Revision of *Perymenium* (Asteraceae - Heliantheae) in Mexico and Central America

by

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Abstract

REVISION OF PERYMENIUM (ASTERACEAE - HELIANTHEAE) IN MEXICO AND CENTRAL AMERICA

by

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A taxonomic revison of the genus Perymenium (Asteraceae-Heliantheae) as it occurs in Mexico and Central America. Thirty-two species and thirteen varieties are recognized in this area. Four species are newly described and six new varietal combinations prpposed. Includes distribution maps for all taxa treated, a list of exsiccatae and index to synonymy.

Introduction

The present revision is based on a study undertaken while a graduate student at City University of New York and The New York Botanical Garden.

Herbarium citations follow Index Herbariorum (Lanjouw and Stafleu 1964) with the exception of that for Escuela Nacional de Ciencias Biologicas de Mexico (ENCB), which does not appear in that work. Unfortunately, specimens borrowed from the University of Texas were returned prior to Turner's (1973) note recommending separate citation of specimens from the Lundell Herbarium appeared. Consequently, all specimens borrowed from that institution are cited as (TEX).

New names and combinations appearing in this paper are intended solely to indicate the author's plans for future publication. They are not meant to be and should not be construed to constitute effective publication of these names or combinations

Acknowledgments

I am grateful to Dr. Arthur Cronquist, who originally suggested this project and who has been a source of advice and encouragement throughout its progress; to Dr. Rogers McVaugh, who kindly provided an advance copy of his treatment of Perymenium for Flora Novo-Galiciana; to Dr. Andrew Torres, for his technical advice regarding cytological preparations from germinating

seeds; to Dr. H. Lorenzen, for supplying a copy of the protologue of *Perymenium discolor*; and to the curators of herbaria who made material available on loan (C, CAS, ENCB, F, GH, MEXU, MICH, MSC, P, TENN, TEX, UC, US).

Above all, I am indebted to my wife, Susan, who has given unselfishly of her time to assist in all phases of the preparation of this paper, from collating specimens to preparing the illustrations.

Frontispiece

Perymenium stenophyllum Blake

A - habit, x ½

B - disc achene, x 5

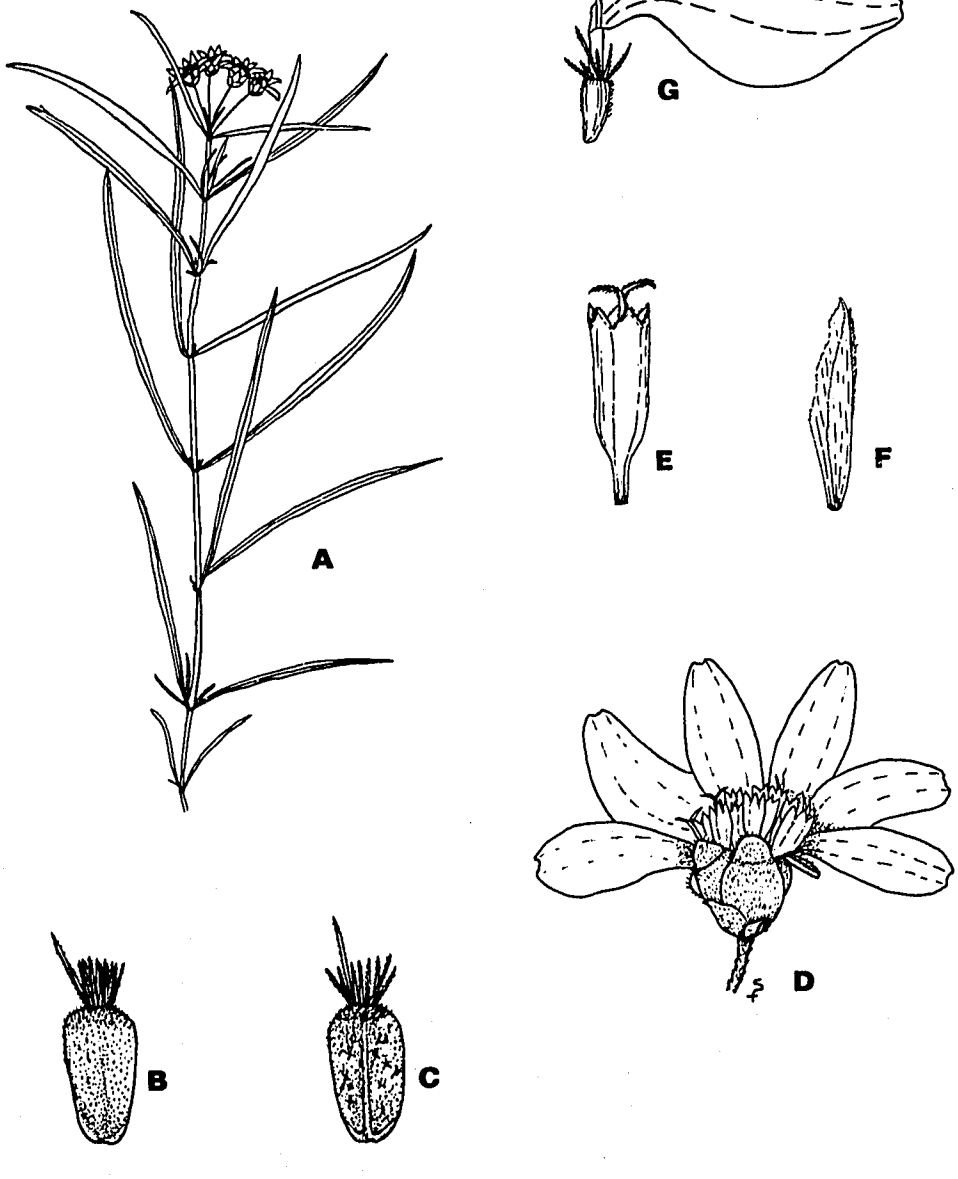
C - ray achene, x 5

D - head, with 2 rays removed, x 2½

E - disc corolla, x 5

F - pale, x 5

G - ray flower, x 5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History of the Genus

Perymenium was described by Schrader (1830), with a single species, P. discolor. Since that time, the genus has remained relatively free of nomenclatural entanglements. It was treated by DeCandolle (1836) in his Prodromus, where he recognized a total of nine species. The first attempt at a revision was that of Robinson and Greenman (1899). Blake (1924) transferred the monotypic genus Oteiza to Perymenium and subsequently (1926) treated the woody members of the genus in Mexico. The most recent revisionary work on the genus is McVaugh's (unpublished) treatment for Flora Novo-Galiciana.

The present study deals with the genus as it occurs in Mexico and Central America and recognizes thirty-two species and thirteen varieties in that area.

Systematic Position of Perymenium

Perymenium is a member of the subtribe Verbesininae, in the tribe Heliantheae. Within this subtribe, it is distinguished by its pappus of deciduous, scabrous awns and yellow-flowered, fertile-rayed heads.

The genera most closely allied to Perymenium seem to be Melanthera, Zexmenia sens. lat., Wedelia, Aspilia and Steiractinia. An additional consideration regarding generic circumscription must be raised concerning the proper placement of P. acuminatum (=Oteiza acuminata) and P. ruacophilum. These several affinities and supposed affinities are discussed below.

Fig. 1

Comparative Achenial Types

A - putative ancestor.

B - Oteiza acuminata LaLlave

C - Perymenium buphthalmoides DC. var. buphthalmoides, x 10

D - Perymenium grande Hemsley var. grande, x 10

E - Melanthera parvifolia x 10

F - Zexmenia fasciculata Gray, x 10

G - Steiractinia grandiceps Blake, x 10

H - Wedelia hispida (DC.) McVaugh, x 10

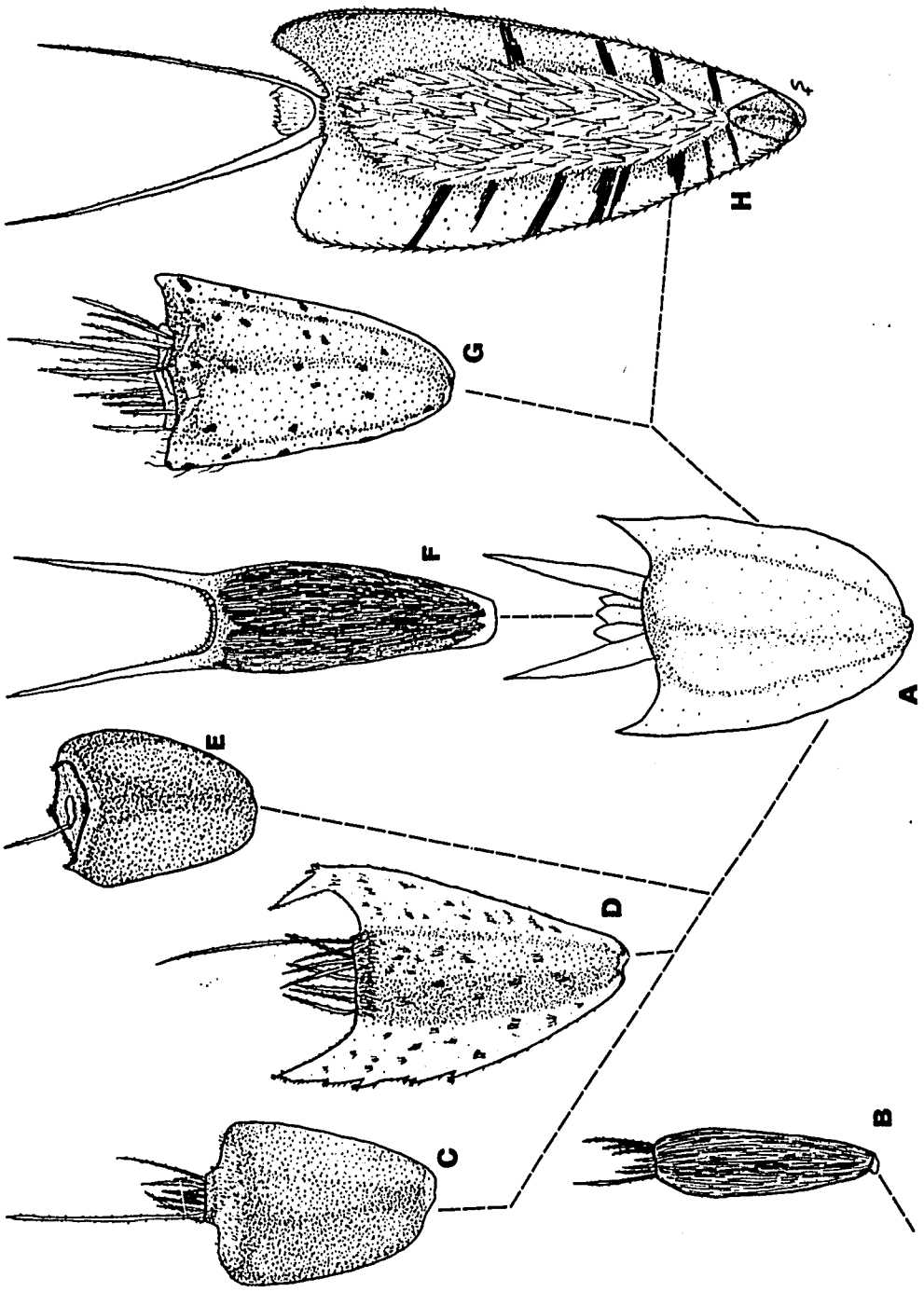

FIG. 1

A key to the genera considered appears at the end of this section.

Melanthera

This genus has often been placed near Perymenium, chiefly because it possesses a pappus of deciduous, scabrous awns. Both genera usually have dark brown or blackish anthers, as do members of several other genera of Heliantheae (e.g. Montanoa, Iostephane); both include species with perennial, woody caudices, again a condition found in several other helianthoid genera (e.g. Viguiera, Sabazia) and both have a basic chromosome number of x=15.

The distinction most frequently used in separating the genera has depended on the burr-like appearance of mature fruiting heads of Melanthera, with sharp-pointed pales radiating in an approximate hemisphere. This character is largely reliable, although difficult to describe with precision, but some taxa of Perymenium might technically have to be included in Melanthera if it were followed strictly (e.g. P. macrocephalum, P. globosum). Another useful, albeit somewhat artificial, criterion for the separation depends on the fact that all known species of Perymenium have fertile ray flowers and yellow corollas, whereas at least all North American species of Melanthera have discoid heads and white corollas. This gap, however, is partially bridged by the several yellow-flowered, neutral-rayed South American and African species of Melanthera. Differences in achenial morphology offer another means for distinguishing between the genera. In both groups, the pappus is attached to a beaklike projection at

the apex of the achene. In Perymenium, this beak expands basally and is continuous with the body of the achene. In Melanthera the apex of the achene is more or less plane, surrounded by a cartilaginous ridge, and the pappiferous beak arises from the center of this apical surface (Fig. 1).

In addition to the criteria mentioned above there are trends which, although not universal, tend to support the recognition of two genera. These include the frequent tendency in species of Melanthera for the leaves to be lobed to some extent, which never occurs in Perymenium, the fact that several species of Perymenium are large shrubs or trees while Melanthera is universally herbaceous, and the frequent occurrence of wings and marginal awns on the achenes of Perymenium and their total absence in Melanthera.

In view of the similarities, particularly that of the pappus, which has traditionally been given heavy weight in the delimitation of genera of Asteraceae, it is rather remarkable that the two genera have never been united. Not even the yellow-flowered, radiate species of Melanthera from South America, which are sometimes segregated as Echinocephalum, have ever been considered to be congeneric with Perymenium. Indeed, the general consensus that the differences outweigh the similarities, even in the absence of any sharply drawn distinction, extends to the routine identification of herbarium specimens. In the preparation of this revision, I have encountered only two specimens of Perymenium mistakenly referred to Melanthera, and not a single instance of the reverse error.

For the reasons outlined above, both historical and morpho-

logical, it seems most reasonable to maintain the distinctness of Perymenium and Melanthera while recognizing their probable close relationship.

If, as it seems likely, yellow flowers, presence and fertility of rays, and woody habit are primitive features in Verbesininae, departures from these conditions in Melanthera would seem to represent relative advancement from an ancestral group which would probably be included in Perymenium if it were extant.

Zexmenia sens. lat., Aspilia and Wedelia

The genus Zexmenia has been usually defined on the basis of fertile rays, compressed achenes and a pappus of 2 awns, with or without additional squamellae (Jones 1916, Blake 1926). Within this traditional concept of the genus, Jones recognized two sections: Euzexmenia, with flattened, unwinged or very narrowly winged achenes and the principal awns continuous with the adaxial and abaxial angles; and Auchenocarpa, with more or less plump, often broadly winged achenes and the pappus borne on a neck at the apex (see fig.1). Both my own observations and those of other recent investigators (McVaugh 1972, Becker 1972) have led to the conclusion that these two sections are not in fact very closely related and that Jones's section Auchenocarpa is closely allied to or congeneric with Aspilia and Wedelia. McVaugh (ibid.) sets forth reasons for combining the three groups in an expanded circumscription of Wedelia.

Unfortunately, it now appears that Jones's interpretation of Zexmenia serrata LaLl., the nomenclatural type of the genus, was incorrect and that it belongs not in his "typical" section,

but in Auchenocarpa (Becker ibid.). For purposes of the present discussion, Zexmenia will be used in the sense Becker has proposed for conservation, i.e. for those species with flattened achenes and awns continuous with the achenial angles, and those species with plump achenes and the pappus raised on a neck will be referred to collectively as Wedelia.

Based on achenial morphology, these two groups seem both to be related to Perymenium, but the homologies of achene structure are radically different. The achene of Perymenium has a pappus of usually numerous members and may possess wings on the adaxial and abaxial angles which often extend upward into marginal awns (see fig. 1). The pappus of Wedelia appears to represent a structure homologous with the pappus of Perymenium, while the awns of Zexmenia seem to be homologous with the marginal awns of Perymenium. It can easily be imagined how an ancestor with a pappus of several or numerous parts, at least some of them probably squamellae, and winged achenes with a tendency to produce marginal awns, could give rise to Perymenium by reduction of all the pappus members to narrow, deciduous awns, to Zexmenia by narrowing of the wings, flattening of the achenes, loss of the primary pappus and its supporting neck and concomitant development of the marginal awns into a firm secondary pappus, and to Wedelia by fusion and reduction of some or all pappus members and loss of marginal awns.

There is, of course, an alternative to this interpretation. The awns of Zexmenia may indeed represent a specialization of primary pappus structure, but, if so, they are remark-

able in the degree to which they are structurally and texturally continuous with the body of the achene. The application of this concept to the awns on achenes of such genera as Verbesina, which appears to follow the Zexmenia pattern, remains to be investigated, but the explanation offered above may lead to a refinement of other generic or even subtribal alignments within the Heliantheae.

Steiractinia

This genus has the obvious feature of a pappus of deciduous awns in common with Perymenium. In certain aspects of achene morphology, however, it resembles Wedelia (sensu McVaugh). The presence of scattered septate trichomes on the surface of the achene; and well-developed wings which do not extend into marginal awns, is particularly suggestive in this regard (see FIG. 1).

Blake (1915) separated Steiractinia from Perymenium largely because of its neutral ray flowers, but considered the concurrence of pappus structure evidence of a close relationship. At present I can only note that no known Perymenium has achenes quite like those of Steiractinia and that it thus seems reasonable to maintain the genera distinct pending a thorough revision of the South American representatives of Perymenium. The most plausible explanation of the observed similarities and differences probably lies in a common ancestry for Perymenium, Wedelia and Steiractinia, with each group subsequently becoming specialized along different lines.

Perymenium acuminatum and P. ruacophilum

The plant from South-central Mexico usually known as Perymenium acuminatum was first described by LaLlave (1832) as Oteiza acuminata. DeCandolle (1836), apparently unaware of LaLlave's work, redescribed the same species as Calea elegans. Blake (1924) made the transfer to Perymenium, citing Calea elegans DC. as a synonym and indicating that it was probably most closely related to Perymenium ruacophilum Donn. Sm., a Guatemalan plant which Blake (1917) had inadvertently redescribed as Calea insignis.

Examination of both species leads me to agree with Blake's suggestion of probable affinity between them, but indicates that neither is particularly closely related to Perymenium proper. In fact the referrals to Calea are far more defensible on the basis of overall morphology than is Blake's eventual acceptance of both in Perymenium, which depended solely on the possession of a pappus of numerous, deciduous, scabrous awns.

The two species possess much more in common with members of the Galinsoginae, of which Calea is a member, than with Perymenium or any other member of the Verbesininae. Both have glabrous, obscurely angled achenes, flattish or rounded, unkeeled pales, a swelling at the base of the style, and ray corollas with a relatively long slender tube and lacking the two prominent abaxial vascular bundles in the lamina which are common in most Heliantheae (and universal in Perymenium).

In addition to the above characters, all of which are anomalous in Perymenium and fairly widespread in Galinsoginae, there are features of these two species which, while not definitely

pointing to any relationship with Galinsoginae, are nevertheless out of place in Perymenium. Chief among these are glabrous phyllaries and conic, papillate style appendages.

Although the affinities of Perymenium acuminatum and P. ruacophilum seem to lie clearly with the Galinsoginae, they would not fit well in any of the established genera in that subtribe, as delimited most recently by Longpre (1970). I feel that the weight of morphological evidence supports their removal from Perymenium and eventual placement in the galinsogoid alliance as the genus Oteiza.LaLlave.

Key to *Perymenium* and genera related to or confused with it

1. Achenes columnar, neither distinctly compressed nor strongly angled, wingless, glabrous; style of disc flowers with a distinct swelling near base; pales flat or curved, never keeled. *Oteiza*

1. Achenes usually distinctly angled and often strongly compressed, with or without wings, usually pubescent to some extent; style of disc flowers not swollen near base; at least the inner pales keeled and enfolding the achenes.

2. Pappus borne on a neck or beak at apex of achene.

3. Pappus of connate squamellae, with or without two firmly attached awns as well. *Wedelia* sensu McVaugh

3. Pappus composed entirely of deciduous awns.

4. Heads radiate, the ray flowers fertile. *Perymenium*

4. Heads discoid, or radiate with neutral rays.

5. Achenes compressed and winged; woody plants. *Steiractinia*

5. Achenes plump, wingless; herbs. *Melanthera*

2. Apparent pappus of two awns continuous with the inner and outer angles of the achene. *Zexmenia*

General Evolutionary Trends

Although some apparent evolutionary trends can be perceived within Perymenium, a detailed scheme of phylogeny within the genus does not seem within reach at this time. The discussion below is offered as a broad outline of phylogeny in the genus. More detailed discussions of specific relationships are presented under individual taxa.

As noted above, achenial structure argues for a common ancestry for Perymenium, Zexmenia, Wedelia, and Steiractinia. If the interpretation of homologous structures offered here for these groups is correct, any putative ancestor would presumably possess achenes with well-developed wings and marginal awns. Furthermore, since all four groups are primarily woody, one would expect them to be derived from a woody ancestry. Three species of Perymenium, all woody, possess achenes of a presumptively primitive type, with well developed wings extending to near the base and continuous with marginal awns: P. grande, P. nicaraguense and P. gymnolomoides. Of these, P. gymnolomoides appears to be relatively specialized in its vine-like habit, recurved peripheral disc flowers and achenes with a stalk-like base. Of the remaining two species, P. nicaraguense is somewhat unusual in the genus as well as the entire alliance in its coriaceous and often subentire leaves, so that P. grande appears a little closer to the supposed ancestry of the genus.

Evolution within Perymenium seems to have proceeded in the direction of reduction in habit and achenial ornament, including

loss of wings and marginal awns in most species and, in some (e.g. P. buphthalmoides, P. diguetii) frequent reduction of the pappus to relatively few awns.

Cytology

The limited number of taxa in Perymenium known cytologically offer an interesting but sketchy picture. Data from the literature, from specimen annotations, and from my own investigations are summarized in Table I. Counts for P. berlandieri, P. globosum var. rotundisquamum and P. mendezii were obtained from flower buds collected in the field, fixed and stored in Newcomer's solution (Newcomer 1953) and squashed in aceto-carmine. Counts of P. discolor and P. grande were obtained from aceto-carmine squashes of radicles of germinating seeds (procedure adapted from Torres, personal communication). The count of P. macrocephalum was obtained from flower buds of a plant grown in New York from seed collected in Mexico.

The data in Table I indicate that x=15 is basic for the genus. Four of the ten species studied, however, exhibit polyploidy in at least some populations.

Three of these species have been reported at more than one ploidy level. These cases are discussed below:

P. berlandieri - In this case, the two populations from which the counts were obtained are geographically separate and show some degree of morphological differentiation. With only a single count from each, however, to attempt any correlation of ploidy level and morphology would be premature. This situation is also discussed in the systematic treatment of the species.

Taxon	Voucher	Reference	n
P. berlandieri (as P. mendezii)	Beaman 2764	Turner, Beaman & Rock 1961	15
P. berlandieri	Fay & Cronquist 105		ca. 45
P. buphthalmoides var. buphthalmoides (as P. flexuosum)	Powell & Edmondson 731	Powell & Turner 1963	ca. 30
P. buphthalmoides var. buphthalmoides	King 3618	Turner Ellison and King unpublished	32+2
P. chloroleucum (as P. parvifolium	Breedlove & Raven 13134	Solbrig et al. 1972	15
P. discolor (as P. microphyllum)	King 2964	Turner, Ellison & King 1961	15
P. discolor	King 3503	Turner, Ellison and King 1961	15
P. discolor	Fay & Cronquist 116		15
P. ghiesbreghtii (as P.cf.chalarolepis)	King 3138	Turner, Ellison & King 1961	15
P. ghiesbreghtii (as P. chalarolepis)	King 3388	Turner, Ellison & King 1961	15

Table 1

Taxon	Voucher	Reference	n
P. ghiesbreghtii (as P. purpusii)	Breedlove 13951	Solbrig et al. 1972	15
P. ghiesbreghtii (as P. purpusii)	Breedlove & Raven 13731	Solbrig et al. 1972	15
P. ghiesbreghtii (as P. purpusii)	Breedlove 13760	Solbrig et al. 1972	ca. 15
P. globosum var. rotundisquamum	Fay & Cronquist 107		15
P grande var. nelsonii	Fay & Cronquist 108		ca. 45
P. grande var. nelsonii (as P. nelsonii)	Breedlove 7082	Solbrig et al. 1972	ca. 86
P. macrocephalum	Fay & Cronquist 106		15
P. mendezii var. angustifolium (as P. hypoleucum)	Powell & Edmondson 659	Powell & Turner 1963	ca. 45
P. mendezii var. mendezii	Fay & Cronquist 100		ca. 30
P. mendezii var. mendezii (as P. parvifolium)	Breedlove 15470	Solbrig et al. 1972	15

Taxon	Voucher	Reference	n
P. mendezii var. verbesinoides (as. P. asperifolium)	King 3488	Turner Powell & King 1962	ca. 45
P. mendezii var. verbesinoides (as P. nelsonii)	King 3654	Turner Ellison & King 1961	15
P. pringlei var. lancifolium (as P. ghiesbreghtii)	King 3719	Turner Ellison & King 1961	15

P. grande var. nelsonii - The two counts in this taxon are from morphologically similar plants growing in the same general area. The fact that the count reported by Solbrig et al. (1972) from meiotic material is roughly double that which I obtained from root squashes suggests that the higher count may have been based on a mistaken scoring of disjoining anaphase I chromosomes as bivalents. Clearly, additional examination is needed. If the higher count is accurate, it represents the highest chromosome number known in the genus, an approximate dodecaploid.

P. mendezii - Morphologically, this is one of the most interesting and puzzling species in the genus, and it appears to be no less so cytologically. Unfortunately so few reports indicating such great diversity can hardly be a basis for fruitful speculation. Both the diploid and hexaploid populations of var. verbesinoides are morphologically atypical for that taxon, which further complicates matters. Again, the situation will only be clarified by sampling additional populations from throughout the considerable range of the species.

Systematic Treatment

Perymenium Schrader, Ind. Sem. Hort. Gott. 1830

Trees, shrubs, scrambling woody vines or herbs from 1 dm to nearly 20 m high. Leaves opposite, subsessile or petiolate, usually trinerved or triplinerved and serrate, rarely penniveined or subentire. Inflorescence a simple or compound terminal cyme or a single head terminating a leafy branch. Heads radiate. Involucre 2-4 seriate; the phyllaries evenly or unevenly imbricate or subequal, inner ones with spreading ciliate apex or appressed and transitional to pales. Ray flowers 5-16; corolla yellow. Disc flowers 9-150; corolla yellow, lobes deltoid, erect or rarely reflexed, throat broadly or narrowly cylindric or rarely cylindro-campanulate, tube narrowly cylindric. Pales distinctly keeled along abaxial surface, enfolding achenes. Disc achenes biconvex or compressed-tetragonal, adaxial and abaxial angles sometimes bearing wings; marginal awns often present. Pappus of deciduous awns inserted on a more or less distinct beak or neck at apex of achene; inner and outer awns usually longest and stoutest. Ray achenes usually triquetrous, otherwise essentially similar to those of disc. Receptacle flattish or more or less convex.

NOTE: All measurements of involucres and floral parts are based on heads removed from herbarium sheets and reconstituted by boiling.

Key to the Species of *Perymenium*

1. Involucre evidently imbricate, the phyllaries usually in three series with the outer shortest.
   2. Achenes winged nearly or quite to the base and with conspicuous marginal awns continuous with the wings.
      3. Involucre 4.5-13.5 mm high, 5-10 mm wide. 1. *P. grande*
      3. Involucre 3.5-4.5 mm high, 3-5 mm wide.
         4. Erect shrub or small tree with straight, ascending branches; leaves sparsely strigillose, coriaceous. 2. *P. nicaraguense*
         4. Erect or more frequently sprawling and vinelike shrub with strongly divaricate, upcurving branches; leaves strigillose, hispidulous or hispid-pilose, herbaceous. 5. *P. gymnolomoides*
   2. Achenes unwinged or winged only on upper angles, with or without distinct or inconspicuous marginal awns.
      5. Plants bearing stipitate-glands on leaves, petioles and young stems.
         6. Leaves 3.5-8 cm long, 1.5-4 cm wide, distinctly serrate; heads with 25-35 disc flowers. 27. *P. cornutum*
         6. Leaves 2.5-3 cm long, 1 cm wide, barely serrate; heads with ca. 17 disc flowers. 28. *P. glandulosum*
      5. Plants lacking stipitate glands though often bearing sessile resin droplets.
         7. Inner phyllaries with spreading or subspreading, yellowish, ciliate apex.
            8. Leaves distinctly whitened beneath with fine, matted, curly tomentum.

9. Heads with 10-22 disc flowers, usually numerous in a freely-branched inflorescence.

10. Leaves linear, 1.5-3 mm wide.

12. P. stenophyllum

10. Leaves lanceolate, 5-20 mm wide.

11. P. discolor

9. Heads with 25-60 disc flowers, usually in small cymes at the ends of leafy branches.

11. Stem and upper leaf surfaces strigillose; heads with ca. 40-60 disc flowers, pales 4-5 mm long.

10. P. klattianum

11. Stem and upper leaf surfaces hispidulous or hispid-pilose; heads with 25-40 disc flowers, pales 5.5-6.5 mm long. 13. P. ovatum

8. Leaves either green beneath or densely strigillose and whitened.

12. Stems densely and softly appressed-hirsute.

7. P. reticulatum

12. Stem variously pubescent to nearly glabrous, never appressed-hirsute.

13. Phyllaries all distinctly oblong, with rounded apex. 3. P. uxoris

13. At least outer phyllaries ovate and acute.

14. Disc achenes 3-4 mm long, disc corollas 5-8.5 mm long, pales 5-8 mm long

15. Leaves ovate, with 15-25 teeth on a side.

21. P. hintonii

15. Leaves lanceolate or narrowly lance-elliptic, with fewer than 10 teeth on a side.

16. Outer phyllaries essentially glabrous; leaves sparsely strigillose above and below. 4. P. jalapanum

16. Outer phyllaries sparsely strigose; leaves hispid above and below. 6. P. episcopale

14. Disc achenes 2-2.5 mm long, disc corollas 3-4.5 mm long, pales 2.5-4.5 mm long.

17. Heads with 20-36 disc flowers. 8. P. pringlei

17. Heads with 9-13 (rarely-19) disc flowers. 9. P. gracile

7. Inner phyllaries generally transitional to pales, without spreading yellowish, ciliate apex.

18. Heads with 8 disc flowers; rays 5, inconspicuous, about equalling disc. 15. P. pinetorum

18. Heads with 13 or more disc flowers; rays more than 5, conspicuous, clearly surpassing disc.

19. Phyllaries in 3 series, those of inner two series approximately equal in length, distinctly oblong, those of outer series shorter, lance-ovate. 16. P. chloroleucum

19. Phyllaries in 3-4 more or less evenly imbricate series, varying gradually from ovate or lance-ovate in outer series to oblongish in inner series.

20. Involucre 1-2 cm wide, head with 40-100 disc flowers, pales 8-11 mm long. 18. P. macrocephalum

20. Involucre less than 1 cm wide, head with 30 or

fewer disc flowers or pales less than 8 mm long.

