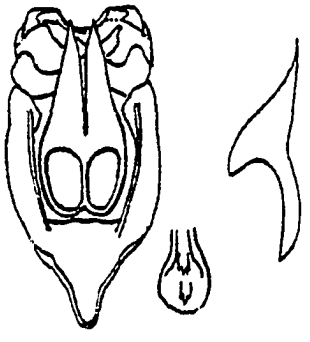
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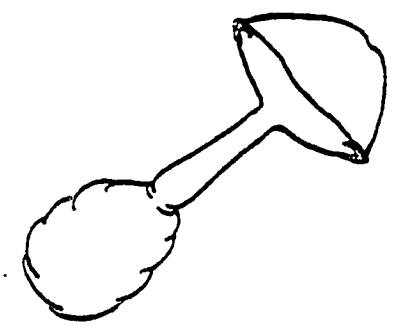


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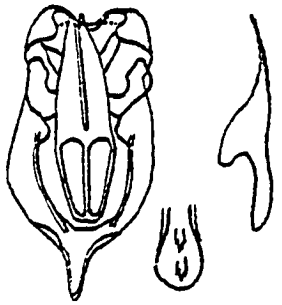


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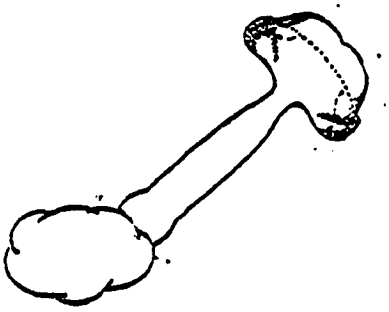
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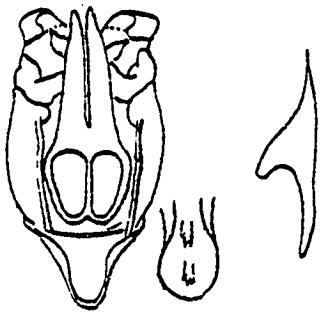
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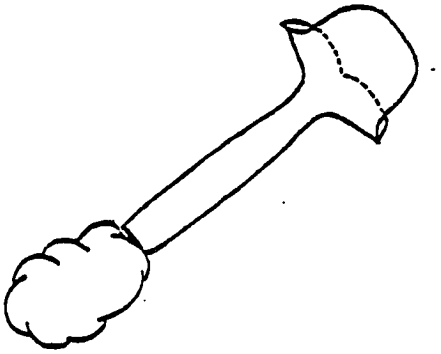
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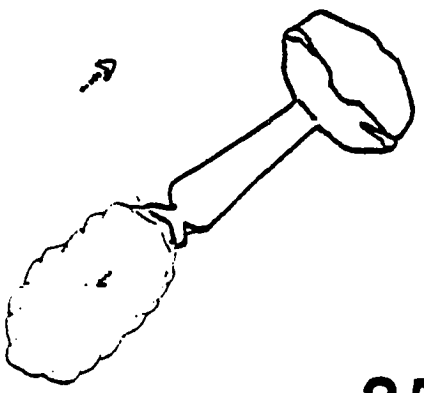


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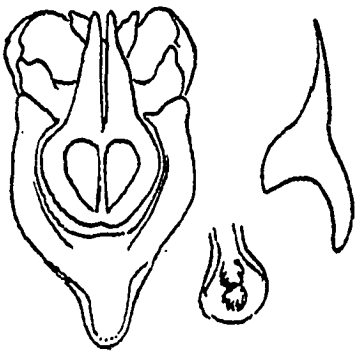


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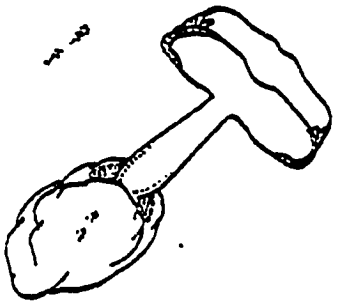
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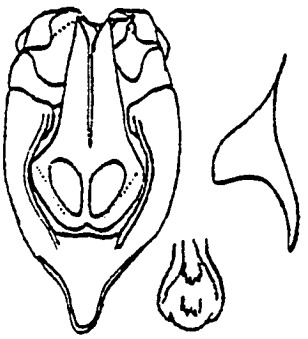
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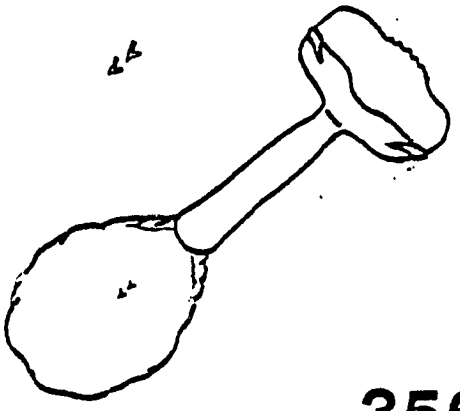
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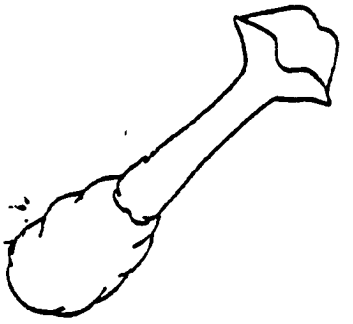


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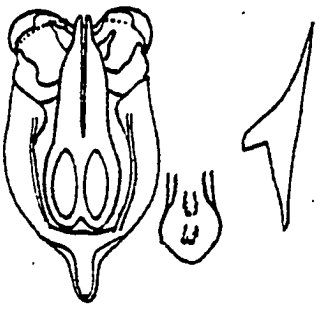


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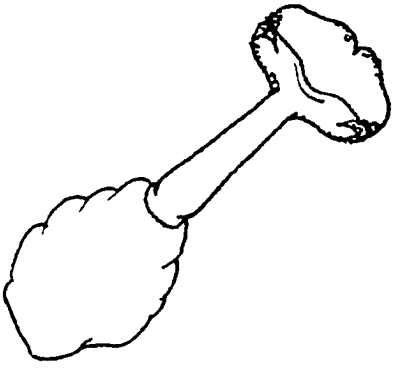
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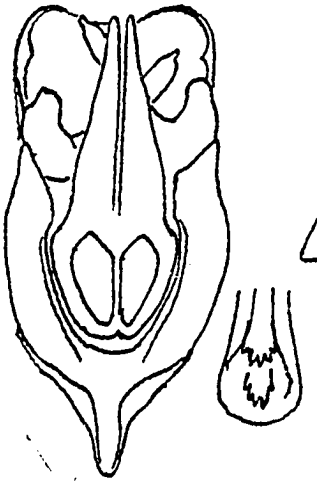
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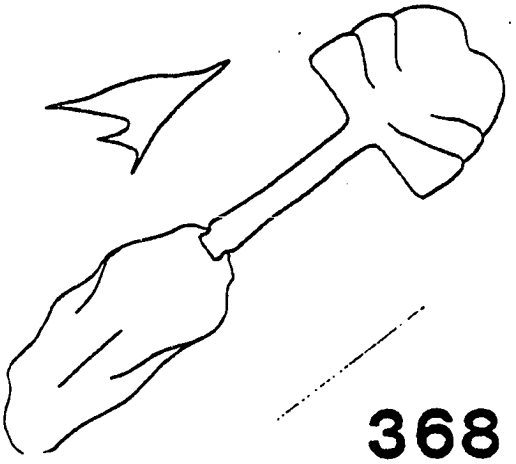
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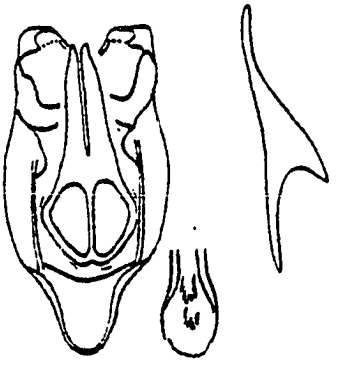
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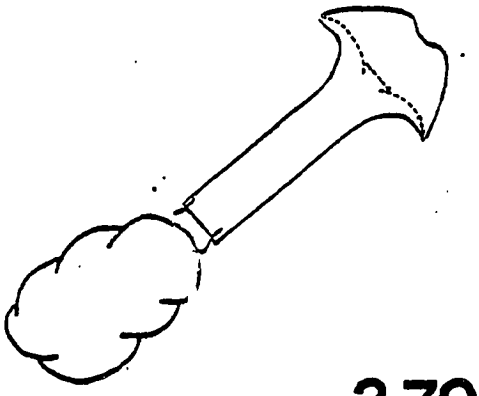


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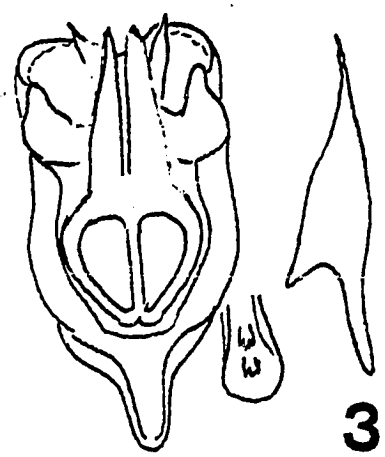


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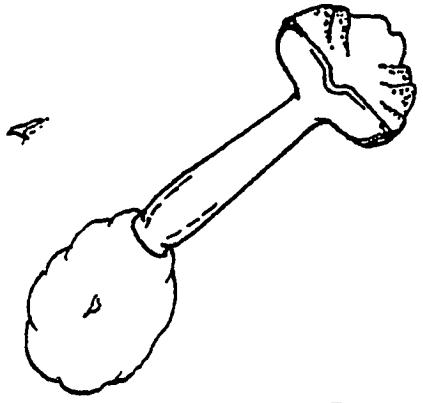
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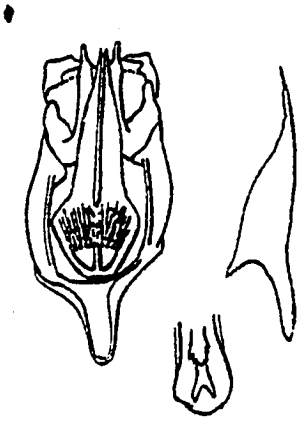
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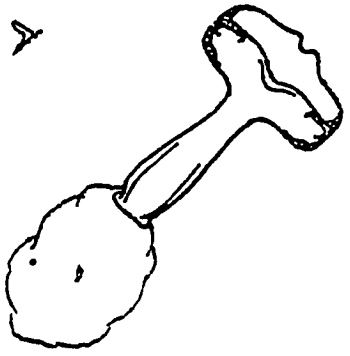
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372A



372B



372C

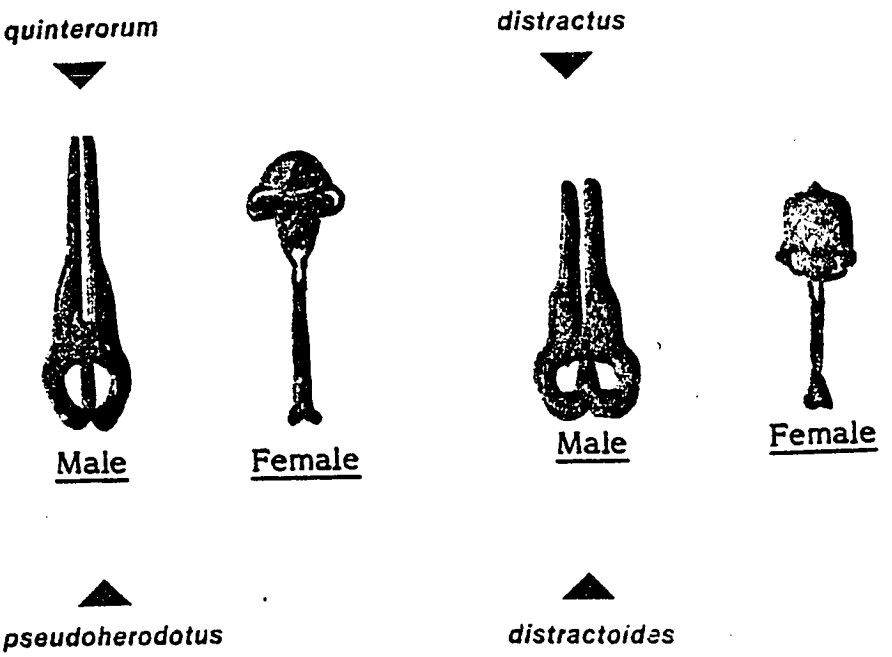
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APPENDIX 7

Characteristic Genitalic Configurations[26]

[26]Silhouetted schematic diagrams (sensu Johnson, 1976a) indicating readily recognized genitalic configurations for taxa and groups.

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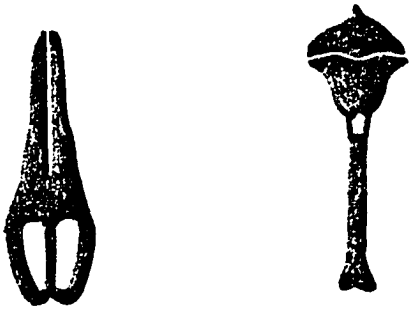
The *distractus* Group

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Male Female

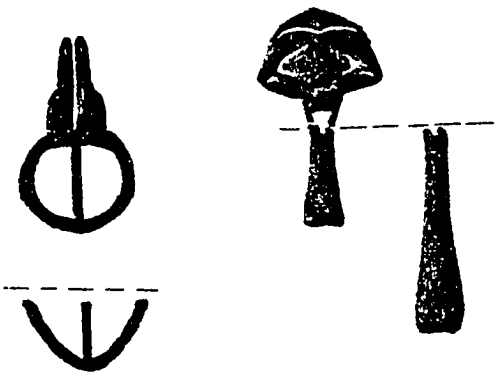
The *platnicki* Group



Male Female

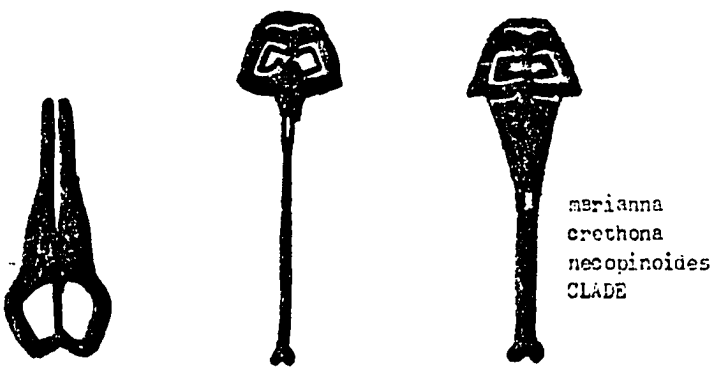
The *amyntor* Group

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Male Female

The *herodotus* Group



Male Female

The *miserabilis* Group

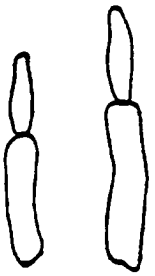
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APPENDIX 8

Palpi[27]

[27] Terminal and second segments are figured. Scales and spines removed by clearing with clorox and acetic acid are not shown. Male is on left, female right. If only one sex is figured, it represents that treated in the text.