21. Tall suffrutescent perennials (more than 1 m in height); inflorescence ample, freely branched, terminal; stem conspicuously 4-grooved.

22. Phyllaries ciliate, usually all attenuate and squarrose or recurved; receptacle slightly or distinctly convex, never hemispheric.

14. P. ghiesbreghtii

22. Phyllaries ciliate and appressed or eciliate and recurved; receptacle then hemispheric.

17. P. globosum

21. Plants otherwise, either distinctly woody, or without distinctly grooved stem, or nearly unbranched perennial herbs less than 1 m high with few (1-5) heads per stem.

23. Herbs, producing annual flowering stems from a caudex.

24. Leaves narrowly lanceolate, more than twice as long as wide; heads with less than 30 disc flowers; rays with lamina less than 1 cm long. 26. P. jaliscense

24. Leaves ovate or lance-ovate, less than twice as long as wide; heads with 30 or more disc flowers; rays usually with lamina more than 1 cm long. 25. P. oxycarphum

23. Shrubs, sometimes arising from a caudex, but the stems then of several seasons duration.

25. Heads with 12-16 rays and 40 or more disc flowers; leaves whitened-hispid beneath, hairs convergent in areolae of veins.
24. P. sedasanum

25. Heads with 5-9 rays and usually fewer than 40 disc flowers; leaves, if whitened beneath, strigose or tomentose.

26. Foliage and pales grayish-green, leaves subcoriaceous, dully lustrous above.

27. Involucre cylindric or cylindro-campanulate, strongly graduate, cuneate-based. 20. P. berlandieri

27. Involucre campanulate or hemispheric, weakly graduated, truncate or indented at base. 19. P. alticola

26. Foliage bright green unless obscured by hairs; pales yellowish, leaves herbaceous, not lustrous above.
22. P. mendezii

1. Involucre not imbricate, the phyllaries in 2-3 series of nearly equal length.

28. Plants herbaceous, with annual flowering stems arising from a caudex.

29. Stems usually simple, branching only in inflorescence; leaves ovate to lance-oblong, if serrate, the teeth acute.
31. P. buphthalmoides

29. Stems regularly branching near the middle; leaves ovate to orbicular, crenate-serrate, with obtuse teeth.

32. P. diguetii

28. Plants with perennial woody stems.

30. Phyllaries ovatish basally, constricted above this, with loose, orbicular to oblong, herbaceous apex.

23. P. subsquarrosum

30. Phyllaries lanceolate or lance-ovate, tapering evenly from near base to apex.

31. Leaves ovate, acute, hispid-pilose beneath; achenes wingless, without a distinct neck.

29. P. asperifolium

31. Leaves lance-attenuate, hispidulous below, achenes winged on upper angles, with a distinct neck ca. 0.5 mm high.

30. P. wilburorum

1. Perymenium grande Hemsl., Biol. Centr. Amer. Bot. 2:181, 1881. TYPE: GUATEMALA: ALTA VERA PAZ: On mountains around Coban, 4300 ft, Jan. 1879, von Tuerckheim 336 (HOLOTYPE: K; ISOTYPES: F(2),GH,MO,NY(2),US; Photos: GH,NY,TEX,US; Drawing: GH).

Shrub or tree, to ca. 20 m in height, usually smaller. Leaves 8-26 cm long, 3.5-9 cm wide, broadly to narrowly ovate, acute or, more often, acuminate-attenuate, with cuneate to truncate or subcordate base, sparsely to densely strigillose above, sparsely strigillose or hispidulous to densely hispid-pilose or tomentellous below, evenly serrate, triplinerved, with 2-several pairs of prominent, parallel secondaries below the major pair; Petiole 1-7 cm long. Stem strongly 4-grooved when young, very sparsely to densely strigillose to pilose or hispid-pilose. Inflorescence terminal, ample, equalling or slightly exceeding the upper leaves, rarely reduced to 3-5 heads subsessile at the end of a leafy branch Peduncles sparsely to densely strigillose to pilose or hispid-pilose. Involucre campanulate to hemispheric, 3-seriate, 4.5-13.5 mm high, 5-10 mm wide at anthesis. Outer phyllaries ovate or lance-ovate, acute, sparsely to moderately strigillose, with appressed to subspreading hairs; inner phyllaries progressively less pubescent and more oblong; all phyllaries usually ciliate. Rays 5-10 (12); lamina 8-17 mm long, tube 1.5-3 mm long. Disc flowers 24-65; corolla 4.0-8.5 mm long, with cylindric throat, slender tube 1-3 mm long and deltoid lobes 0.6-1 mm long; anthers with blackish thecae 1.4-2.7 mm long and ovate or lance-ovate yellowish appendage 0.4-0.7 mm long; style branches 1.0-1.8 mm long, with short acute, hispidulous appendage. Pales 5-8.8 mm long, with acute to

obtuse or rounded, usually erect apex and distinct, ciliate keel. Disc achenes compressed-biconvex, winged on inner and outer angles (wings 0.5-1.0 mm wide) and possessing well-developed marginal awns up to 2 mm long, wings and marginal awns often ciliate-lacerate; body 2.8-4.5 mm high, excluding marginal awns, 1-3.5 mm wide, including wings; faces smooth and glabrous or tuberculate and tufted-strigillose, finely puberulent near apex. Pappus consisting of ca. 15 deciduous awns, the adaxial one usually longest, up to 4.0 mm in length, the others irregularly shorter. Ray achenes triquetrous or obcompressed-triquetrous, winged on all three angles or the inner one occasionally wingless, 2.5-4.5 mm high, 1.2-3.0 mm wide, otherwise similar to those of disc. Receptacle slightly to strongly convex.

Key to varieties of P. grande

1. Involucre smaller, 4.5-6 mm high, 5-6.5 mm wide; inner phyllaries erect or nearly so, never with conspicuously spreading apex; pales 5-6 mm long. 1a. P. grande var. grande

1. Involucre larger, 6.5-13.5 mm high, 6-10 mm wide; inner phyllaries with blunt, spreading apex; pales 6.5-8.8 mm long. 1b. P. grande var. nelsonii

1a. Perymenium grande Hemsl. var. grande., P. turckheimii Klatt, Leopoldina 20:95, 1884.

Perymenium grande Hemsl. var. strigillosa Robins. & Greenm. Proc. Amer. Acad. Arts 34:529, 1899. P. strigillosum (Robins.

& Greenm.) Greenm. Field Col. Mus. Bot. Ser. 2:348, 1912. TYPE: GUATEMALA: SANTA ROSE: Cenanguilla, 1200 m, Nov. 1892, Heyde & Lux 4244 (HOLOTYPE: GH; ISOTYPES: F(2),MICH,MO,US).

Leaves 10-26 cm long, 3.5-7.5 cm wide, with cuneate to truncate base, sparsely to moderately strigillose above, sparsely to densely hispidulous to hispid-pilose below; petiole 1.5-7 cm long. Involucre 4.5-6 mm high, 5-6.5 mm wide. Innermost phyllaries erect or nearly so, frequently transitional to the pales. Rays 7-8; lamina 8-13 mm long, tube 1.6-2.3 mm long. Disc flowers 24-26; corolla 4-4.5 mm long, tube 1-1.5 mm long, lobes 0.6-0.7 mm long; anthers with thecae 1.4-1.7 mm long. Pales 5-6 mm long. Disc achenes 2.8-3.5 mm high, excluding marginal awns, 1.5-2.5 mm wide, including wings. Adaxial pappus awn up to 2.8 mm in length, rarely fused to the adaxial marginal awn. Ray achenes 2.5-3 mm high. Receptacle low-convex. Forests in southern Guatemala, Honduras and El Salvador at altitudes from 900 m to 3000 m. Blooming Sept. through April.

Selected Specimens:

GUATEMALA: ALTA VERA PAZ: Coban, alt. 1350 m, Nov. 1907, von Turckheim II1511 (C(2),F,MICH,MO,US). CHIQUIMULA: Upper slopes of Montana Tajuran, in vicinity of El Barriol, alt. 1200-1700 m, Oct. 28, 1939, Steyermark 30775 (F). GUATEMALA: Between kms. 18-22 hwy from Guatemala City to Antigua; alt. 1600 m, Nov. 26, 1969, Molina & Molina 24852 (F,NY). HUEHUETENANGO: Along Aguacatan road east of Huehuetenango at km 13-14, alt. ca. 1950 m, Jan. 2, 1941, Standley 81969 (F). La Sierra (Tujimach) across river from San

Juan Atitlan, Sierra de los Cuchumatanes; alt. 2500-2900 m, Sept. 8, 1942, Steyermark 51970 (F,GH). JALAPA: Between Jalapa and Montana Miramundo, alt. 1500-2000 m, Dec. 7, 1939, Steyermark 32878 (F). EL PROGRESO: Trail between Finca Piamonte east to Finca San Miguel, Feb. 9, 1942, Steyermark 43723 (F,GH). SACATEPEQUEZ: Volcan Agua, alt. 7500 ft, Feb. 4, 1908, Kellerman 7425 (F,NY). Finca El Hato, NE of Antigua, alt. 1950-2040 m, Dec. 28, 1938, Standley 61208 (F,GH,NY). SOLOLA: About 5 km east of Panajachel, above Lake Atitlan, alt. 2200 m, Dec. 5, 1963, Williams et al. 25226 (F,NY,US). HONDURAS: COMAYAGUA: Vicinity of Siguatepeque, alt. 1080-1400 m, Feb. 14-27, 1928, Standley 55932 (F,GH,US). INTIBUCA: Cordillera Opalaca, between Pela Nariz and Calaveras, road to La Esperanza, alt. 2000 m, Sept. 3, 1968, Molina 22619 (F,NY,US(2)). EL SALVADOR: LA LIBERTAD: Area west of Santa Tecla, alt. 3000 ft, Nov. 6, 1958, Allen 7069 (F,NY,TEX, US). SAN VICENTE: Volcan de San Vicente, alt. 1200-1500 m, March 7,8, 1922, Standley 21478 (GH,NY,US). SANTA ANA: Cerro de San Jacinto, 1925, Calderon 2253 (GH,US). SONSONATE: Road to Cerro Verde area south of Lake Coatepeque, alt. 3500 ft, Nov. 6, 1958, Allen 7071 (GH,NY,TEX,US).

1b. Perymenium grande Hemsl. var. nelsonii (Robins. & Greenm.) Fay, comb. nov. P. nelsonii Robins. & Greenm., Proc. Amer. Acad. Arts 34: 529, 1899. TYPE: MEXICO: CHIAPAS: Between San Cristobal and Teopisca, 2050-2600 mm, Dec. 4, 1895, Nelson 3465 (LECTOTYPE: GH; ISOTYPE: US).

Perymenium latisquamum Blake, Contr. U.S. Natl. Herb. 22:

626, 1926. TYPE: MEXICO: CHIAPAS: Sierra de Tonala, Sept. 1913, Purpus 6647 (HOLOTYPE: GH; ISOTYPE: UC; Photos: US(2)).

Shrub or small tree to about 8 m high. Leaves 8-18 cm long, moderately to densely strigillose to hispidulous above; petiole 1-4 cm long. Stem moderately to densely strigillose to pilose or hispid-pilose. Inflorescence rarely reduced to 3-5 heads subsessile at the end of a leafy branch. Peduncles densely strigillose to pilose. Involucre 6.5-13.5 mm high, 6-10 mm wide at anthesis; inner phyllaries with strongly spreading, obtuse or rounded membranous apex. Rays with lamina 9.5-17 mm long. Disc flowers with corolla 5-8.5 mm long, tube 1.5-3 mm long, lobes 0.8-1 mm long; anthers with thecae 1.7-2.7 mm long and appendage 0.6-0.7 mm long. Pales 6.5-8.8 mm long. Disc achenes with marginal awns up to 1.0 mm long, body 3.0-4.5 mm high, excluding marginal awns and 1-3.5 mm wide, including wings. Forests from southeastern Oaxaca to northern Costa Rica at altitudes from 250 m to 2200 m. Blooming May through Dec.

Selected Specimens:

MEXICO: CHIAPAS: El Sumidero, 22 km north of Tuxtla Gutierrez, alt. 4500 ft, Oct. 16, 1965, Breedlove & Raven 13395 (DS,ENCB,MICH,NY). 23 miles NE of Arriaga, alt. ca. 1900 ft, Nov. 1, 1965, Cronquist 10460 (NY). 21 miles south of Comitan, alt. ca. 3500 ft, Nov.3, 1965, Cronquist 10478 (NY). Mountains about 20 km east of Chiapa del Corzo, between Tuxtla Gutierrez and San Cristobal de las Casas, alt. ca. 1200 m, Nov. 2, 1970, Fay & Cronquist 108 (NY). Hills 10 km east of Teopisca, alt.

2300 m, Nov. 2, 1970, Fay & Cronquist 111 (NY). Along Rio Grijalya 10 km south of Mex. Hwy 190 along road to Acala at Mandaburri, alt. 1600 ft, Oct. 24, 1966, Laughlin 2644 (DS,ENCB,MICH). Along road from El Bosque to Simojovel, alt. 3000 ft, Oct. 10, 1967, Alush Shilom Ton 3093 (DS,ENCB,NY). OAXACA: Chivela, Sept. 10, 1928, Mell s.n. (US). GUATEMALA: HUEHUETENANGO: San Miguel Acatan, alt. 6400 ft, Aug. 19, 1934, Skutch 1019 (F,GH,TEX,US). JALAPA: Vicinity of Jutiapa, alt. ca. 850 m, Oct. 24-Nov. 5, 1940 Standley 74998 (F). ZACAPA: Near divide on road between Zacapa and Chiquimula, alt. 500-660 m, Oct. 9, 1940, Standley 73765 (F). HONDURAS: MORAZAN: Along Rio Yeguare, east of El Zamorano, alt. ca. 750 m, Sept.-Dec. 1948, Standley 12734 (F). Along road from El Zamorano toward San Antonio de Oriente, alt. 825-950 m, Sept.-Nov. 1948, Standley 14251 (F,MICH,NY,US). Bank of Rio Caparrosa, vicinity of El Zamorano, alt. 800-850 m, July 23, 1949, Standley 21587 (F). EL PARAISO: Forest between Manzaragua and San Lucas, alt. 1350 m, Sept. 22, 1968, Molina & Molina 22700 (F,NY,US). Rio Choluteca, alt. 600 m, Oct. 18, 1951, Standley 28936 (F). SANTA BARBARA: Llano del Conejo, 1 km de Santa Barbara, alt. 300 m, Dec. 11, 1950, Molina 3667 (F,GH). EL SALVADOR: SAN SALVADOR: La Cebadilla, 1922, Calderon 1207 (GH,US). NICARAGUA: MATAGALPA: On hwy to Matagalpa, alt. 600 m, Oct. 29, 1968, Molina 22844 (F,NY,US(2)). COSTA RICA: GUANACASTE: 31 miles NW of Liberia, alt. 850 ft, July 20, 1962, Webster et al 12470 (MICH).

P. grande, as recognized here, encompasses four previously recognized species, two of which are accepted as varieties. Although these two varieties are relatively distinct and easily

separable in a majority of cases, a number of collections of var. grande from Guatemala are morphologically intermediate in various ways between that taxon and var. nelsonii (e.g. Kellerman 7040, Standley 21478, 63170, 77267, 82927, von Tuerckheim 1511).

The two varieties occupy largely discrete ranges, with var. nelsonii occuring over a very wide area from Mexico to Costa Rica and var. grande restricted to a relatively narrow territory from Guatemala to El Salvador. There appears to be partial altitudinal isolation between the two varieties as well. Their altitudinal limits overlap broadly between 1000 m and 2000 m, but only var. nelsonii is commonly found below 1000 m and only var. grande is commonly found above 2000 m. Seasonal separation is similarly incomplete, with var. nelsonii reaching its peak of blooming from August to November and var. grande peaking from November through February.

P. grande var. strigillosa of Robinson and Greenman, later raised to specific rank by Greenman, is based on trivial differences of pubescence and leaf shape that the much more complete collections now available show to be well within the normal range of variation in P. grande var. grande.

P. latisquamum, based by Blake on a collection from the Sierra de Tonalá, in southwest Chiapas is scarcely distinguishable from typical var. nelsonii. Its peculiarly rudimentary achenial wings and marginal awns, as well as the palmate venation of at least the upper leaves, however, render it rather unusual. Two similar collections from Chivela, across the border in Oaxaca (Mell s.n.) are the only Mexican records of P. grande outside the

state of Chiapas. Despite these morphological and distributional anomalies, I feel it is best to consider these collections slightly unusual representatives of geographically marginal and perhaps isolated populations of P. grande var. nelsonii. The wide phyllaries of P. latisquamum, which Blake considered its strongest diagnostic character, fall well within the presently known range of variation for P. grande var. nelsonii.

Robinson and Greenman originally published P. nelsonii without designating a type. I have followed Blake's (1926) choice of Nelson 3465 as lectotype.

2. Perymenium nicaraguense Blake, Contrib. U.S. Natl. Herb. 22:624, 1924. TYPE: NICARAGUA: JINOTEGA: Pine woods at San Rafael del Norte, alt. 1200-1350 m, March 25-26, 1917, Miller and Griscom 44 (HOLOTYPE: US).

Shrub or small tree to ca. 5 m in height. Leaves rather coriaceous, oval or ovate to lance-oval or lanceolate, acute or obtuse at apex, with cuneate or truncate base, subentire or shallowly serrate with ca. 6-20 teeth on a side, usually triplinerved, frequently with 2-several pairs of prominent, parallel secondaries below the major pair, rarely pinnate-veined, both surfaces very sparsely fine-strigillose, with strongly appressed hairs along the veins only, and minutely bullate beneath, with impressed veinlets; petiole 0.2-2 cm long. Stem 4-grooved at least when young, very sparsely to moderately strigillose. Inflorescence composed of few to numerous small (ca. 3-6-headed) cymes, borne terminally and from the upper axils, exceeded by or

slightly exceeding the upper leaves, rarely very ample, with ca. 200 heads in a compound terminal cyme. Peduncles moderately strigillose, with appressed or subspreading hairs. Involucre turbinate-campanulate, 3.5-4.5 mm high, 3-5 mm wide, 3-4 seriate. Outer phyllaries ovate, acute, moderately strigillose, progressively less pubescent and more oblong and blunter inward, obscurely ciliate toward the base, with hairs no longer than those on the back of the phyllary. Rays 7-9; lamina 3.5-7.1 mm long, tube 0.7-2 mm long. Disc flowers 10-30; corolla 3.8-5.1 mm long, with narrow tube 1.1-1.7 mm long, cylindric throat, and broadly or narrowly deltoid lobes 0.5-0.9 mm long; anthers with blackish thecae 1-1.8 mm long and ovate or lance-ovate, yellowish appendage 0.3-0.5 mm long; style branches ca. 1 mm long, including the indistinct, acute, minutely hispidulous appendage. Pales 4.5-6 (7.3) mm long, with acute, erect or inflexed apex. Disc achenes biconvex, narrowly winged (wing up to 0.3 mm wide) or, rarely, merely callose-margined on the angles, with distinct, flat, frequently dissected, marginal awns up to 1 mm long; 2-28 mm high, exclusive of the marginal awns, 0.9-1.5 mm wide, including wings. Pappus consisting of ca. 15-20 deciduous awns, the adaxial one longest, up to ca. 2 mm in length. Receptacle low-convex. Forests from southeastern Guatemala to northwestern Nicaragua at elevations from 600 m to 2000 m. Blooming all year, collected in flower in every month but April.

Selected specimens:

GUATEMALA: CHIQUIMULA: Montana Castilla, vicinity of Montana Cebollas, along Rio Lucia Saso, 3 miles SE of Quezaltepeque, alt.

1200-1500 m, Nov. 6, 1939, Steyermark 31322 (F). GUATEMALA: Mountains between Agua Caliente and San Antonio La Paz SW of the city of El Progreso, July 9, 1960, King 3254 (DS,MICH,NY,TEX,UC, US). JALAPA: Hills NE of Jalapa, alt. 1400-1600 m, Nov. 10, 1940, Standley 76848 (F). ZACAPA: Upper slopes along Rio Repollal to summit of mountain, Sierra de Las Minas, alt. 2100-2400 m, Jan. 12-13, 1942, Steyermark 42519 (F,GH,NY,US). HONDURAS: COMAYAGUA: Entre Las Mercedes y Villa de Flores, alt. 650 m, June 28, 1964, Molina 14373 (F,NY). Vicinity of Siguatepeque, alt. 1080-1400 m, Feb. 14-27, 1928, Standley 55845 (F,GH,US). INTIBUCA: Quebrada El Huise, 9 kms al Este de La Esperanza, alt. 1800 m, May 23, 1964, Molina & Molina 14015 (F). MORAZAN: Cerro Uyuca, north of Zamorano, alt. 1550 m, Nov. 23, 1958, Hawks, Hjerting & Lester 2009 (C,F). Forests above Tatumbla, slope of Montana Uyuca, Dec. 26, 1962, Williams & Molina 23233 (C,CAS,DS,F,GH,MEXU,MICH,MO,NY,P,UC, US). OCOTEPEQUE: Between Sinuapa and La Providencia, alt. 900 m, Aug. 29, 1968, Molina 22374 (F,NY,US). EL PARAISO: Barranco entre San Jose y Fatima carretera a Yuscaran, alt. 900 m, Feb. 2, 1964. Molina 13598 (F,NY). TEGUCIGALPA: Montana de la Flor, alt. 3200 ft, Dec. 1937, von Hagen & von Hagen 1134 (NY). NICARAGUA: JINOTEGA: San Rafael del Norte, alt. 1200-1350 m, Mar. 25, 1917, Miller & Griscom 45 (US). San Rafael del Norte, alt. 1200-1350 m, Mar. 25, 1917, Miller & Griscom 76 (US). MATAGALPA: Jinotega Rock Quarry about 5 km NW of Sta. Maria de Ostuma, alt. 1450-1500 m, Jan. 18, 1965, Williams et al. 27907 (F,GH,NY,US).

Perymenium nicaraguense has previously only been recognized from the type and other collections mentioned by Blake in the

protologue. Material of this species from Honduras and Guatemala has been referred with about equal frequency to P. grande and P. purpusii (here treated as a synonym of P. ghiesbreghtii). From P. grande, it can be distinguished by its more narrowly winged achenes, generally smaller, more coriaceous and less serrate leaves, and from P. ghiesbreghtii it can be distinguished by its winged achenes with distinct marginal awns, appressed phyllary apices, and more distinctly woody habit. A single collection from Cerro Uyuca, Honduras (Hawkes et al. 2009) has a large, ample inflorescence, and somewhat spreading apices on the phyllaries, suggestive of P. ghiesbreghtii, but has achenes perfectly typical of P. nicaraguense, and seems to be no more than an unusual variant of that species.

P. nicaraguense does not seem to be very closely related to any other species in the genus. Solely on achenial morphology, it strongly resembles P. grande and like that species it appears to represent a relatively primitive line within the genus. Its possible relationship to P. uxoris is discussed under the latter.

3. Perymenium uxoris McVaugh Contr. Univ. Michigan Herb. 9:439, 1972. TYPE: MEXICO: NAYARIT: 6-8 km E of Los Varas, on the new road to Compostela elev. 2000 m, Dec. 20, 1970, McVaugh 25583 (HOLOTYPE: MICH).

Hard-wooded shrub ca. 2 m high. Leaves lanceolate or lance-oblong, 7-9.5 cm long, 1.5-3.5 cm wide, acute or attenuate, rounded or slightly attenuate at base, very shallowly serrate, with ca. 5-13 small, callose teeth on a side, very sparsely strigillose on both surfaces, pinnately veined; petiole 9-13 mm long. Stem distinctly 4-grooved, sparsely strigillose. Inflorescence composed of crowded compound cymes borne terminally and on the upper branches, about equalling the upper leaves. Peduncles short, densely strigillose, or the heads sessile. Involucre cylindric-ovoid, 7-7.5 mm high, 2.5-3.5 mm wide, 2-seriate. Outer phyllaries oblong, sparsely strigillose and distinctly ciliate, usually intergrading with bracts on the peduncle; inner phyllaries similar in size and shape, subglabrous on the back, with somewhat lax, yellowish, rounded ciliate apex. Rays ca. 3-5; lamina 4.5-5 mm long, tube ca. 2.5 mm long. Disc flowers 7-9; corolla ca. 5 mm long, with slender tube ca. 1.5 mm long, cylindric-ovoid throat and deltoid lobes 0.6-0.8 mm long; anthers with blackish thecae ca. 1.7 mm long and yellowish, ovate appendage 0.4-0.5 mm long; style branches ca. 1.5 mm long, including the short, acute appendage. Pales 3.5-4.8 mm long, narrowly keeled and ciliate along the keel, with erect, acute or roundish apex. Disc achenes biconvex, with distinct, usually dissected, marginal awns ca. 1 mm long and narrow wings on the upper angles; 2.5-3 mm high, excluding the marginal awns, 0.9-1.1 mm wide, including the wings, smoothish and very sparsely strigillose on the faces, minutely puberulent near the apex. Pappus consisting of ca. 50-60 deciduous awns, not conspicuously unequal, ca. 1.5 mm long. Ray achenes compressed-triquetrous, slightly shorter and wider than, but otherwise similar to, those of disc. Receptacle flat.

P. uxoris is without obvious close relatives within the genus. The only species it resembles even remotely is P. nicaraguense, which is itself morphologically isolated. Both have rather crowded terminal inflorescences, winged achenes with marginal awns and entire or nearly entire leaves with relatively sparse and fine pubescence. The two species can easily be distinguished on the basis of the phyllaries, which in P. uxoris are nearly equal in length and in P. nicaraguense are graduate. In addition, the former has only 7-9 disc flowers in a head and the latter 10-30.

P. uxoris is known from the type collection, at relatively low altitude in Nayarit, far from the Central American uplands where P. nicaraguense is found.

4. Perymenium jalapanum Standl. & Steyerm., Publ. Field Mus. Nat. Hist., Bot. Ser. 23:144, 1944. TYPE: GUATEMALA: JALAPA: Between Miramundo and summit of Montana Miramundo, 6 miles S of Miramundo, alt. 2000-2300 m, Dec. 5, 1939, Steyermark 32685 (HOLOTYPE: F).

Shrub, or perhaps largely herbaceous above, to ca. 2 m in height. Leaves lanceolate, 4-11.5 cm long, 1.2-3.4 cm wide, acute or attenuate, with rounded-cuneate base, serrate, with ca. 6-9 teeth on a side, sparsely strigillose on both surfaces, triplinerved; petiole 6-15 mm long. Stem strongly 4-grooved, very sparsely to moderately strigillose. Heads borne terminally and from upper axils in cymes of 3-10. Involucre campanulate, 6.5-8.5 mm high, 5-6 mm wide, 3-seriate. Outer phyllaries ovate, acute, essentially glabrous on the back and ciliate, progressive-

ly more oblong and rounded or blunt inward; the innermost with lax, yellowish, ciliate apex. Rays 8; lamina ca. 7.5 mm long, tube ca. 2.5 mm long. Disc flowers ca. 25; corolla 5-6.5 mm long, with narrow tube 1.2-2 mm long, cylindric throat and narrowly deltoid lobes ca. 1 mm long; anthers with blackish thecae 2-2.5 mm long and yellowish acute appendage 0.5-0.6 mm long; style branches 1.5-2.3 mm long, including the short-acute appendage. Pales 7-7.5 mm long, narrowly keeled, with acute, often inflexed, apex. Disc achenes 3-3.5 mm high, 1.1-1.3 mm wide, biconvex, slightly tuberculate and tufted-strigillose on the faces, more densely so near the apex. Pappus consisting of ca. 15 deciduous awns, the adaxial one usually longest, up to ca. 2 mm in length. Ray achenes triquetrous, slightly shorter and wider, otherwise similar to those of disc. Receptacle flat. In and near cloud forests in Guatemala at elevations from 2000 m to 2300 m. Known to bloom Dec. through May.

Specimens examined:

GUATEMALA: GUATEMALA: Montana de Las Nubes about 20 kms west of San Jose Pinula, alt. 2000 m, Jan. 22, 1949, Williams & Molina 15291 (F). JALAPA: Montana de las Nubes, near Soledad, alt. 2100 m, May 23, 1948, Williams 14236 (F,GH).

Perymenium jalapanum remains an obscure species of doubtful affinities. In the form of the involucre it somewhat resembles P. grande var. nelsonii, but its lanceolate leaves and wingless achenes without marginal awns provide ample distinction.

5. Perymenium gymnolomoides (Lessing) DC. Prodr. 5:609, 1835. Lipotriche gymnolomoides Lessing Linnaea 6:408, 1831. TYPE: MEXICO: VERACRUZ: Along route 180, ca. 17 miles north of Naranjos, March 7, 1961, King 4108 (NEOTYPE: NY; ISOTYPES: F,MICH,TEX,UC,US).

Perymenium goldmanii Greenm. Publ. Field Mus. Nat. Hist., Bot. Ser. 2:269, 1907. TYPE: MEXICO: CAMPECHE: Apazote, near Yohaltun, Dec. 27, 1900, Goldman 487 (LECTOTYPE: US; Photos: MO,TEX).

Perymenium peckii Robins. Proc. Amer. Acad. Arts 47:211, 1911. TYPE: BRITISH HONDURAS: BELIZE: Forest near Manatee Lagoon, Jan. 12, 1906, Peck 284 (HOLOTYPE: GH).

Erect or sprawling and vinelike shrub to ca. 2 m in height. Leaves lanceolate or lance-ovate, acute or attenuate, with cuneate or rounded to truncate base, serrate, with 10-20 shallow teet on a side, tri- or tripli-nerved, moderately to rather densely strigillose or hispidulous above, with curved hairs, sparsely to densely hispidulous or hispid-pilose below; petiole 0.4-1.1 cm long. Stem 4-grooved, sparsely to densely strigillose or hispid-pilose. Inflorescence composed of small (ca. 3-7- headed) cymes arising terminally and at the ends of spreading lateral branches, these departing at nearly right angles to the main stem from the upper axils and curving upward. Pubescence of the peduncles similar to that of the stem, usually somewhat denser Involucre campanulate or somewhat turbinate, (2)3-seriate, 3.5-4 mm high, 3-4.5 mm wide. Outer phyllaries ovate or oblongish, acute to acuminate or occasionally blunt, sparsely to rather

densely strigillose or hispid-pilose and distinctly ciliate, often conspicuously resin-dotted; inner phyllaries more distinctly oblong, longer and usually less densely pubescent. Rays 5-7; lamina 3.5-5 mm long, tube 1.6-2.1 mm long. Disc flowers 20-28; corolla 2.7-4 mm long, with narrow tube 1.1-2 mm long, cylindric or cylindro-campanualte throat and deltoid, spreading or reflexed lobes 0.4-0.7 mm long; corollas of peripheral flowers somewhat recurved and spreading; anthers with blackish thecae 1.1-1.5 mm long and ovate, yellowish appendage 0.3-0.5 mm long; style branches ca. 1-1.5 mm long, including the short, acute, minutely hispidulous appendage. Pales 3.2-5.2 mm long, with narrow, minutely ciliate keel, apex acute and crumpled or blunt and erect. Disc achenes biconvex, strongly winged on the angles, wings ca. 0.5-1 mm wide, extending upwardly into distinct marginal awns; 2-3 mm high, exclusive of marginal awns, 0.9-2 mm wide, including wings, usually narrowed to a stipitiform base, smoothish and glabrous on the faces, minutely puberulent near the apex, wings ciliate. Pappus consisting of ca. 15-25 deciduous awns, the adaxial one usually longest, up to ca. 2 mm in length. Ray achenes obcompressed-triquetrous, winged on all three angles, the adaxial wing frequently narrower than the other two; 1.7-2.5 mm high, 0.9-3 mm wide. Receptacle low-convex. Moist areas from San Luis Potosi and Vera Cruz to British Honduras and Guatemala at elevations from 100 m to 1000 m. Blooming Dec. through May, mostly during January.

Selected Specimens:

MEXICO: CAMPECHE: Apazote, near Yohaltun, Dec. 29, 1900,

Goldman 502 (MO(photo),US). Tuxpeña, Dec. 3, 1931, Lundell 1012 (F,GH,MICH(3),US(2)). PUEBLA: Near Metlatoyuca, alt. 800 ft, Jan. 27, 1898, Goldman 28 (US). SAN LUIS POTOSI: 5 km al SE de Tamasopo, alt. 700 m, Jan. 16, 1956, Rzedowski 6901 (ENCB). VERACRUZ: Along route 180, ca. 18 miles south of Tampico el Alto, March 7, 1961, King 4101 (F,MICH,NY,TEX,UC,US). Zacualpan, May, 1931, Purpus 15352 (UC). 1 km al W de Sta. Cruz Pue. km 279 Mex.-Tuxpan, a 16 km. de Poza Rica, alt. ca. 200 m, Jan. 2, 1962, Romero 28 (ENCB). Near Jalapa, 1894, C. Smith 1636 (F(3)). La Florida, municipio de Coatepec, alt. 1100 m, Jan. 28, 1971, Ventura 3023 (ENCB). BRITISH HONDURAS: BELIZE: Maskall Pine Ridge, Jan. 1934, Gentle 1041 (F(2),GH,MICH,MO,NY,P,TEX(2),UC,US). STANN CREEK: Savannah Forest Station, Mongo Creek, Jan. 30, 1960, Hunt 322 (US). TOLEDO: Swasey Branch, Monkey River, Jan. 23, 1942, Gentle 3890 (F,GH,MICH,MO,NY). GUATEMALA: ALTA VERA PAZ: Between Sachaj and Sacacac, alt. 150-180 m, Mar. 20, 1942, Steyermark 45170 (F,MICH). PETEN: La Libertad and vicinity, Jan. 29, 1934, Aguilar 344 (MICH, MO,NY,US). Dos Arroyos, Mar. 15, 1931, Bartlett 12110 (GH,MICH, TEX,US). Santa Elena, km 6 west of Santa Marta Road, May 5, 1966, Contreras 5681 (TEX,US).

Lipotriche gymnolomoides, upon which Perymenium gymnolomoides is based, was described by Lessing from a specimen collected by Schiede and Deppe at Misantla, Vera Cruz. It was subsequently transferred to Perymenium by DeCandolle, apparently without seeing material of the type. From Lessing's description (Frutex scandens .....Ovaria....bialata, alis angustis, ciliatis) and the type locality, there can be little doubt that the name properly applies

to the plant generally called P. peckii or P. goldmanii. The type (Schiede & Deppe 1256) was apparently deposited only at Berlin. I have not found duplicates of this number among material obtained on loan from Paris or Copenhagen and can only presume that all of the type material was destroyed. King 4108, also from Vera Cruz, is therefore selected as a neotype.

P. gymnolomoides apparently represents another relatively early line of differentiation within the genus. While achenial morphology alone tends to tie it in with the more primitive elements; in most respects it appears to be relatively advanced. Its vinelike habit and unusual divariacate inflorescence are particularly distinctive.

This species, P. gracile and P. klättianum are the only members of the genus recorded from both sides of the Isthmus of Tehuantepec. Of the three, only P. gymnolomoides has a considerable recorded range in both areas. Presumably, the moist lowland habitats in which it occurs are fairly continuous throughout this area, or were during the time that it attained its present distribution. No collections are known from the area between Vera Cruz and Campeche, however, and the species may presently be extinct in that area. Populations from west of the isthmus average slightly more densely and coarsely pubescent and tend to have a higher average number of disc flowers in a head than those to the east of the isthmus and this may reflect an actual discontinuity in present distribution.

In the protologue of P. goldmanii, Greenman cited two Goldman collections without designating a type. I have chosen Goldman 487 as lectotype.

Fig. 2

Perymenium episcopale Fay, sp. nov.

A - habit, x ½

B - pale, x 5

C - disc corolla, x 5

D - ray flower, x 5

E - disc achene, x 5

F - ray achene, x 5

G - head, x 2½

FIG. 2

6. Perymenium episcopale Fay sp. nov. TYPE: MEXICO: GUERRERO: In mountains along route 95, 54 miles north of Acapulco, Aug. 20, 1961, Powell & Edmondson 781 (HOLOTYPE: TEX; ISOTYPES: F,MICH).

Species a P. grande var. nelsonii similis, achaeniis exalatis, ecornutis, foliis angustioribus (1.5-4 cm latis) differt; de P. reticulato involucro majore (7-8 mm alto, ca. 10 mm lato), ramis hispidis distinguatur.

Shrub or half-shrub to about 2 m tall. Stems hispid, usually distinctly 4-grooved. Leaves lanceolate or lance-elliptic, 4-11.5 cm long, 1.5-4 cm wide, more or less evidently triplinerved or pinnately veined, base acute to truncate, apex acute, margins serrate, with shallow, remote teeth, sparsely to moderately hispid above, moderately to densely hispid below; petiole 0.3-1.5 cm long. Inflorescence a terminal cyme of 5-ca. 30 heads. Involucre 3-4 seriate, 7-8 mm high, about 10 mm wide. Outer phyllaries ovate acute or obtusish, roughly strigose; inner phyllaries progressively less pubescent and more oblong and obtuse, innermost with spreading yellowish, frequently rounded apex; all conspicuously ciliate. Rays (6)8; lamina 6.7-9.5 mm long, tube 1.2-2 mm long. Disc flowers ca. 20; corolla 5-7 mm long, with cylindric throat and short, sometimes indistinct tube, lobes narrowly deltoid, 0.9-1.4 mm long; anthers with brown or blackish thecae 1.8-2.5 mm long and yellowish appendage 0.5-0.8 mm long; style branches hispidulous, 1.4-1.7 mm long, flattened, broadest near the tip, rather abruptly contracted to the short, acute appendage. Pales oblongish, with

a distinct ciliate keel, obtuse or rounded at the laciniate apex, 5-7 mm long. Disc achenes (those seen not completely mature) oblongish, biconvex or compressed-quadrangular, ciliate on inner and outer margins, 3.5-4 mm long. Pappus of ca. 20-25 deciduous awns, the adaxial one longest, up to 3.6 mm long, the others irregularly shorter, down to 0.2 mm long. Ray achenes obcompressed-triquetrous, otherwise similar to those of disc. Receptacle low-convex. Fig. 2.

Selected Specimens.

MEXICO: GUERRERO: Agua de Obispo, alt. 1100 m, Aug. 12, 1962, Kruse 787 ENCB).

P. episcopale appears to be closely related to P. reticulatum, another previously unrecognized species described here. The two are easily separable, however; P. reticulatum having heads distinctly smaller (involucre 4-7 mm wide, 3-5 mm high) and usually more numerous; densely and softly hirsute stems and leaves tomentose beneath.

Together, these two species seem to relate on the one hand to a loose alliance centering on P. pringlei, with narrow leaves, relatively small heads and more or less spreading and membranous inner phyllaries and on the other hand to the presumptively more primitive elements of the genus, as exemplified by P. grande.

P. episcopale is known only from five collections in the state of Guerrero, at about 1000 m altitude in the vicinity of Agua de Obispo.

Fig. 3

Perymenium reticulatum Fay, sp. nov.

A - habit, x ½

B - pale, x 5

C - disc flower, x 5

D - ray flower, x 5

E - disc achene, x 5

F - ray achene, x 5

G - head, x 2½

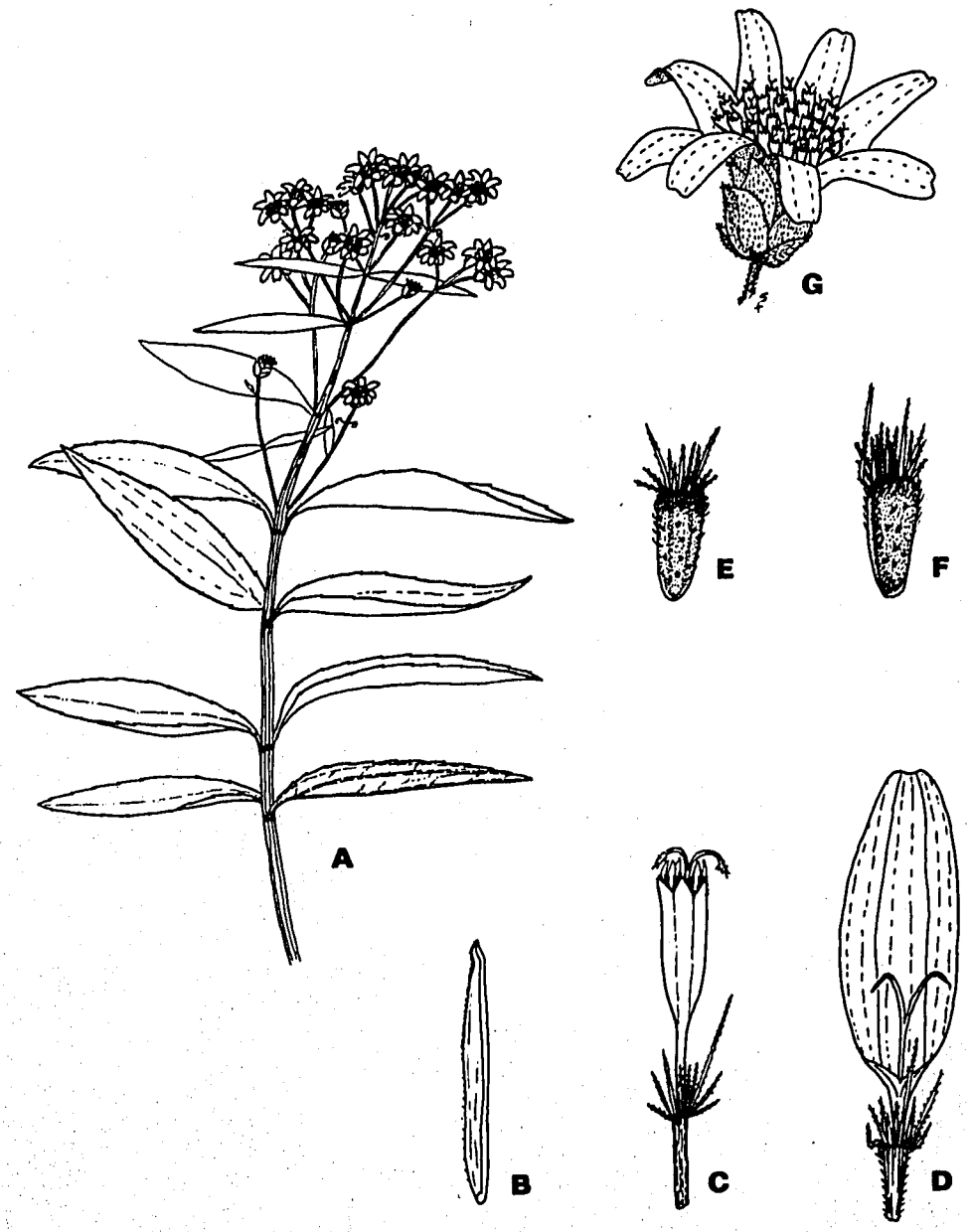

FIG. 3

7. Perymenium reticulatum Fay sp. nov. TYPE: MEXICO: MEXICO: Temascaltepec, Aug. 11, 1935, Hinton et al. 7985 (HOLOTYPE: NY; ISOTYPES: MICH,P,TEX,UC,US).

Species a P. pringlei similis, foliis subtus reticulatis, tomentosis, ramis hirsutis differt. P. episcopale capitulis minoribus (involucro 4-7 mm lato, 3-5 mm alto), ramis hirsutis, foliis subtus tomentosis distinguatur.

Shrub to 3 m high. Stems slender, generally conspicuously 4-grooved, densely and softly appressed-hirsute, at least above. Leaves 5-11 cm long, 0.9-2.5 cm wide, lanceolate, tri- or triplinerved, base cuneate or rounded, apex acute to attenuate, upper surface densely scabrous, with curved tuberculate-based hairs, lower surface dicidedly reticulate-veined and moderately tomentose, scarcely rough to the touch; petiole 2-6 mm long. Heads numerous, in a much-branched, leafy, terminal cyme or, occasionally, as few as five clustered at the end of a branch. Involucre 3-4 seriate, 4-7 mm wide, 3-5 mm high. Outer phyllaries ovate, rough-strigose and ciliate, frequently with more or less spreading herbaceous apex; inner series progressively less pubescent and more oblong and scarious, innermost usually yellowish, occasionally eciliate and transitional to the pales. Rays usually 8; lamina 9-10 mm long, tube 1.5-2 mm long. Disc flowers ca. 25-30; corollas 4-6 mm long, with cylindric throat, narrow tube and lobes 0.6-0.7 mm long; anthers with blackish thecae 1.5-2 mm long and yellowish appendages 0.4-0.5 mm long; style branches about 2 mm long, broadest near the hispidulous tip, contracted abruptly to

a short, acute appendage. Pales 5-6.5 mm long, narrowly keeled; at least the inner with acute, incurved or crumpled apex, disc achenes 2.5-3 mm high, ca. 1 mm wide, oblongish, biconvex or compressed-quadrangular, ciliate on inner and outer edges, lightly tuberculate on the faces, with tufts of minute appressed hairs on the tubercles, lacking wings and marginal awns. Pappus of 30-40 deciduous awns, the longest usually toward the adaxial angle of the achene and up to 3 mm long, the others irregularly shorter. Ray achenes similar, triquetrous. Receptacle small, slightly convex. Western part of state of Mexico, at altitudes between 1500 m and 2500 m. Blooming June through November. Fig. 3.

Selected Specimens:

MEXICO: MEXICO: (Pantoja) Temascaltepec, June 26, 1935, Hinton et al. 7924 (MICH,NY,P,TEX,UC,US). Cerro Ahumada, cerca del Rancho Nuevo, 4 km al N. de Huehuetoca, alt. 2350 m, Nov. 11, 1971, Rzedowski 28396 (ENCB).

P. reticulatum bears an obvious resemblance to P. episcopale, to which it is probably most closely related. Diagnostic characters are mentioned under the latter species. It might also be confused with P. pringlei var. lancifolium or narrow-leaved forms of P. pringlei var. pringlei, neither of which, however, would have the hirsute stem or reticulate, tomentose leaf under-surfaces characteristic of P. reticulatum. It does not seem, however, that there is any very close relationship between the two species.

8. Perymenium pringlei Robins. & Greenm. Proc. Amer. Acad. Arts 34:526, 1899. TYPE: MEXICO: JALISCO: Slopes of cañons near Guadalajara, Oct. 11, 1889, Pringle 2338 (HOLOTYPE: GH; ISOTYPES: F,MICH,MO,NY(2),UC(3),US).

Shrub, or possibly herbaceous above, to about 2 m high. Leaves 3.5-12 cm long, 1-5 cm wide, ovate to lance-ovate, lanceolate or lance-oblong, serrate, with up to ca. 20 teeth on a side or subentire, acute or acuminate, with truncate to cuneate or rounded base, sparsely to moderately strigillose or hispidulous above, hispidulous or silvery-strigillose beneath; petiole 0.2-2.0 cm long. Stem strongly or obscurely 4-grooved when young, sparsely to moderately strigillose or hispidulous. Inflorescence composed of few or numerous small (3-5 headed) cymes or a large compound cyme, or the heads rarely solitary. Peduncles slender, sparsely to moderately strigillose. Involucre 4.0-4.5 mm high, 4.0-6.0 mm wide, campanulate, 3-4 seriate. Outer phyllaries ovate or lance-ovate, acute or blunt, moderately strigillose and more or less ciliate, progressively less pubescent and more oblong inward; innermost phyllaries with obtuse or rounded, yellowish, spreading, strongly ciliate apex. Rays commonly 8, lamina 5-10 mm long; tube 1-1.5 mm long. Disc flowers 20-36; corolla 3.0-4.0 mm long, with slender tube 0.6-2 mm long, cylindric or cylindro-campanulate thraot and deltoid lobes 0.5-1.5 mm long. Anthers with light brown or blackish thecae 1.1-1.7 mm long and a broadly ovate, yellowish appendage 0.2-0.4 mm long, style branches 0.6-1.0 mm long, including the short, acute, hispidulous appendage. Pales 2.8-4.5 mm long, rounded to acute or attenuate at apex. Disc

achenes 2.5 mm high and 1.0-1.2 mm wide, biconvex, tufted-strigillose and tuberculate on the faces, with or without small marginal awns. Pappus consisting of ca. 15-30 deciduous awns, the adaxial one up to 2.0 mm long, the others irregularly shorter. Ray achenes slightly triquetrous, shorter than, but otherwise similar to those of the disc. Receptacle slightly to strongly convex.

Key to varieties of P. pringlei

1. Leaves hispidulous beneath, not silvery; achenes without marginal awns.
   2. Leaves 2-3 times as long as wide, with ca. 10-20 teeth on a side; inflorescence equalling or exceeding the upper leaves; pales 3.5-4.5 mm long; receptacle low-convex. 8a. P. pringlei var. pringlei
   2. Leaves 5-6 times as long as wide, with ca. 10 or fewer teeth on a side; inflorescence exceeded by the upper leaves; pales 2.8-3.5 mm long; receptacle strongly convex. 8b. P. pringlei var. lancifolium
1. Leaves densely silvery-strigillose beneath; achenes with small but distinct marginal awns. 8c. P. pringlei var. croceum

8a. Perymenium pringlei Robins. & Greenm. var. pringlei.

Leaves ovate to lance-ovate or lanceolate, 5.5-11 cm long, 2-5 cm wide, serrate, with ca. 10-20 shallow or salient teeth on a side, sparsely to moderately hispid-strigillose above, with sub-

appressed, curved hairs, sparsely to moderately hispidulous beneath; petiole 1-2 cm long. Stem strongly 4-grooved when young, very sparsely to moderately strigillose. Inflorescence a freely branched compound terminal cyme, usually with ca. 100 heads, rarely with as few as 15, equalling or slightly exceeding the upper leaves. Involucre 4.0-4.5 mm high, 4.0-6.0 mm wide, campanulate, 3-4 seriate. Rays with lamina 5.0-6.0 mm long. Disc flowers 20-30; corolla 3.0-4.0 mm long. Pales 3.5-4.5 mm long, acute or tapering to a blunt apex. Disc achenes callose-thickened and ciliate on the angles. Pappus consisting of ca. 25-30 awns. Receptacle low-convex. Jalsico to Sinaloa at altitudes from 350 m to 1400 m. Blooming Aug. through Oct.

Selected specimens:

MEXICO: JALISCO: Barrancas, west of La Wuemada, alt. 1300-1400 m, Aug. 21, 1935, Pennell 19903 (GH,US). SINALOA: Los Humayes, San Ignacio, alt. 390 m, Gonzalez Ortega 87 (MEXU).

8b. Perymenium pringlei Robins. & Greenm. var. lancifolium (Blake) Fay, comb. nov. Perymenium lancifolium Blake, Contr. U.S. Natl. Herb. 22:623, 1924. TYPE: MEXICO: SINALOA: Batel, Concordia, alt. 1600 m, Sept. 1919, Dehesa 1621 (HOLOTYPE: US).

Apparently hard-wooded shrub. Leaves 8-12 cm long, 1.5-2 cm wide, narrowly lanceolate, shallowly serrate or subentire, narrowly cuneate at base, sparsely hispidulous beneath; petiole ca. 1 cm long. Stem strongly 4-grooved when young, sparsely to mod-

erately strigillose. Inflorescence composed of numerous small (ca. 6-headed) cymes, terminating main and lateral branches, exceeded by the upper leaves. Involucre campanulate, 4-5 mm wide, outer phyllaries ovate. Rays with lamina 7.0-10.0 mm long, Disc corollas 3.0-3.8 mm long, with narrow tube 1.0-1.5 mm long, and deltoid lobes ca. 0.5 mm long. Anthers with blackish thecae. Pales 2.8-3.5 mm long, with an attenuate apex. Disc achenes without marginal awns. Receptacle strongly convex. Sinaloa and Durango at altitudes from 1000 m to 2000 m. Blooming Aug. through Oct.

Selected specimens:

MEXICO: DURANGO: West side of Sierra Madre Occidental, about 93 km. SW of El Salto, elev. ca. 2000 m, Oct. 7, 1970, Fay & Cronquist 102 (NY). 2 miles SW of La Palmito, between Durango & Villa Union, mountainside along Mex. 40, elev. ca. 5000 ft; Sept. 8, 1965, Torres 1773 (MSC). SINALOA: Mountains along route 40, ca. 18 miles SW of the Sinaloa-Durango border, Aug. 14, 1960, R.M. King 3719 (DS,MEXU,MICH,NY,TEX,UC,US).

8c. Perymenium pringlei Robins. & Greenm. var. croceum (Robins. & Greenm.) Fay, comb. nov. Perymenium croceum Robins. & Greenm., Proc. Amer. Acad. Arts 34:527, 1899. TYPE: MEXICO: DURANGO: Aug. 15, 1897, Rose 2321 (LECTOTYPE: GH; ISOTYPES: GH,US; Photos: NY(2)).

Perymenium microphyllum Robins & Greenm. Proc. Amer. Acad. Arts 34:528, 1899. TYPE: MEXICO: DURANGO: Aug. 13, 1897, Rose 2252 (LECTOTYPE: GH; ISOTYPES: GH,US).

Leaves 3.5-8.5 cm long, 1-2 cm wide, cuneate to rounded at base, shallowly and remotely serrate, with up to ca. 10 pairs of teeth, or subentire, sparsely to moderately strigillose above, very finely and densely silvery-strigillose beneath; petiole 0.2-0.5 mm long. Stem moderately strigillose. Heads in small (3-5-headed) cymes terminating leafy branches or arising in upper axils, or solitary in the upper axils, usually exceeded by the upper leaves. Involucre broadly campanulate, 4-4.5 mm high, 4.5-6.5 mm wide. Outer phyllaries ovate. Rays with lamina ca. 6.0-9.0 mm long. Disc flowers 30-36; corolla 3.3-4.0 mm long, with narrow tube 1-1.5 mm long and deltoid lobes ca. 0.5-1.0 mm long. Anthers with blackish thecae, appendage 0.3-0.4 mm long. Pales 4-4.5 mm long, narrowly keeled, acute or rounded at apex. Disc achenes with small marginal awns ca. 0.5 mm long. Pappus consisting of ca. 20 awns. Receptacle slightly convex.

Specimens examined:

MEXICO: CHIHUAHUA: Vicinity of Areponapuchic (Lat. approx. 27°30" N, Long. 107°50" W) slopes of Barranca de Urique, elev. 1000-1800 m, Aug. 23, 1954, Knobloch 1359 (MICH,MSC). DURANGO: Along Hwy 40, between KMs 1154 & 1155 ca. 30 miles E of Portrerillos, elev. ca. 8000 ft, June 23, 1965, DeJong 1386 (MSC). NAYARIT: Along route 15 ca. 10 miles north of Tepic. Aug. 11, 1960 R.M. King 3692 (DS,MEXU,MICH,NY,TEX,UC,US). Foothills of Sierra Madre, Territoria de Tepic, between Pedro Paulo & San Blascito, Aug. 4, 1897, Rose 1991 (GH(2),US).

In combining P. pringlei, P. croceum and P. lancifolium as

varieties of a single inclusive species, I have been guided by morphological evidence of intergradation, although the taxa are not obviously separated along geographical, altitudinal or seasonal lines. This apparent sympatry, however, may well be illusory, since it is impossible, on the basis of present knowledge, to assign a range to any of the three taxa with any confidence.

On the other hand, even with as few collections as are now in hand, I feel evidence of morphological intergradation is compelling in any consideration of the status of these plants. Among the sixteen collections examined, two of var. crocceum (DeJong 1386 and Rose 2252, the type of P. microphyllum) seem to show definite tendencies toward var. lancifolium in the amount of pubescence on the leaves, and two collections assigned to var. lancifolium (Fay & Cronquist 102 & Torres 1773) have thicker, more distinctly serrate leaves than are typical for that variety and in this respect resemble var. pringlei.

While this situation leaves considerable room for interpretation, acceptance at varietal level seems more reasonable than an attempt to maintain three closely related species when so few collections are known and such a large percent of these are intermediate in one way or another.

If and as more collections become available, the anomaly of apparently extensive range overlap among the varieties of P. pringlei may resolve itself. It is possible that current collection data give a faulty picture of distributional concentrations, or that edaphic or climatologic factors are significant in isolating the varieties within range overlaps.

The type of P. microphyllum, in addition to being somewhat intermediate between var. croceum and var. lancifolium, has very small leaves (less than 2.0 cm long and 2.0-4.0 mm wide). It seems likely, however, that it is merely a depauperate individual and not worthy of recognition (this has also been suggested by McVaugh (unpubl.)).

Because of its distinctive leaf pubescence, P. pringlei var. croceum could be confused with P. discolor, P. klattianum, or even P. stenophyllum. These three latter species, however, all owe the whitened undersurface of their leaves to the presence of a very dense and fine tomentum quite unlike the straight appressed hairs found in the former.

Distinctions between P. pringlei and two other similar species, P. gracile and P. reticulatum, are discussed under those species.

9. Perymenium gracile Hemsl., Biol. Centr. Amer. Bot. 2:181, 1881. TYPE: MEXICO: VERACRUZ?: Region d'Orizaba, San Cristobal, Aug. 11 or Oct. 11, 1866, Bourgeau 3206 (HOLOTYPE: K; ISOTYPES: F(fragment),P(2),US(photo & fragment); Photos: US(2)).

Perymenium microcephalum Schultz Bip. in Klatt, Leopoldina 23:143, 1887. TYPE: MEXICO: OAXACA: Sta. Talea (as Sta. Talca), Aug. 1842, Liebmann 374 (LECTOTYPE: C; ISOTYPES: C(2),GH(fragment & sketch); Photos: NY,US(3)).

Shrub or possibly partially woody herb, sparsely and minutely strigillose throughout, height unknown. Leaves ovate or lance-ovate, 3-8 cm long, 1.5-3.5 cm wide, acute or attenuate, with rounded base, shallowly serrate, with ca. 6-7 teeth on a side, tri- or tripli-nerved; petiole 8 -17 mm long. Stem distinctly 4-grooved. Inflorescence a leafy, terminal compound cyme containing ca. 20-100 heads. Involucre 3-seriate, cylindro-campanulate or turbinate, 4.5-5.7 mm high, 2.7-3.8 mm wide. Outer phyllaries ovate, acute, ciliate at least distally; inner phyllaries oblong, with lax, yellowish, minutely ciliate, blunt apex. Rays 5-8; lamina 6-9 mm long, tube 1.0-1.4 mm long. Disc flowers ca. 9-13(-19); corolla 3.8-4.2 mm long, with narrow tube 0.9-1.5 mm long, cylindric throat and deltoid, frequently reflexed, lobes 0.5 mm long; anthers with brownish or blackish thecae 1.4-1.6 mm long and ovate, yellowish appendage 0.4-0.5 mm long; style branches 0.7-1.2 mm long, including the short, acute, barely hispidulous appendage. Pales 4.2-4.5 mm long, narrowly keeled, with acute, erect or incurved apex. Disc achenes ca. 2-2.5 mm high and 1 mm wide, biconvex, with slender manginal awns ca. 0.5 mm long, essentially glabrous on the face, very finely puberulent near the apex. Pappus consisting of ca. 20 deciduous awns. Ray achenes obcompressed-triquetrous, slightly shorter and broader, otherwise similar to those of disc. Receptacle flat. Vera Cruz(?), Oaxaca and Guatemala, at altitudes from 900 m to 2400 m. Blooming July through Oct.

Specimens examined:

MEXICO: OAXACA: 3 km east of Ixtlan de Juarez, along a trail

to the water source for the city, elev. 7700 ft, Aug. 27, 1965, Breedlove 12227 (CAS,ENCB, MICH). Near Totontepec, elev. 5500 to 3700 ft, July 15-28, 1894, Nelson 783 (GH,US). GUATEMALA: SUCHITEPEQUEZ: Finca Moca, elev. 3200 ft, Oct. 18, 1934, Skutch 1470 (GH,TEX).

P. gracile appears to be related to P. pringlei, especially resembling P. pringlei var. pringlei, which has leaves with more numerous (10-20 on a side) and distinct teeth, larger heads (involucre 4-4.5 mm high, 4-6 mm wide) with shorter rays (lamina 5-6 mm long), more numerous (20-30) disc flowers and achenes without marginal awns.

P. gracile is one of only three species in the genus that have been collected on both sides of the isthmus of Tehuantepec. It is known from so few widely scattered collections, however, that it is impossible to ascertain what its actual range is or explain its unusual distribution.

Robinson and Greenman (1899) used the supposedly longer leaves of P. gracile to distinguish that species from P. microcephalum, while noting that they might prove to be conspecific. Blake (1926) added to this a difference in the length of peduncles, with those of P. gracile averaging longer. Neither Robinson and Greenman nor Blake, however, apparently had access to type material of P. gracile. Comparison of the two excellent isotypes from Paris, the several type specimens of P. microcephalum from Copenhagen and additional material enumerated above has shown both distinctions to be based on extremes in fairly continuous variation.

In publishing P. microcephalum, Schultz designated the Copenhagen duplicate of Liebmann 374 as type. A loan of material from Copenhagen included 3 duplicates of this number, one of which has been chosen as Lectotype and so annotated.

10. Perymenium klattianum Fay, sp. nov. TYPE: MEXICO: VERACRUZ: Orizaba, May, 1905, Purpus 1163 (HOLOTYPE: NY; ISOTYPES: F, MO,UC).

Perymenium foliis lanceolatis vel lanceolato-ovatis, subintegris vel leviter serratis, subtus tomentellis, albidis, a P. discolori capitulis majoribus (involucro 5.0-8.5 mm alto, 6-8 mm lato), floribus disci numerosioribus (40-60) differt.