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373



374



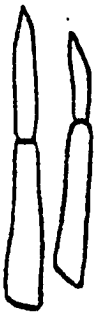
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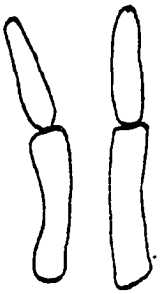
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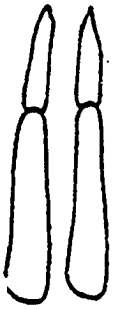
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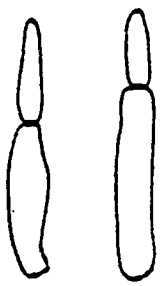


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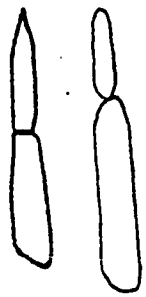


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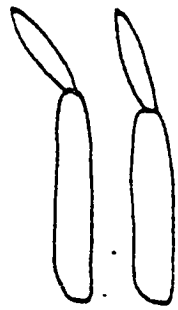
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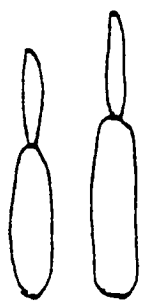
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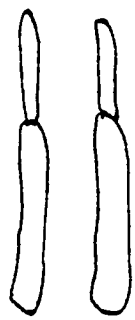
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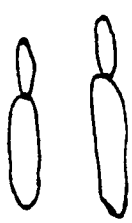
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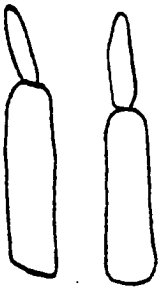


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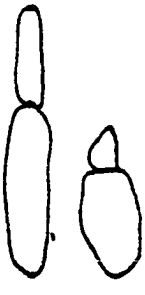
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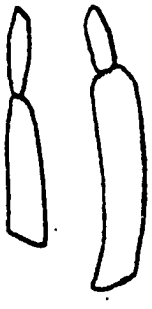
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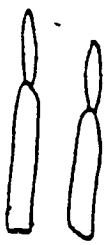
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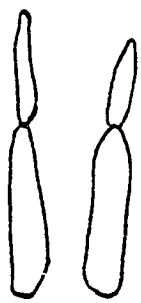
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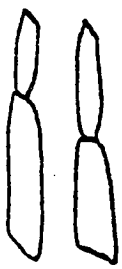
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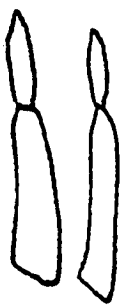
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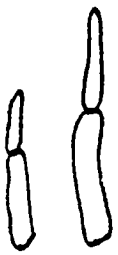


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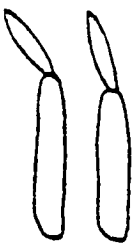
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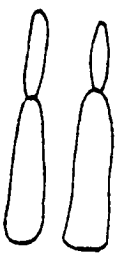
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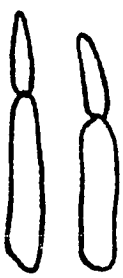
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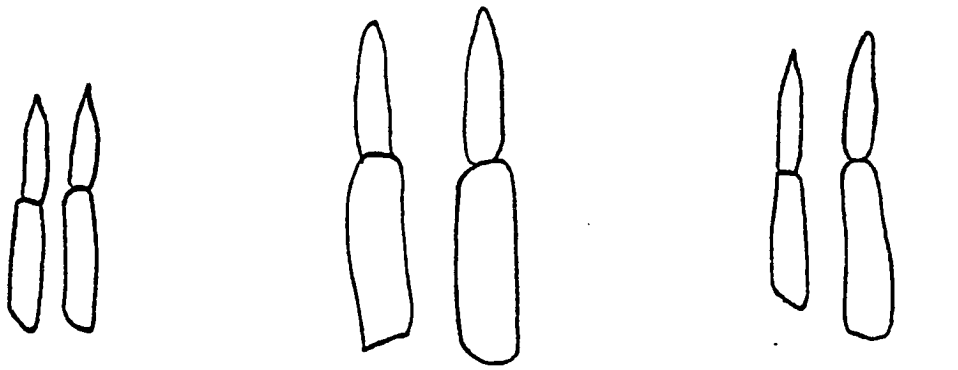


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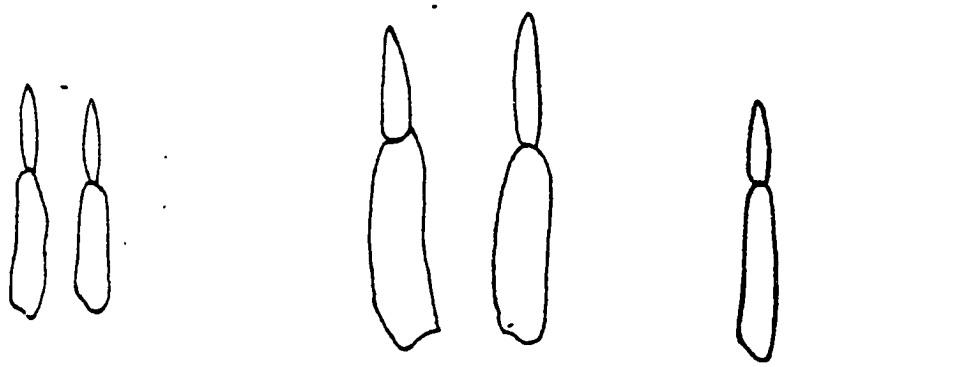


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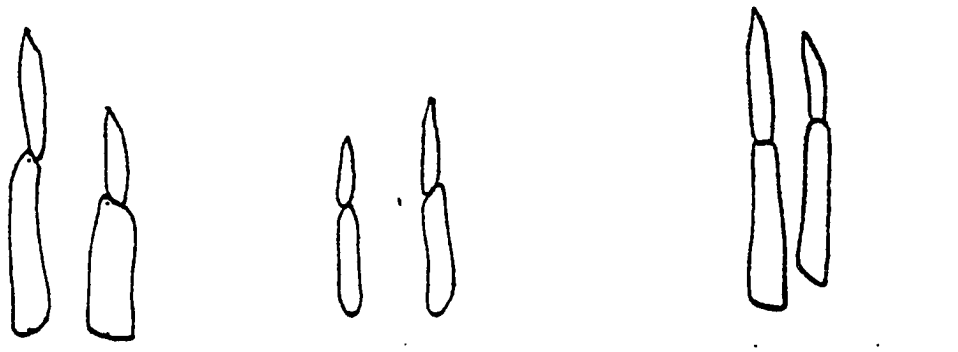
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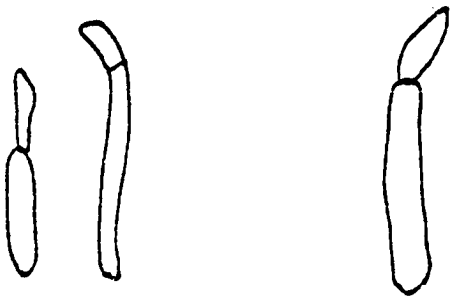


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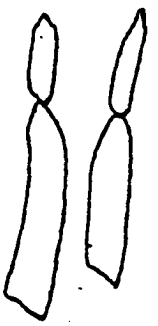


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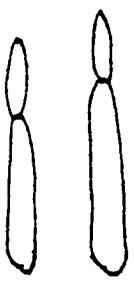
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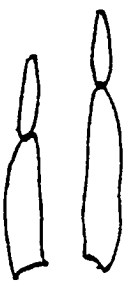
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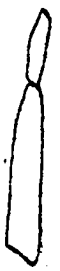
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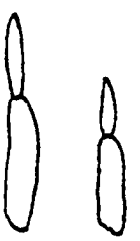
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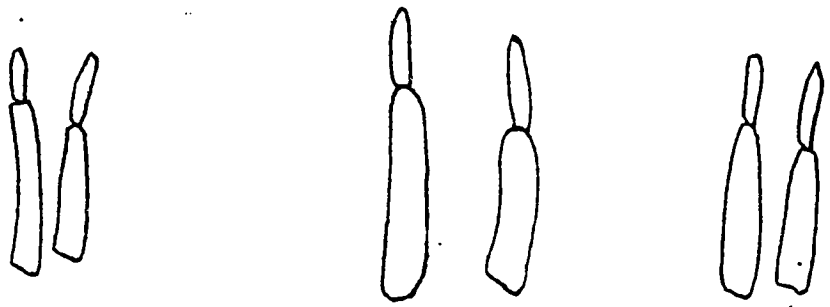
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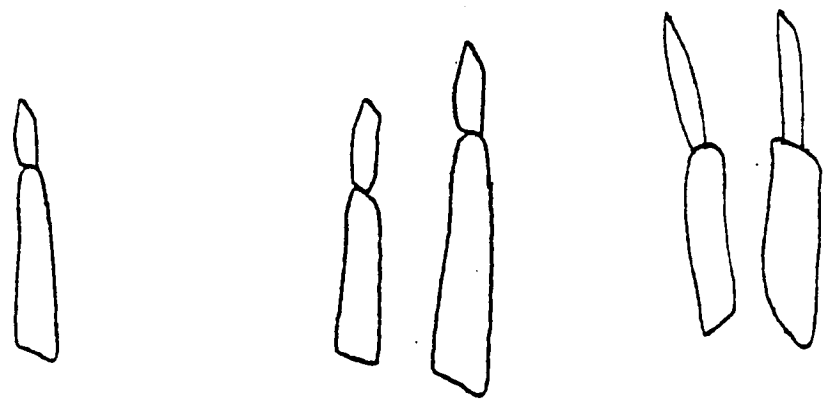
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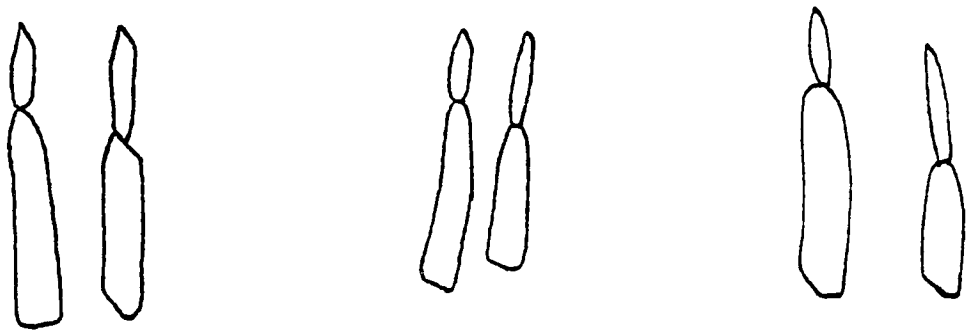
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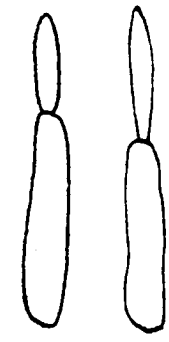


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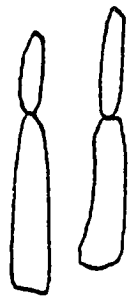


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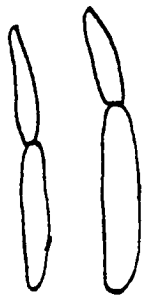
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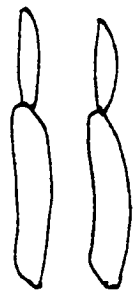
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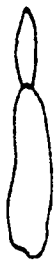
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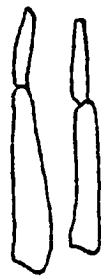
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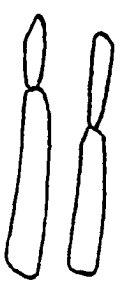


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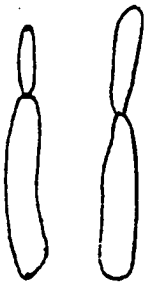
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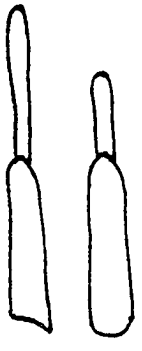
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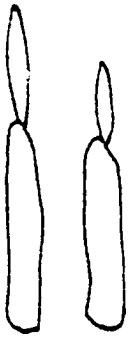
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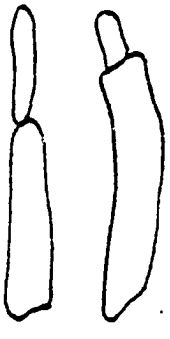
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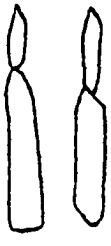
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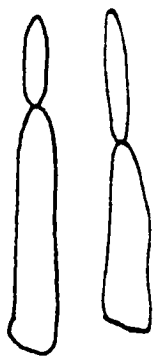


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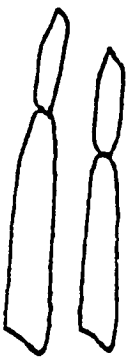


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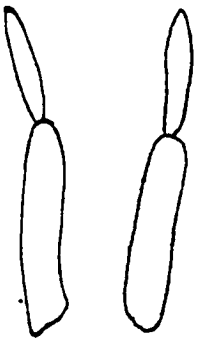
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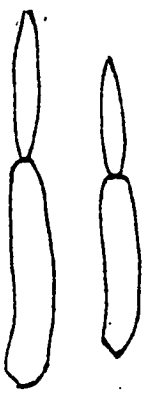
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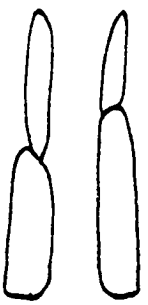
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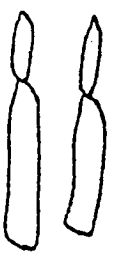
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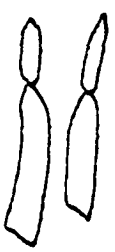
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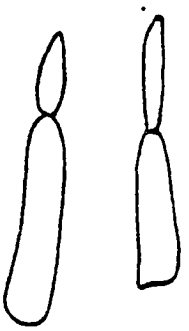
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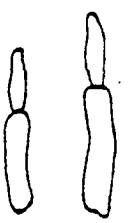
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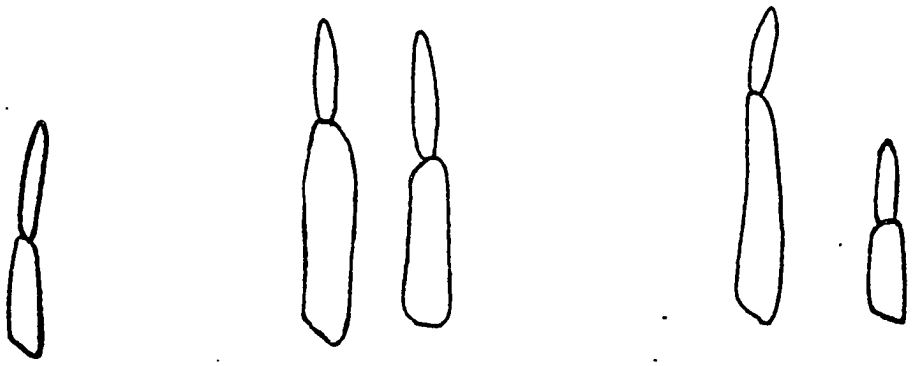


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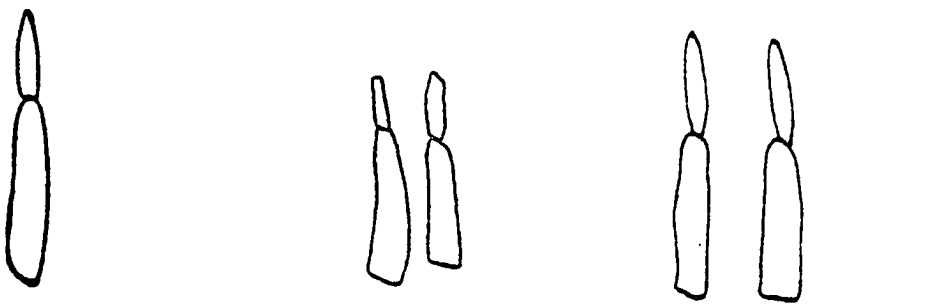


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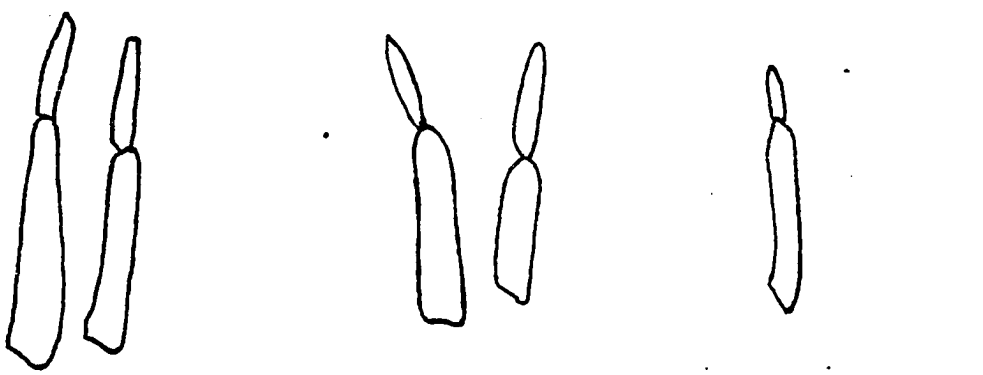
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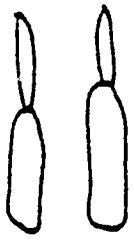


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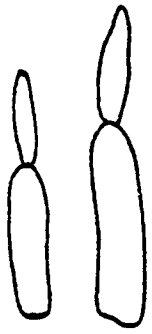


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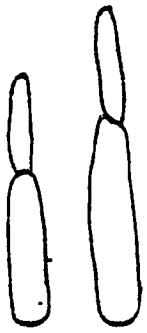
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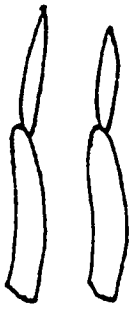
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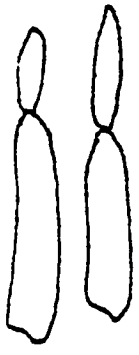
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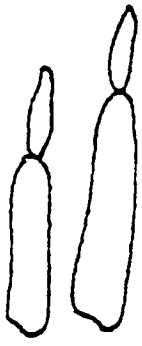
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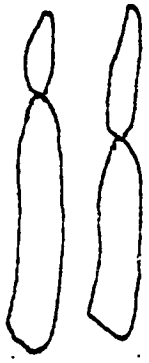
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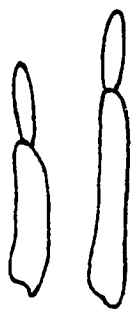


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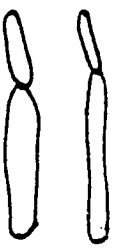