Shrub, or perhaps largely herbaceous above, to ca. 2 m in height. Leaves 3.3-8 cm long, 0.8-2.5 cm wide, lanceolate to lance-ovate or ovate, acute or acuminate, narrowly cuneate to rounded or truncate at base, subentire or with up to ca. 15 very shallow, remote teeth on a side, the margin usually somewhat revolute, moderately strigillose above, very densely and finely matted-tomentellous and whitish below, triplinerved; petiole 3-8 mm long. Stem 4-grooved, sparsely to moderately strigillose. Inflorescence composed of small (usually 3-headed) cymes arising terminally and from the upper axils. Peduncles moderately appressed or loosely strigillose. Involucre 5-8.5 mm high, 6-8 mm wide, 3-seriate. Outer phyllaries ovate, acute or rounded, moderately strigillose and strongly ciliate, progressively more oblong, blunter and less pubescent inward, the innermost

ones with loosely spreading, rounded, yellowish, ciliate apices. Rays 9-12; lamina 5-8 mm long; tube 1-1.5 mm long. Disc flowers ca. 40-60; corolla 3.8-4.7 mm long, with narrow tube, cylindric throat and deltoid lobes 0.5-0.7 mm long; anthers with blackish thecae 1.4-1.6 mm long and ovate, yellowish appendage 0.4-0.5 mm long; style branches ca. 1 mm long, including the short, acute, minutely hispidulous appendage. Pales 4-5 mm long, with narrow, ciliate keel, usually inflexed at the acute apex. Disc achenes ca. 2-2.5 mm high and 1 mm wide, biconvex, smoothish and tufted-strigillose on the faces, finely puberulent near the apex. Pappus consisting of ca. 15 deciduous awns, the adaxial one usually longest, up to ca. 2.5 mm in length. Ray achenes obcompressed-triquetrous, slightly shorter, otherwise similar to those of disc. Receptacle low-convex. Known from the vicinity of Orizaba, Vera Cruz and a single collection in southeastern Chiapas, apparently growing in open, rocky areas at from 1200 m to 1500 m altitude. Blooming May through Dec.

Selected Specimens:

MEXICO: CHIAPAS: Mt. Ovando, Dec. 17, 1936, Matuda 0783 (MICH,TEX,US). VERA CRUZ: Orizaba, alt. 4000 ft, 1891, Seaton 125 (F,GH,NY,US(2)). Cordoba, Aug. 19, 1940, Miranda 687 (MEXU). Orizaba, 1864, Thomas s.n. (GH).

The name usually applied to this plant has been Perymenium pellitum Klatt. This name, however, must now be interpreted as a synonym of P. discolor Schrader. In publishing P. pellitum, Klatt cited two specimens, without designating a type. One of

these, Liebmann 375, labelled Yevesia, Oaxaca, is P. discolor. The other, Thomas s.n., is labelled as coming from Orizaba and consists of a small fragment of P. discolor and a larger branch of P. klattianum. The branch of P. discolor is apparently included by some error, since that species is not otherwise known from Orizaba. Robinson & Greenman, in their 1899 revision, list the Liebmann specimen first and cite the Thomas specimen in a further list of collections, including several others, without, however, definitely designating a lectotype. Blake (1926) however, makes a clear, if implicit, selection of the Liebmann specimen as lectotype, giving the range of P. pellitum as "Vera Cruz and Oaxaca; type from Yavesia, Oaxaca." This leaves no choice but to relegate P. pellitum to synonymy under P. discolor and propose a new name for the plant from Vera Cruz.

P. klattianum is one of three species in the genus reported from both sides of the Isthmus of Tehuantepec (the others are P. gymnolomoides and P. gracile). To the west of the isthmus it seems to be confined to the vicinity of Mount Orizaba, in Vera Cruz. Its occurrence to the east of the isthmus is documented by a single collection (Matuda 783) from Monte Ovando (Obando), in southeast Chiapas, some 600 km from Orizaba. The occurence of this otherwise apparently local species at such a great distance from its principal area of concentration is, to say the least, puzzling, but pending further information, particularly confirmation and delimitation of its range in Chiapas, I can offer no plausible explanation of the anomaly.

Although P. klattianum strongly resembles P. discolor, neither species is very variable and no intermediates are known.

P. discolor has smaller heads (involucre 3.0-4.5 mm high, 3-5 mm wide) with less spreading apices on the inner phyllaries, fewer (14-22) disc flowers and a usually more ample inflorescence. These two species, P. stenophyllum and P. ovatum, seem to form a natural assemblage characterized by leaves with shallowly serrate or subentire margins and an unusually dense tomentum on the underside. The assemblage seems to be most closely related to P. pringlei and P. gracile. The resemblance of P. klattianum to P. pringlei var. croceum is particularly striking, though the latter has leaves that are strigillose rather than tomentellous beneath.

11. Perymenium discolor Schrad., Ind. Sem. Hort. Götting. p. 4, 1830. TYPE: Grown at Göttigen from seed collected by Schiede in Mexico; not examined. Apparent duplicates grown at: Berlin s.n., 1838 (P); Copenhagen: 2545, Sept. 7, 1865 (C); Paris: s.n. 1839 (GH), s.n. 1867 (P).

    Perymenium pellitum Klatt, Leopoldina 23:143, 1887. TYPE: MEXICO: OAXACA: Yavesia, Sept. 1842, Liebmann 375 (LECTOTYPE: C; ISOTYPE: P).

    Several-stemmed shrub from a woody caudex, to ca. 3 m in heig Leaves 2.5-10.5 cm long, 1.5-2 cm wide, lanceolate to lance-oblong acute to acuminate, narrowly cuneate at base, margin usually sligh ly revolute, entire or with up to 12 very shallow, remote teeth on a side, moderately to densely fine-strigillose above, very finely and densely matted-tomentellous and whitish beneath, triplinerved;

petiole 2.0-4.0 mm long. Stems 4-grooved, moderately strigillose or hispidulous. Inflorescence composed of small (3-8-headed) cymes arising terminally and terminating elongate internodes from the upper axils..Involucre campanulate or turbinate, 3-4.5 mm high, 3-5 mm wide, 3-seriate; outer phyllaries ovate or lance-ovate, acute, moderately strigillose and ciliate, progressively less pubescent on the back and more oblongish and blunter inward; the innermost ones with blunt, ciliate, yellowish, usually subspreading apex. Rays 5-8; lamina 2.5-7 mm long; tube 0.7-1.6 mm long. Disc flowers 14-22; corolla 3.5-4.8 mm long, with narrow tube 1.1-1.8 mm long, cylindric throat and deltoid lobes 0.4-1.0 mm long; anthers with blackish thecae 1.3-1.6 mm long and yellowish, ovate appendage 0.4-0.6 mm long; style branches ca. 1-1.5 mm long, including the short, acute, minutely hispidulous appendage. Pales 3.8-5.5 mm long, usually crumpled at the acute apex, with a narrow, ciliate keel. Disc achenes biconvex, 2.0-2.3 mm high, 1.0-1.2 mm wide, lacking wings or well-developed marginal awns, occasionally with small bumps on the upper angles, smoothish and tufted-strigillose on the faces, minutely puberulent near the apex. Pappus consisting of ca. 20 deciduous awns, the adaxial one up to 2.7 mm in length, the others irregularly shorter. Ray achenes obcompressed-triquetrous, slightly shorter and broader, otherwise similar to those of disc. Receptacle low-convex. Chromosome no.: n=15, from both mitotic and meiotic material. In open, dry areas from the valley of Oaxaca north to the area of Tehuacan, in the states of Oaxaca and Puebla, at altitudes from 1500 m to 2500 m. Blooming from April to November , with a peak from June to September.

Selected Specimens:

MEXICO: OAXACA: Slope of Cerro San Felipe, south side, above town of San Felipe del Agua, elev. 1700-2000 m, July 20, 1968, Anderson & Anderson 4858 (MICH). Junio in deitione, Andrieux 305 (P). Cerro Nate, 3.5 km al SSW de Magdalena Jicotlan, alt. 2450 m, Aug. 4, 1968, Crùz C. 2008 (ENCB). Cerro Solo 7 km al NE de Tepelmeme de Morelos, elev. 2350 m, Aug. 24, 1968, Cruz C. 2114 (ENCB). South slopes of Sierra San Felipe overlooking Diaz Ordaz, about 17 km NE of Tlacolula, elev. ca. 2200 m, Nov. 12, 1970, Fay & Cronquis 116 (NY). Sierra Mazateca E. of Teotitlan, Aug. 31, 1963, alt. 650(ft, Gentry et al. 20379 (NY). Foothills above Oaxaca, alt. 6500 ft, May 26, 1894, Pringle 4650 (C,CAS,F(2),GH(2),MEXU,MICH,MO(2),MSC, NY(2),TEX(2),UC,US); Las Sedas, June 20, 1899, Rose 4628 (MEXU,US). Monte Alban, near Oaxaca, alt. betw. 5500-6000 ft, Oct. 4, 1894, C.L. Smith 286 (F,GH,NY,US). Rancho de Calderon, alt. 6000 ft, Sept. 10, 1894, L.C. Smith 129 (GH). La Carbonera, alt. 7000 ft, Sept. 19, 1895, L.C. Smith 820 (GH). 1 mile E. of El Tule, July 20 1947, Webster et al 17M421 (MICH,TEX). PUEBLA: Entre Ozumbilla Y Aculcingo, Aug. 29, 1948, Miranda 4519 (MEXU). Coxcatlan, elev. 7-8000 ft, Sept. 1909, Purpus 4123 (MO,UC).

P. discolor is apparently most closely allied to P. klattianu which occurs slightly farther north, at lower altitudes in Vera Cruz. The two may well have a shared range near the Puebla-Vera Cruz border. Distinctions between these species, as well as my reasons for relegating P. pellitum to synonymy under P. discolor, are discussed under P. klattianum. See also the discussion of P. mendezii var. angustifolium for the possible contribution of P. discolor to its origin.

12. Perymenium stenophyllum Blake, Proc. Biol. Soc. Wash. 32: 191, 1919. TYPE: MEXICO: SINALOA: San Ignacio, Camino de Tinamaxtita al Saucito, alt. 860 m, Aug. 20, 1918, Salazar 501 (HOLOTYPE: US; ISOTYPES: MEXU,US).

Slender shrub to ca. 2 m in height. Leaves linear, 3-13.5 cm long, 1.5-3 mm wide, tapering gradually to acute or acuminate apex and attenuate base, very sparsely to moderately strigillose above, very finely and densely matted-tomentellous and whitened below, margins entire and revolute; petiole, if present, up to 2.5 mm long. Stem obscurely 4-grooved, sparsely strigillose or essentially glabrous. Inflorescence composed of small (ca. 3-7 headed) cymes arising terminally and on branches from the upper axils, usually exceeded by the upper leaves. Peduncles slender, sparsely to moderately strigillose. Involucre campanulate, 3-seriate; outer phyllaries ovate, acute or tapering to a blunt apex, essentially glabrous to moderately fine-strigillose, always ciliate, progressively longer and more oblong inward; innermost phyllaries with lax, yellowish, acute or blunt, ciliate apex. Rays 5-8; lamina ca. 8 mm long, tube ca. 1-2 mm long. Disc flowers 10-14; corolla 4-5 mm long, with slender tube, 1.2-1.7 mm long, cylindric throat and deltoid lobes 0.6-0.7 mm long; anthers with blackish thecae 1.5-1.6 mm long and ovate, yellowish appendage 0.5 mm long; style branches ca. 1.0-1.5 mm long, including the often indistinct, acute, minutely hispidulous appendage. Pales 4.3-5.5 mm long, narrowly keeled, with acute or blunt, erect, apex Disc achenes biconvex, 2.2-3.0 mm high, 1.2-1.4 mm wide, tufted-strigillose and smoothish or somewhat tuberculate on the faces,

finely puberulent near the apex. Pappus consisting of ca. 20 deciduous awns, the adaxial one longest and thickest, up to 2.5 mm in length. Ray achenes triquetrous, 2-3 mm high, 1.1-1.5 mm wide, otherwise similar to those of the disc. Receptacle low-convex. In pine and oak forests from southeastern Sinaloa to southern Sonora and western Chihuahua, at elevations from 800 m to 1600 m, apparently blooming August to October. Frontispiece.

Selected specimens:

MEXICO: CHIHUAHUA: Guasaremos, Rio Mayo, Aug. 16, 1936, H. S. Gentry 2394 (F,GH,UC,US). SINALOA: Quebrado de Mansana, Sierra Surotato, alt. 4000-5000 ft, Sept. 10-14, 1941, H.S. Gentry 6468 (GH,MICH,MO,NY). SONORA: Ridge south of arroyo Gochico, east of San Bernardo, alt. 1100-1200 m, Aug. 5-9, 1935, F.W. Pennell 19685 (MEXU,US).

P. stenophyllum is an extremely distinctive species with a considerable range in the northern Sierra Madre Occidental. Its nearest allies seem to be P. discolor and P. klattianum, both of which it resembles in leaf shape, pubescence and, to some extent, involucral morphology.

P. stenophyllum also resembles P. pringlei var. lancifolium in its narrow leaves and small heads with strongly spreading inner phyllaries. This however, may be more indicative of parallel trends in different phyletic lines than of any close direct relationship.

13. Perymenium ovatum Brandeg., Zoe 5:261, 1908. TYPE: MEXICO: PUEBLA: Barranca de Tlacuilosto, vicinity of San Luis Tultitlanapa, near Oaxaca, July 1907, Purpus 2527 (HOLOTYPE: UC; ISOTYPES: F,GH,MO,NY,US).

Perymenium collinum Brandeg., Univ. Calif. Publ. Bot. 3:395, 1909. TYPE: MEXICO: PUEBLA: Cerro de Gentile, Aug. 1908, Purpus 3086 (HOLOTYPE: UC; ISOTYPES: F,GH,MO,NY,US).

Freely branched, distinctly woody shrub. Stems 4-grooved, densely hispidulous or hispid-pilose. Leaves ovate, 1.5-3.5 cm long, 0.9-2.0 cm wide, acute, broadly cuneate to truncate or subcordate at base, shallowly serrate, with ca. 6-7 teeth on a side, moderately to densely hispidulous above, densely tomentose and whitened below, tri- or tripli-nerved. Heads terminal and from the upper axils of leafy branches, 3-5 per branch, about equalling or slightly exceeding the upper leaves. Involucre campanulate or hemispheric, 3-4 seriate, ca. 6.0-6.5 mm high and 5.0-6.5 mm wide; outer phyllaries ovate, acute or blunt, rather densely hirsute-strigose and strongly ciliate, progressively less densely strigose and more oblong inward, innermost with lax, yellowish or herbaceous, ciliate, acute or blunt apex. Rays 8-9; lamina 10-11 mm long; tube 2.1-2.5 mm long. Disc flowers 25-40; corolla 4.5-5.3 mm long, with slender tube 1.6-2 mm long, cylindric throat and deltoid lobes 0.7-0.9 mm long; anthers with blackish thecae 1.6-1.9 mm long and ovate, yellowish appendage 0.5-0.7 mm long; style branches ca. 1.5 mm long, including the acute or long-acute, thinly puberulent

appendage. Pales 5.4-6.5 mm long, with erect or inflexed, acute apex. . Disc achenes biconvex, 2.2-2.5 mm high, 1-1.5 mm wide, smooth and tufted-strigillose on the faces. Pappus consisting of ca. 15 deciduous awns, the adaxial one longest, up to ca. 2.5 mm in length. Ray achenes triquetrous, slightly broader, otherwise similar to those of disc. Receptacle flat.

The type of P. collinum has smaller leaves with less of a bluish cast beneath than the type of P.ovatum, but the two are so similar otherwise that neither of these differences seems sufficient to justify the recognition of more than one species.

The type localities have been located by Sousa (1969) as follows: Barranca de Tlacuilosto (Tlacualiste), 18°13"N, 97°21"E; Cerro de Gentile (del Gentil), 18°12"N, 97°07"E. These two nearby collections are the only known records of P. ovatum.

Although this species does not closely resemble any other in the genus, its tomentose leaves and spreading inner phyllaries suggest a relationship to P. discolor, P. klattianum and P. stenophyllum, perhaps as a fourth member of that alliance.

14. Perymenium ghiesbreghtii Robins. & Greenm., Proc. Amer. Acad. Arts, 34:525, 1899. TYPE:MEXICO: CHIAPAS: 1864-1870, Ghiesbreght 576 (HOLOTYPE:GH).

P. chalarolepis Robins. & Greenm., loc. cit. TYPE: MEXICO: CHIAPAS: 1864-1870, Ghiesbreght 563 (HOLOTYPE: GH; ISOTYPE: MO, fragment at UC).

P. purpusii Brandeg., Univ. Calif. Publ. Bot., 3:395, 1914. TYPE: MEXICO: CHIAPAS: Cerro del Boqueron, 1913, Purpus 6639 (HOLOTYPE: UC; ISOTYPES: F,GH(2),MO,NY,US).

P. leptopodum Blake, Proc. Aner. Acad. Arts, 51:523, 1916. TYPE: GUATEMALA: ALTA VERA PAZ: Near Coban, alt. 4300 ft, Jan. 1879, Turckheim 339 (HOLOTYPE: K(not seen); ISOTYPE AND PHOTO: GH).

P. inamoenum Standl. & Steyerm., Publ. Field Mus. Nat. Hist., Bot. Ser., 23:143, 1944. TYPE: GUATEMALA: ZACAPA: Sierra de las Minas, trail between Rio Hondo and summit at Finca Alejandria, alt. 1000-1500 m, Oct. 11, 1939, Steyermark 29737 (HOLOTYPE: F).

Sprawling or erect suffrutescent plant to about 3 m high. Stems of the season strongly 4-grooved, frequently purplish and green-spotted, sparsely to densely strigose or hispid. Leaves 2.5-11.5 cm long, 1.0-3.0(5.5) cm wide, lanceolate or occasionally lance-ovate, acute to attenuate, with cuneate to rounded or truncate base, obscurely to strongly serrate, sparsely strigillose or hispidulous above, sparsely to moderately so below or rarely hispid-pilose; petiole slender, 0.5-2.2 cm long. Inflorescence usually ample, freely branched, terminal, occasionally reduced to a small terminal cyme. Peduncles moderately to densely strigillose or hispidulous. Involucre 3-seriate, 3-5 mm high, 4.5-8.0 mm wide; outer phyllaries ovate, obtuse to acute or, most frequently, attenuate and recurved, sparsely to moderately strigillose

and more or less ciliate; inner phyllaries progressively more oblong and less pubescent, but usually retaining recurved, attenuate apices. Ray flowers 6-9(12); lamina 3.5-8.0(12.5) mm long, tube 0.7-1.5 mm long. Disc flowers 13-36(49); corolla 3.0-5.3 mm long with cylindric throat, narrow tube 0.5-1.8 mm long and deltoid lobes 0.4-0.9 mm long; anthers with blackish or, rarely, light brown thecae 1.0-1.8 mm long and ovate yellowish appendages 0.3-0.6 mm long; style branches 0.7-1.5 mm long, including the short, acute, hispidulous appendage. Pales 3.8-7.5 mm long, at least the inner sharply acute, more or less strongly keeled and ciliate on the keel, particularly upward. Disc achenes 1.8-3.0 mm high, 0.9-1.5 mm wide, biconvex or obscurely triquetrous, more or less ciliate on the angles, nearly glabrous or with tufted, ascending hairs on the faces, strongly hispidulous near the apex. Pappus of about 15-35 deciduous awns, the adaxial one longest and thickest, up to 4.0 mm long, the others irregularly shorter. Ray achenes 1.5-3 mm high, 0.8-1.4 mm wide, obcompressed-triquetrous, otherwise similar to those of disc flowers. Receptacle obscurely to strongly convex. Chromosome no. from meiotic material: n=15; n=ca. 15. Forests from central Chiapas to southern Guatemala, at altitudes from 650 m to 3800 m, blooming year-round, with a lull from March through June.

Selected specimens:

MEXICO: CHIAPAS: Near San Cristobal, elev. 7000-8800 ft, Sept. 18, 1895, Nelson 3205 (GH,US). 17 miles east of La Tri-

nitaria along road to the Lagos de Montebello, elev. 5000 ft, Oct. 12, 1965, Breedlove & Raven 12973 (MICH,DS). 19 kilometers north of Ocozocoautla along raod to Mal Paso, elev. 5100 ft, Oct. 28, 1965, Breedlove 13951 (MICH,DS,ENCB). Southwest of Mexican Hwy 190 near Rancho Nuevo about 9 miles southeast of San Cristobal las Casas, elev. 9000 ft, Nov. 7, 1965, Breedlove 14161 (MICH,DS,ENCB,NY). Mt. Tacana, elev. 1000-2000 m, Aug. 1938, E. Matuda 2458 (MICH(3),MEXU,US). 3 km northwest of Pueblo Nuevo Solistahuacan, elev. 5400 ft, ca. 92'40" W Long., 17'30" N Lat., July 21, 1970, Zuill 115 (DS). GUATEMALA: ALTA VERA PAZ: Near Coban, elev. 1260-1440 m, Mar. 26-Apr. 15, 1939, Standley 69134 (F,GH,NY). Along road, between San Cristobal Verapaz and Chixoy, alt. 1200-1300 m, Feb. 19, 1942, Steyermark 43888 (F,NY). CHIQUIMULA: Volcan Quezaltepeque, 3-4 miles northeast of Quezaltepeque, alt. 1500-2000 m, Nov. 8, 1939, Steyermark 31455 (F,GH). GUATEMALA: Along F.D.R. Hwy NW of Guatemala City, alt. 1800 m, Jan. 12-23, 1966, Molina et al 16022 (F,NY,US). HUEHUETENANGO: San Juan Ixcoy, alt. 8000 ft, Aug. 22, 1934, Skutch 1073 (GH,TEX). Along road 13 km west of Huehuetenango, near Puente de Xinaxo, alt. ca. 1800 m, Dec. 30, 1940, Standley 81534 (F). Along Rio Trapichillo between Paso del Boqueron below La Libertad and Democracia, alt. 1000-2100 m, Aug. 22, 1942, Steyermark 51034 (F). JALAPA: Mountains along the road between Jalapa and Paraiso, alt. 1400-1700 m, Nov. 14, 1940, Standley 77261 (F). Cerro Alcoba, just east of Jalapa, alt. 1300-1700 m, Dec. 2, 1939, Steyermark 32593 (F). QUETZALTENANGO: Forest, Barranca Buena Vista, about 5 km northwest of San Juan Ostuncalco, alt. 2800-2900 m, Dec. 11, 1962, Williams et al 22837 (F). SOLOLA: Volcan

Santa Clara, south-facing slopes to summit, alt. 2100-3000 m, June 5, 1942, Steyermark 46986 (F,NY). Volcan Santa Clara, north-facing slopes towards Lago de Atilan, alt. 2000-2950 m, June 6, 1942, Steyermark 47059 (F,NY). About 4 km east of Godinez, alt. 2100 m, Dec. 5, 1963, Williams et al 25200 (F,NY,US). TOTONICAPA: Near Momostenango, alt. 2100 m, Nov, 21, 1967, Molina 21333 (F, NY,US).

This is an extremely variable species which has had several names applied to it. Despite large variations, however, in such features as head size, leaf shape and serration, and vesture, I cannot find adequate reason to recognize more than one taxon when all the material now available is taken into consideration.

P. ghiesbreghtii can usually be recognized by its small to medium-sized heads with attenuate, spreading or reflexed phyllaries. Less constant, but useful, characters include its suffrutescent habit, a tendency for the stems to be spotted, and its usually freely branched and ample inflorescence.

Pubescence is particularly variable in this species. Most frequently it is rather fine and sparse, but in the type of P. inamoenum and several other collections, the stem and lower leaf-surfaces are densely hispid-pilose. Such plants, however, occur within the range of P. ghiesbreghtii and in characters other than pubescence are within its normal limits of variation.

P. ghiesbreghtii resembles, and may be related to, P. globosum var. globosum of central and western Mexico, which differs in its eciliate phyllaries, more numerous (45-55) disc flowers, generally shorter (2.5-4.0 mm) pales, and the burr-like appearence of its fruiting heads.

15. Perymenium pinetorum Brandeg., Univ. Calif. Publ. Bot., 10:420, 1924. TYPE: MEXICO: CHIAPAS: Rocky pine forests near Hacienda Monserrate, Sept. 1923, Purpus 9072 (HOLOTYPE: UC; ISOTYPES: DS,F,GH,MEXU,MO,NY,US).

Shrub. Leaves rather coriaceous, ovate or more commonly elliptic-ovate, serrate to subentire, 2.0-4.5 cm long, 1.0-2.5 cm wide, very sparsely strigillose below, chiefly along the veins, but quite rough to the touch, somewhat more densely so above, but the hairs not quite so strongly appressed; petioles slender, 3-7 mm long. Stems 4-grooved, sparingly strigose. Heads borne in small, leafy, terminal or axillary cymose clusters, containing about 3-10 heads each. Pubescence of peduncles similar to that of the stem, but somewhat more dense. Involucre 4.0-4.5 mm high, 3.0-4.0 mm wide, 3-seriate; outer phyllaries ovate, acute and appressed or with recurved attenuate apex, densely strigillose and more or less ciliate; inner phyllaries narrower, less densely pubescent, long-acute, usually with spreading apices. Rays 5; lamina 3.3-4.0 mm long, barely equalling the disc; tube 0.7-1.2 mm long. Disc flowers 8, corollas 3.8-4.1 mm long, with cylindric throat, indistinct tube 0.5-1.0 mm long and deltoid lobes 0.6-0.8 mm long; anthers with blackish thecae 1.5 mm long and yellowish appendage 0.4 mm long; style branches 1.0-1.5 mm long, strigillose, with gradually tapering appendage. Pales 5 mm long, narrowly keeled and ciliate on the keel, apex long-acute and, at least on inner pales, usually somewhat contorted. Disc achenes biconvex, ca. 2 mm high and 1 mm wide, ciliate on angles above, sparingly tufted-strigillose or nearly glabrous on the faces, densely hispidulous near the apex. Pappus of about 15 deciduous

awns, the adaxial one usually longest and thickest, up to 2 mm in length , the others irregularly shorter. Ray achenes obcompressed-triquetrous, otherwise similar to those of disc. Receptacle low-conic. In pine forest in the Sierra Madre de Chiapas, near the Oaxaca border. Blooming June and July.

Specimens examined:

MEXICO: CHIAPAS: Fenix, July 1925, Purpus 345 (GH). Fenix, May or June 1925, Purpus 10245 (AA,UC,US).

P. pinetorum is apparently most closely related to P. ghiesbreghtii. It can, however, be differentiated, at least in the material now available, by its fewer (5) rays which barely equal the disc, and fewer (8) disc flowers, with more tapering style branches.

The three known collections of this species are from the same vicinity in the Sierra Madre de Chiapas. Sousa (1969) locates Hacienda Monserrate at 16°33" N, 94" W, outside the known range of P. ghiesbreghtii.

16. Perymenium chloroleucum Blake, Brittonia 2:349, 1932.
TYPE: GUATEMALA: HUEHUETENANGO: In deep ravine, Chiantla, alt. 2156 m, Dec. 15, 1934, Skutch 1966 (HOLOTYPE: GH).

Slender-stemmed, freely branched shrub up to about 1.5 m in height. Leaves 1.5-4.0 cm long, 0.5-2.7 cm wide, ovate or oval-ovate, acute, with cuneate or rounded to truncate base, subentire or with ca. 5-8 shallow teeth on a side, sparsely to moderately strigillose above, moderately to very densely silvery-

strigillose and distinctly lighter beneath, tri- or triplinerved; petiole 2-11 mm long. Stem moderately strigillose, with appressed or subspreading hairs, peduncles more densely so. Heads disposed in small (3-5-headed) cymes, usually raised on elongate internodes terminally and from the upper axils. Involucre 4.5-6.5 mm high, 3.5-5.5 mm wide, campanulate or cylindro-campanulate, 3-seriate. Outer phyllaries lance-ovate, acute, moderately to rather densely strigillose and obscurely ciliate; inner two series longer, equal or nearly so, distinctly oblong, acute or bluntish and often less densely pubescent than outer series. Rays 7-9; lamina 4.5-8.5 mm long, tube 0.9-1.2 mm long. Disc flowers 15-32; corolla 3.1-3.7 mm long, with narrow tube 0.6-1.1 mm long, cylindric or somewhat funnelform throat and deltoid, commonly reflexed, lobes 0.4-0.7 mm long; anthers with blackish thecae 1.2-1.4 mm long and yellowish, ovate appendages 0.3-0.5 mm long; style branches ca. 1 mm long, including the short, acute, indistinct appendage. Pales 3.8-5.5 mm long, with acute, erect, apex. Disc achenes purplish, ca. 2.5-3.0 mm high and 1.0-1.5 mm wide, biconvex, sparingly tufted-strigillose. Pappus consisting of ca. 20 deciduous awns, the adaxial one usually longest, up to ca. 2 mm in length. Ray achenes slightly shorter and broader, triquetrous, otherwise similar to those of disc. Receptacle flat or obscurely convex. In forests of southeast Chiapas and the department of Huehuetenango in southwest Guatemala, at elevations from about 1700 m to 2500 m, blooming September through December.

Specimens examined:

MEXICO: CHIAPAS: 3 miles south of Aguacatenango along road to Penola Las Rosas, elev. 5600 ft, Oct. 13, 1965, Breedlove & Raven 13134 (MICH,DS,ENCB,NY). Hills 6 miles southwest of Teopisca, elev. ca. 5900 ft, Nov. 4, 1965, Cronquist 10487 (NY). Hills 10 km east of Teopisca, elev. 2300 m, Nov. 2, 1970, Fay & Cronquist 112 (NY). Between San Cristobal & Teopisca, alt. 6700-8500 ft, Dec. 4, 1895, Nelson 3453 (GH,US). GUATEMALA: HUEHUETENANGO: Above San Sebastian, alt. 7900 ft, Sept. 9, 1934, Skutch 1188 (F,GH,US). Aguacatan, alt. 6500 ft, Dec. 13, 1934, Skutch 1926 (GH). Mountains west of Aguacatan, on road to Huehuetenango, alt. ca. 1950 m, Dec. 27, 1940, Standley 81230 (F,NY). La Sierra (Tujimach) across river from San Juan Atitan, alt. 2500-2900 m, Sept. 8, 1942, Steyermark 52012 (F,GH,NY). Near Barranco "Lo de Chaues" 8 km west of Aguacatan, alt. 2200 m, Nov. 28, 1962, Williams et al 21862 (F).

This infrequently collected species can be distinguished by its unusual involucre, with two subequal inner series of oblong phyllaries which are distinctly longer than the outermost series. This type of involucre is not known to occur in any other species in the genus. In some respects it resembles P. mendezii var. mendezii, which, however, has an evenly graduate involucre and rarely has its leaves so densely strigillose or lighter beneath. P. chloroleucum might also be confused with the sympatric P. ghiesbreghtii, but that species also has an evenly graduate involucre and usually longer leaves (2.5-11.5 cm). The only individuals of P. ghiesbreghtii known to have leaves distinctly

lighter beneath than above are the hispid-pilose plants formerly known as P. inamoenum. Although P. chloroleucum and P. ghiesbreghtii apparently share both range and habitat, no intermediates between the two species are known.

17. Perymenium globosum Robins., Proc. Amer. Acad. Arts, 43: 40, 1907. TYPE: MEXICO: MICHOACAN: Uruapan, alt. 5000 ft, Jan. 25, 1907, Pringle 10354 (HOLOTYPE: GH; ISOTYPES: C, CAS, F,MEXU,MICH(2),MO,NY,P,UC,US(2)).

Slender, several-stemmed half-shrub, woody toward the base, but largely herbaceous above, to ca. 3 m high. Leaves ovate to narrowly lance-oblong, 4-16 cm. long, 1.5-5.5 cm wide, acute to acuminate, with cuneate or rounded to truncate or subcordate base, serrate, with ca. 15-30 teeth on a side, obscurely or distinctly tirplinerved, sparsely to moderately hispid-strigillose above, sparsely to moderately hispidulous or strigillose below; petiole 0.3-3 cm. long. Stem strongly 4-grooved, moderately to densely strigillose, hispidulous or hispid-pilose. Inflorescence composed of usually numerous 3-20-headed cymes borne terminally and terminating elongate internodes from the upper axils. Peduncles slender, moderately hispidulous or subspreading strigillose. Involucre hemispheric or campanulate at anthesis, 3-4 seriate 2.5-6 mm high, 4.5-7 mm wide; outer phyllaries ovate to lance-ovate, acute or acuminate, moderately strigillose, progressively less densely pubescent inward. Rays 7-10, lamina 3.5-6.2 mm long; tube 1.0-1.5 mm long. Disc flowers ca. 30-60; corolla 3.0-5.0 mm long, with slender tube 0.8-1.8 mm long, cylindric or cylindro-campanulate throat and deltoid lobes 0.4-0.8 mm long; anthers

with blackish thecae 1.0-1.5 mm long and short-ovate, yellowish appendage 0.2-0.4 mm long; style branches ca. 1 mm long, including the short, acute, hispidulous appendage. Pales 2.5-6.0 mm long, narrowly keeled, with acute, erect or reflexed apex. Disc achenes biconvex, 1.3-2.5 mm high, 1.0-1.4 mm wide, smooth to rugulose or tuberculate and glabrous or tufted-strigillose on the faces, finely puberulent near the apex. Pappus consisting of ca. 15-50 deciduous awns, the adaxial one longest, up to 3.5 mm in length. Ray achenes 1.5-2 mm high, 1.1-1.5 mm wide, triquetrous, otherwise similar to those of disc. Receptacle slightly to very strongly convex or convex-hemispheric.

Key to varieties of P. globosum

1. Involucre hemispheric at anthesis, 2.5-3.5 mm high; phyllaries essentially eciliate, hairs on the margins resembling those of the outer surface; rays longer (lamina 6-8.5 mm long); receptacle strongly convex-hemispheric.

   17a. P. globosum var. globosum

1. Involucre campanulate at anthesis, 4-6 mm high; phyllaries more or less distinctly ciliate; rays shorter (lamina 3.5-6 mm long); receptacle slightly to strongly convex.

   17b. P. globosum var. rotundisquamum

17a. Perymenium globosum Robins. var. globosum.

Leaves ovate to lance-ovate or narrowly lance-deltoid, 3-5 cm wide, frequently more or less decurrent on the petiole, hispidulous below; petiole 1.5-2.5 cm long. Stem moderately hispidulous. Involucre broadly hemispheric, eventually subrotate, 3-seriate, 2.5-3.5 mm high and 4.5-5.0 mm wide at anthesis. Phyllaries frequently spreading or reflexed at apex, essentially eciliate, the hairs on the margin resembling those of the outer surface. Rays with lamina 6.2-8.2 mm long. Disc flowers ca. 45-55; corolla 3.5-4.0 mm long. Pales 2.5-4 mm long. Receptacle very strongly convex-hemispheric. In forests from Jalisco to Guerrero and Mexico, at altitudes from 1200 m to 2200 m, blooming October through January, with records also in May and August.

Selected specimens:

MEXICO: GUERRERO: Taxco, Aug. 12, 1937, Abbott 342 (GH). Mountains above Mazatlan, Dec. 27, 1947, Correll 14398 (TEX). Cruz de Ocote, about 25 km west-southwest of Camotla, about 50-60 km west of Chilpancingo, elev. 2000 m, Dec. 3, 1963, Feddema 2864 (MICH(2)). Rio Frio, Mina, alt. 1340 m, Nov. 21, 1936, Hinton 9872 (MICH,NY,P,TEX,UC,US). JALISCO: Sierra del Tigre, 3 miles south of Mazamitla, elev. 2100-2200 m, Oct. 18, 1952, McVaugh 13602 (MICH). Sierra del Halo, near lumber road leaving Colima hwy 7 SSW of Tecalitlan, 13-16 miles from hwy, elev. 2000-2200 m, Nov. 28-30, 1959, McVaugh & Koelz 1144 (MICH). MEXICO: Naranjo, Temascaltepec, alt. 860 m, Nov. 13, 1932, Hinton 2573 (F,GH,NY,MO,US). Valle de Bravo, alt. 1800-2000 m, Nov. 23, 1952, Matuda et al 27356 (MEXU,NY). Sultepec, Nov. 3, 1956, Paray 2243 (ENCB). MICHOACAN: Tancitaro, Uruapan, alt.

2075 m, Nov. 6, 1940, Hinton 15640 (MICH,NY,P,TEX,UC,US). Northwestern foothills of Cerro Tancitaro, 13-14 km south of Periban de Ramos, elev. 1650-1700 m, Nov. 29, 1970, McVaugh 24801 (MICH). Toreo el Alto, cerca Uruapan, Man. 26, 1926, Woronow 2914 (US). Circa Uruapan, Jan. 21, 1926, Woronow 2724 (US).

17b. Perymenium globosum Robins. var. rotundisquamum (Blake) Fay, comb. nov.

Perymenium rotundisquamum Blake, Contr. U.S. Natl. Herb. 22:623, 1924. TYPE: MEXICO: GUERRERO: Vallecitos, alt. 950 m, Sept. 18, 1898, Langlassé 363 (HOLOTYPE: US; ISOTYPE: P; Photo:NY).

Leaves lanceolate to narrowly lance-oblong, cuneate or rounded at base. Involucre campanulate at anthesis, 4-6 mm high, 4.5-7.0 mm wide, rarely subrotate in mature fruiting heads, 3-4 seriate. Outer phyllaries acute, progressively more oblong and sometimes blunter inward. Rays with lamina 3.5-6.0 mm long.. Pales 3.5-6.0 mm long. Disc achenes 1.8-2.4 mm high, smooth or finely rugulose and glabrous on the faces. Receptacle slightly to strongly convex. In forests and their margins on Pacific slope of Sierra Madre in Oaxaca and Guerrero at altitudes from 250 m to 1200 m, blooming September through November.

Specimens examined:

MEXICO: GUERRERO: Vallecitos, Montes de Oca, Sept. 21, 1937, Hinton 11404 (F,MICH,NY,P,TEX,UC,US). OAXACA: About 10 km

north of Putla and 80 km southwest of Tlaxiaco, elev. about 900-1000 m, Oct. 30, 1970, Fay & Cronquist 107 (NY). About 17 km north of Pochutla, and 30 km north of Puerto Angel, elev.ca. 250 m, Nov. 10, 1970, Fay & Cronquist 114 (NY). South slope of Sierra Madre del Sur, ca. 50 km north of Pochutla, elev. ca. 1200 m, Nov. 10, 1970, Fay & Cronquist 115 (NY). 3 km al N de Chacalapa, elev. 400 m, Sept. 26, 1965, Rzedowski 21195 (ENCB).

P. globosum var. globosum is a well-defined and rather easily recognizable taxon which exhibits great morphological coherence throughout its range. In contrast, P. globosum var. rotundisquamum, heretofore recognized only from the type (as P. rotundisquamum). presents a puzzling pattern of morphological diversity.

Coastal populations from Oaxaca and Guerrero (the type; Fay and Cronquist 114) represent a morphological extreme very different from the typical variety, with narrow, thick-textured leaves and relatively few disc flowers in a head. Two populations sampled in the course of this study, however, (Fay & Cronquist 107, 115) clearly indicate a progression toward var. globosum in their broader, thinner leaves and more numerous disc flowers.

P. globosum appears to be related, through its typical variety, to P. macrocephalum, which is similar in habit, leaf shape and texture and in the form of its heads. P. macrocephalum, however, has very much larger heads (involucre 1.3-2 cm wide, 0.6-1 cm high) and there is not much likelihood of confusion.

P. globosum var. globosum also resembles P. pringlei var. pringlei, but this is probably largely superficial. The latter is distinguishable by its campanulate rather than hemishperic involucre with distinctly ciliate phyllaries, less numerous disc flowers (20-30 per head) and barely convex receptacle. Similarities and differences between var. globosum and P. ghiesbreghtii are discussed under the latter species.

18. Perymenium macrocephalum Greenm. Proc. Amer. Acad. Arts, 39:108, 1903. TYPE: MEXICO: GUERRERO: Limestone mountains above Iguala, alt. 4000 ft, Sept. 27, 1900, Pringle 8416 (HOLOTYPE: GH; ISOTYPES: C,F,MEXU,MICH,MSC,NY,P,UC,US(2)).

Several-stemmed perennial herb or half-woody shrub to about 2 m high. Stem slender, strongly 4-grooved, sparingly branched, generally blotched with purple, sparsely strigillose or hispidulous and often conspicuously hirsute at the nodes. Leaves ovate, (4)6-13 cm long, 2.5-13.5 cm wide, attenuate, truncate to cordate at base, serrate, often unevenly so, with 15-30 teeth on a side, both surfaces sparsely to moderately hispidulous or strigillose and rough to the touch; petioles slender, 1-3 cm long, sometimes narrowly winged to the base. Heads 1-several, terminal or from upper axils, or up to about 30 in an openly branched terminal inflorescence. Peduncles 1-9.5 cm long, pubescence similar to that of stem, but denser. Involucre hemispheric or broadly campanulate, 1.3-2.0 cm wide, 0.6-1.0 cm high, 3-4 seriate; outer phyllaries ovate, moderately to densely appressed-hispid and usually conspicuously ciliate, progressively more oblong and

less pubescent inward; innermost transitional to the pales; outer and middle usually with loose, herbaceous, attenuate to acute or rounded apex. Rays 8-13; lamina 9 - 11 mm long; tube 1.5-2.5 mm long. Disc flowers ca. 40-100; corollas 4-6 mm long, with cylindric throat and short tube, lobes ca. 1 mm long; anthers with blackish thecae 2-2.5 mm long and yellowish appendages 0.3-0.7 mm long; style branches ca. 2 mm long, slender, tapering, hispidulous, apparent stigmatic lines extending nearly to the tip, appendage short, acute, indistinct. Pales 8-11 mm long, indurate, lance-attenuate, keeled, minutely ascending-hispidulous on the back of the upper portion, equalling or slightly surpassing the disc flowers. Disc achenes ca. 4 mm long, 1.5 mm wide, biconvex, wingless at maturity, with short, blunt marginal awns, tuberculate, with tufted, ascending hairs on the tubercles. Pappus of 2—25 deciduous awns, adaxial awn longest, to 6 mm in length. Ray achenes triquetrous, otherwise similar to those of disc. Immature achenes frequently appearing to have narrow, light-colored wings, these apparently thickening and darkening at maturity to become indistinguishable from the body of the achene. Receptacle low-convex. In oak forests in Guerrero, at altitudes from 800 m to 1700 m, blooming July through September. Chromosome no., from meiotic material, n=15.

Specimens examined:

MEXICO: GUERRERO: North of Iguala, access road leaves Mex. hwy 95D ca. 9 miles north of Iguala, near Km. 155, elev. 1450-1700 m; July 26, 1968, Anderson & Anderson 4903 (MICH). Canon de

Zapilotes, Sept. 1932, Bravo 9203 (MEXU). Mountains overlooking Iguala, from the northeast, elev. ca. 1300 m, Oct. 23, 1970, Fay & Cronquist 106 (NY). Manchon, Mina, alt. 1150 m, Aug. 12, 1936, Hinton et al 9250 (MICH,NY,US). Rio Balsas, Aug. 26, 1910, Orcutt 4163 (F,MO,US). Iguala canyon, elev. 3000 ft, July 24, 1907, Pringle 10385 (CAS,ENCB,F,GH,MICH,MSC,TEX(3),UC,US). Balsas Station, Sept. 27, 1905, Pringle 13651 (CAS,F,GH,MICH, MSC,TEX,UC,US). Zumpango del Rio, 6 km al S sobre la carretera a Chilpancingo, alt. 1350 m, July 4, 1966, Ramirez s.n. (ENCB, MSC). Near Iguala, Aug. 10 & 12, 1905, Rose et al 9302 (US). Canon de la Mano Megra, near Iguala, Aug. 11, 1905, Rose et al 9331 (NY,P,US). Limon Mt., alt. 4510 ft, July 28, 1910, Rusby 355 (NY,US). Casa Verde, cerca de Xochipala, alt. 800 m, Sept. 3, 1962, Rzedowski 16088 (DS,ENCB,MICH). 1787-1795-1804, Sesse et al. 2966 (F).

Its relatively enormous heads render this one of the most distinctive and easily recognizable species in the genus. Apparently its only close relative is P. globosum var. globosum which, however, has much smaller heads (involucre 2.5-3.5 mm high, 4.5-5.0 mm wide at anthesis), shorter disc corollas (3.5-4.0 mm long) and pales (2.5-4.5 mm long) and smaller achenes (1.3-2.5 mm high, 1.1-1.4 mm wide).

19. Perymenium alticola McVaugh, Contr. Univ. Michigan Herb., 9:432, 1972. TYPE: MEXICO: JALISCO: Between El Chante and Cuzalapa, 25-30 km southeast of Autlan, elev. 2000-2250 m, March 19-22, 1965, McVaugh et al. 23173 (HOLOTYPE: MICH; Photo: NY).

Robust herb or nearly unbranched shrub to ca. 3 m in height. Leaves lanceolate or lance-ovate, frequently ternate on major stems, 3-14 cm long, 1.0-4.5 cm wide, acute or attenuate, rounded at base, serrate, with ca. 6-12 shallow, remote teeth on a side, very sparsely to moderately strigillose above, sparsely or very sparsely strigillose or hispidulous below, tri- or tripli-nerved; petiole 3-25 mm long. Stem obscurely 4-grooved, moderately strigillose. Inflorescence composed of terminal cymes of ca. 3-20 heads each, often arising on a series of lateral branches from the main axis, usually exceeded by the upper leaves. Involucre campanulate or hemispheric, 6.5-9 mm high, 4.5-7 mm wide, 3-seriate, graduate. Outer phyllaries oblong- or lance-ovate, acute or obtuse, moderately strigillose and obscurely ciliate, progressively more oblong and less densely strigillose inward. Rays 5-8; lamina ca. 1-2 cm long, tube 2.0-2.6 mm long. Disc flowers ca. 20-30; corolla 6.5-9.6 mm long, with narrow tube 1.3-3.0 mm long, cylindric throat and deltoid lobes 0.9-1.7 mm long; anthers with blackish thecae 2.0-2.7 mm long and ovate appendage 0.5-1.0 mm long; style branches ca. 2-2.5 mm long, including the short acute appendage. Pales 7-10 mm long, with acute, crumpled apex. Disc achenes biconvex 2.8-4.4 mm high, 1.1-1.5 mm wide, smoothish and very sparsely and finely strigillose on the faces, minutely puberulent near the apex. Pappus of ca. 30 deciduous awns, the adaxial one longest, up to 3.5 mm in length. Ray achenes triquetrous, 2.6-3.5 mm high, otherwise similar to those of disc. Receptacle low-convex. In pine and fir forests in the western Sierra Transversal, from southern Jalisco to Michoacan at elev-

ations between 2000 m and 2900 m.

Specimens examined:

MEXICO: JALISCO: Southeastern slopes of Nevado de Colima, along lumber road which ascends from a point about 11 miles from Atenquique on the Tonila road, elev. ca. 2850 m, April 2, 1951, McVaugh 11712 (MICH), McVaugh 11712A (MICH). MICHOACAN: Mt. Tancitaro, Tancitaro, elev. 9500 ft, July 25, 1941, Leavenworth and Hoogstraal 1208 (F,GH,MO,NY).

P. alticola appears to be most closely related to P. berlandieri, which it resembles in its sparse, fine pubescence, relatively long, narrow achenes and greenish pales with crumpled apex, as well as its general appearance. The two species can be distinguished most consistently by the involucre, which in P. alticola is broadly campanulate or hemispheric and barely graduate and in P. berlandieri is cylindro-campanulate or cylindric and strongly graduate. The two species can also be distinguished, though less consistently, by the base of the involucre, which in P. alticola is rounded or indented and in P. berlandieri is usually obconical.

From present collection data, these two taxa appear to occupy ranges on opposite ends of the Sierra Transversal, without overlap. It would be interesting to know whether either or both species occur on Nevado de Toluca, which lies between their currently known ranges.

20. Perymenium berlandieri DC., Prodr. 5:608, 1835. TYPE: MEXICO: Cordillera Gochilaque (Guichilapa?), Oct. 21, 1827, Berlandier 1040 (HOLOTYPE: G(not seen), microfiche seen at NY; ISOTYPE: F; Photo & fragment: US; Photo: US(2)).

Perymenium mendezii DC. var. cylindrocephalum Robins. & Greenm., Proc. Amer. Acad. Arts 34:528, 1899. TYPE: MEXICO: MORELOS: Mountainside near Cuernavaca, alt. 2500 m, May 22, 1898, Pringle 7658 (HOLOTYPE: GH; ISOTYPE: US).

Shrub to ca. 3 m high. Leaves 2.5-9(13) cm long, 1-4 cm wide, ovate or, more frequently, lance-ovate, acute or attenuate, rounded to truncate base, subentire or shallowly serrate, with 6-17 teeth on a side, tri- or tripli-nerved, moderately strigillose above, sparsely strigillose or occasionally hispidulous below, chiefly along the veins; subsessile or on a petiole up to 11(15) mm long. Inflorescence a compact terminal cyme about equalling the upper leaves or more open, consisting of small, terminal and subterminal cymes raised above the foliage on elongate upper internodes. Peduncles sparsely to densely strigillose. Involucre 3.5-6.5 mm wide, 5.5-8 mm high, 3- 4-seriate, cylindrocampanulate; outer phyllaries ovate or lance-ovate and acute or bluntish, moderately strigillose; progressively more oblong and less densely pubescent inward, frequently rounded at apex; innermost transitional to the pales. Ray flowers 5-8; lamina 8-13 mm long, tube 1.5-3.5 mm long. Disc flowers 13-29; corolla 4.3-7.7 mm long, with cylindric throat, slender tube 1-4 mm long and deltoid lobes 0.7-1.1 mm long; anthers with blackish or brown thecae 1.5-3.7 mm long and ovate appendage 0.5-0.8 mm long; style

branches 1.5-1.9 mm long, abruptly contracted to a short, acute, hispidulous appendage. Pales (5.5)6.0-8.5 mm long, dingy-greenish, at least the inner ones crumpled at apex, with very narrow, ciliate keel. Disc achenes compressed-biconvex, 2.4-4.7 mm long, 1.0-1.5 mm wide, ciliate on the angles, sparsely to moderately tufted-strigillose or nearly glabrous on faces, occasionally with rudimentary or, rarely, well-developed marginal awns. Pappus consisting of ca. 25-40 deciduous awns, the adaxial one usually longest and thickest, up to 4.5 mm in length. Receptacle flat or slightly convex. Chromosome numbers, from meiotic material: n=15, n=45. In forests, western state of Mexico to Puebla and southern Hidalgo to Morelos, usually at altitudes from 2400 to 3000 m, occasionally as low as 2000 m or as high as 3500 m. Blooming August through January.

Selected specimens:

MEXICO: D.F. FEDERAL DISTRICT: About 35 km South of Mexico City above Ajusco, elev. ca. 2700 m, Oct. 22, 1970, Fay & Cronquist 103 (NY). HIDALGO: Entre Nicolas Flores y Santuario Sept. 16, 1961, L. Paray 3215 (ENCB). Cerro de las Ventanas, 6 km al N de Pachuca, alt. 2950, Nov. 4, 1965, Rzedowski 21652 (DS,ENCB,MICH,MSC). MEXICO: Cerro de Pinal, Otzoloapan, alt. 2300-2500 m, Oct. 18-22, 1954, Matuda et al 31814 (NY). Cerca de San Pedro Nexapa, alt. 2550 m, Oct. 9, 1966, Rzedowski 23282 (DS,ENCB,MICH,MSC). MORELOS: Along cuota camino from Cuernavaca to Mexico about 30 km north of Cuernavaca, elev. 2700 m, Oct. 23, 1970, Fay & Cronquist 105 (NY). Mountains above Cuernavaca, alt. 8000 ft, Sept. 1, 1900, Pringle 8462 (C,F,GH,

MEXU,MICH,MO,MSC,NY,P,UC ,US). PUEBLA: Mountains between Mexico City and Puebla about 66 km east of Mexico City and 3 km from the D.F. boundary, elev. 2800 m, Nov. 17, 1970, Fay & Cronquist 120 (NY). Cerro Tomaquilo, cerca de Zacapoaxtla, alt. 2100 m, Nov. 3, 1958, L. Paray 2795 (ENCB). In woodlands at Honey Station, alt. 5800 ft, Sept. 15, 1904, Pringle 13071 (C,CAS,F,MICH,MSC,MO,TEX,US). WITHOUT LOCALE: Valle de Mexico, forets de San Nicolas, Aug. 27, 1865-1866, M. Bourgeau 964 (C,GH,NY,P(2),US). Schmitz 390 (GH).

The typical phase of P. berlandieri is apparently confined to the area of the Valley of Mexico, in the Federal District and the states of Mexico and Morelos. Plants from north and east of there, in Hidalgo and Puebla, tend to have a more lax inflorescence, shorter petioles, shorter achenes, and to be generally less robust. Habitally, these plants suggest P. mendezii var. mendezii, with which at least the Hidalgo populations are sympatric, and there may have been some introgression from P. mendezii in these areas. There is little question of these plants being direct hybrids between P. mendezii var. mendezii and more typical P. berlandieri, however, since the typical phase of P. berlandieri does not seem to be present in Hidalgo or Puebla.

More cytological sampling of P. berlandieri may be of some help in clarifying the situation. Present cytological information is rather puzzling. The only population of typical P. berlandieri sampled is hexaploid, with n=45, and the sole count

from outside the Valley of Mexico is diploid, with n=15, from Hidalgo.

Three collections from the state of Mexico (Paray 2241 & 2253, Matuda et al. 32021) are remarkable for their very long (up to 13 cm), lanceolate leaves and well-developed marginal awns on the achenes. In other features, however, these plants agree with P. berlandieri, and, at least provisionally, I have assigned them to this species.

For a comparison of P. berlandieri with P. nicaraguense and P. alticola, see the latter two species.

21. Perymenium hintonii McVaugh, Contr. Univ. Michigan Herb., 9:437, 1972. TYPE: MEXICO: MICHOACAN: Acahuato, Apatzingan, alt. 740 m, Aug. 17, 1938, Hinton et al. 12045 (HOLOTYPE: MICH; ISOTYPES: GH,NY,P,TEX,UC; Photo: NY).

Shrubby or treelike, up to ca. 4 m in height. Leaves ovate 6.5-10 cm long, 2.6-5.2 cm wide, acute or attenuate, rounded or truncate at base, shallowly serrate, with ca. 15-25 teeth on a side, sparsely to moderately strigillose above, with curving hairs, sparsely to moderately hispidulous below, tri- or tripli-nerved; petiole 4-15 mm long. Stem obscurely 4-grooved, sparsely to moderately strigillose. Inflorescence branching freely, the heads slender-peduncled, in cymose clusters of 3-8. Peduncles sparsely to moderately strigillose, with subspreading hairs. Involucre 6.5-8.7 mm high, 5 mm wide, cylindro-campanulate, 3-4 seriate. Outer phyllaries ovate, acute, sparsely strigillose and distinctly ciliate, progressively more oblong, blunter, and less pubescent inward; the innermost

oblong, subglabrous, with lax, strongly ciliate, blunt apex. Rays 8; lamina 9.5-12.0 mm long, tube 1.5-2.0 mm long. Disc flowers ca. 15-20; corolla 6-8.5 mm long, with narrow tube 1-2 mm long, cylindric throat and narrowly deltoid lobes ca. 1 mm long; anthers with blackish thecae 2.0-2.5 mm long and narrowly ovate yellowish appendages 0.7-0.8 mm long; style branches ca, 2 mm long, about half this length consisting of an indistinct, narrowly acute, minutely hispidulous appendage. Pales 4.7-7.7 mm long, distinctly keeled, with an erect, bluntish apex. Disc achenes biconvex, 3-4 mm high, and 1.5-2 mm wide, tuberculate and tufted-strigillose on the faces, ciliate along the angles, finely puberulent near the apex, with or without distinct marginal awns ca. 1 mm long. Ray achenes obcompressed or obcompressed-triquetrous, slightly shorter and broader, otherwise similar to those of disc. Pappus consisting of ca. 25 deciduous awns, the adaxial one longest and thickest, up to 5.2 mm in length. Receptacle low-convex. Forest in Michoacan and Mexico, altitude 700-1000 m, blooming August through October.

Specimens examined:

MEXICO: STATE OF MEXICO: Naranjo, Temascaltepec, Oct.8, 1935, Hinton 8534 (C,DS,F,MICH,MO,NY(2),P,TEX(2),UC,US). MICHOACAN: Above Acahuato, Apatzingan, alt. 3200 ft, Aug. 17, 1941, Leavenworth & Hoogstraal 1660 (F,GH,MICH,MO,NY).

P. hintonii is a distinct and distinguishable species which went unrecognized for a number of years. It can be dis-

tinguished from P. pringlei var. pringlei by its fewer, larger heads (involucre 6.5-8.7 mm high), longer disc corollas (3.0-3.8 mm long) and longer achenes (3.0-4.0 mm). From P. mendezii var. verbesinoides it differs in its spreading, blunt and very strongly ciliate inner phyllaries and usually fewer disc flowers (15-20) with longer corollas.

P. hintonii is presently known from three collections in Michoacan and Mexico. A single additional specimen from Oaxaca (MacDougall s.n., Zapote) may also represent this species, but has larger heads with about 40 disc flowers and more spreading pubescence throughout. A final disposition of this material awaits additional collections from the area. For now, it is only tentatively referred to P. hintonii.

22. Perymenium mendezii DC. Prodr. 5:608, 1836. TYPE: MEXICO: Circa Villalpando, Mendez s.n. (HOLOTYPE: G(not seen) microfiche seen at NY; Fragment?: GH; Photos: US(2); Tracing?:GH).

Shrub to ca. 4 m high. Leaves ovate to narrowly lance-oblong, 2-12 cm long, 1.6-5 cm wide, subentire to serrate, with up to 25 teeth on a side, acute or attenuate, with attenuate to subcordate base, strigillose or hispidulous beneath, subsessile or on a petiole up to 2 cm long. Stems sparsely to densely strigillose or hispidulous, obscurely 4-grooved. Inflorescence composed of one to many small (3-6-headed) cymes. Pubescence of peduncles similar to that of stem. Involucre campanulate or subcylindric, 3-6 mm high, 3.5-7 mm wide, 2-3 seriate. Phyllaries various. Rays 5-9; lamina 4-10 mm long, tube 1-2 mm long. Disc flowers 17-41, corolla 2.8-5.9 mm long, with slender tube 0.7-2.7 mm long, cylindric or somewhat funnelform throat and deltoid lobes 0.4-0.9 mm long; anthers with blackish or brown thecae 0.5-2.1 mm long and ovate yellowish appendage 0.4-0.8 mm long, style branches 1-2 mm long, including the acute to attenuate, finely hispidulous appendage. Pales 3.5-7.0 mm long, narrowly keeled, with acute apex. Disc achenes biconvex or compressed-triquetrous, 1.8-4 mm high, 1-2.2 mm wide, smoothish to strongly tuberculate and tufted-strigillose on faces, ciliate on angles, with or without distinct marginal awns. Pappus consisting of 10-25 deciduous awns, adaxial one longest and thickest, up to 4.5 mm in length. Ray achenes obcompressed-triquetrous, 1.5-3.5 mm high, otherwise similar to those of disc. Receptacle low-convex.

Key to varieties of P. mendezii

1. Leaves serrate, with 12-25 teeth on a side, minutely bullate beneath; petiole 5-20 mm long.

22a. P. mendezii var. verbesinoides

1. Leaves subentire or serrate with 10 or fewer teeth on a side, lower surface flat or obscured by pubescence; petiole up to 3 mm long.

2. Leaves densely strigillose or hispidulous and distinctly whitish beneath. 22c. P. mendezii var. angustifolium

2. Leaves usually sparsely strigillose beneath, rarely hispidulous, never distinctly whitish.

22b. P. mendezii var. mendezii

22a. Perymenium mendezii DC. var. verbesinoides (DC) Fay, comb. nov. Perymenium verbesinoides DC Prodr. 5:608, 1836. TYPE: MEXICO: Cultivated, 1826, Berlandier 565 (HOLOTYPE: G(not seen), microfiche seen at NY; ISOTYPE: P; Photos: US(2), Tracing: GH).

Leaves ovate to lance-ovate or, exceptionally, lanceolate, 3-12 cm long, 2-6.5 cm wide, evenly serrate, with usually 12-25 teeth on a side, moderately strigillose above, sparsely to rather densely strigillose or hispidulous and usually minutely bullate with strongly impressed veinlets below. Petiole 0.5-2.0 cm long. Inflorescence terminal, consisting of numerous small cymes terminating leafy branches, frequently 50-100 heads in an entire inflorescence. Involucre 3-seriate. Outer phyllaries ovate or lance-ovate, sharply acute at the herbaceous

apex moderately and rather coarsely strigillose and usually strongly ciliate; inner phyllaries progressively more sparingly and less coarsely strigillose, usually sharply acute, but not herbaceous. Rays (5)7-8. Disc flowers 19-30; corolla 3.8-5.5 mm long, anthers with blackish thecae 1.2-2.1 mm long. Pales 5-7 mm long. Disc achenes 1.8-2.8 mm high and 1-1.5 mm wide. Ray achenes 1.5-2.5 mm high. Chromosome number, from meiotic material, n=15. In mesic situations from Guerrero to Puebla, at altitudes from 750 m to 2100 m. Blooming July through October.

Selected specimens:

MEXICO: GUERRERO: Iguala Canyon, alt. 2500 ft, Sept. 28, 1905, Pringle 13563 (C, CAS, GH,MICH, MSC, TEX(2),US). MEXICO: Ixtapan de la Sal, Aug. 4, 1960, Paray 3080 (ENCB). 9 km N of Ixtapan de la Sal at km 138 on hwy 55, alt. ca. 1950 m, 18°50"N,99°35" W, Sept. 9, 1965, Roe & Roe 1876 (ENCB MICH,UC). 2 km N of Ixtapan at km 145 on Hwy 55, alt. ca. 1930 m, 18°50" N, 99°25" W, Sept 9-10, 1965, Roe & Roe 1917 (MICH). MORELOS: about 30 km west of Cuautla, alt. ca. 1600 m, Oct. 22, 1970, Fay & Cronquist 104 (NY). Hillsides above Cuernavaca, alt. ca. 5000 ft, July 28, 1896, Pringle 6398 (C,CAS,F,GH,MEXU, MO,MSC,NY,UC,US). PUEBLA: Matamoros, Sept. 7, 1943, Miranda 2892 (MEXU).

22b. Perymenium mendezii var. mendezii.

Perymenium cervantesii DC. Prodr. 5:609. TYPE: MEXICO: Montagnes des environs de Mexico, 1831, Alaman s.n. (HOLOTYPE: G(not seen), microfiche seen at NY; Photo:US).