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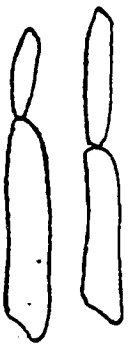
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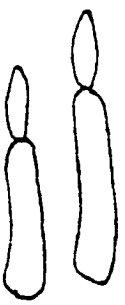
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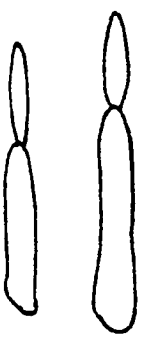
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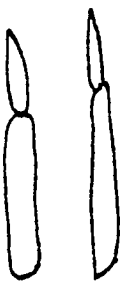
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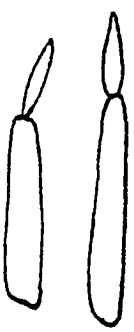
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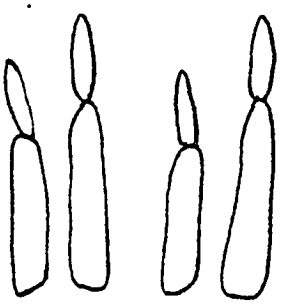
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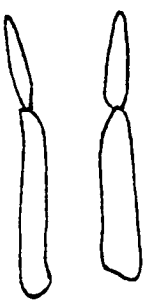
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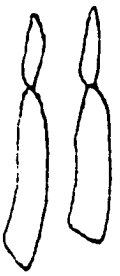


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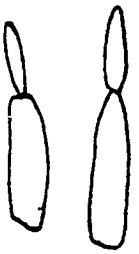


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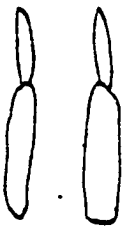
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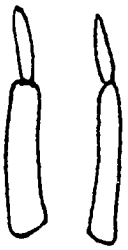
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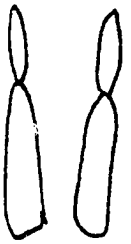
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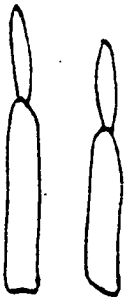
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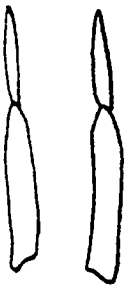
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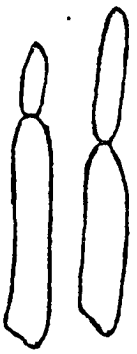
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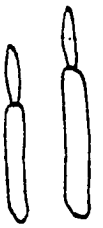
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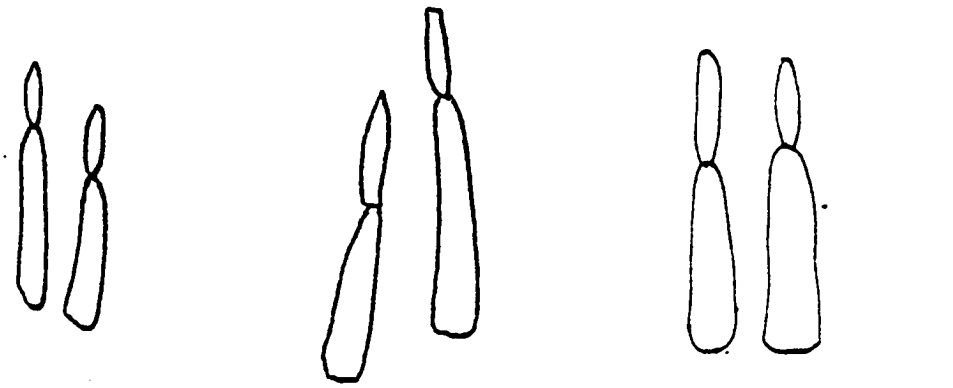


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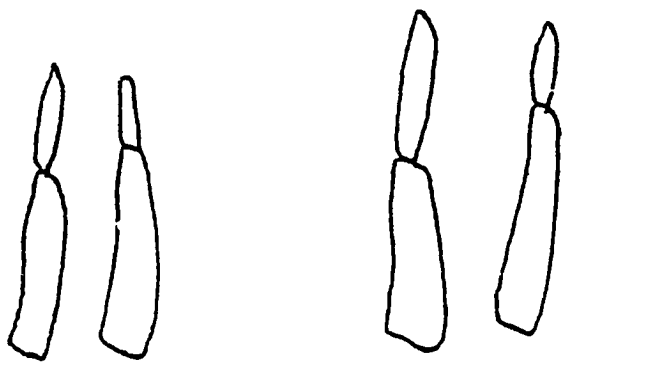


508

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509 510 511



512 513

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APPENDIX 9

Distribution Maps[28]

[28]Localities are from the material examined only, except as noted by literature citations on individual maps. Large dots represent multiple localities in one regional area, smaller dots individual localities.

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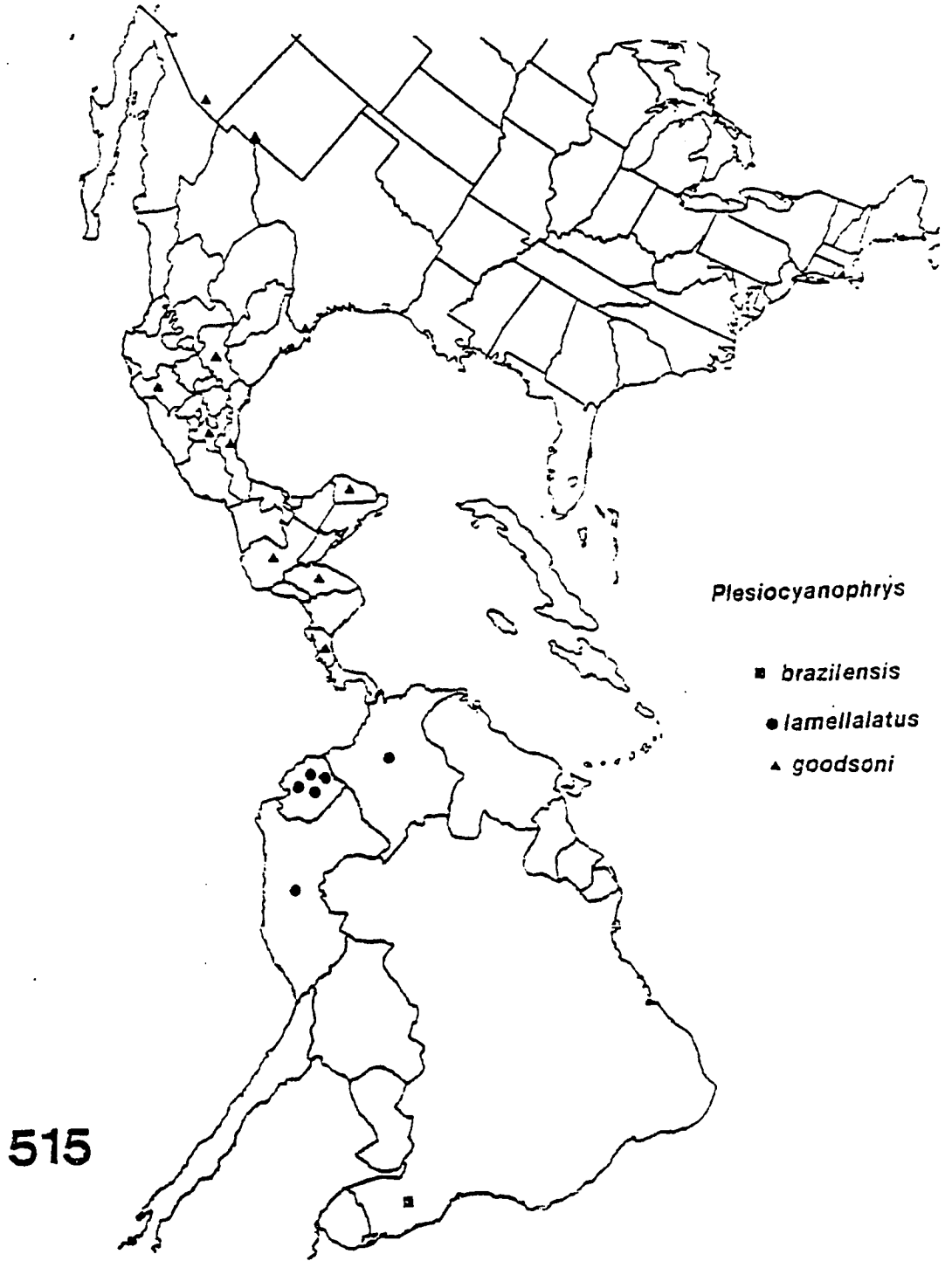


Secondary Series, *Plesiocallophrys*

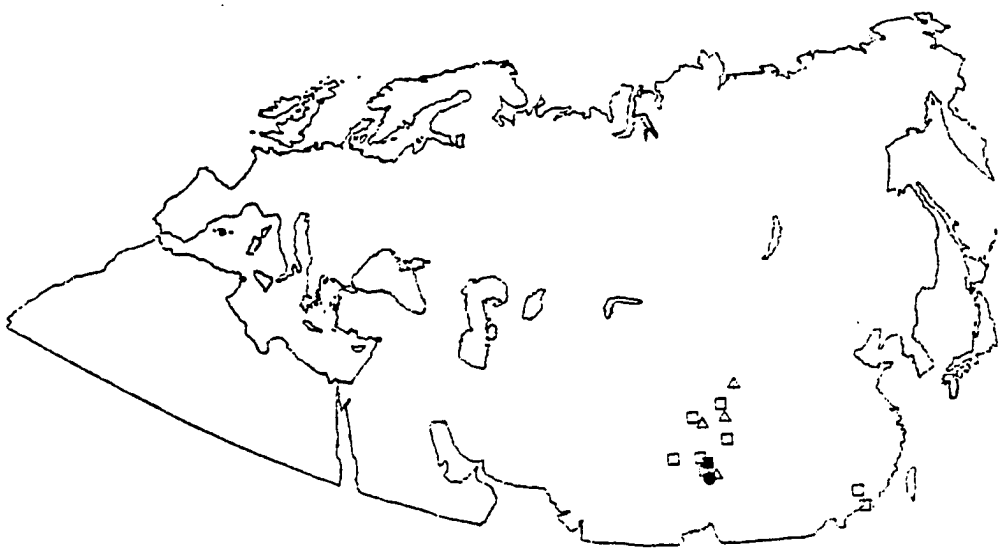
- ● ***pseudoargentinensis***
- ■ ***runa***
- ▲ ***roberti***
- ○ ***argentinensis***
- ♦ ***maccourtorum***
- ▼ paranensis

514

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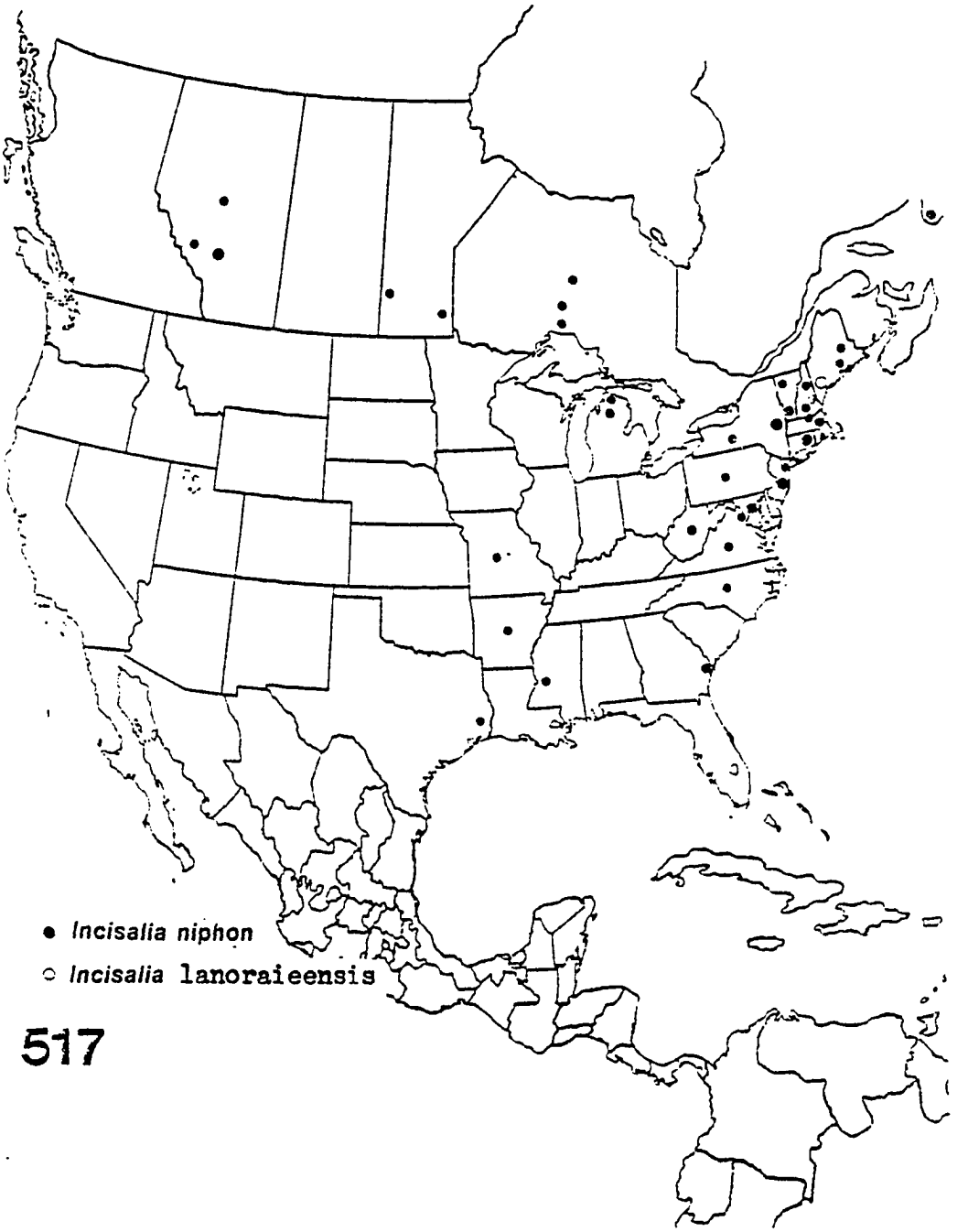


Cissatsuma

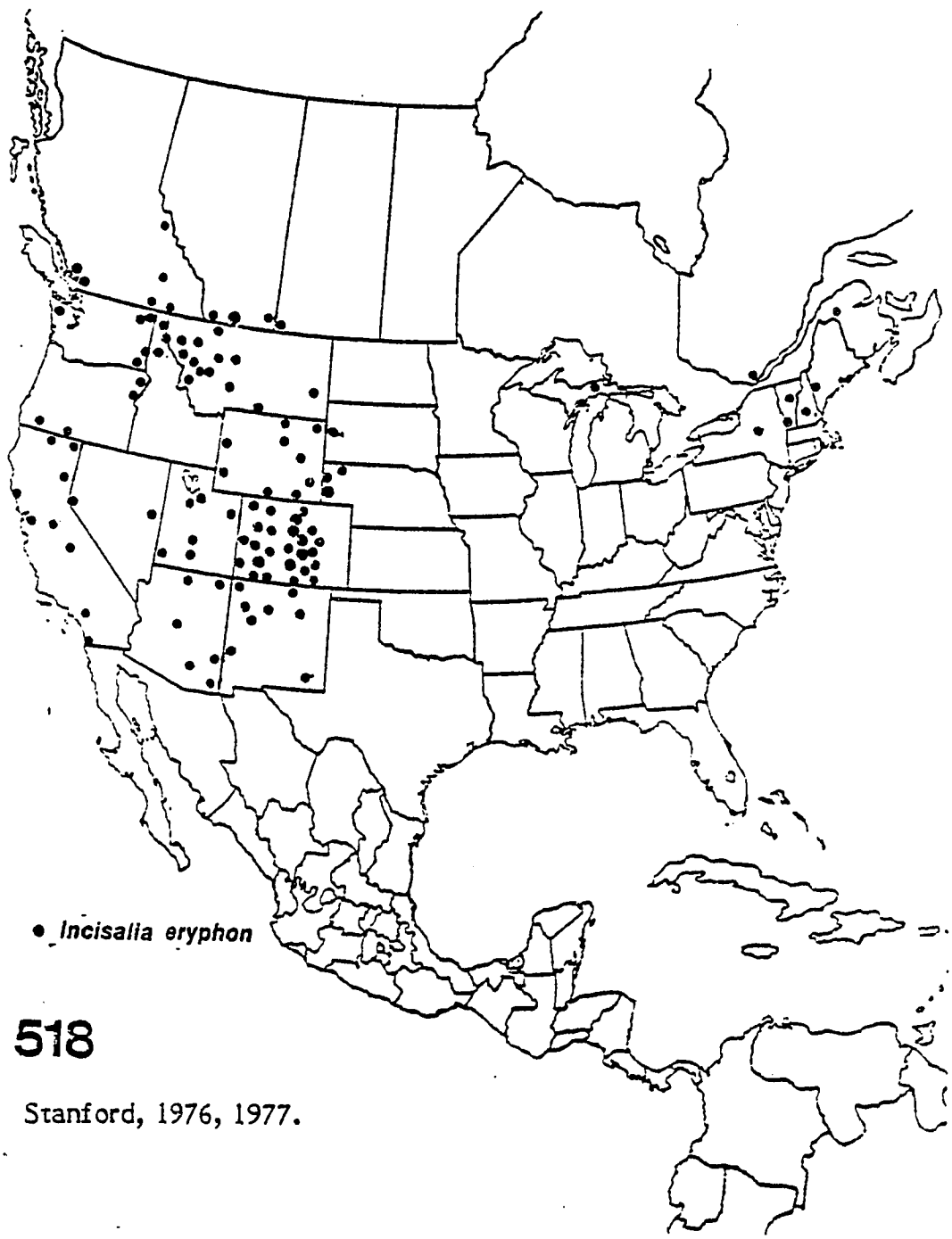
● *contexta* ▫ *albilinea* ▪ *tuba* △ *wellsorum*