Perymenium parvifolium Gray Proc. Amer. Acad. Arts 15:36, 1880. TYPE: MEXICO: SAN LUIS POTOSI: In the region of San Luis Potosi, 22° N Lat., alt. 6000-8000 ft., August, 1878, Parry & Palmer 475 (HOLOTYPE: GH; ISOTYPES: F(2), MO(2), NY(2),P,US).

Perymenium rude Robins.& Greenm. Proc. Amer. Acad. Arts 34:526, 1899. TYPE: MEXICO: OAXACA: Ravines of hills of Las Sedas, alt. 5800 ft, August 16, 1894, Pringle 4803 (LECTOTYPE: GH; ISOTYPE: CAS, Photo & fragment: US. Duplicates of Pringle 4803 at F,MEXU,MICH,MO,MSC,NY,P,UC and US are P. sedasanum).

Perymenium subcordatum Blake Contr. U.S. Natl. Herb. 22: 622, 1924. TYPE: MEXICO: OAXACA: On mountains, Tlapancingo, alt. 1830 m to 2440 m, Dec. 7, 1894, E.W. Nelson 2067 (HOLOTYPE: US; ISOTYPE: GH).

Often intricately branched and tangled shrub, sometimes climbing in other vegetation. Leaves lanceolate to lance-ovate or ovate, 2.5-5.5 cm long, 1-3 cm wide, subentire to serrate,

with 10 or fewer teeth on a side, moderately strigillose above sparsely to moderately strigillose or rarely hispidulous beneath. Basic inflorescence a small 3-5 headed cyme, these usually arising terminally and from upper axils and borne on elongate internodes ca. 7-15 cm long, the cymes rarely reduced to one head each or the individual peduncles, rather than upper internodes, lengthened. Involucre campanulate, 4-5.5 mm high. Outer phyllaries ovate, acute or rounded, usually herbaceous-tipped, sparsely to moderately strigillose, with fine, strongly appressed hairs and more or less ciliate, inner phyllaries progressively longer, less pubescent and less herbaceous, several of the innermost frequently transitional to the pales. Rays most frequently 8. Disc flowers 14-28, corolla 3.7-5.9 mm long; anther thecae 1.5-2 mm long. Pales 5-7 mm long. Chromosome number, from meiotic material n=15, n=30. In desert areas in the central highlands from Chihuahua to Oaxaca, at elevations from 1600 m to 2600 m. Blooming May through December.

Selected Specimens:

MEXICO: AGUASCALIENTES: 6 km al NE de Ojocaliente, alt., 1800 m, Aug. 25, 1960, Rzedowski 14066 (ENCB,MICH). CHIHUAHUA: 10 miles south of Villa Matamoros and 27 miles south of Parral, alt. ca. 5700 ft, Sept. 30, 1965, Cronquist 10250 (NY). 22 miles west of Chihuahua, Oct. 21, 1963, Cummins 63-408 (MICH). Crest of the Sierra de Zarca, road from Bermejillo west to the Palmito Dam, alt. ca. 6800 ft, Sept 19, 1938, Johnston 7778 (GH). Meoqui, Aug. 6, 1936, LeSueur 1009 (F,TEX). Sierra Azul (Sierra Mapula)

southwest of Mapula, alt. 1600-1700 m, Sept. 10, 1934, Pennell 18641 (MICH,NY). Hills south of Organos, northern slopes of the igneous Sierra de Los Organos, ca. lat. 28°18"N, Oct. 5-6, 1941, Stewart & Johnston 2064 (GH,TEX). DURANGO: Along road from J.G. Aguillera to Guatimape, between KMs 32 & 33, alt. ca. 6000 ft, Aug. 13, 1965, DeJong 1757 (MSC). Foothills of the Sierra Madre Occidental, about 10 km west of Durango, alt. ca. 1700 m, Oct. 5, 1970, Fay & Cronquist 100 (NY). Mexico Hwy 45, 3 miles N of Rodeo, Nov. 9, 1964, Flyr 333 (MSC,TEX). Tejamen, Aug. 21-27, 1906, Palmer 544 (F,GH,MO,NY,UC,US). Cerro de los Remedios, Sierra Madre Occidental, alt. 1900-2000 m, Aug. 24, 1934, Pennell 18128 (NY,US). Mountain slopes south of La Purisima, alt. 7800 ft, Aug. 26, 1939, Shreve 9185 (GH,MICH,UC). GUANAJUATO: Sierra de Guanajuato, alt. 2000 m, 1872, M.E. Guillemin-Tarayre s.n. (GH). 22-23 km west of Dolores Hidalgo, elev. 2100-2200 m, Nov. 9, 1970, McVaugh 24096 (MICH). Along route 57, 76 miles north of Queretaro, 5 miles south of Santo Domingo, Sept.10, 1962, Turner & Powell 1125 (TEX). Pachuca, Hidalgo, alt. 8050 ft, July 19, 1935, Fisher 35238, (F,MO,NY,P,US). HIDALGO: 10 km S of Ixmiquilpan, alt. 1900 m, June 5, 1966, Gonzalez Quintero 3603 (ENCB). Cerro Juarez, cerca de Tasquillo, alt. 2600 m, Aug. 5, 1956, Paray 2039 (ENCB). JALISCO: Paso de la Troje, near km. 26 southwest of Ojuelos on road to Aguascalientes,

alt. 2100-2300 m, Aug. 9-12, 1958, McVaugh et al 16751 (MICH (2)). 9 mi E of La Punta, district de Lagos, Sept. 1, 1939, Shreve 9293 (GH,MICH,UC). MEXICO: Lecheria, valley of Mexico, alt. 7500 ft, July 4, 1904, Pringle 8816 (C,F,GH,MEXU,MO,MSC, NY,TEX,UC,US). OAXACA: About 15 km north of Telixtlahuaca, along road to Tehuacan, alt. 2100 m, Nov. 13, 1970, Fay & Cronquist 118 (NY). 2 mi NE Huajuapan, July 28, 1960, King 3535 (DS,MEXU,MICH,TEX,UC,US). Vicinity of Yalalag, alt. 4000-7800 ft, July 1894, Nelson 954 (GH,US). QUERETARO: alt. 7000 ft, July 1904, Kuntze 23433 (NY(3)). Near San Juan del Rio, Aug. 18, 1905, Rose et al 9546 (GH,NY,US). SAN LUIS POTOSI: Along paved road to Zacatecas, 8.5 miles northwest of San Luis Potosi, elev. 6200 ft, Sept. 8, 1966, Breedlove 15470 (CAS,ENCB,MICH). Charcas, July-Aug. 1934, Lundell 5297 (MEX,MICH,MO,UC,US). Presita atras del Cerro de La Corona,Sierra de San Miguelito, alt. 1900 m, July 18, 1959, F. Medellin-Leal 1259 (ENCB). Cerro del Gallo 3 km al S de Gallinas , alt. 2280 m, Oct. 4, 1962, F. Medellin-Leal 1500 (ENCB). Santa Maria del Rio, June 23, 1954, Rzedowski 3201 (ENCB). Km 15 carretera San Luis-Matehuala, alt. 1750 m, July 1, 1954, Rzedowski 3301 (ENCB). ZACATECAS: Road from Zacatecas to Guadalajara via Jalpa, 11.5 miles S of Villanueva, Km. 235, alt. 2160 m, Dec. 30, 1969, Anderson & Anderson 5262

(ENCB,MICH). Pass through Sierra Papanton near hwy, alt. 2400-2500 m, Sept. 25-30, 1948, Gentry 8559 (GH,MICH,US(2)). Crest 4 miles south of Noria de Angeles, alt. 7400 ft, Sept. 6-8, 1938, Johnston 7464 (TEX,US).

22c. Perymenium mendezii var. angustifolium (Brandeg.) Fay. Perymenium angustifolium Brandeg. Zoe 5:260, 1908. TYPE: MEXICO: PUEBLA: Cerro San Luis, July-Aug. 1907 or 1908, Purpus 2518 (HOLOTYPE: UC; ISOTYPES: F,GH,MO,NY,UC,US).

Perymenium blepharolepis Blake Proc. Amer. Acad. Arts 51:522, 1916. TYPE: MEXICO: PUEBLA: Coxcatlan, elev. 7000 ft-8000 ft, Sept. 1909, Purpus 4143 (HOLOTYPE:BM(not seen) ISOTYPES: F,GH,MO,NY,UC,US).

Perymenium hypoleucum Blake Proc. Amer. Acad. Arts. 51: 523, 1916. TYPE: MEXICO: PUEBLA: Variously as Cerro de Tunge or San Luis Tultitlanapa, July 9, 1908, Purpus 3087 (HOLOTYPE: BM(not seen);ISOTYPES: F,GH,MO,NY,P,UC,US).

Perymenium lasiolepis Blake Contr. U.S. Natl. Herb. 22:625, 1924. TYPE:MEXICO: PUEBLA: San Simon, Sept. 1909, Purpus 4138 (HOLOTYPE:US;ISOTYPES:F,GH,MO,NY,UC).

Perymenium consobrinum Blake Contr. U.S. Natl. Herb. 22:626, 1924. TYPE:MEXICO: Variously as vicinity of San Luis Tultitlanapa, Puebla or Las Naranjas, Oaxaca, July 1908, Purpus 3097 (HOLOTYPE:US;ISOTYPES: F,GH).

Leaves 2-5 cm long, 0.6-3 cm wide, acute, with attenuate to truncate base and 3-13 shallow or distinct teeth on a side, subsessile or short-petiolate, the petiole up to 3 mm long, densely strigillose or tomentellous and conspicuously whitish below. Older stems frequently exhibiting conspicuous rounded lenticels. Inflorescence consisting of small (3-6 headed) terminal and subterminal cymes, these either raised on elongate upper internodes or borne close to the leaves, several sometimes borne close together near a branch tip. Involucre campanulate, 3-seriate. Phyllaries very variable in shape and pubescence, lance-attenuate to ovate and acute or even rounded, usually conspicuously herbaceous toward the frequently spreading apex, moderately to densely strigillose to hirsute-pilose with coarse hairs, and conspicuously long-ciliate, outer phyllaries usually most densely pubescent or all equally so. Pales 3.5-5.5 mm long. Chromosome number, from meiotic material, n=45.

Selected Specimens:

MEXICO: PUEBLA: 26 miles southwest of Tehuacan, elev. ca. 6500 ft, Oct. 23, 1965, Cronquist 10391 (NY). Along route 125, 53 miles south of Tehuacan, Aug. 13, 1961, Powell & Edmondson 659 (F,MICH,TEX). Tlacuiloltepac, alt. 7-8000 ft, Aug. 1909, Purpus 4137 (DS,UC). Acatitlan, alt. 6-7000 ft, June 1909,

Purpus 4142 (UC).

P. mendezii, in the broad sense recognized here, encompasses a great deal of morphological diversity among its often strikingly different phases. Despite this diversity, extensive intergradation leads me to recognize only three rather well-defined varieties of a single inclusive species: P. mendezii var. mendezii is a widespread, small-leaved shrub with generally fine and appressed pubescence and small inflorescences, which tends to grow in open, dry areas from Chihuahua to Puebla and Oaxaca, where it intergrades with the other two varieties. P. mendezii var. verbesinoides is a larger-leaved plant with coarser and more frequently spreading pubescence and more ample inflorescences of more mesic habitats from Jalisco to Puebla and Oaxaca. P. mendezii var. angustifolium, the most geographically circumscibed of the three varieties, is known only from the state of Puebla, in the vicinity of Puebla and Tehuacan. It is nevertheless extremely variable morphologically, resembling in general P. mendezii var. mendezii, but differing largely in having leaves distinctly whitened beneath with dense strigillose or hispidulous pubescence and phyllaries often densely hirsute and lance-ovate or lanceolate. In its pubescence, the latter variety often appears to be intermediate between var. mendezii and one of three densely pubescent species found in Puebla and Oaxaca: P. discolor, P. ovatum or P. klattianum.

Given this apparent intermediacy as well as the extraordinary variability of P. mendezii var. angustifolium, it seems likely that this variety is of hybrid origin, deriving from intro-

gression between var. mendezii and one of the three other species mentioned above. Morphologically, var. angustifolium is almost perfectly confluent with var. mendezii and quite distinct from P. discolor, P. ovatum and P. klattianum.

Intermediates between vars. mendezii and verbesinoides are scattered within the range of var. mendezii but are most strikingly represented in Oaxaca where almost all populations are intermediate in some way or other.

The extremely complex pattern of variability in this species seems to be related to partial isolation in widely separated populations of small size, a situation which became apparent during field work related to the present revision. This isolation seems to have promoted the differentiation of seemingly distinct local populations, which can, however, be seen to intergrade completely when considered as a whole. The three varieties recognized here represent what I believe to be the major modes within this morphological continuum.

Selected intermediates between vars. mendezii and verbesinoides:

MEXICO: AGUASCALIENTES: Road to Calvillo west of Aguascalientes near Km 40, alt. 1850 m, Aug. 25, 1960, McVaugh 18325 (MICH). JALISCO: Along route 15, ca. 48 miles SE of Guadalajara, Aug. 7, 1960, R.M. King 3654 (DS,MEXU,MICH,NY,TEX,UC,US). Tequila, July5-6, 1899, Rose 4749 (MEXU). PUEBLA: Vicinity of Puebla, hacienda de Santa Barbara, alt. 2160 m, July 16, 1910, Arsene & Nicolas 5267 (GH,MICH,MO,NY,US). OAXACA: Slope 5 miles northeast of Mex. Hwy 190 near Oaxaca along road to Ixtlan de Juarez,

alt. 6500 ft, Aug. 26, 1965, Breedlove 12197 (CAS,ENCB,MICH,NY, US). 24 km NE of Sola de Vega along road to Oaxaca, alt. 5800 ft, Aug. 30, 1965, Breedlove 12281 (CAS,ENCB,MICH,NY). Slope of Sierra San Felipe, overlooking Diaz-Ordaz, ca. 20 km NE of Tlacolula, alt. ca. 2600 m, Nov. 12, 1970, Fay & Cronquist 117 (NY).

23. Perymenium subsquarrosum Robins. & Greenm. Proc. Amer. Acad. Arts 34: 524 1899. TYPE:MEXICO: ZACATECAS: Near Plateado, Sept. 2-4, 1987, Rose 3649 (LECTOTYPE:GH;ISOTYPE: GH,US).

Branching shrub to ca. 1 m high. Leaves ovate, 2.5-7 cm long, 1-3 cm wide, acute or attenuate, with rounded base, serrate, with 5-9 shallow or somewhat excurrent teeth on a side, scabrid above, with short, sharp, curved, tuberculate-based hairs, sparsely rough-hispidulous below, chiefly along the veins; petiole up to ca. 5 mm long or nearly lacking. Stem slender, moderately strigose and barely rough to the touch. Inflorescence a cyme of ca. 2-5 heads, these raised considerably above the foliage by elongation of upper internodes or individual peduncles. Involucre campanulate or broadly cylindric, 2-3-seriate, 5-7 mm high, 7-10 mm wide; phyllaries strigose and ciliate, nearly equal, the outer slightly shorter, basal portion ovatish, usually somewhat constricted above this, with a loose, orbicular to oblongish, obtuse or acute, spreading herbaceous apex, some of the innermost usually narrower and lacking herbaceous apex. Rays usually 8; lamina 9-11 mm long, tube 1.5-2 mm long. Disc flowers

20-25, corolla 5-7 mm long, with cylindric throat and narrow tube, lobes 0.7-1.0 mm long; anthers with blackish thecae 2.0-2.3 mm long and appendages 0.7-0.9 mm long; style branches 1.5-2 mm long, abruptly contracted to a short, narrow appendage. Pales 7-8.5 mm long, with ciliate keel. Disc achenes 4 mm long, 2 mm wide, biconvex or compressed-tetragonal, with or without small marginal awns, tuberculate and tufted-strigillose. Pappus of 15-20 deciduous awns, adaxial one up to 4.7 mm long. Ray achenes similar to those of disc, but triquetrous and somewhat shorter and broader. Receptacle flattish or slightly convex. In Jalisco, Zacatecas and Aguascalientes in western Mexico at altitudes from 2000 m to 2200 m, blooming August and September.

Specimens examined:

MEXICO: AGUASCALIENTES: Foothills of Cerro de los Gallos, ca. 15 miles S of Aguascalientes, ca. 2 miles W of Hacienda Las Rosas, alt. ca. 2100 m, Aug. 18, 1958, McVaugh 17124 (MICH). 28 km W de Aguascalientes,,sobre el camino a Calvillo, alt. 2200 m, Aug. 25, 1960, Rzedowski 14038 (ENCB,MEXU,US). JALISCO: Road to Huejuquilla el Alto, 1 mile west of the road junction 18 miles south of Valparaiso on the road to Mexquitic, alt. 2000-2100 m, Lat. ca. 22°38"N, Long. 103°48"W, Sept. 4-5, 1958, McVaugh 17700 (MICH). ZACATECAS: Near Plateado, Sept. 2, 1897, Rose 2751 (GH,US).

P. subsquarrosum seems to be closely allied to P. mendezii var. mendezii, which it resembles in habit and type of inflorescence. The remarkable spreading, herbaceous phyllaries and larger heads of the former, however, render it easily distinguish-

Fig. 4

Perymenium sedasanum Fay, sp. nov.

A - habit, x ½

B - ray flower, x 5

C - disc flower with enfolding pale, x 5

D - disc achene, x 10

E - ray achene, x 10

F - involucre, x 2½

G - head, x 2½

H - undersurface of leaf, x 1½

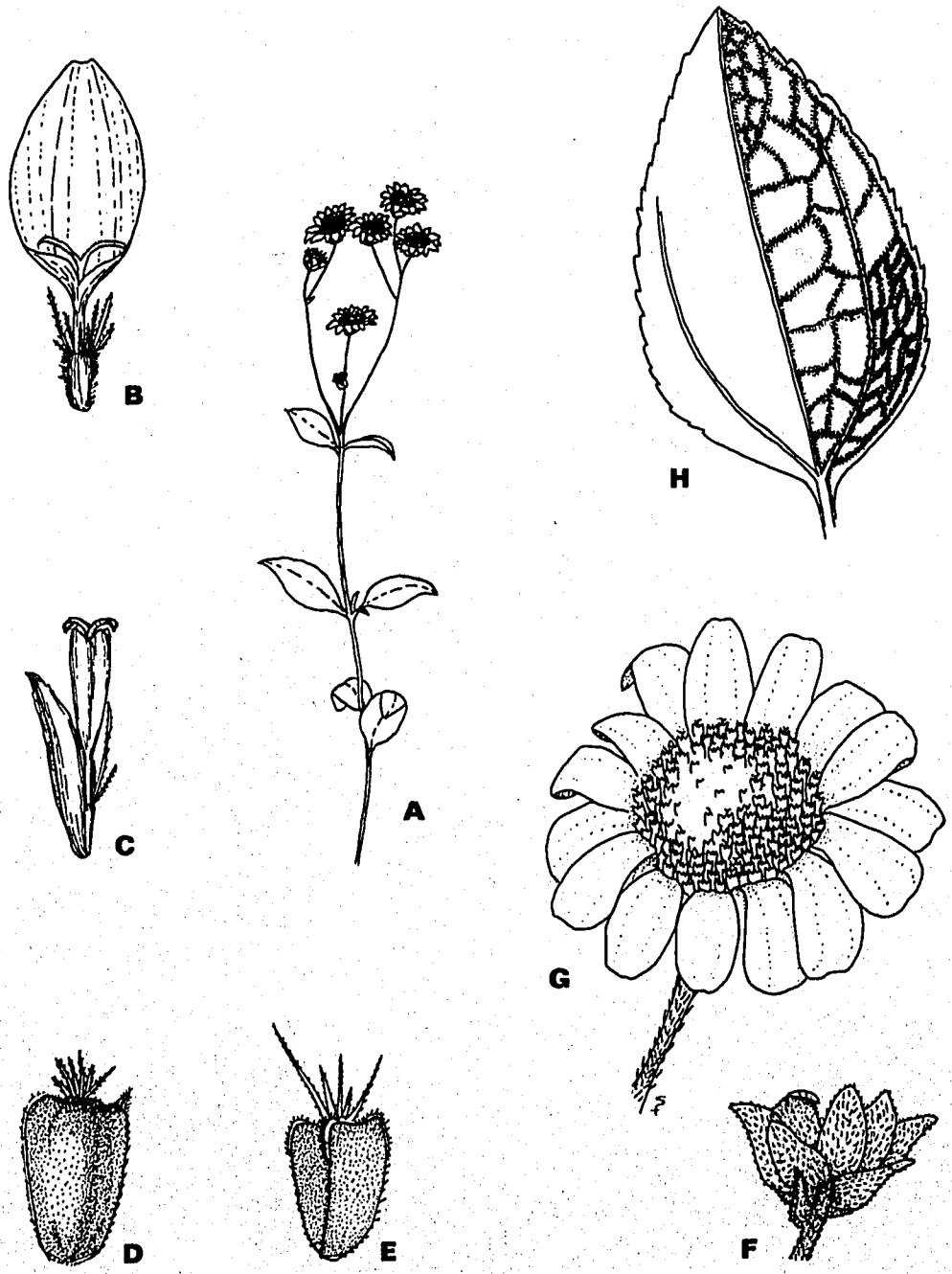

FIG. 4

able. Geographically, the few known collections of P. subsquarrosum occupy a range marginal to that of P. mendezii var. mendezii.

24. Perymenium sedasanum Fay sp. nov. TYPE: MEXICO: OAXACA: Las Sedas, alt. 6000 ft, Sept. 1894, C.L. Smith 616 (HOLOTYPE: US; ISOTYPES: F(2),MO(2)).

Species a P. mendezii similis, foliis subtus dense hispidulis, pilis convergentibus; palearum apicibus recurventibus, radiis 12-16 differt.

Apparently a freely branched shrub. Leaves ovate to oval- or oblong-ovate, 3-5 cm long, 1.5-2.5 cm wide, acute or blunt, with cuneate or rounded to truncate base, frequently decurrent on the petiole, finely and evenly serrate, with ca. 20 teeth on a side, moderately to densely strigillose above, very densely canescent-hispidulous below, the hairs convergent in the areolae; petioles ca. 1-1.5 cm long. Stem obscurely or distinctly 4-grooved, sparsely strigillose. Inflorescence composed of small (ca. 3-7 headed) cymes or occasionally solitary heads, arising terminally and on side branches from the upper axils. Involucre ca. 5 mm high and as broad, campanulate or hemispheric, 3-seriate; outer phyllaries lanc ovate, with acute, herbaceous, usually spreading apex, moderately fine-strigillose and ciliate. Inner phyllaries generally more oblon but otherwise similar. Rays 12-16; lamina 4.5-5.5 mm long, tube ca. 1-1.5 mm long. Disc flowers ca. 40-60; corolla 2.6-4 mm long, with narrow tube 0.7-1.6 mm long, cylindric throat and deltoid lobes 0.5 mm long; anthers with brownish or blackish thecae 1.1-1.3 mm long and yellowish, ovate appendage 0.2-0.5 mm long; style branches ca. mm long, including the sharply acute, minutely hispidulous appenda Pales 4.3-5.2 mm long, ciliate-keeled, with a sharply acute,

strongly reflexed apex. Disc achenes biconvex, 2-2.5 mm high, 1.2-1.3 mm wide, smoothish and tufted-strigillose on the faces, densely puberulent near the apex, sometimes inconspicuously winged on the upper angles. Pappus of ca. 20 deciduous awns, the adaxial one usually longest, up to 2 mm in length. Ray achenes obcompressed-triquetrous, 1.5-2.3 mm high, 0.9-1.6 mm wide, otherwise similar to those of disc. Receptacle low-convex. Known only from the vicinity of Las Sedas, Oaxaca at altitudes from 1700 m to 1900 m, blooming August and September. Fig. 4.

Selected Specimen:

MEXICO: OAXACA: Ravines of hills of Las Sedas, alt. 5800 ft, Aug. 16, 1894, Pringle 4803 (F,MEXU,MICH,MO,MSC,NY,P,UC,US.)

Perymenium sedasanum appears to be a very distinct, very local species. The dense and rather peculiar pubescence on the undersurface of the leaves, the sharply recurved apex of the pales, and the relatively large number of both ray and disc flowers in a head, none of which is unique when taken by itself, nevertheless are unique and distinctive in combination. Its closest relative is probably P. mendezii . Apparently, however, P. sedasanum and P. mendezii var. mendezii are closely sympatric near Las Sedas, without any indication of intermediates. Pringle 4803, the Harvard sheet of which is the lectotype of P. rude (= P. mendezii var. mendezii), is a mixed collection containing totally distinct elements of P. mendezii var. mendezii and P. sedasanum. Of the duplicates of this collection that I have examined, only the Harvard sheet represents P. mendezii var.

mendezii, the others are all P. sedasanum. The possible distinctness of P. sedasanum was first noted by Blake (1924) in the protologue of P. chihuahuense (=P. mendezii var. mendezii).

25. Perymenium oxycarphum Blake Contrib. U.S. Natl. Herb. 22:622, 1924. TYPE: MEXICO: MICHOACAN OR GUERRERO: Real de Guadelupe, alt. 1300 m, Sept. 15, 1898, Langlasse 354. (HOLOTYPE: US; ISOTYPES: MICH,P.)

Perymenium jaliscense Robins. & Greenm. var. latifolium Mc Vaugh, Contr. Univ. Michigan Herb., 9:439 1972. TYPE: MEXICO: JALISCO: Llano Verde cerca de los Corales, alt. 1600 m, Oct. 24, 1963, Rzedowski 17415 (HOLOTYPE: MICH; ISOTYPE: ENCB).

Herb, sometimes woody near the base, up to ca. 1 m high, with one to several usually simple, annual stems arising from a stout or occasionally slender and branching woody caudex. Leaves (3-10 pairs) ovate to lance-ovate, acute or obtuse, with truncate or broadly cuneate base, serrate, with 5-15 shallow or prominent teeth on a side, sparsely strigillose or hispidulous on both surfaces; petiole 2-10 mm long. Stem erect or somewhat decumbent, 4-grooved, sparsely to moderately strigillose or hispidulous. Heads solitary or in small cymes, arising terminally and from upper axils, usually raised above the foliage on lengthened internodes up to 25 cm long. Involucre campanulate, 4-5.5 mm high, 4.5-6.5 mm wide, 3-seriate. Phyllaries ovate to oblong, acute to acuminate or occasionally rounded,

the outer ones moderately strigillose and conspicuously ciliate at least near the base, the inner ones less so. Rays 7-11; lamina (6.8) 10.5-15 mm long, tube 1-1.8 mm long. Disc flowers ca. 30-50; corolla 3.8-6 mm long, with slender tube 1-2.4 mm long, cylindric throat and broadly or narrowly deltoid lobes 0.6-1.1 mm long; anthers with blackish thecae 1.4-2.2 mm long and ovate appendage 0.4-0.8 mm long; style branches ca. 1-1.5 mm long, including the abruptly or gradually acute, hispidulous appendage. Pales 4.4-8 mm long, acute or subacuminate. Disc achenes ca. 3-4 mm long and 2 mm wide, plumply biconvex, finely strigillose. Pappus either of ca. 20 deciduous awns, the adaxial one longest, up to 3 mm in length, or essentially 2-awned, with all but the adaxial and abaxial awns rudimentary. Ray achenes slightly shorter, triquetrous, otherwise similar to those of disc. Receptacle low-convex. From Sinaloa to Oaxaca, mostly on Pacific slope of the Sierra Madre Occidental at elevations from 1000 m to 2400 m, blooming August through October.

Selected specimens:

MEXICO: GUERRERO: Zitaquaro-Filo Mayor, Mina, alt. 1700 m, Aug. 20, 1936, Hinton et al 9296 (MICH,NY,UC). JALISCO: Las Vidrieras, 10 km al NW de El Platanar, alt. 2450 m, Sept. 1, 1968, Rzedowski 26190 (ENCB,MICH). Sierra de La Venta, al W de Guadalajara, Sept. 8, 1968, Villarreal de Puga 2037 (ENCB). MEXICO: 8 km al WSW de Luvianos sobre el camino a Nanchititla, alt. 1800 m, Sept. 2, 1965, Rzedowski 20693 (ENCB). MICHOACAN: Tancitaro region, forest above Acahuato, elev. 3500 ft, Aug. 23, 1941, Leavenworth & Hoogstraal 1802 (F). NAYARIT: SW slopes

of Cerro Sanganguey, 11 miles south of Tepic, alt. ca. 1600-1800 m, Aug. 24, 1959, Feddema 937 (MICH). Km 870, 22 miles Se of Tepic, alt. 1150 m, Aug. 26, 1957, McVaugh 16407 (MICH). OAXACA: Pacific slopes of Sierra Madre del Sur, along road to Puerto Angel, 16 miles S of San Miguel Suchixtepec, alt. 1550 m, July 16, 1968, Anderson & Anderson 4812 (MICH). SINALOA: Ocurahui, Sierra Surotato, alt. ca. 6000-7000 ft, Sept. 1-10, 1941, Gentry 6444 (NY). Cerro de la Sandia NE of Panuco, Aug. 29-30, 1935, Pennell 20051 (NY).

P. oxycarphum is the oldest name for what appears to be a very widespread but sparsely represented herbaceous species of western and southern Mexico, with broad leaves and an imbricate involucre. Upon consideration of material from through out this range, P. jaliscense var. latifolium appears to be merely a part of this more widely distributed taxon. P. oxycarphum resembles both P. jaliscense and P. buphthalmoides, which are also relatively low herbs producing annual flowering stems from a perennial caudex. The present species, however, has broader leaves than P. jaliscense (at most twice as long as wide), and an imbricate involucre which distinguishes it from P. buphthalmoides.

26. Perymenium jaliscense Robins. & Greenm. Amer. J. Sci. 50: 154, 1895. TYPE: MEXICO: JALISCO: Rio Blanco, Aug. 1886, Palmer 310 (HOLOTYPE: GH; ISOTYPES: NY(2),US).

Several-stemmed herb from a woody caudex, apparently to ca.

5 dm high, sparsely to moderately strigillose throughout.. Leaves narrowly lanceolate, 2-5 cm long, 1-1.6 cm wide, acute, with rounded base, entire or shallowly or distinctly serrate, with 1-7 teeth on a side, petiole 3-15 mm long. Stem 4-grooved, simple or sparingly branched below the inflorescence. Heads solitary or in small (2-5-headed) terminal or subterminal cymes, long-peduncled. Involucre campanulate, 3-4 seriate, 4.5-5.5 mm high, 4.5-5.0 mm wide. Outer phyllaries ovate, acute, finely ciliate; middle series similar, but usually broader and obtuse; innermost oblong, acute, transitional to the pales. Rays 5-6; lamina 7 mm long, tube 1.5 mm long. Disc flowers ca. 25; corolla ca. 5 mm long, with narrow tube 1-2 mm long, cylindric throat, and deltoid lobes 0.5-1 mm long; anthers with blackish thecae 1.5-2 mm long and ovate appendage 0.5 mm long; style branches ca. 1.5 mm long, including the acute, hispidulous appendage. Pales 4.7-5.5 mm long, narrowly keeled, with acute, erect apex. Disc achenes plumply biconvex, 2.5-3.1 mm high, 1.7-2.2 mm wide, with or without slender marginal awns ca. 0.5 mm long, tuberculate and essentially glabrous or tufted-strigillose on the faces, minutely puberulent near the apex. Pappus consisting of up to ca. 15 deciduous awns, the adaxial one longest, up to ca. 2 mm in length, the others frequently reduced or mostly wanting. Ray achenes plumply triquetrous, 2-2.5 mm high, 1.8-3 mm wide, otherwise similar to those of disc. Receptacle low-convex. Known only from the area north and west of Guadalajara in the state of Jalisco, at altitudes from ca. 1700 m to 1900m, blooming August through October.

Selected specimens:

MEXICO: JALISCO: Near Guadalajara, Aug. 23, 1893, Pringle 5426 (GH). Sierra de San Esteban near Guadalajara, alt. 6000 ft, Oct. 21, 1903, Pringle 11818 (C,GH,MICH(2),MO,TEX(3),UC,US). Etzatlan, Oct. 23, 1903, Pringle 11819 (TEX).

P. jaliscense is a very distinct species which apparently is rare even within its rather limited known range. McVaugh (1972) has recognized a wider-leaved plant from the same general area as P. jaliscense var. latifolium. I have here included this variety in P. oxycarphum, a widespread and variable species which is undoubtedly related to P. jaliscense but differs principally in its broader leaves. P. jaliscense proper appears to be a rather local and monomorphic taxon.

27. Perymenium cornutum Brandeg. Univ. Calif. Publ. Bot. 4:192 1911. TYPE: MEXICO: SAN LUIS POTOSI: Agua Media, Nov. 1910, Purpus 4767 (HOLOTYPE: UC; ISOTYPES: F,GH,MO,US).

Probably a barely woody perennial . Leaves ovate or lance-ovate, 3.5-8 cm long, 1.5-4 cm wide, acute to attenuate, with truncate or subcordate base, serrate, with ca. 15-25 teeth on a side, sparsely to moderately hispidulous and stipitate-glandular on both surfaces, glands particularly conspicuous along veins below; petiole 8-12 mm long, conspicously glandular on the abaxial surface. Stem 4-grooved, sparsely to moderately strigillose or hispidulous and moderately to very densely gland-

ular. Inflorescence terminal, openly branched, heads disposed on elongate, sparsely strigillose and moderately to densely glandular peduncles in 3-headed cymes or, rarely, solitary and terminal. Involucre campanulate, 5-6 mm high and ca. 5 mm wide, 3-seriate. Phyllaries all lance-ovate or the inner ones lanceolate, moderately strigillose and sometimes sparsely glandular, obscurely ciliate. Rays 6-8; lamina 7-8 mm long, tube ca. 1 mm long. Disc flowers 25-35; corolla 4-6 mm long, with narrow tube 1.2-1.9 mm long, cylindric throat and deltoid lobes 0.5-1 mm long; anthers with blackish thecae 1.5-2.2 mm long and ovate appendage 0.4-0.6 mm long; style branches ca. 1-2 mm long, including the often indistinct, acute, minutely hispidulous appendage. Pales 5.3-7.5 mm long, with acute, rigid, erect, scabrid apex and narrow, ciliate keel. Disc achenes biconvex, 2.5-3.8 mm high, 1.9-2.5 mm wide, tuberculate and tufted-strigillose on the faces, minutely puberulent near the apex, with or without slender marginal awns up to ca. 1 mm long. Pappus of ca. 15 deciduous awns, the adaxial one usually longest and thickest, up to ca. 4 mm in length. Ray achenes triquetrous or obcompressed-triquetrous, otherwise similar to those of disc. Receptacle obscurely or distinctly convex. Known from San Luis Potosi, Hidalgo and doubtfully Vera Cruz, blooming July through November.

Selected Specimens:

MEXICO: HIDALGO: Entre Nicolas Flores y Santuario, Sept. 16, 1961, Paray 3211 (ENCB). SAN LUIS POTOSI: Minas de San Rafael, July 1911, Purpus 5247 (F,GH,MO,NY,UC,US). 10 km SW

de Guadalcazar, alt. 1650 m, Nov. 2, 1954, Rzedowski 5395 (ENCB). VERA CRUZ: Barranca de Santa Maria Zacuapan, Nov. 1911, Purpus 5616 (F,GH,UC).

Perymenium cornutum appears to be a very distinct and rather restricted species, known definitely only from 6 collections in San Luis Potosi and Hidalgo. A single collection (Purpus 6516), from Zacuapan, Vera Cruz, may also represent this species, but lacks the glandular pubescence which is its most distinctive characteristic. Final disposition of this Vera Cruz population must await more collections both of it and of typical P. cornutum from San Luis Potosi and Hidalgo.

This species and P. glandulosum are the only two in the genus known to have glandular pubescence. The latter has smaller leaves (2.5-3 cm long, 1 cm wide), which are barely serrate, shorter petioles (ca. 2 mm long), and fewer disc flowers in a head (ca. 17).

28. Perymenium glandulosum Brandeg. Zoe 5:261, 1908. TYPE: MEXICO: PUEBLA: Barranca de Tlacuilosto, August, 1907, Purpus 2525 (HOLOTYPE: UC; ISOTYPES: F,GH,MO,NY,US).

Apparently a small shrub. Leaves lanceolate or lance-ovate, 2.5-3 cm long, 1 cm wide, acute or attenuate, with cuneate or rounded base, shallowly serrate, with ca. 8 teeth on a side, moderately hispidulous and glandular above, sparsely hispidulous and moderately glandular below; petiole ca. 2 mm long, distinctly glandular. Stem ungrooved, moderately to densely

glandular, with scattered, ascending hairs. Inflorescence composed of several small (ca. 5-8-headed) cymes arising terminally and from the upper axils. Involucre 5.5-6.5 mm high, 4-4.4 mm wide, cylindro-campanulate, 3-seriate. Outer phyllaries lance-ovate, acute, sparsely strigillose and densely glandular, glandular-ciliate, with lax, herbaceous apex; inner phyllaries lanceolate, otherwise similar to outer. Rays ca. 8; lamina 7-8 mm long; tube 2 mm long. Disc flowers ca. 17; corolla 4-5.1 mm long, with narrow tube 1-1.7 mm long, cylindric throat and deltoid lobes 0.5-0.6 mm long; anthers with blackish thecae 1.5-1.6 mm long and ovate appendage 0.4 mm long; style branches ca. 1 mm long, including the long-acute, minutely hispidulous appendage. Pales 5.2-5.4 mm long, narrowly keeled, with erect acute apex. Disc achenes biconvex, ca. 2.3-2.4 mm high and 1.2-1.4 mm wide, smoothish and tufted-strigillose on the faces, minutely puberulent near the apex. Pappus of ca. 15 deciduous awns. Ray achenes obcompressed, otherwise similar to those of disc. Receptacle low-convex. Known only from the type.

The affinities of P. glandulosum remain obscure. The only obviously similar species is P. cornutum, the only other member of the genus known to have glandular pubescence.

29. Perymenium asperifolium Schultz Bip ex Klatt, Leopoldina 23: 143, 1887. TYPE:MEXICO: OAXACA: Ejutla, October 1842, Liebmann 568 (HOLOTYPE: C; ISOTYPE: P; Drawings: GH; Photo: US).

Distinctly woody shrub to ca. 1.5 m in height. Leaves ovate, 3.3-5.4 cm long, 1.3-3 cm wide, acute, with truncate or subcordate base, moderately hispidulous above, densely hispid-pilose beneath, petiole 3-4 mm long. Stem indistinctly 4-grooved, moderately hispidulous or strigillose. Heads solitary or up to ca. 10, terminal and from the upper axils of leafy branches. Peduncles moderately hispidulous or strigillose. Involucre ca. 10 mm high and 8 mm wide, campanulate, in 3 nearly equal series. Phyllaries lance-ovate, acute, moderately hirsute-strigose and long-ciliate, with appressed or subspreading herbaceous apex. Rays ca. 8-12; lamina 8-8.5 mm long, tube 1.5 mm long. Disc flowers ca. 40; corolla 5-5.6 mm long, with narrow tube 1.4-1.7 mm long, cylindric throat and deltoid lobes 0.7-0.9 mm long, anthers with blackish thecae 1.7-1.8 mm long and ovate appendage 0.6 mm long; style branches ca. 1.5 mm long, tapering gradually to an acute apex, without well-defined appendage Pales 5.9-6.7 mm long, narrowly keeled, with erect, acute, sometimes distinctly hispidulous apex. Disc achenes ca. 2.5-3 mm high and 1.5 mm wide, biconvex, smooth and essentially glabrous. Pappus of ca. 10-15 deciduous awns, the adaxial one longest, up to ca. 2.5 mm in length. Ray achenes triquetrous, slightly broader, otherwise similar to those of disc. Receptacle low-convex. Scattered localities in Oaxaca and Puebla at altitudes from ca. 1700 m to 2300 m, blooming July through October.

Specimens examined:

MEXICO: OAXACA: About 21 km south of Oaxaca along the road to Ejutla, alt. ca. 1700 m, Nov. 7, 1970, Fay & Cronquist 113

(NY). About 40 km NNW of Telixtlahuaca, along road to Tehuacan, alt. ca. 1900 m, Nov. 13, 1970, Fay & Cronquist 119 (NY). PUEBLA: Near Coxcatlan on Cerro Ajuereado and the adjacent valley, alt. ca. 1000-1800 m, July 1961, Smith et al 3609 (F,GH, MEX,NY,TEX,US). La Candelaria, alt. 2250 m, Aug. 24, 1970, Ventura 2148 (ENCB).

Perymenium asperifolium is definitely known at present from only four collections in Oaxaca and Puebla. These are superficially rather diverse, but share peculiarities of involucre and pubescence that argue for uniting them as a single species. A fifth collection (Ventura A. 2148) from Puebla is here included with reservations, It differs from the other known representatives of the species in its less densely pubescent leaves with fewer teeth (ca. 5 on a side) and its blunt phyllaries. In other respects, however, it agrees well with P. asperifolium and may well be within the normal limits of variation of the species. These limits should become more apparent if and as more material becomes available.

30. Perymenium wilburorum McVaugh, Contr. Univ. Michigan Herb., 9:441, 1972. TYPE: MEXICO: JALISCO: 7 miles south of Autlan, toward La Resolana, alt. 3500 ft, July 15, 1949, Wilbur & Wilbur 1751 (HOLOTYPE: MICH).

Slender, distinctly woody shrub to ca. 3 m high. Leaves lance-attenuate, with truncate or subcordate base, 7-8 cm long, 2-3 cm wide, serrate, with ca. 10-20 shallow teeth on a side,

sparsely subappressed-strigillose above, with curved hairs, moderately hispidulous below; petiole 5-10 mm long, often winged with the decurrent blade. Stem slender, 4-grooved, moderately strigillose. Heads usually 3-5, terminating a leafy stem. Involucre broadly turbinate, 2-seriate, 6-10 mm high, 5-6 mm wide across the base. Phyllaries subequal, lanceolate, acute, gibbous at the base, moderately strigillose and distinctly ciliate, with subspreading, herbaceous apex. Rays 8; lamina 10.5-12.5 mm long, tube 1.3-1.6 mm long. Disc flowers ca. 40; corolla 6-6.5 mm long, with indistinct tube 0.8-1 mm long, cylindric throat and deltoid lobes ca. 1 mm long; anthers with brownish thecae ca. 2 mm long and ovate appendages 0.4-0.5 mm long; style branches ca. 2 mm long, including the narrowly acute appendage. Pales 5.5-7.9 mm long, narrowly keeled, with erect, acute, hispidulous apex. Disc achenes biconvex, with distinct marginal awns ca. 0.5 mm long, usually winged on the upper angles, 3-3.5 mm high, exclusive of the marginal awns, 1.4-1.5 mm wide, including the wings, if any, smooth and very sparingly fine-strigillose on the faces and minutely puberulent near the apex. Pappus consisting of ca. 15-20 deciduous awns, attached to a very distinct neck ca.. 0.5 mm high, adaxial awn frequently longest, up to 4 mm in length. Ray achenes triquetrous, otherwise similar to those of disc. Receptacle flat.

Specimen examined:

MEXICO: JALISCO: Slope 2 miles west of Autlan, SW Jalisco, alt. 3000 ft, July 13, 1949, Wilbur & Wilbur 1718 (MICH).

P. wilburorum is a very distinct and apparently local species, known only from two collections near Autlan, in Jalisco. In its subequal phyllaries and shrubby habit, it resembles P. asperifolium, which, however, is coarsely hispid almost throughout and has achenes without either marginal awns or a very distinct neck. P. buphthalmoides and P. diguetii, also with subequal phyllaries, are both distinctly herbaceous, producing only annual flowering stems from an underground caudex.

31. Perymenium buphthalmoides DC. Prodr. 5:609, 1835. TYPE: MEXICO: 1831, Alaman s.n. (HOLOTYPE: G(not seen, microfiche seen at NY); Photos: US(2); Tracing: GH).

Herbaceous perennial to ca. 5 dm high, with ca. 1-10 simple or branched annual stems arising from a woody caudex. Leaves (ca. 3-8 pairs), lance-ovate or lance-oblong to ovate or oblong-ovate, acute or obtusish, with cuneate to truncate or subcordate base, 2-8 cm long, 2.5-3.5 cm wide, serrate or subentire, sparsely strigillose to hirsute or pilose above and below; subsessile or on a petiole up to 6 mm long. Stem erect or ascending, strigillose to hispid-pilose. Heads 1-several, terminal, on peduncles 3-16 cm long. Involucre campanulate to hemispheric, 5-10 mm wide, eventually subrotate; phyllaries in 2 or rarely 3 nearly equal series, lanceolate or lance-ovate, 4-10 mm long, with acute to obtuse or rounded, herbaceous apex and usually gibbous base, sparsely strigillose to densely hirsute or pilose. Rays 7-13; lamina 1-2 cm long, tube(0.5-) 1-2 mm long. Disc flowers 20-50; corolla 3.5-6.5 mm long, with narrow tube 0.5-2.5 mm long, cylindric or narrowly funnelform throat and deltoid lobes 0.5-1

mm long; anthers with blackish or brown thecae 1-2 mm long and ovate appendage 0.4-0.9 mm long; style branches 1.0-1.5 mm long, rather abruptly contracted to a short acute appendage. Pales 3.2-7.7 mm long, apex acute to acicular. Disc achenes plumply compressed-boconvex, 2.0-3.0 mm high, 1.0-2.3 mm wide, smooth and glabrous or puberulent to distinctly tuberculate and tufted-strigillose. Pappus of up to ca. 12 deciduous awns, the adaxial up to 4.5 mm long, the others usually reduced and inconspicuous, or the abaxial nearly as long as the adaxial. Ray achenes obcompressed-triquetrous, slightly shorter and wider, otherwise similar to those of disc. Receptacle strongly convex to hemispheric.

Key to varieties of P. buphthalmoides

1. Pales 3.2-5.5 mm long, apex deltoid-acute
   31a. P. buphthalmoides var. buphthalmoides
1. Pales 5.5-7.7 mm long, apex long-acute, attenuate or acicular.
   2. Plant sparsely strigillose throughout; pales with erect or curved, yellow, acicular apex.
      31b. P. buphthalmoides var. occidentale
   2. Plant distinctly hirsute or pilose at least on involucre and usually elsewhere; pales long-acute or attenuate at apex, not acicular. 31c. P. buphthalmoides var. tenellum

31a. Perymenium buphthalmoides var. buphthalmoides

Perymenium flexuosum Greenm. Proc. Amer. Acad. Arts 41:

263, 1905. P. buphthalmoides var. flexuosum (Greenm.) McVaugh Contr. Univ. Michigan Herb. 9:435, 1972. TYPE: MEXICO: FEDERAL DISTRICT: Serrania de Ajusco, alt. 9500 ft, July 9, 1898, Pringle 7636 (HOLOTYPE: GH).

Stems simple or sparingly branched, sparsely to moderately strigillose or hispidulous. Leaves serrate, with up to 16 teeth on a side, or subentire, with as few as 1 very shallow tooth on a side. Heads solitary or up to 4. Rays 7-10. Pales 3.2-5.5 mm long, usually with an acute deltoid apex, frequently purplish. Chromosome number, from meiotic material: n=30, n=30± 2. Meadows and coniferous forest, mostly in the Sierra Volcanica Transversal of south-central Mexico at altitudes from 1500 m to 2900 m, blooming June through September.

Selected specimens:

MEXICO: AGUASCALIENTES: Sierra del Laurel, cerca de Calvillo, alt. 2500 m, Aug. 27, 1960, Rzedowski 14096 (ENCB). JALISCO: El Terrero, on route 110 at km 59-60 about 20 miles due WSW of Jiquilpan, June 17, 1956, Gregory & Eiten 75 (MICH, MSC). Las Vidrieras, 10 km al NW de El Platanar, alt. 2450 m, Sept. 1, 1968, Rzedowski 26189 (MICH). FEDERAL DISTRICT: Lomas de Sta. Fe, Aug. 1929, Lyonnet 429 (NY). Meadows, Tres Marias Station, alt. 9500 ft, Sept. 7, 1905, Pringle 10051 (C, CAS,F,GH,MEXU,MICH,MO,NY,P,TEX,UC). San Jeronimo, Aug. 1913, Salazar s.n. (US). HIDALGO: 10 km al W de Alfajayucan, alt. 2000 m, July 16, 1965, Gonzalez Quintero 2695 (ENCB). MEXICO: Rancho Tobias, near Villa Guerrero, July 22, 1945, Gilly, Alex-

ander & Xolocoatzi 78 (MICH,NY). Foot of the volcan, Temascaltepec, July 18, 1932, alt. 1410 m, Hinton 1075 (MICH,NY(2),US). Valle de Mexico, Cuajimalpa-Rio Hondo, alt. 2400 m, June 29, 1952, Matuda 26292 (NY). Flor de Maria, Aug. 1, 1890, Pringle 3169 (F,GH(2),MEXU,MICH,MO,MSC,NY,UC,US). 1 km al W de Cahuacan, alt. 2600 m, June 27, 1963, Rzedowski 16820 (ENCB). Cerca de Santo Tomas 15 km NE de Texcoco, sobre la carretera a Calpulalpan, alt. 2550 m, Aug. 17, 1971, Rzedowski 28487 (ENCB). MICHOACAN: Zitacuaro-Guanoro, alt. 1700 m, July 20, 1938, Hinton et al 13041 (MICH(2),NY,US). Along road from Jiquilpan to Ciudad Guzman, ca. 3 km NE and above Puerta El Zapatero, 19°52"N, 103° 03"W, alt. ca. 2400 m, July 30, 1960, Iltis et al 558 (MEXU,MICH, TEX,UC). In mountains along route 15, ca. 24 miles E of Morelia, Aug. 4, 1960, R.M. King 3618 (DS,MEXU,MICH,NY,TEX,UC,US). On road from Tancitaro to Apatzingan, alt. 5000 ft, Aug. 17, 1940, Leavenworth 611 (F,GH,MO). Puerto del Gato, 7 km al NW de Zitacuaro, alt. 1950 m, July 20, 1964, Rzedowski & de la Sota 18350 (ENCB). Angahuan to Pico de Tancitaro via Rancho Capilla, alt. 8000-11000 ft, Aug. 21-22, 1957, Straw & Gregory 1214 (GH,MEXU,MICH). MORELOS: Along route 95, 12 miles N of Cuernavaca, toward Mexico City, Aug. 16, 1961, Powell & Edmondson 731 (F,MICH,TEX). OAXACA: Mountains along route 190, ca. 8 miles SE of Nochixtlan, July 27, 1960, R.M. King 3530 (DS,MICH,NY,TEX,UC,US). PUEBLA: Near hacienda Batam barranca de la Alseseca, vicinity of Puebla, alt. 2120 m, June 13, 1907, Arsene 1481 (US). SAN LUIS POTOSI: 26 miles E of San Luis Potosi, along hwy 86 to Rio Verde, alt. ca. 8000 ft, July 14, 1963, McGregor et al 694 (MSC). El Aguijon, 28 km al SSW de Rioverde, alt. 1850 m, June 8, 1956, Rzedowski

7705 (ENCB). SONORA: Yecora, Aug. 3, 1970, Pennington 115 (TEX). TLAXCALA: 4 km al W de Apizaco, alt. 2450 m, July 8, 1967, Ruiz s.n. (ENCB).

31b. Perymenium buphthalmoides var. occidentale McVaugh Contr. Univ. Michigan Herb. 9:434, 1972. TYPE:MEXICO:JALISCO: Puente San Pedro, 5 miles SW of Tecalitlan, alt. 1200 m, July 16, 1957, McVaugh et al. 15439 (HOLOTYPE: MICH;ISOTYPES: MEXU,TEX

Finely strigillose throughout, sparsely so on leaves and stem, more densely so on peduncles and involucre. Leaves 3-8 cm long, 1-3 cm wide, serrate, with ca. 7-20 teeth on a side. Phyllaries 6-8.5 mm long. Rays 8-10. Disc flowers 30-45; corolla 4-5.5 mm long. Pales 5.8-7.7 mm long, terminating in a smooth, acicular, erect or curved yellow apex. On the Pacific slope in Nayarit, Jalisco and Michoacan, farther inland in Guerrero at altitudes from 300 m to 2100 m, blooming June through August.

Selected specimens:

MEXICO: GUERRERO: 4 km al SE de Tetipac, sobre la carretera a Taxco, alt. 2000 m, Aug. 4, 1968, Rzedowski 26020 (ENCB). JALISCO: Along hwy 110 between Mazamitla and Tamazula, between KMs 60 & 61, alt. 6000 ft, Aug. 4, 1965, DeJong 1677 (MSC). La Palma, June 9, 1892, M.E. Jones 283 (US). Sierra del Halo, near lumber road leaving Colima hwy 7 miles SSW of Tecalitlan, alt. 2000 m, Aug. 15, 1957, McVaugh 16218 (MICH(2),NY,US). Hills near Guadalajara, Aug. 7, 1902, Pringle 8624 (C,F,GH,MEXU,MO,MSC,

NY,P,UC). About 19 miles SSW of Autlan and 3 miles north of La Resolana, alt. ca. 1000 ft, July 6, 1949, R.L. & C.R. Wilbur 1548 (MICH,US). MICHOACAN: Sierra Naranjillo, July 13, 1939, Hinton et al 13925 (F,GH,MO,NY,TEX(2)). NAYARIT: Mountains 10 miles SE of Ahuacatlan on road to Barranca del Oro, alt. 1100-1300 m, July 7, 1957, McVaugh et al 15147 (MEXU,MICH).

31c. Perymenium buphthalmoides var. tenellum (Gray) McVaugh Contr. Univ. Michigan Herb. 9:435, 1972. P. tenellum Gray Proc. Amer. Acad. Arts 15:36, 1879. TYPE:MEXICO: SAN LUIS POTOSI: In the region of San Luis Potosi, alt. 6000-8000 ft, Aug. 1878, Parry & Palmer 450 (HOLOTYPE: GH; ISOTYPES: F,MO,NY).

Perymenium rosei Robins. & Greenm. Proc. Amer. Acad. Arts 34:523, 1899. TYPE:MEXICO:JALISCO: Road between Mesquintec (Mezquitic) and Monte Escobedo, Aug. 26, 1897, Rose 2608 (HOLOTYPE: GH; ISOTYPE: F).

Perymenium simulans Blake Contr. U.S. Natl. Herb. 22:621, 1924. TYPE:MEXICO:DURANGO: Otinapa, July 25-Aug. 5, 1906, Palmer 408 (HOLOTYPE:US; ISOTYPES: F,GH,MO,NY,UC).

Stems simple or rather freely branched. Leaves 2-3.5 cm long, 1-1.5 cm wide, serrate, with 5-11 frequently salient teeth on a side. Peduncles 3-7 cm long. Phyllaries moderately to copiously hirsute or pilose. Pales 5.5-7.5 mm long, narrowly keeled, long-acute to attenuate. Chihuahua and Durango to San

Luis Potosi, in dry montane forests and grasslands, at altitudes from 1500 m to 2800 m, blooming June through November.

Selected specimens:

MEXICO: AGUASCALIENTES: 30 km al W de Aguascalientes, sobre el camino a Calvillo, alt. 2200 m, Aug. 24, 1960, Rzedowski 14015 (ENCB,MSC). CHIHUAHUA: Mojarachic, S.W. of San Juanito, 27°52" N, 108°W, alt. 2140 m, Aug. 11, 1954, I.W. Knobloch 1243 (MICH, MSC). Norogachic, alt. ± 5000 ft, July 18, 1955, Pennington 678 (TEX). Cerro Mohinora, 10 miles S of Guadelupe y Calvo, alt. 2300-2400 m, Nov. 8, 1958, Straw & Forman 1960 (MICH). DURANGO: Meadows along hwy 40, between kms 1106-1107, 2 kms E of La Ciudad, alt. 8000 ft, Aug. 10, 1965, DeJong 1732 (MSC). 13 km N of El Soldaro, on road to Otinapa, alt. 2100 m, Oct. 6, 1970, Fay & Cronquist 101 (NY). Coyotes Hacienda, 63 miles WSW of Durango, alt. 2400-2500 m, July 16, 1955, Maysilles 7856 (MICH, NY,TEX). FEDERAL DISTRICT: Cerro de Santa Catarina, 1951, Paray 29392 (MEXU). GUANAJUATO: Silao, Aug. 1903, Purpus 471 (MO,UC, US). HIDALGO: Cerro Ventoso, entre Pachuca y Real del Monte, alt. 2700 m, Aug. 29, 1965, Rzedowski 20606 (ENCB,MICH,MSC). MEXICO: 2.5 km al NW de Tepozotlan, alt. 2350 m, Aug. 2, 1970, Esquivel Munoz 86 (ENCB). QUERETARO: 15 miles SE of Queretaro alonghwy 45, alt. 6000 ft, Aug. 3, 1956, Fearing & Thompson 148 (MSC,TEX). SAN LUIS POTOSI: Ex convalli San Luis Potosi, du montibus San Miguelito, Sept. 1876, Schaffner 302 (GH,MEXU,NY).

As McVaugh (1972) has pointed out, the highly variable complex which includes P. buphthalmoides cannot reasonably be divided into more than one species, although several more or

less distinctive phases have received specific recognition in the past. The relatively abundant material available at present demonstrates a continuity of morphological variation within and among three general regional groupings which are here recognized as varieties. McVaugh has recognized four varieties in this species. Two of these, however, vars. buphthalmoides and flexuosum do not appear to merit separate recognition at even the varietal level and accordingly I have combined them here.

A single collection from Sonora (Pennington 115, Yecora), tentatively referred to var. buphthalmoides, may represent yet another regional variety, but the only specimen I have examined is incomplete and rather immature. This station is far outside the otherwise known range of the species and, more particularly, of var. buphthalmoides.

P. buphthalmoides is apparently closely related to P. diguetii, which has generally smaller (1-2.5 cm long, 1-2 cm wide) more rotund leaves, a more freeely branching stem and shorter rays (lamina 5-10 mm long).

Habitally, P. buphthalmoides resembles P. jaliscense and P. oxycarphum, both of which have graduate involucres. Other species with strongly herbaceous, subequal phyllaries are P. asperifolium and P. wilburorum, both distinctly woody shrubs.

Selected intermediates between vars. buphthalmoides and occidentale:

MEXICO: AGUASCALIENTES: Sierra del Laurel, near the Jalisco-Aguascalientes border, ca. 10 miles SE of Calvillo, elev. 2500-

2700 m, Aug. 26-28, 1960, McVaugh et al 18351 (MICH). MEXICO: About 5 km al W de Atizapan de Zaragoza, alt. 2500 m, June 24, 1966, Cruz C. 743 (ENCB,MICH). MICHOACAN: Vicinity of Morelia, alt. 1950 m, July 5, 1910, Arsene 5694 (GH,MO,NY(2),US). PUEBLA: Tepoxuchil, Oct. 1909, Nicolas s.n. (P).

Selected Intermediates between vars. buphthalmoides and tenellum:

MEXICO: MEXICO: 2 km al WSW de Lecheria, alt. 2350 m, July 30, 1966, Cruz Cisneros 798 (DS;ENCB(2),MICH). 8 km al E de Coatlinchan, alt. 2600 m, Sept. 17, 1966, Cruz Cisneros 1305 (ENCB,(2), MICH). San Bartolo Naucalpan, alt. 2420 m, Aug. 1963, Rojano s.n. (ENCB). PUEBLA: Entre les haciendas Santa Barbara et Cristo, sur l'Alseseca, alt. 2150 m, June 27, 1907, Arsene 1777 (US). SAN LUIS POTOSI: Cerro al E de Jesus Maria, alt. ca. 2250 m, June 28, 1956, Rzedowski 7889 (ENCB).

32. Perymenium diguetii McVaugh Contr. Univ. Michigan Herb. 9:437, 1972. TYPE: MEXICO: NAYARIT: Sierra del Nayarit, partie occidentale, Diguet s.n. (HOLOTYPE: MICH; Photo: NY).

Rather freely branching perennial herb with several apparently decumbent annual stems arising from a persistent caudex. Leaves ovate to orbicular, 1-2.5 cm long, 1-2 cm wide, crenate-serrate, with ca. 9-15 teeth on a side, above, usually with some longer, coarser hairs along the main veins, pubescence below similar, but frequently more spreading; petioles 1-4 mm long.

Stem sparsely to moderately strigillose or pilose. Heads in groups of 2-3, terminating branches. Peduncles moderately to densely strigillose to hirsute or pilose, ca. 4-5 cm long. Involucre broadly campanulate or nearly rotate in fruiting specimens, ca. 5 mm wide at anthesis. Phyllaries subequal, in 2 series, oblong to lance-ovate, 4-5.5 mm long; acute to obtuse or rounded at the herbaceous apex; somewhat gibbous at base, sparsely strigillose and frequently also rather densely subspreading hirsute. Rays 7-9; lamina 5-10 mm long, tube 1-1.5 mm long. Disc flowers 23-40; corolla 3-3.5 mm long, throat cylindric or somewhat funnelform, tube slender, 0.9-1.2 mm long, lobes deltoid, 0.4-0.6 mm long; anthers with blackish thecae ca. 1 mm long and ovate appendage 0.3-0.4 mm long. Pales sharply acute at the frequently purplish apex, 3-4 mm long, keeled. Disc achenes plumply biconvex, 1.7-2.2 mm high, 1.5-1.8 mm wide, smooth or tuberculate. Pappus of as many as 15 deciduous awns, the adaxial one longest, up to 2 mm in length, the others usually much reduced or rudimentary. Ray achenes triquetrous, 1.7-2 mm high, otherwise similar to those of disc. Receptacle strongly convex.

Selected specimens:

MEXICO: DURANGO: Llano Grande, 42 miles WSW of C. Durango, elev. 2400-2450 m, Aug. 10, 1955, Maysilles 8490-A (MICH). NAYARIT: Between Santa Gertrudis & Santa Teresa, Sierra Madre, territorio de Tepic, Rose 2077 (GH(2),US).