516

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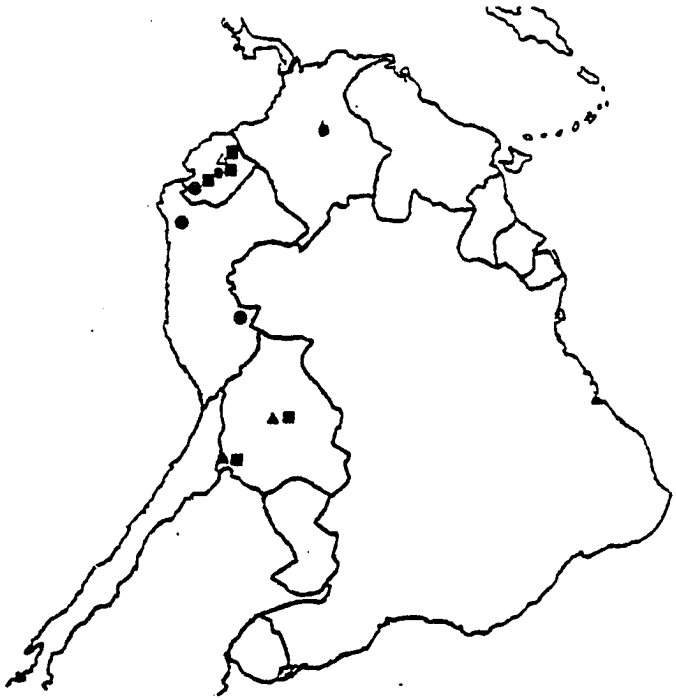
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Penaincisalia

▲ *bimediana*

■ *culminicola*

△ *oribata*

◓ *ansoma*

● *alatus*

519

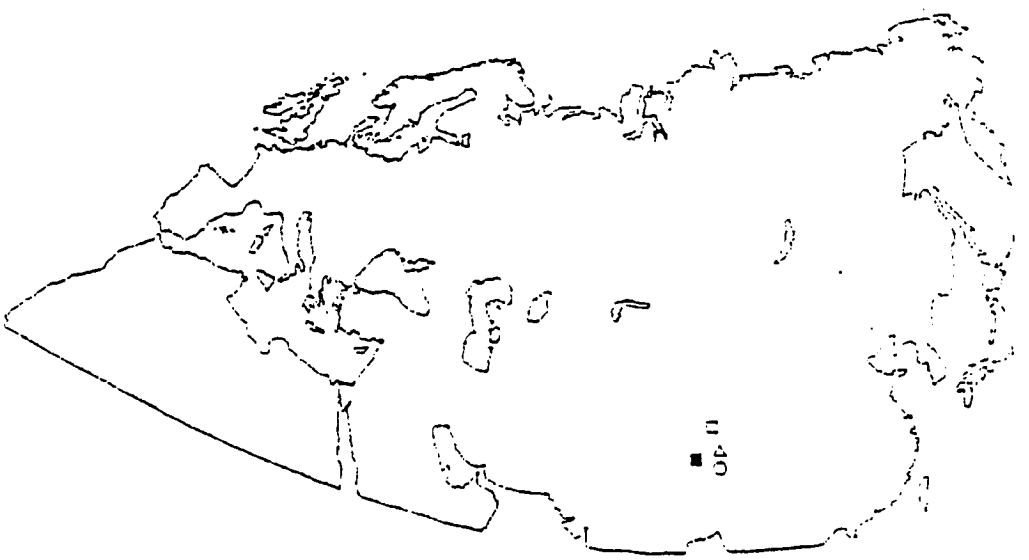
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Novosatsuma

520

○ *collosus* ● *magnasuffusa* △ *plumbagina* ▲ *pratti*

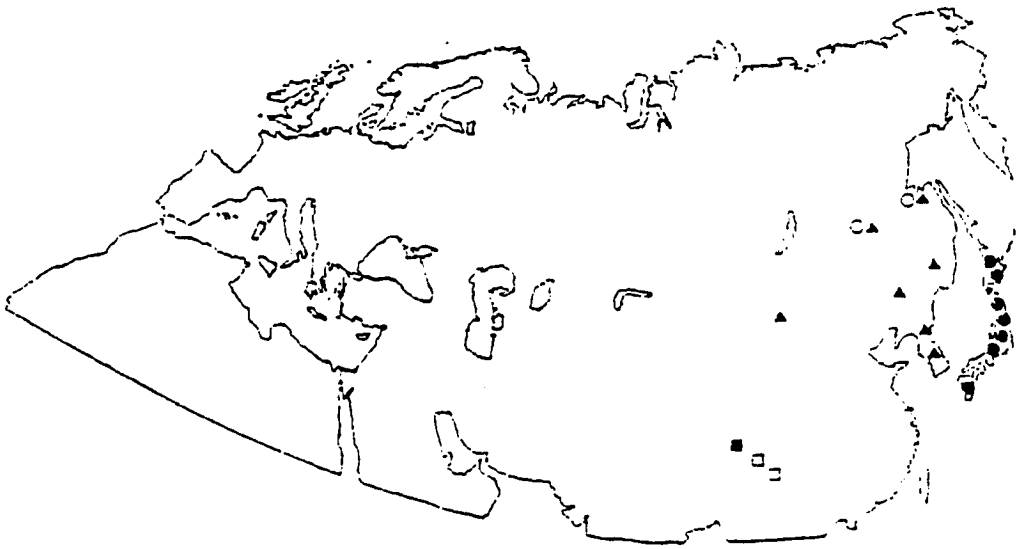


Novosatsuma

521

○ *cibdela* □ *grossfieldi* ■ *monstrabila* △ *oppocoenosa*

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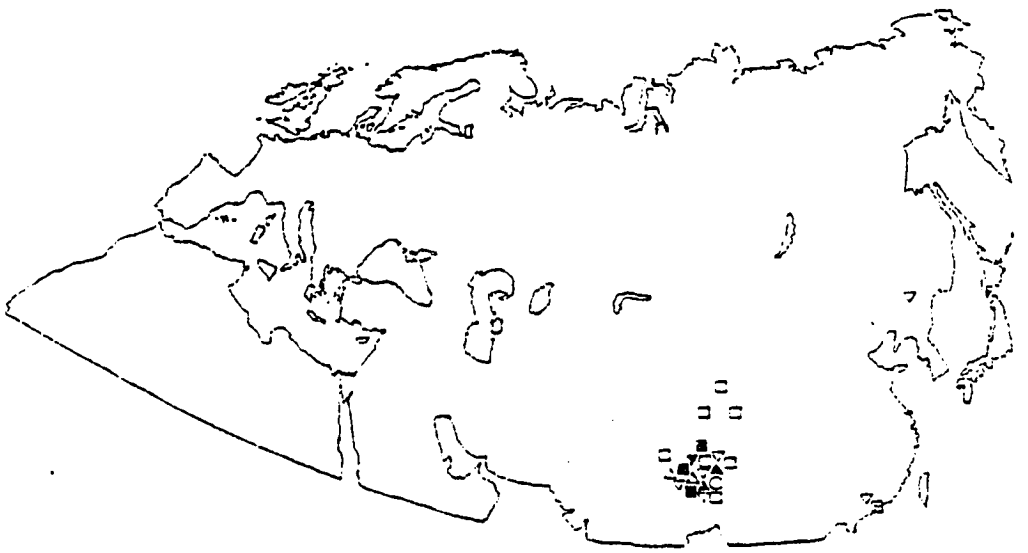


The *chalybea* and *ferrea* Groups, Ginzia

□ *chalybeia* ■ *casinorum* ● *ferrea* ▲ *kimi*

○ *abromattaguta*

522



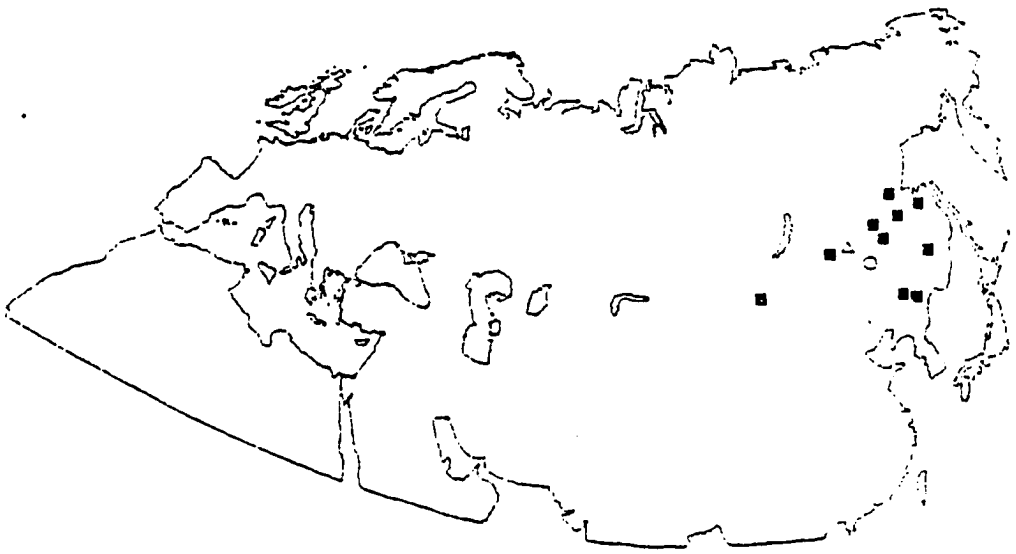
The *pluto* Group, Ginzia

△ *brabazonorum* ▲ *krishnai* □ *pluto*

▽ *hortoni* ▼ *milleri* ■ *tsekouensis*

523

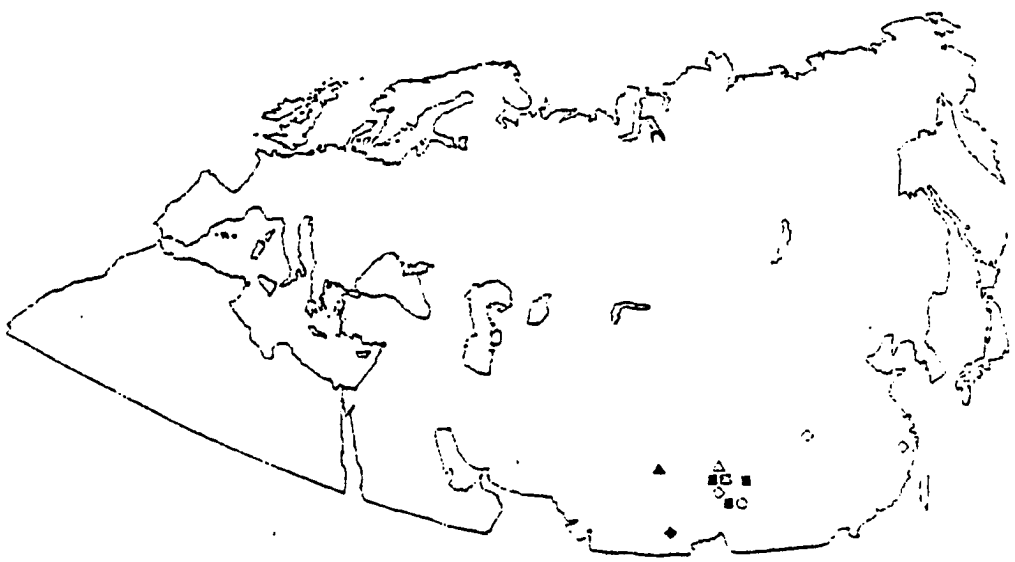
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The *frivaldskyi* Groups, *Ginzia*

524

○ *aquilonaria* ■ *frivaldskyi* △ *tricaudata*



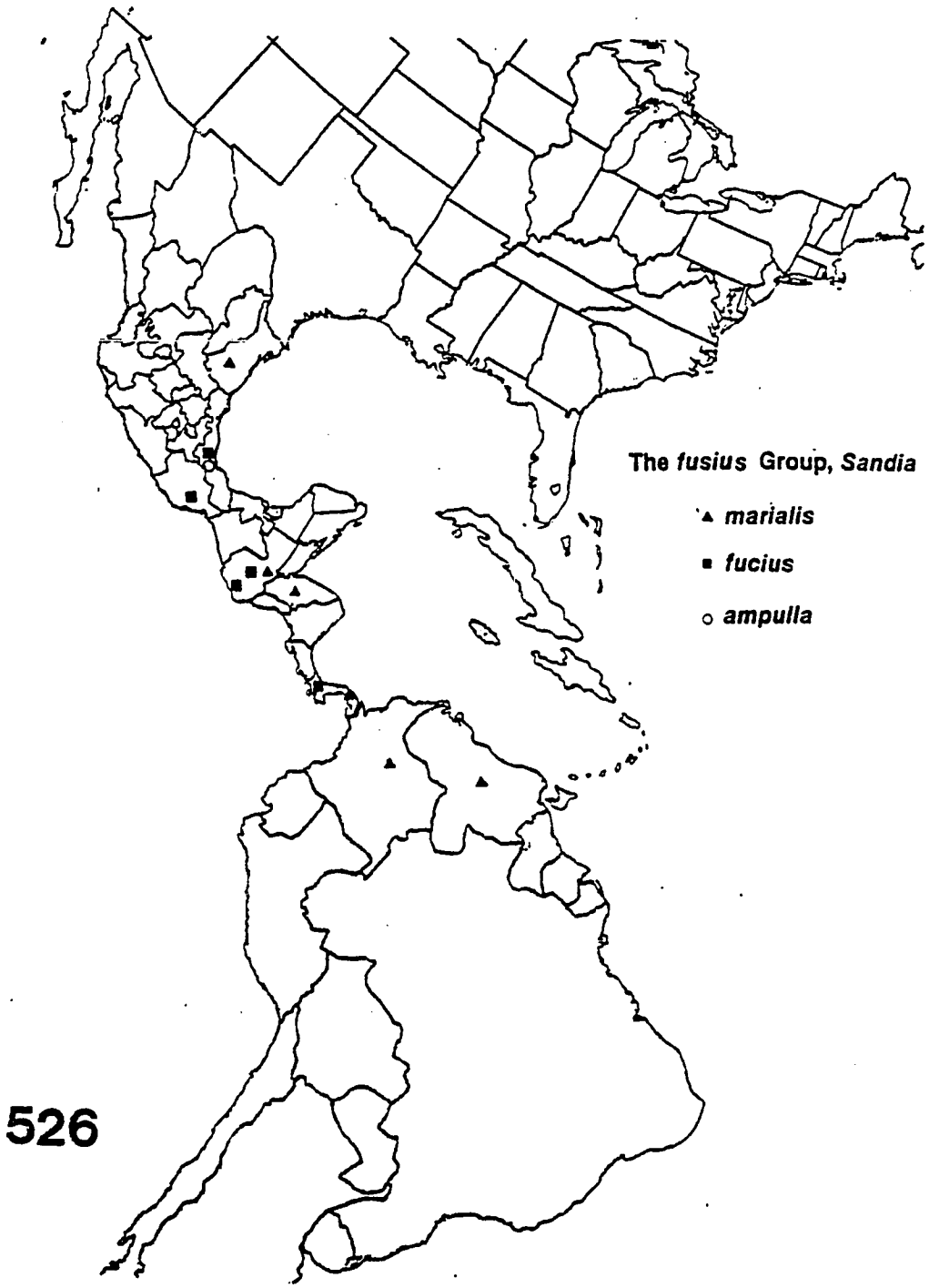
The *circe* and *leechi* Groups, *Ginzia*

▫ *caesius* ▪ *circe* △ *fritzi* ▲ *montivaga* ○ *prodiga*

525

◇ *leechi* ◆ *nicevillei*

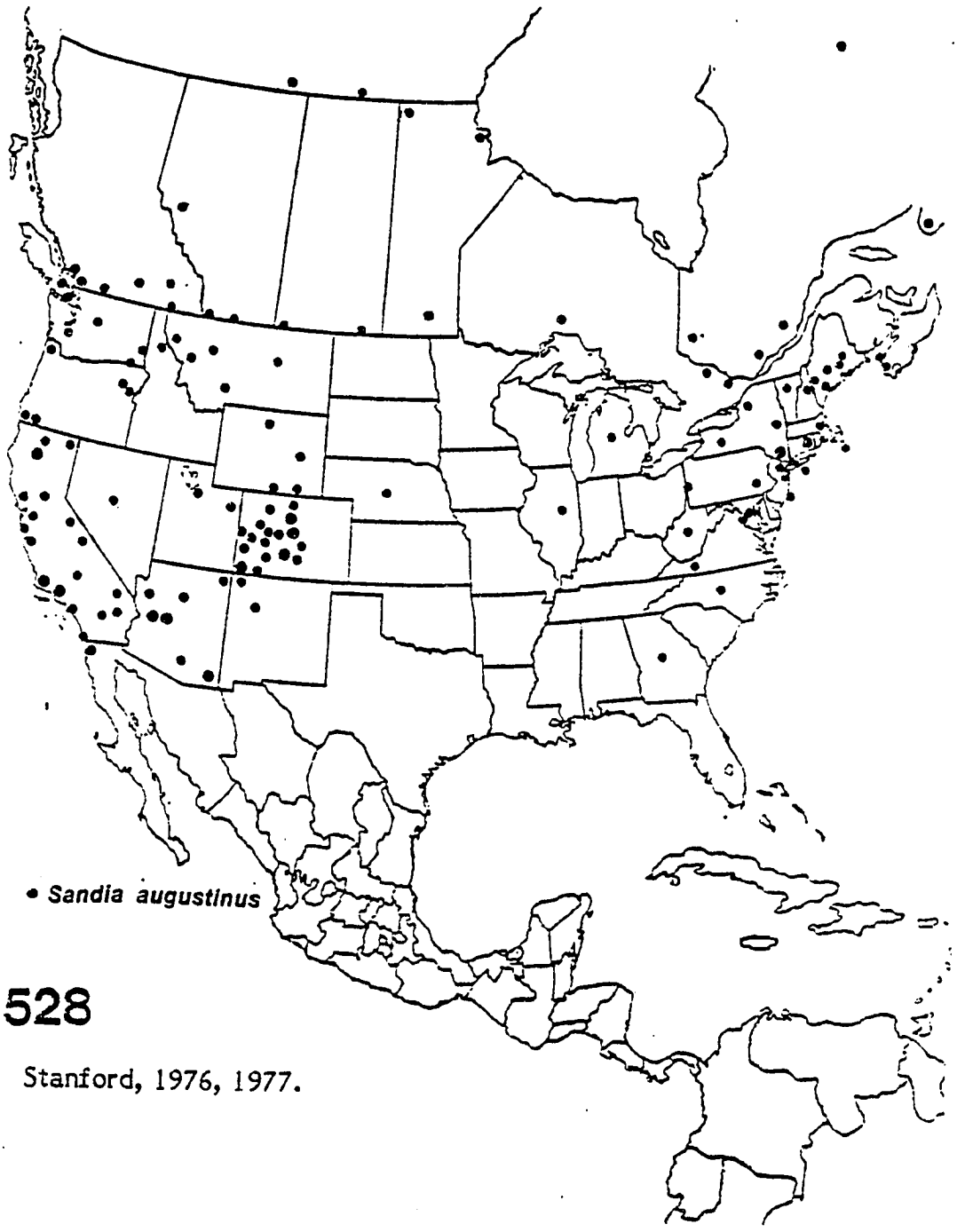
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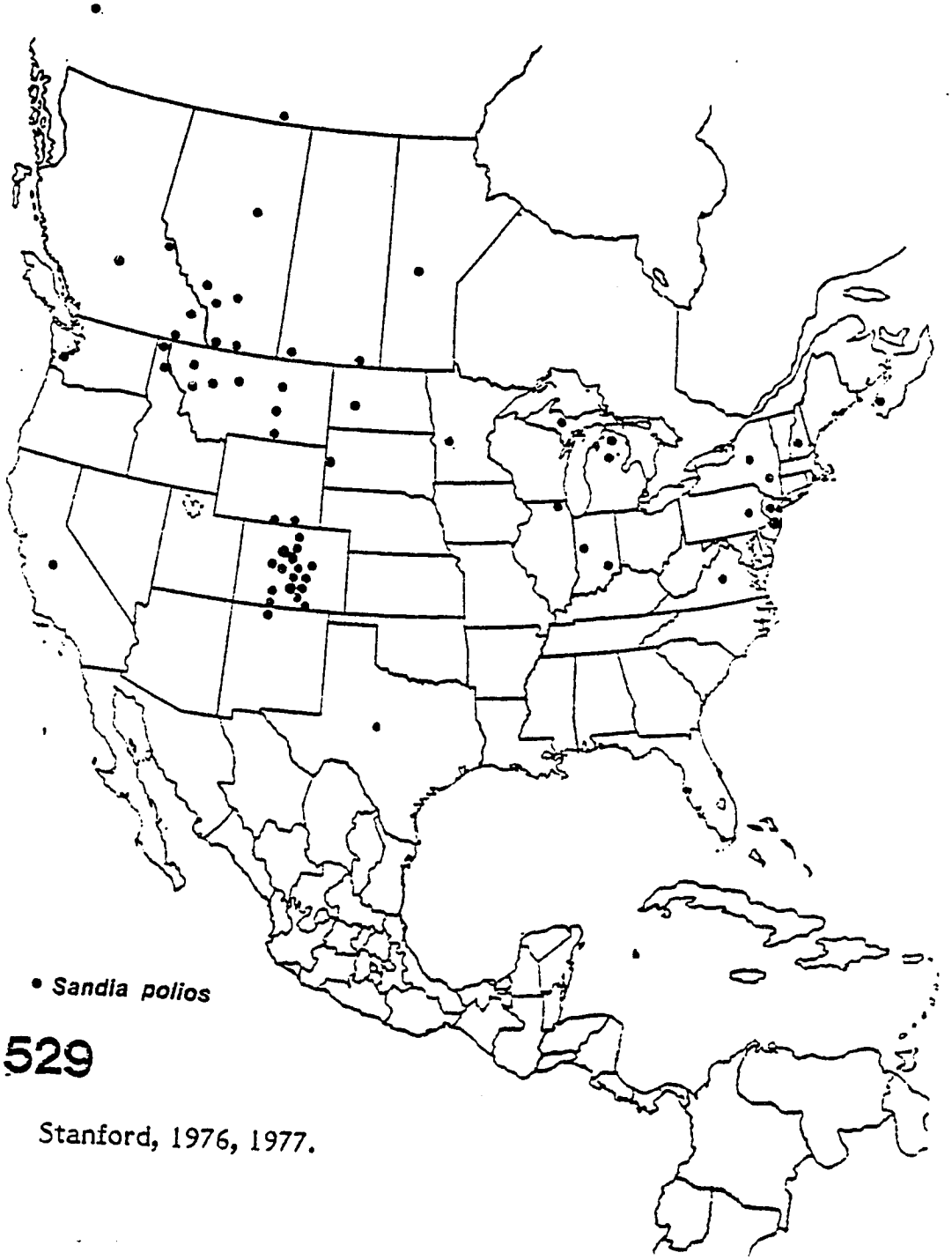
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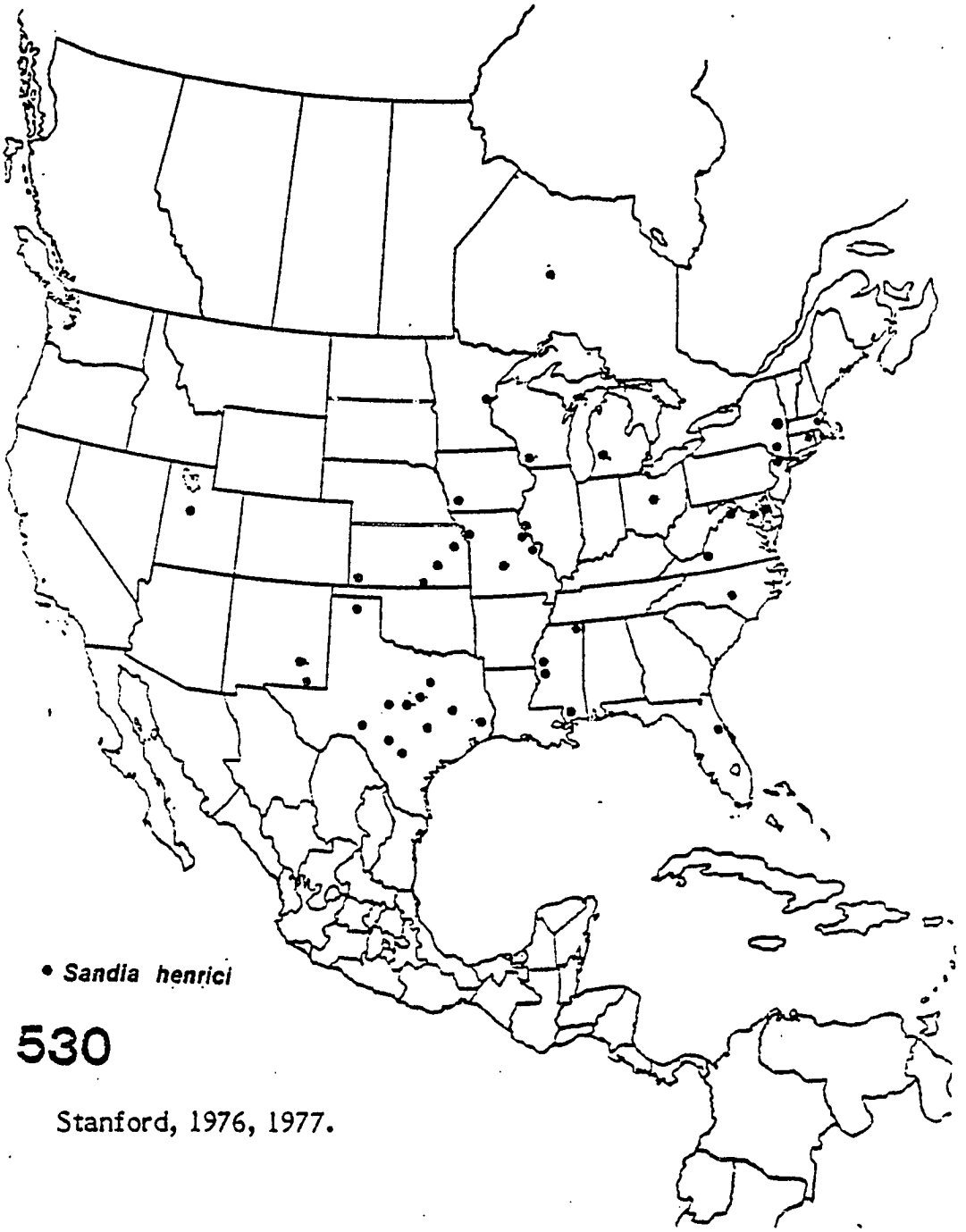
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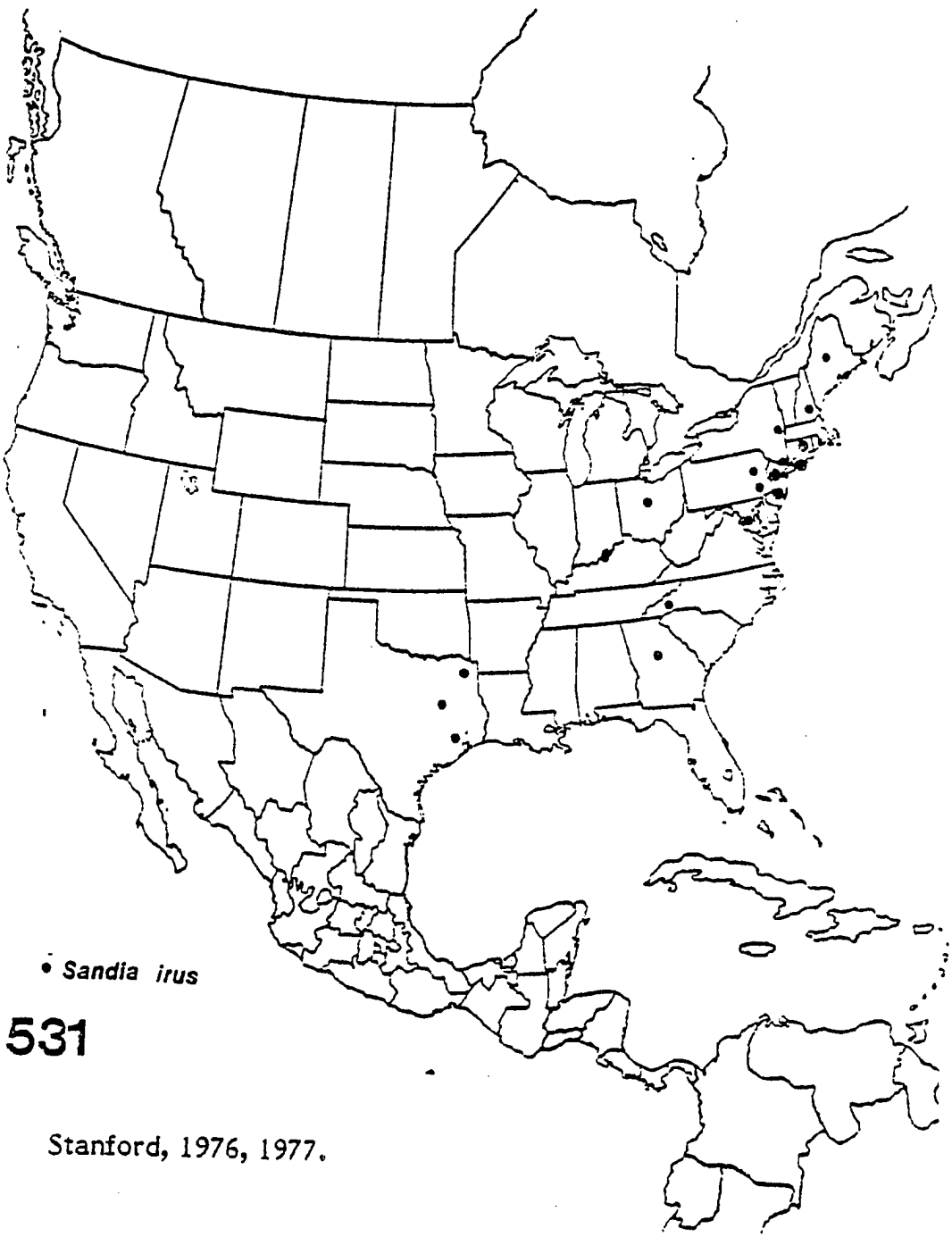
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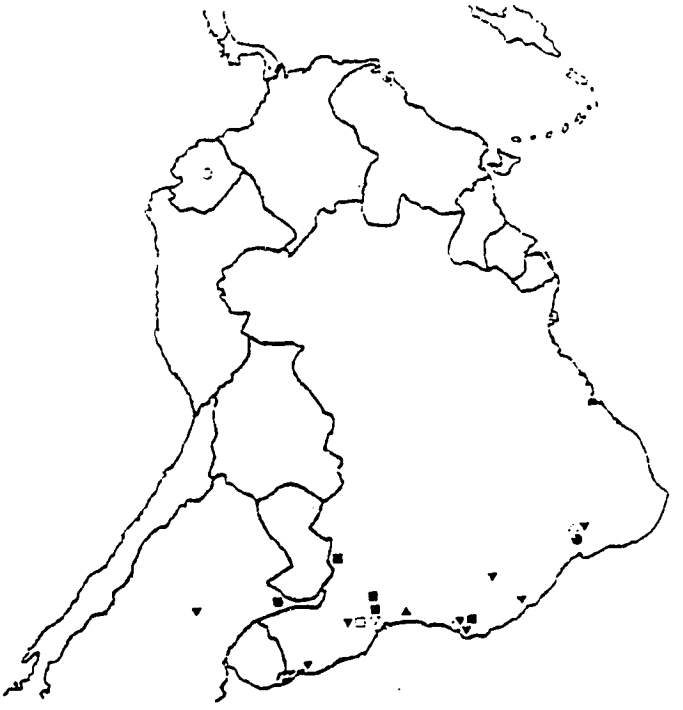
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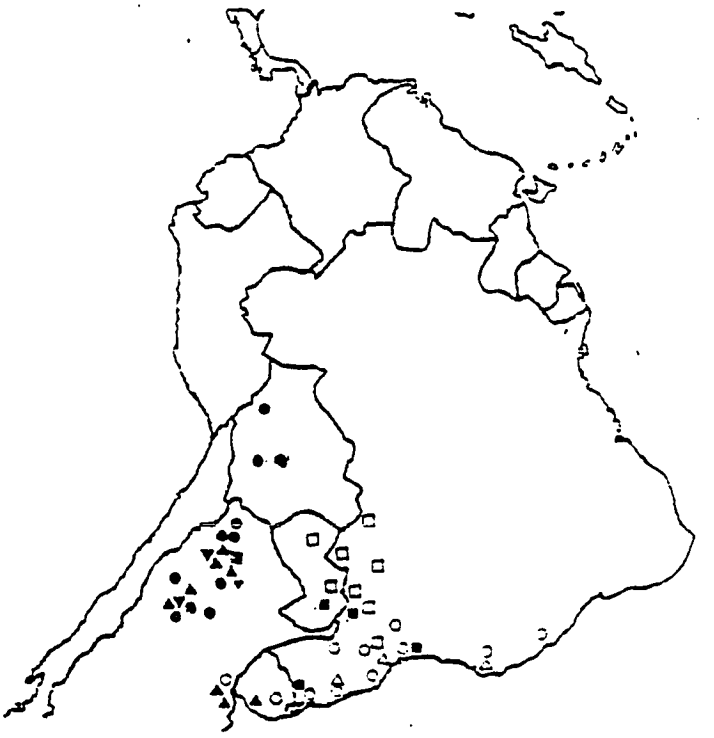


The *legionis* and *caramba* Groups,
Mesocyanophrys

- *adelaidae*
- *caramba*
- *kyanos*
- *legionis*
- *opaspangorum*
- *paratetrameres*
- *rachelae*
- *tertameres*

532

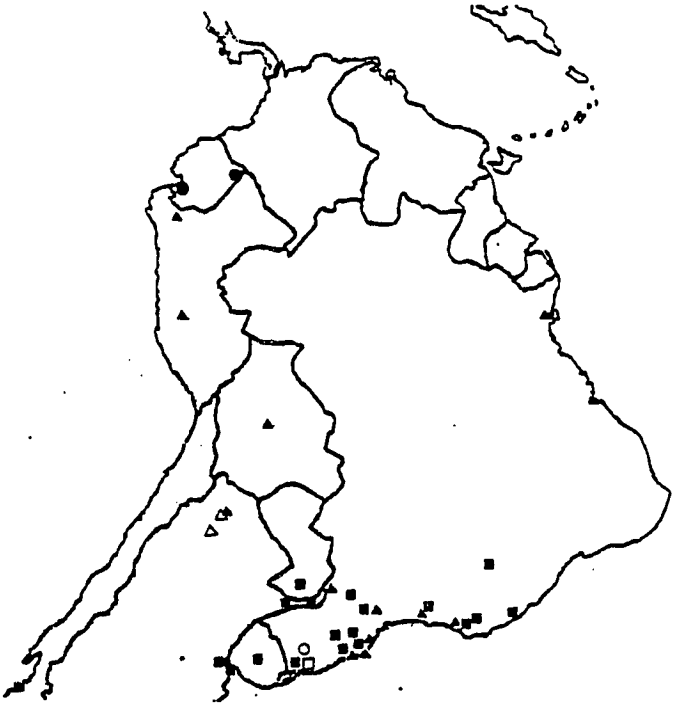
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533

The *acaste* Group, *Mesocyanophrys*

- *acaste*
- *acastoides*
- *tobias*
- *abnormis*
- *catharinensis*
- *lycimna*
- *pantobias*

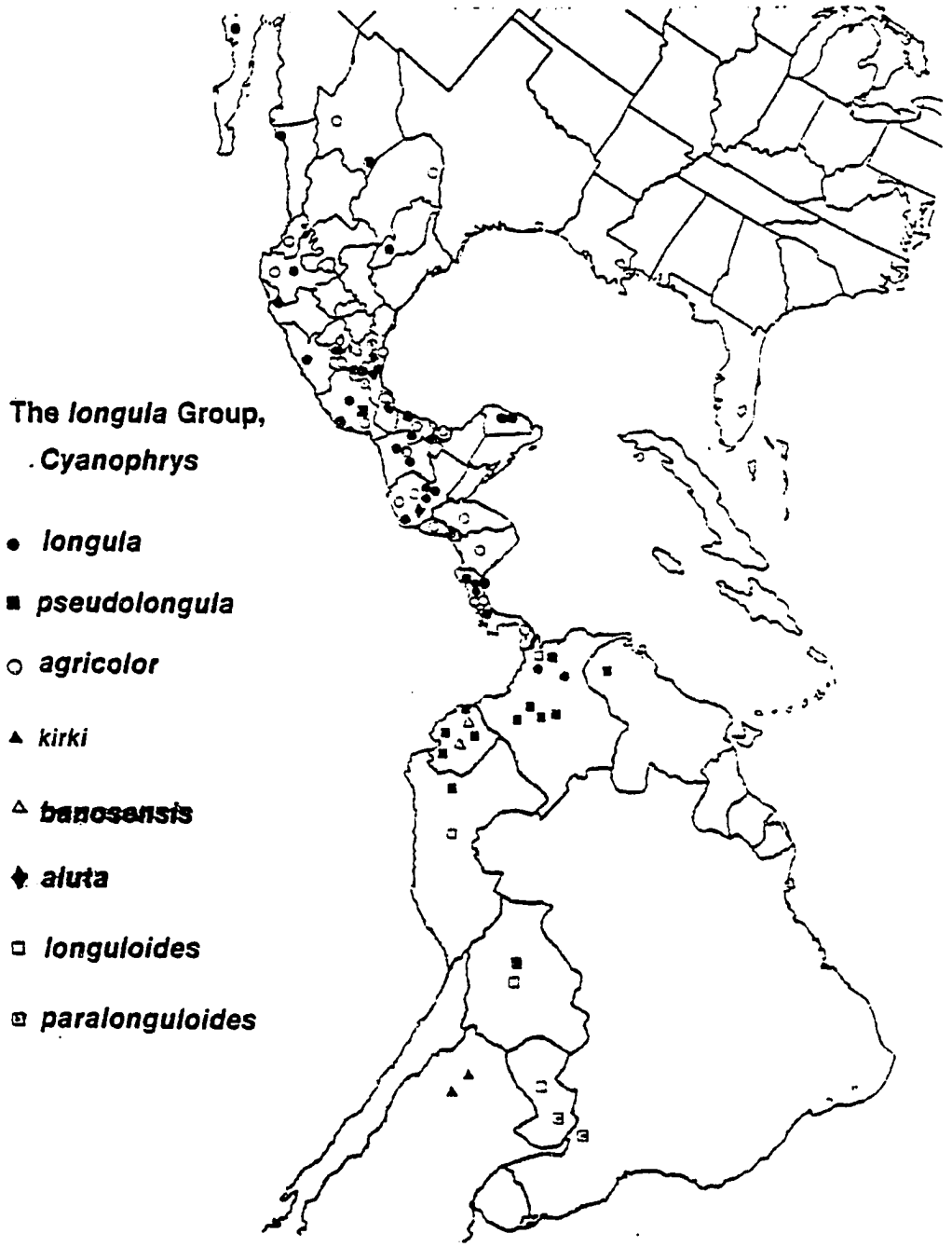


534

Paracyanophrys

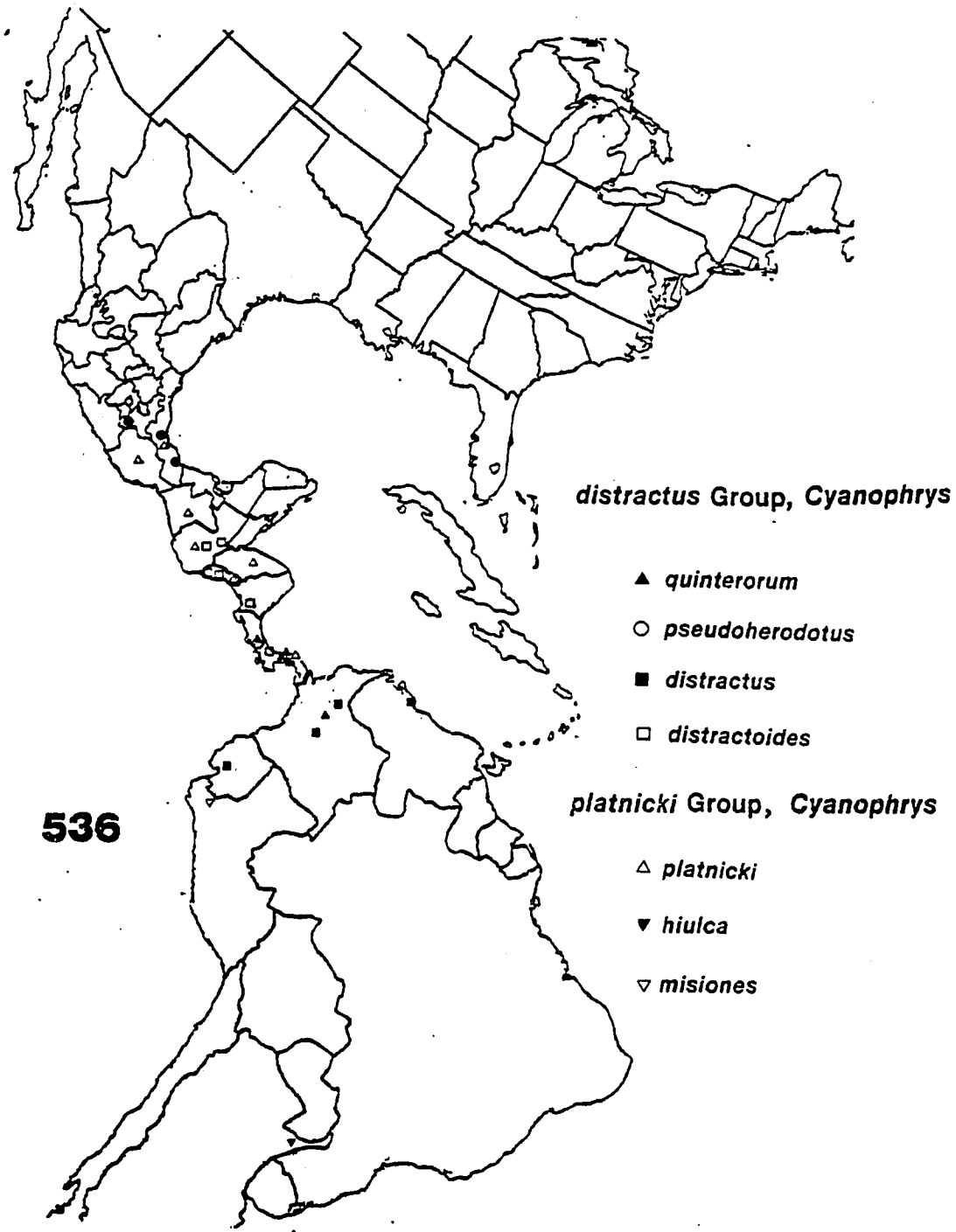
- *amphoteros*
- *mykros*
- *remuborealis*
- *remus*
- *rindgei*
- *sapphirus*

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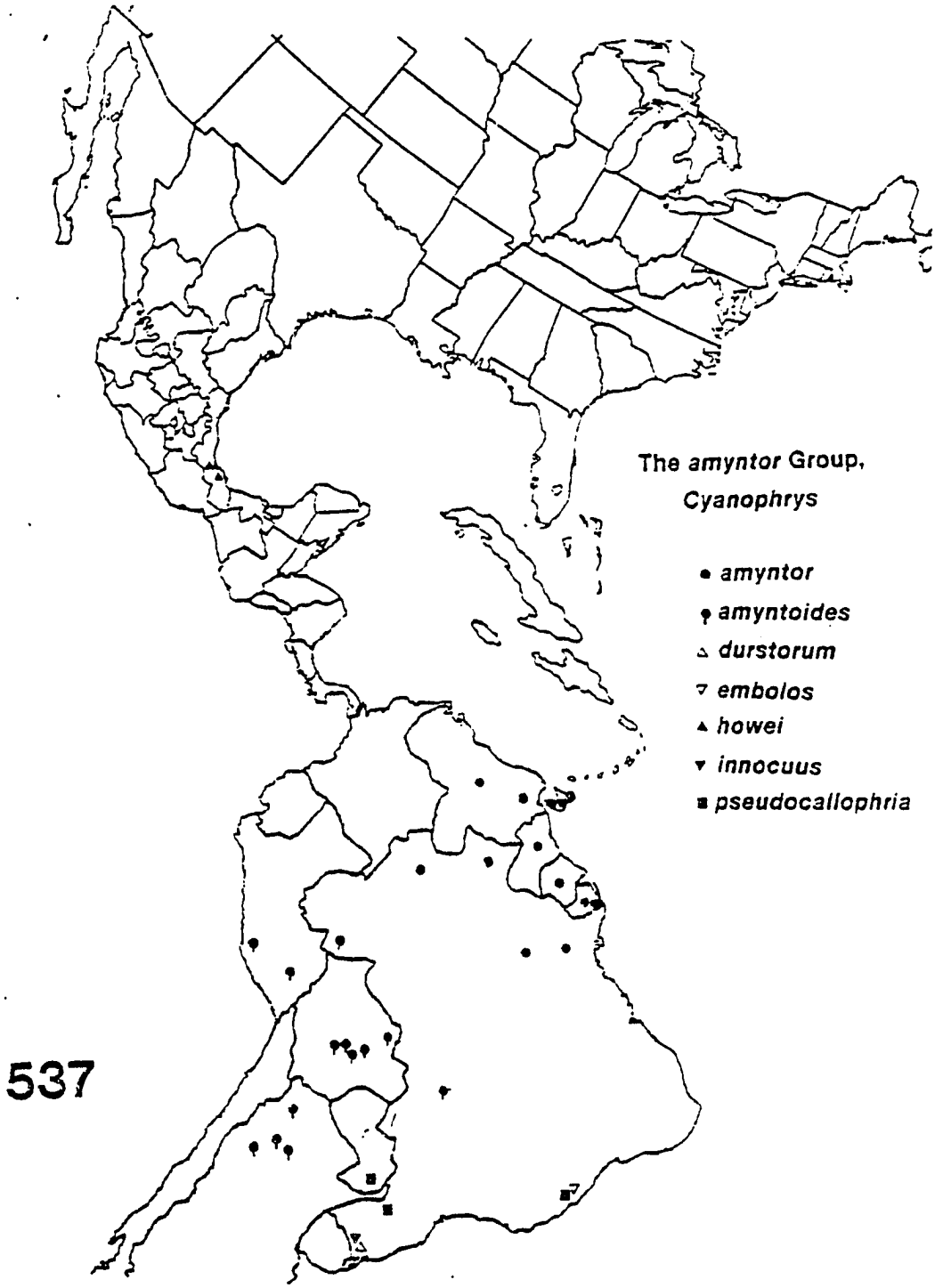


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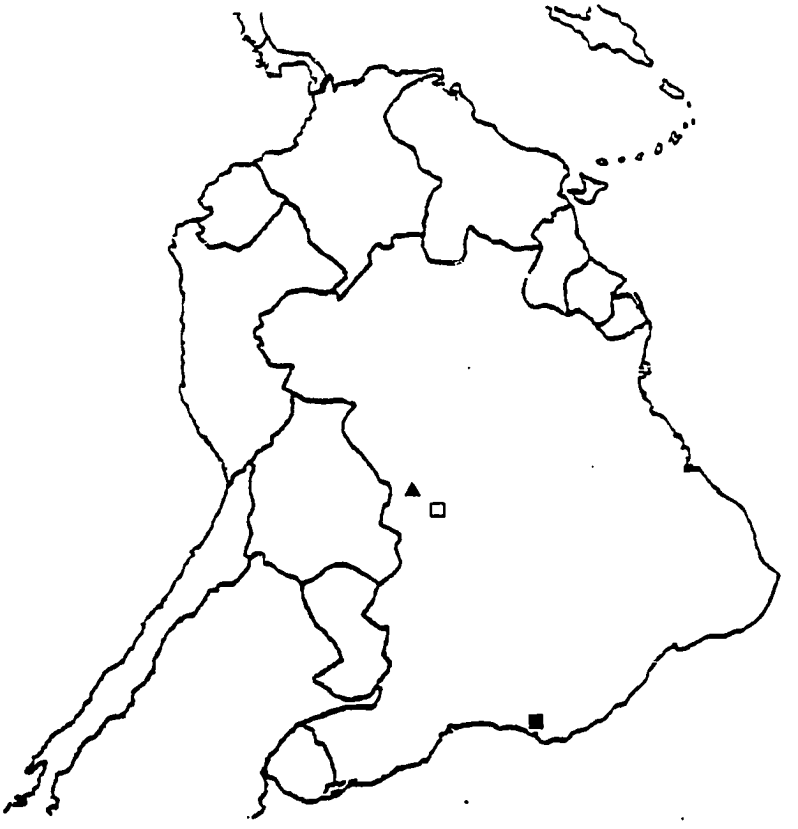
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iggii Group, ***Cyanophrys***

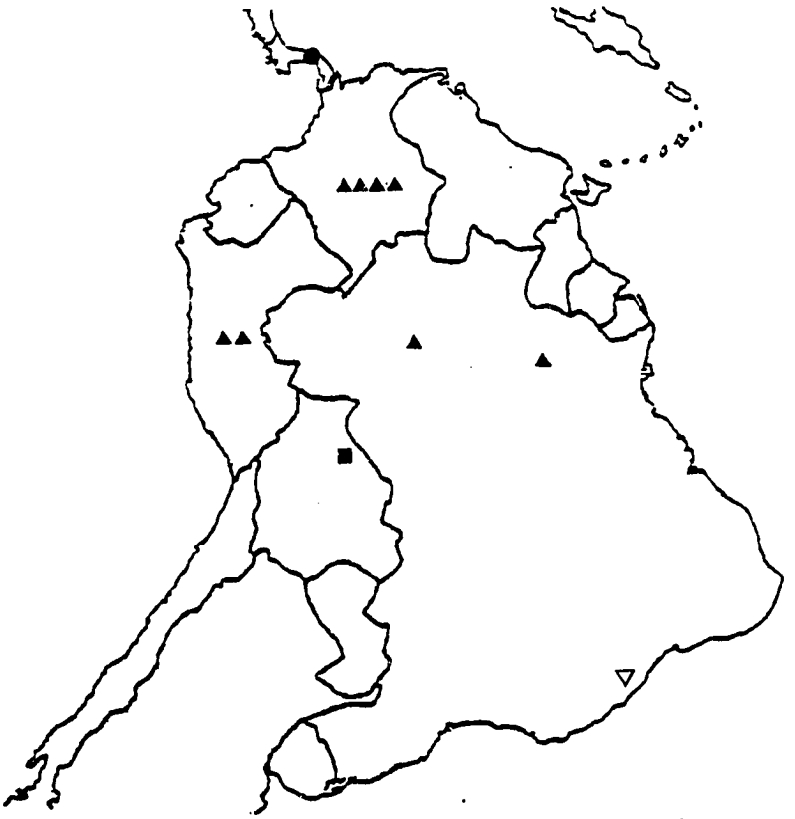
■ ***iggii***

□ ***chapadaensis***

▲ ***fragmentum***

538

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circumcyanophrys Group

▲ *eiselei*

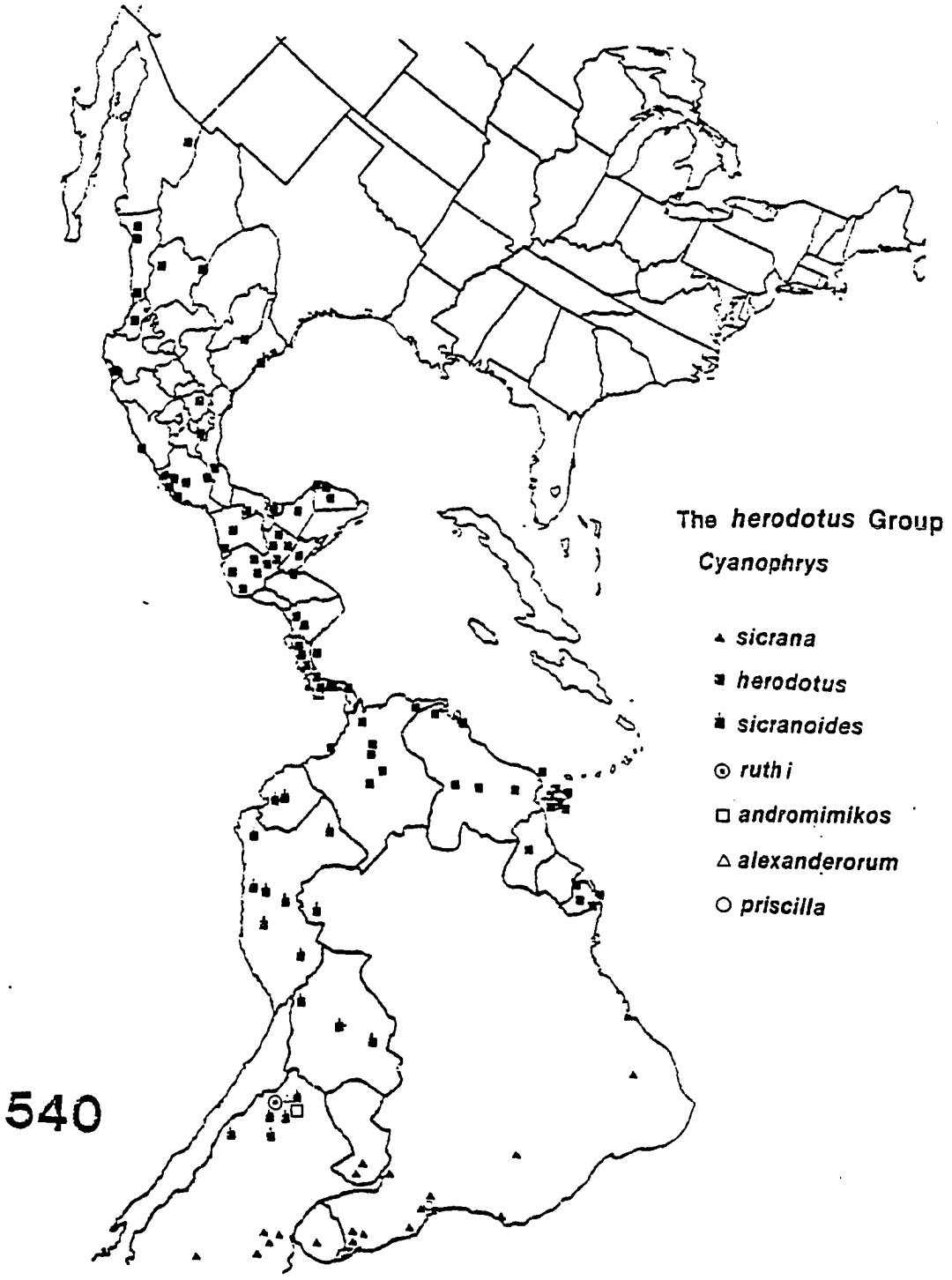
▽ *embolos*

● *circumcyanophrys*

■ *clenchi*

539

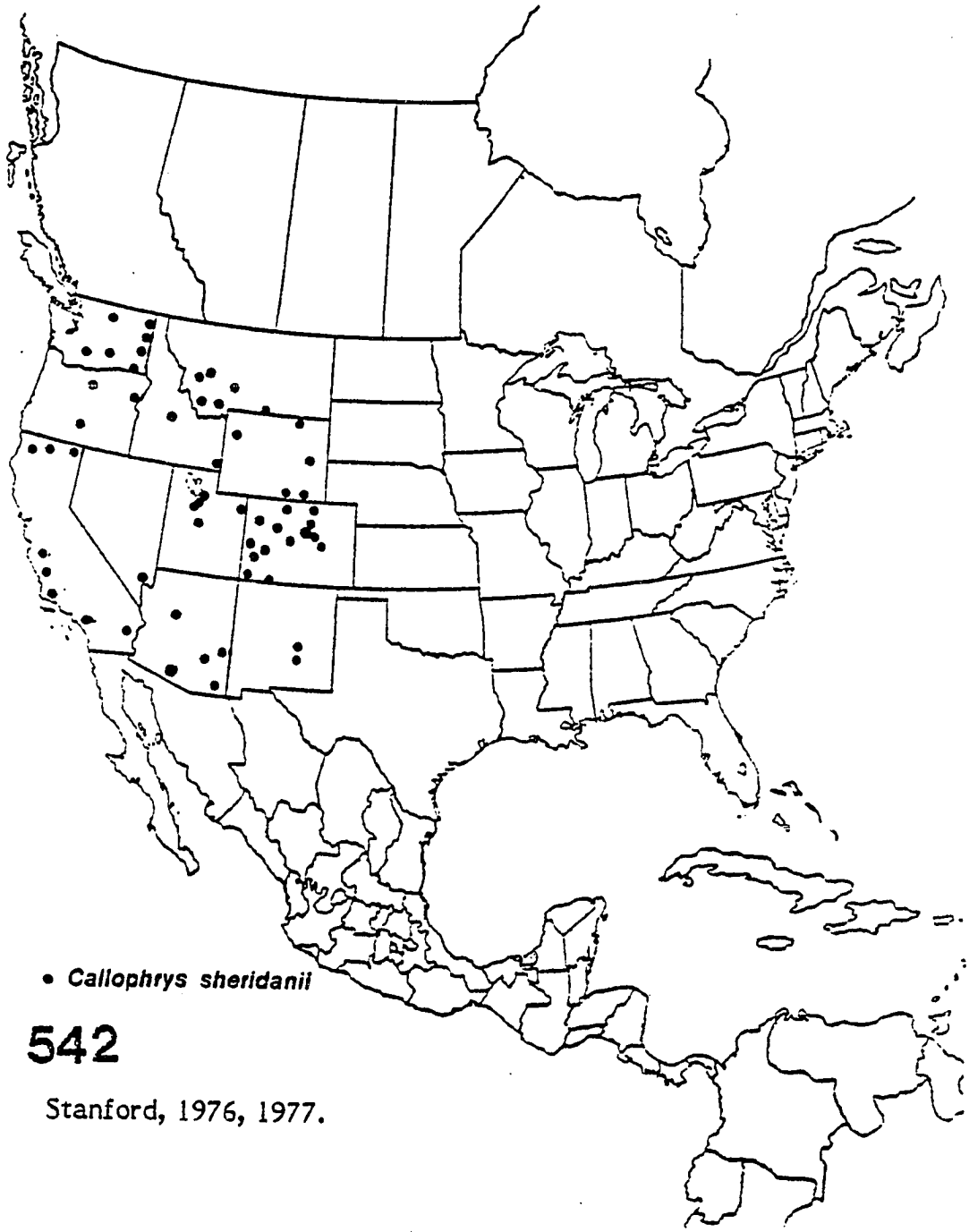
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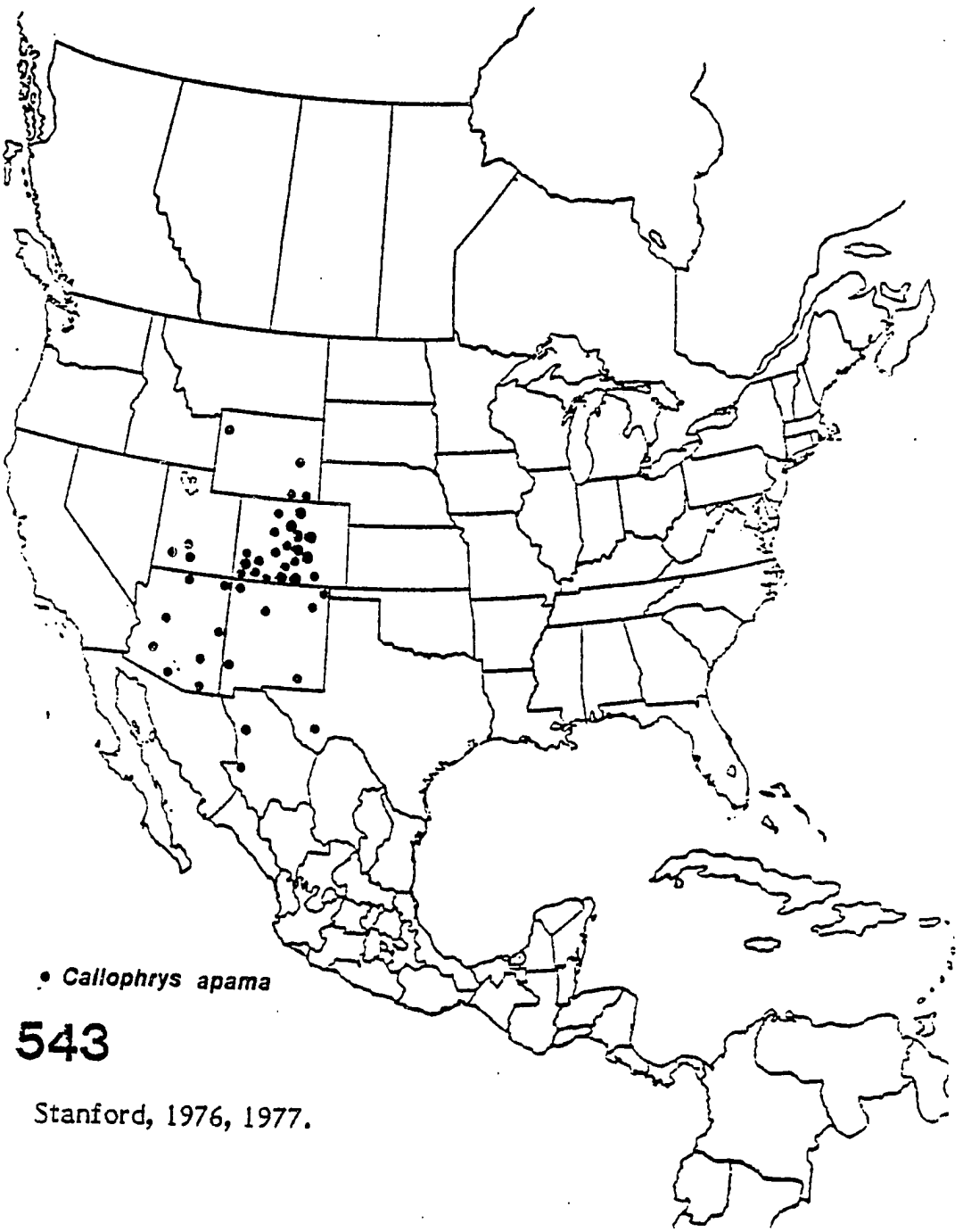


• *Callophrys sheridanii*

542

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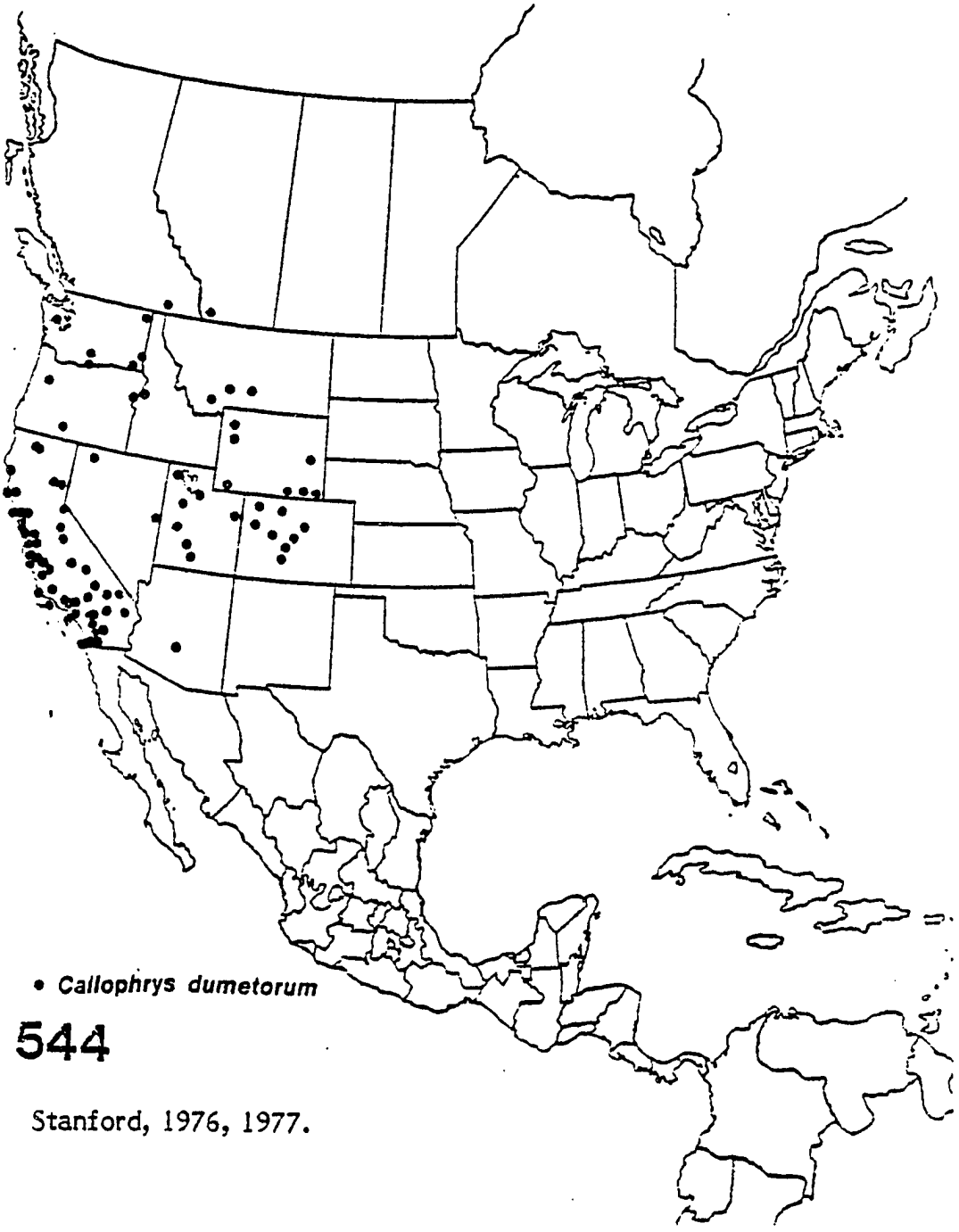


• *Callophrys apama*

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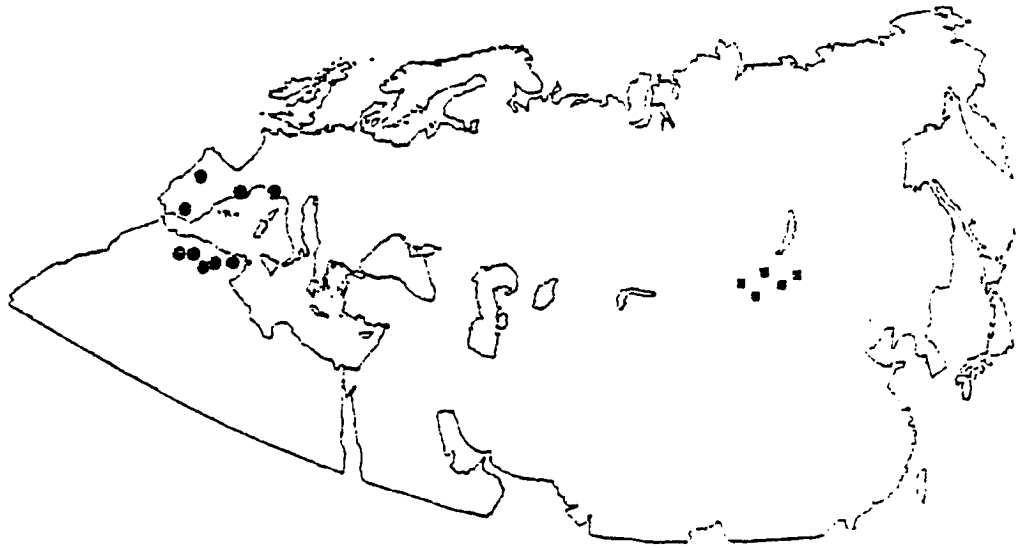


• *Callophrys dumetorum*

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▪ *Callophrys cynthia*

• *Callophrys avis*

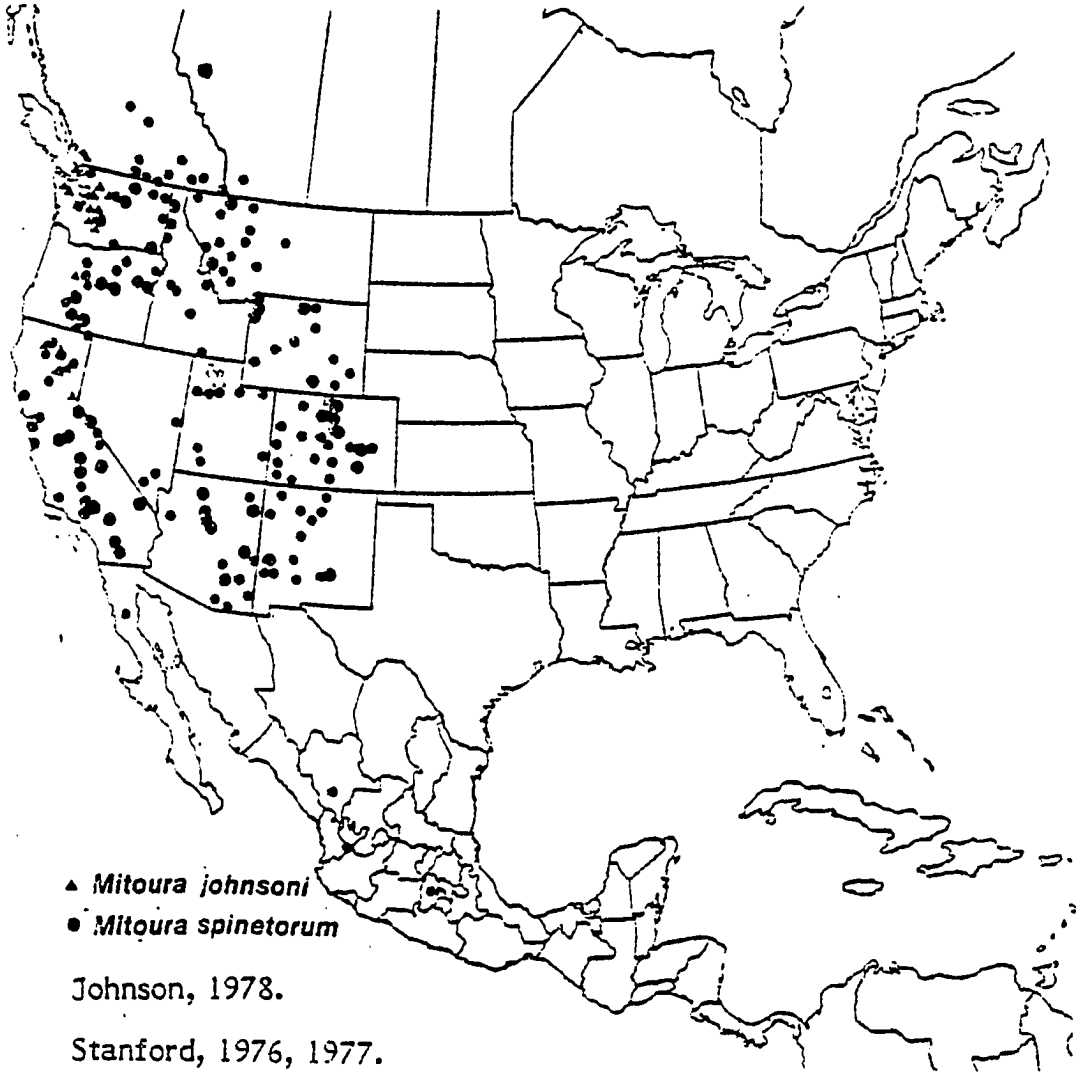
545

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Callophrys

546 ▲ *virgatus* ▫ *neofervida* ▪ *atlasensis*

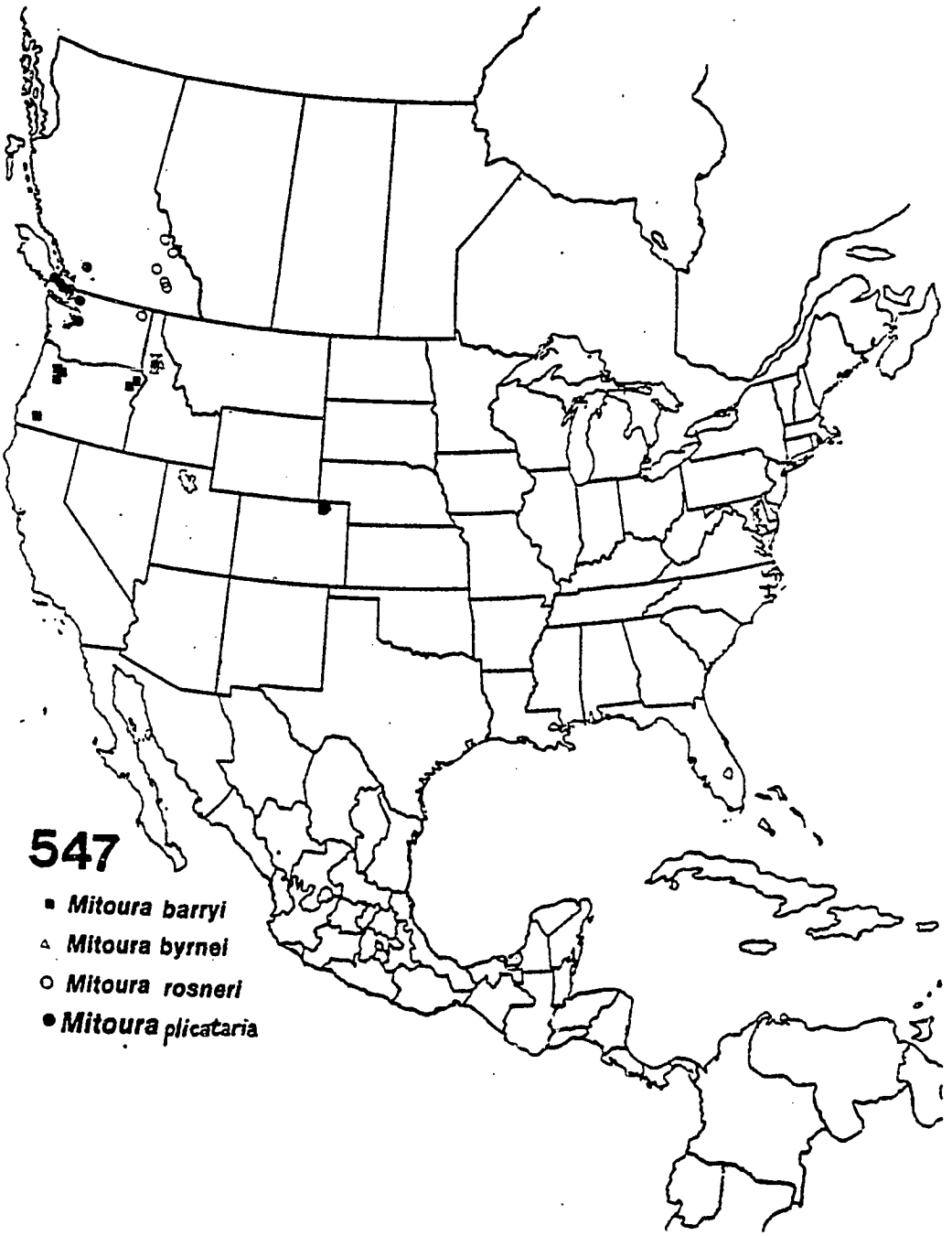


▲ *Mitoura johnsoni*
● *Mitoura spinetorum*

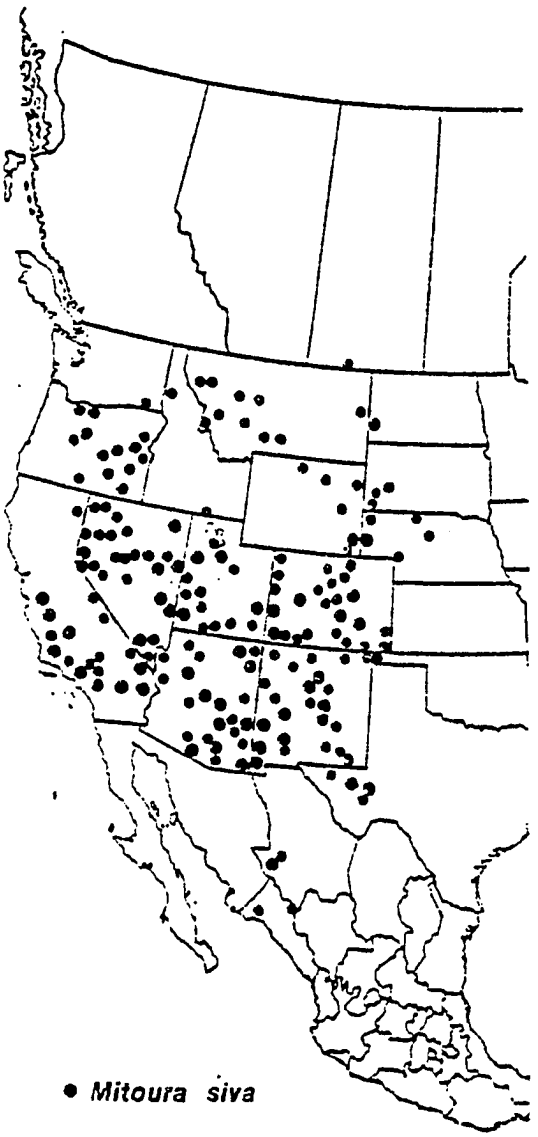
Johnson, 1978.

Stanford, 1976, 1977.

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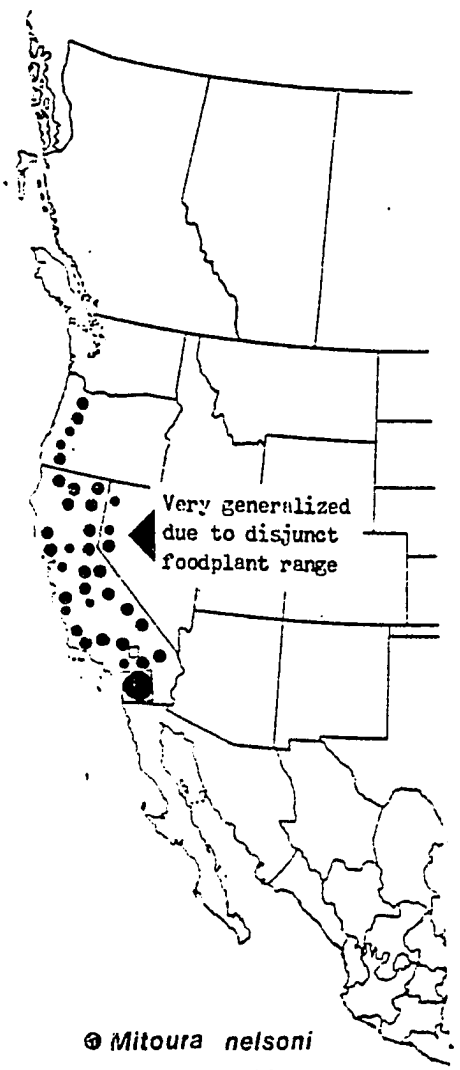
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• *Mitoura siva*

548

Johnson, 1978.

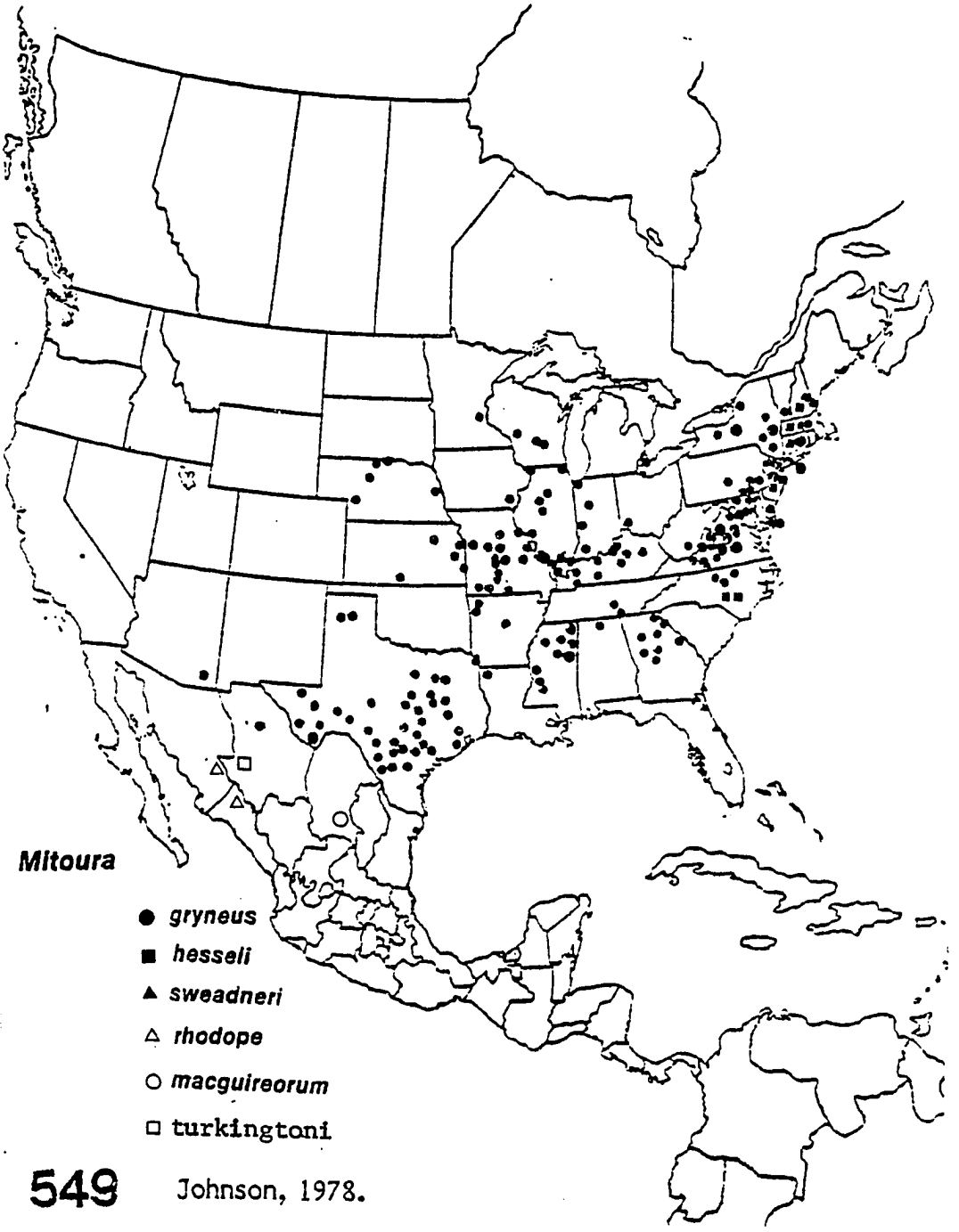


⊕ *Mitoura nelsoni*

□ *Mitoura loki*

548A

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549 Johnson, 1978.

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