P. diguetii is evidently most closely related to P. buphthalmoides. Within that species it most closely resembles var. tenellum, with which it is a least marginally sympatric. Label data on Maysilles 8490-A suggest that it may have been growing in a moist or marshy habitat. If this proves true, P. diguetii may represent a specialized offshoot of P. buphthalmoides which has adapted to a particular ecological regime. Despite the close resemblance between the two taxa, there are no known intermediates in the area of sympatry.

Doubtful and Excluded Species

Perymenium acuminatum (LaLlave) Blake Contr. U. S. Natl. Herb. 22:627, 1924 = Oteiza acuminata LaLlave (discussed under systematic position of Perymenium).

Perymenium album Watson Proc Amer. Acad. Arts 25:154, 1890. = Calea scabrifolia Benth. & Hook.f.

Perymenium barclayanum DC. Prodr. 5:608, 1836. (TYPE: Mr. Barclay's garden, from Mexico. Holotype G (not seen), microfiche seen at NY.) The type of this species is so immature and fragmentary that it is impossible to assign definitely to any recognized species in the genus.

Perymenium calvum Greenm. Proc. Amer Acad. Arts 40:41, 1904. This plant, known only from the type (Rose 3225, GH!,

US!) was tentatively assigned to Perymenium by Greenman because of a superficial resemblance to P. tenellum (=P. buphthalmoides var. tenellum) in habit and involucre. The completely epappose achenes and hyaline, keelless pales, however, would be very anomalous in Perymenium. Unfortunately the type is rather immature and difficult to place elsewhere. It resembles Wedelia mexicana (Schultz Bip.) McVaugh about as much as it does any species of Perymenium and may well eventually be placed in Wedelia.

Perymenium ruacophilum Donn. Sm. Bot. Gaz. 55:437 1913. - not Perymenium, perhaps Oteiza (see discussion under systematic position of Perymenium).

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Numerical List of Taxa

1. *P. grande*
1a. *P. grande* var. *grande*
1b. *P. grande* var. *nelsonii*
2. *P. nicaraguense*
3. *P. uxoris*
4. *P. jalapanum*
5. *P. gymnolomoides*
6. *P. episcopale*
7. *P. reticulatum*
8. *P. pringlei*
8a. *P. pringlei* var. *pringlei*
8b. *P. pringlei* var. *lancifolium*
8c. *P. pringlei* var. *croceum*
9. *P. gracile*
10. *P. klattianum*
11. *P. discolor*
12. *P. stenophyllum*
13. *P. ovatum*
14. *P. ghiesbreghtii*
15. *P. pinetorum*
16. *P. chloroleucum*
17. *P. globosum*
17a. *P. globosum* var. *globosum*
17b. *P. globosum* var. *rotundisquamum*

18. P. macrocephalum
19. P. alticola
20. P. berlandieri
21. P. hintonii
22. P. mendezii
22a. P. mendezii var. verbesinoides
22b. P. mendezii var. mendezii
22c. P. mendezii var. angustifolium
23. P. subsquarrosum
24. P. sedasanum
25. P. oxycarphum
26. P. jaliscense
27. P. cornutum
28. P. glandulosum
29. P. asperifolium
30. P. wilburorum
31. P. buphthalmoides
31a. P. buphthalmoides var. buphthalmoides
31b. P. buphthalmoides var. occidentale
31c. P. buphthalmoides var. tenellum
32. P. diguetii

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Anderson 4812 (25); 4858 (11); 4903 (18); 5191 (31c); 5262 (22b).

Andrieux 305 (11); s.n. (22b).

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Palmer 1886: 310 (26); 1896: 320 (22b); 1902: 43 (22b); 1904: 202 (31a); 1906: 231 (22b); 408 (31c); 544 (22b).

Paray 648 (31a-c); 768 (31a); 1195 (31a); 1347 (20); 2039 (22b); 2163 (22b); 2183 (20); 2243 (17a); 2395 (31a); 2429 (31a); 2795 (20); 2839 (20); 2938 (31a); 2953 (22b); 3080 (22a); 3211 (27); 3215 (20); 3338 (17a); 29392 (31c).

Parry 450 (31c); 475 (22b);

Paxson 17M809 (6).

Peck 284 (5).

Pennell 17644 (22b); 18128 (22b); 18641 (22b); 19567 (12); 19685 (12); 19903 (8a); 20051 (25).

Pennington 115 (31a); 678 (31c).

Penalosa 749 (31a).

Pineda R. 566 (20); 592 (20).

Pittier 1906 (1a).

Powell 654 (22c); 659 (22c); 731 (31a); 781 (6).

Pringle 152 (22b); 1096 (22b); 2338 (8a); 3169 (31a); 4650 (11); 4803 (F,MEX,MICH,MO,MSC,NY,P,UC,US) (24); 4803 (CAS,GH) (22b); 5426 (26); 6398 (22a); 7610 (20); 7636 (31a); 7658 (20); 8264 (20); 8351 (20); 8397 (22a); 8416 (18); 8462 (20); 8591 (22b); 8624 (31b); 8816 (22b); 9091 (22a); 9322 (31a); 10051 (31a); 10354 (17a); 10385 (18); 11559 (20); 11818 (26); 11819 (26); 13071 (20); 13563 (22a); 13651 (18); 13994 (20); 15041 (20).

Purpus 8 (20); 174 (20); 345 (15); 460 (22b); 471 (31c); 1163 (10); 1169 (22c); 1338 (22b); 1537 (20); 1538 (20); 2518 (22c); 2518A (22c); 2525 (28); 2527 (13); 3086 (13); 3087 (22c); 3097 (22c); 3509 (11); 4123 (11); 4136 (11); 4137 (22c); 4138 (22c); 4140 (22c); 4141 (22c); 4142 (22c); 4143 (22c); 4767 (27); 5159 (27); 5247 (27); 5616 (27); 6639 (14); 6647 (1b); 9072 (15); 9073 (1b); 10245 (15); 15352 (5); s.n. (22b); s.n. (22c); s.n. (22c).

Ramirez s.n. (18).

Record s.n. (5).

Renson 50 (1a).

Rock M-454 (22b).

Roe 375 (22a); 1014 (1b); 1123 (1b); 1278 (10); 1876 (22a); 1917 (22a).

Rojano s.n. (31a-c).

Romero 28 (5).

Rosalio Gomez 1075 (1a).

Rosas 453 (10).

Rose 1991 (8c); 2077 (32); 2252 (8c); 2321 (8c); 2608 (31c); 2715 (23); 3313 (32); 3649 (23); 4628 (11); 4749 (22a-b); 4858 (22b); 5453 (31a); 5880 (22b); 6611 (22a); 8441 (31a); 8979 (22b); 9302 (18); 9331 (18); 9546 (22b); 11053 (22a); 11402 (22b).

Ruiz B. s.n. (31a).

Rusby 355 (18).

Rzedowski 2170 (20); 2292 (20); 3156 (22b); 3201 (22b); 3301 (22b); 4925 (27); 5395 (27); 6901 (5); 7705 (31a); 7889 (31a-c); 9004 (22c); 9795 (5); 11257 (22b); 11419a (22b); 14015 (31c); 14038 (23); 14066 (22b); 14096 (31a); 16088 (18); 16820 (31a); 16847 (31a); 17239 (31a-c); 17415 (25); 18350 (31a); 19340 (20); 19349 (20); 20606 (31c); 20693 (25); 21195 (17b); 21652 (20); 22942 (20); 23024 (20); 23048 (20); 23282 (20); 23910 (22b); 24283 (20); 24298 (20); 24302 (31a-c); 25291 (17a); 26020 (31b); 26189 (31a); 26190 (25); 26330 (31a); 26461 (20); 26693 (20); 26694 (20); 28026 (20); 28396 (7); 28454 (31c); 28487 (31a).

Salazar 501 (12); s.n. (31a).

Santos 3201 (11).

Sartorius s.n. (5).

Sauer 1577 (2).

Schaffner 302 (31c); 352 (22b); s.n. (22b); s.n. (22b); s.n. (31c).

Schmitz 390 (20).

Schnee s.n. (22b).

Schoenwetter JSOX-48 (22a-b).

Seaton 125 (10).

Seler 2970 (1b).

Sesse 2857 (1b); 2873 (31a); 2949 (31a); 2966 (18); 2996 (7).

Sharp 44533 (31a); 44871 (10).

Shreve 8644 (22b); 9185 (22b); 9293 (22b).

Skutch 4 (14); 714 (14); 826 (14); 1019 (1b); 1073 (14); 1188 (16); 1490 (9); 1611 (14); 1926 (16); 1966 (16).

Smith, C. L. 286 (11); 606 (11); 616 (24); 1636 (5).

Smith, L. C. 129 (11); 218 (22a-b); 820 (11).

Smith 3609 (29); 3953 (22c).

Standley 792 (2); 2650 (1a); 4333 (2); 5739 (2); 6351 (1a); 9545 (2); 12489 (1b); 12734 (1b); 13226 (1b); 13657 (1b); 14251 (1b) 14594 (1b); 14964 (1b); 17249 (2); 19261 (1a); 21478 (1a); 21587 (1b); 23763 (2); 25195 (2); 25423 (1a); 28936 (1b); 29262 (2); 55825 (2); 55845 (2); 55932 (1a); 59231 (14); 59977 (1a); 60537 (1b); 60939 (14); 61208 (1a); 61604 (14); 61672 (14); 62630 (14); 63170 (1a); 63799 (1a); 66098 (14); 67542 (14); 69134 (14); 69483 (1a); 69811 (14); 69905 (14); 70134 (1a); 73765 (1b); 74998 (1b); 76729 (2); 76844 (1b); 76848 (2); 77261 (14); 77267 (1a); 79877 (1a); 81230 (16); 81534 (14); 81969 (1a); 82062 (14); 82927 (1a); 85222 (14); 92119 (1a).

Stewart 2064 (22b).

Steyermark 29650 (14); 29737 (14); 30775 (1a); 31322 (2); 31455 (14); 31642 (14); 31711 (1a); 32517 (14); 32593 (14); 32685 (4); 32846 (14); 32878 (1a); 42304 (14); 42470 (14); 42508 (14); 42519 (2); 42989 (2); 43064 (14); 43723 (1a); 43888 (14) 45170 (5); 46986 (14); 47059 (14); 48442 (14); 50954 (14); 51034 (14); 51970 (1a); 52012 (16).

Straw 1214 (31a); 1960 (31c).

Tejada 115 (1a); 118 (1a).

Thomas s.n. (10).

Ton 506 (14); 1026 (14); 1325 (14); 1333 (14); 1462 (1b); 1636 (14); 1728 (14); 1787 (14); 1871 (14); 1918 (14); 2425 (14); 2705 (1b); 2848 (14); 2973 (1b); 3093 (1b); 3349 (14).

Torres 1745 (11); 1773 (8b).

Tuerckheim, von 336 (1a); 339 (14); II1504 (14); II1511 (1a); II1983 (14).

Turner 1125 (22b).

Ugent 2712 (22a-b).

Urbina s.n. (22a).

Valerio Rodriguez 733 (2); 857 (2); 937 (1b); 958 (1b); 1176 (1b); 1360 (1b); 1690 (2); 1777 (2); 1800 (2).

Velasco 8987 (1a).

Ventura 2148 (29); 3023 (5).

Viereck 1336 (22b).

Villarreal de Puga 2037 (25).

Von Hagen 1134 (2).

Waterfall 12557 (22b); 12669 (31c); 15533 (22b); 16171 (22b); 16173 (31c).

Weber 624 (20).

Webster 17M421 (11); 17M518 (21b); 11908 (2); 11965 (2); 12470 (1b).

Wilbur 1548 (31b); 1606 (31b); 1718 (30); 1751 (30).

Wilkinson 95 (22b).

Williams 10306 (2); 10431 (2); 10604 (2); 11110 (2); 13315 (2); 13664 (2); 14236 (4); 15291 (4); 15696 (2); 18492 (2); 21769 (14); 21862 (16); 22696 (14); 22837 (14); 22914 (14); 23233 (2); 23911 (2); 25200 (14); 25226 (1a); 26178 (14); 27907 (2).

Woronow 2724 (17a); 2914 (17a).

Zuill 115 (14); 268 (14); 558 (14).

P. alticola McVaugh

P. angustifolium Brandeg. = P. mendezii var. angustifolium

P. asperifolium Schultz Bip. ex Klatt

P. berlandieri DC.

P. blepharolepis Blake = P. mendezii var. angustifolium

P. buphthalmoides DC.

P. buphthalmoides DC. var. buphthalmoides

P. buphthalmoides DC. var. flexuosum (Greenm.) McVaugh = P. buphthalmoides var. buphthalmoides

P. buphthalmoides DC. var. occidentale McVaugh

P. bupthalmoides DC. var. tenellum (Gray) McVaugh

P. cervantesii DC. = P. mendezii var. mendezii

P. chalarolepis Robins. & Greenm. = P. ghiesbreghtii

P. chloroleucum Blake

P. collinum Brandeg. = P. ovatum

P. consobrinum Blake = P. mendezii var. angustifolium

P. cornutum Brandeg.

P. croceum Robins. and Greenm. = P. pringlei var. croceum

P. diguetii McVaugh

P. discolor Schrad.

P. episcopale Fay

P. flexuosum Greenm. = P. buphthalmoides var. buphthalmoides

P. ghiesbreghtii Robins. & Greenm.

P. glandulosum Brandeg.

P. globosum Robins.

P. globosum Robins. var. globosum

P. globosum Robins. var. rotundisquamum (Blake) Fay

P. goldmanii Greenm. = P. gymnolomoides (Less.) DC.

P. gracile Hemsl.

P. grande Hemsl.

P. grande Hemsl. var. grande

P. grande Hemsl. var. nelsonii (Robins. & Greenm.) Fay

P. grande Hemsl. var. strigillosa Robins. & Greenm. = P. grande var. grande

P. gymnolomoides (Less.) DC.

P. hintonii McVaugh

P. hyploeucum Blake = P. mendezii var. angustifolium

P. inamoenum Standl. & Steyerm. = P. ghiesbreghtii

P. jalapanum Standl. & Steyerm.

P. jaliscense Robins. & Greenm.

P. jaliscense Robins. & Greenm. var. latifolium McVaugh = P. oxycarphum

P. klattianum Fay

P. lancifolium Blake = P. pringlei var. lancifolium

P. lasiolepis Blake = P. mendezii var. angustifolium

P. latisquamum Blake = P. grande var. nelsonii

P. leptopodum Blake = P. ghiesbreghtii

P. macrocephalum Greenm.

P. mendezii DC.

P. mendezii DC. var. angustifolium (Brandeg.) Fay

P. mendezii DC. var. cylindrocephalum Robins. & Greenm. = P. berlandieri

P. mendezii DC. var. mendezii

P. mendezii DC. var. verbesinoides (DC.) Fay

P. microcephalum Schultz Bip. = P. gracile

P. microphyllum Robins. & Greenm. = P. pringlei var. croceum

P. nelsonii Robins. & Greenm. - P. grande var. nelsonii

P. nicaraguenese Blake

P. ovatum Brandeg.

P. oxycarphum Blake

P. parvifolium Gray - P. mendezii var. mendezii

P. peckii Robins. = P. gymnolomoides

P. pinetorum Brandeg.

P. pringlei Robins. & Greenm.

P. pringlei Robins. & Greenm. var. croceum (Robins. & Greenm.) Fay

P. pringlei Robins. & Greenm. var. lancifolium (Blake) Fay

P. pringlei Robins. & Greenm. var. pringlei

P. purpusii Brandeg. = P. ghiesbreghtii

P. reticulatum Fay

P. rosei Robins. & Greenm. = P. buphthalmoides var. tenellum

P. rotundisquamum Blake = P. globosum var. rotundisquamum

P. rude Robins. & Greenm. = P. mendezii var. mendezii

P. sedasanum Fay

P. simulans Blake = P. buphthalmoides var. tenellum

P. stenophyllum Blake

P. strigillosum (Robins. & Greenm.) Greenm. = P. grande var. grande

P. subcordatum Blake = P. mendezii var. mendezii

P. subsquarrosum Robins. & Greenm.

P. tenellum Gray = P. buphthalmoides var. tenellum

P. turckheimii Klatt = P. grande var. grande

P. uxoris McVaugh

P. verbesinoides DC. = P. mendezii var. verbesinoides

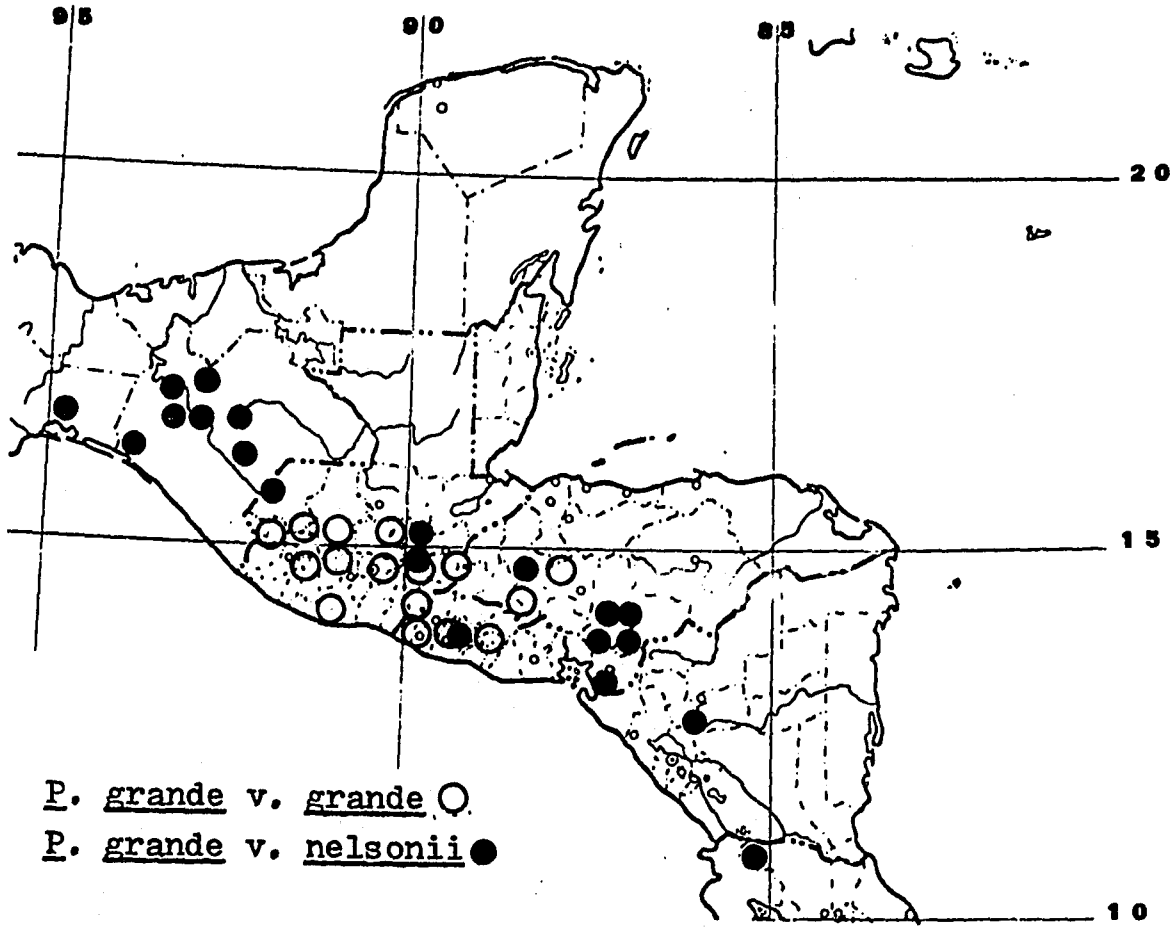
P. wilburorum McVaugh

Appendix A - Distribution Maps

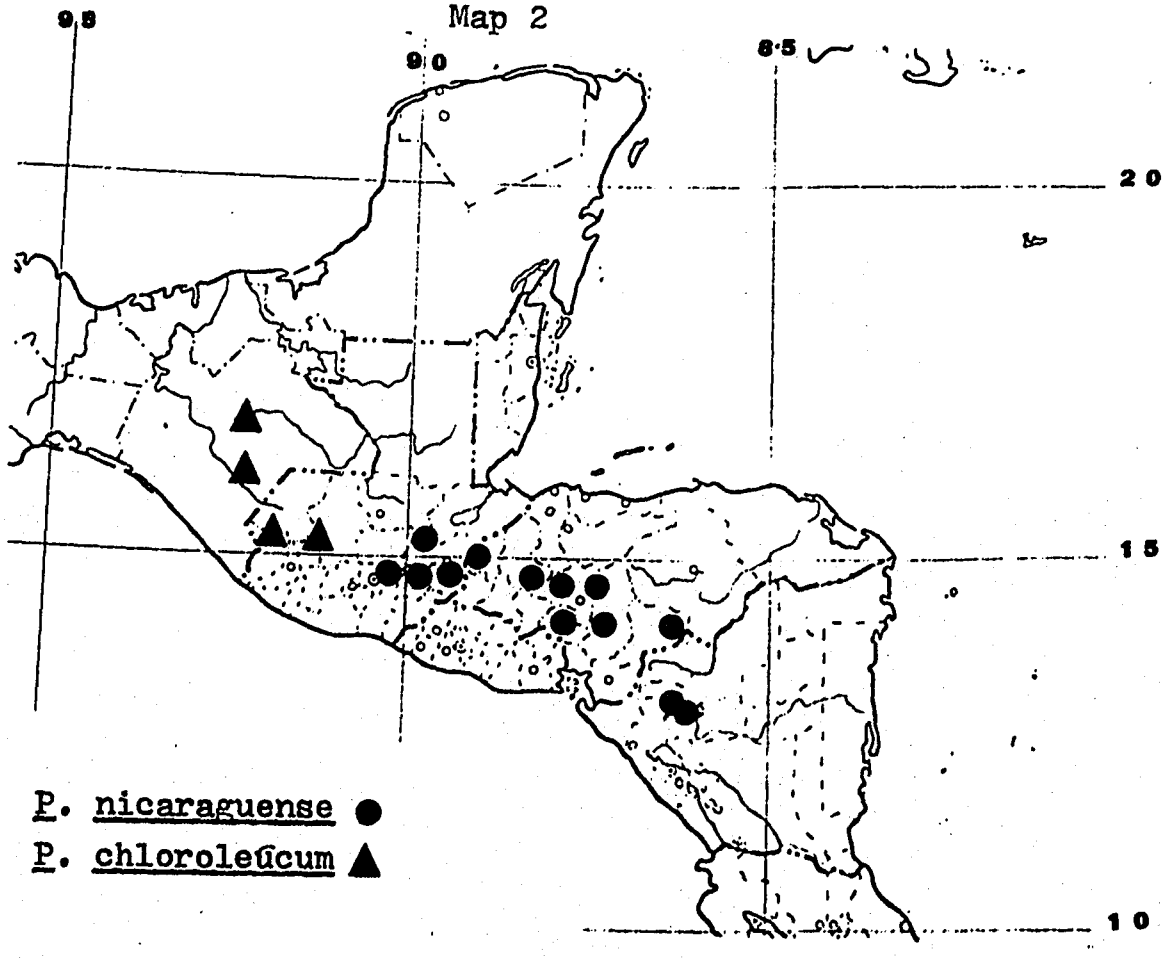
Index to Maps

Species	Map Number	Species	Map Number
P. alticola	5	P. jalapanum	4
P. asperifolium	5	P. jaliscense	11
P. berlandieri	5	P. klattianum	4
P. buphthalmoides	12	P. macrocephalum	8
P. chloroleucum	2	P. mendezii	10
P. cornutum	11	P. nicaraguense	2
P. diguetii	9	P. ovatum	9
P. discolor	7	P. oxycarphum	11
P. episcopale	7	P. pinetorum	3
P. ghiesbreghtii	3	P. pringlei	6
P. glandulosum	11	P. reticulatum	7
P. globosum	8	P. sedasanum	9
P. gracile	4	P. subsquarrosum	9
P. grande	1	P. stenophyllum	8
P. gymnolomoides	4	P. uxoris	7
P. hintonii	9	P. wilburorum	8

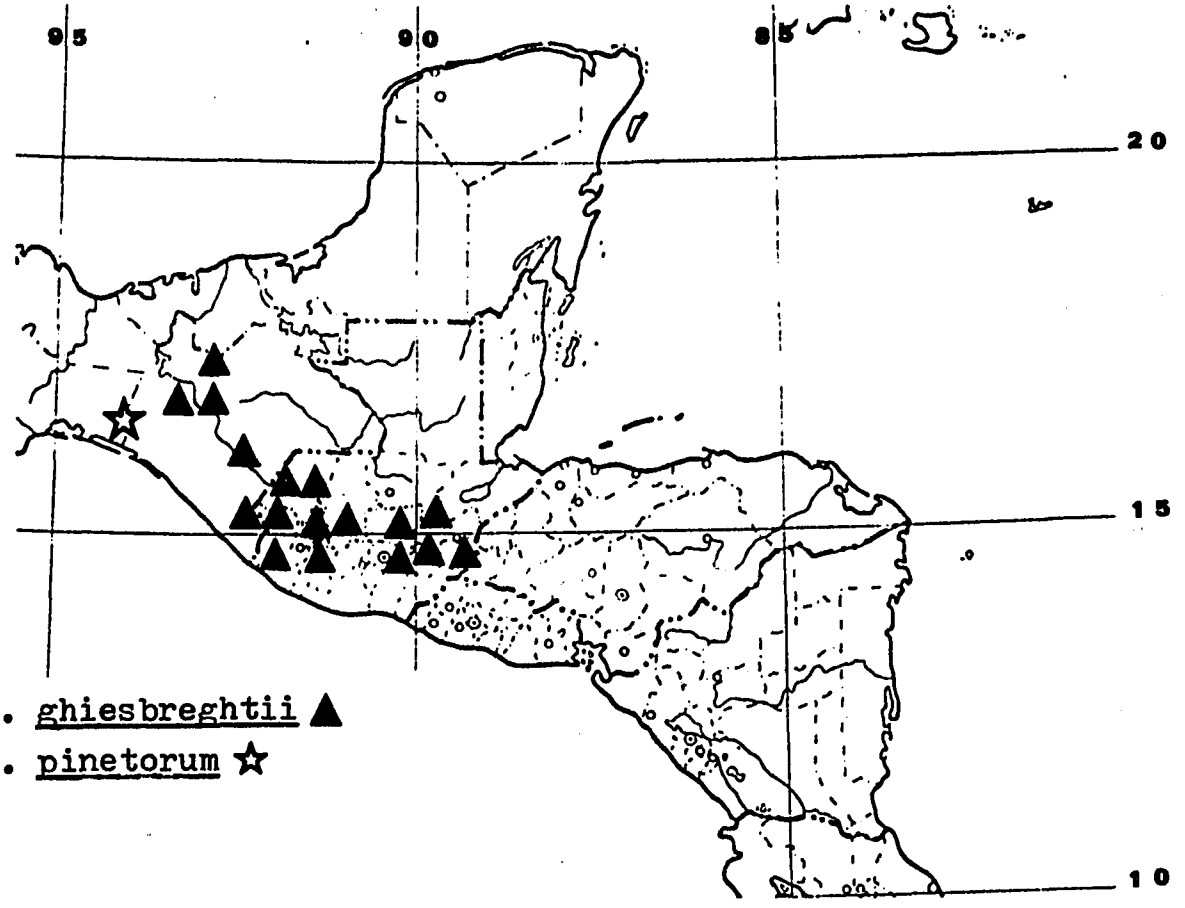
Map 1


9.5
9.0
8.5
20
15
10
P. grande v. grande ○
P. grande v. nelsonii ●

Map 2

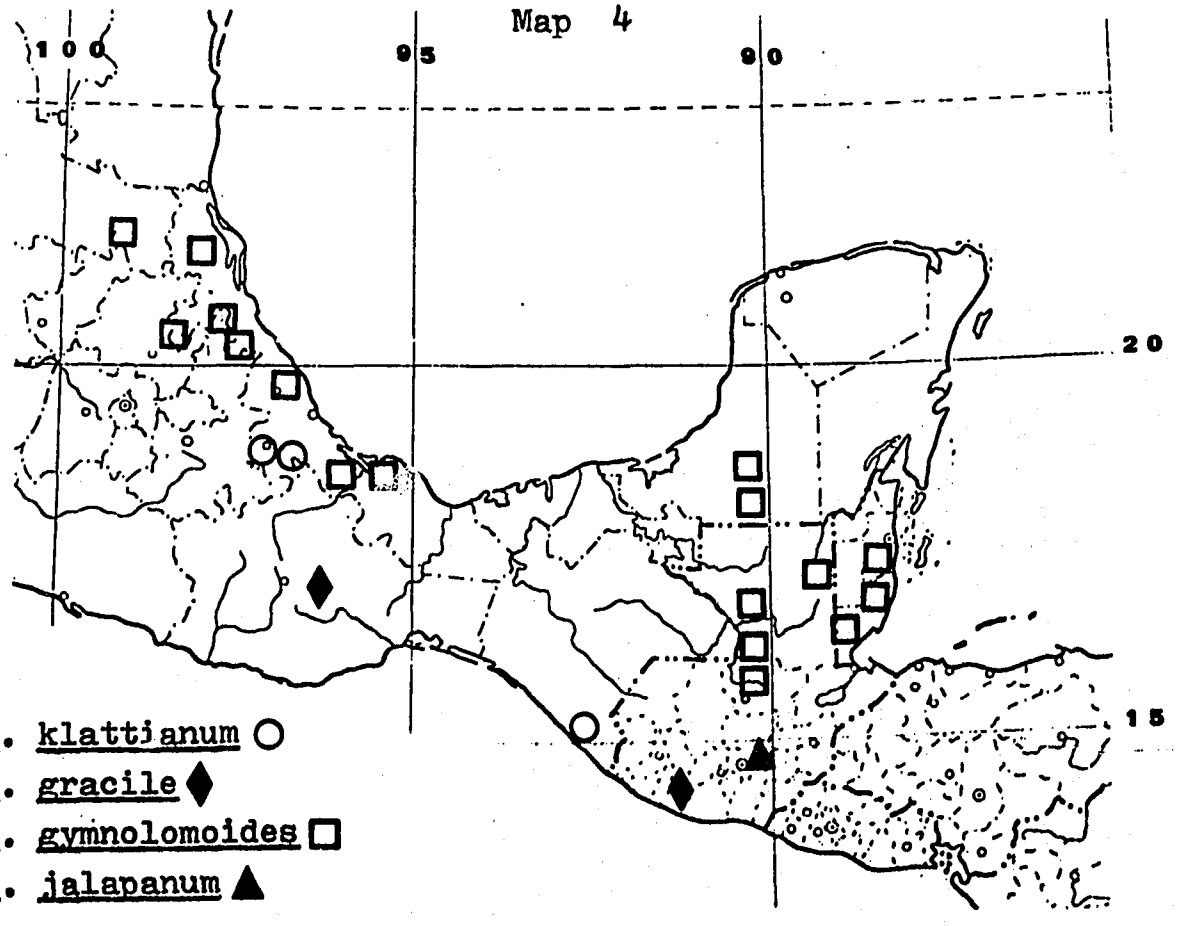

9.5
9.0
8.5
20
15
10
P. nicaraguense ●
P. chloroleucum ▲

Map 3



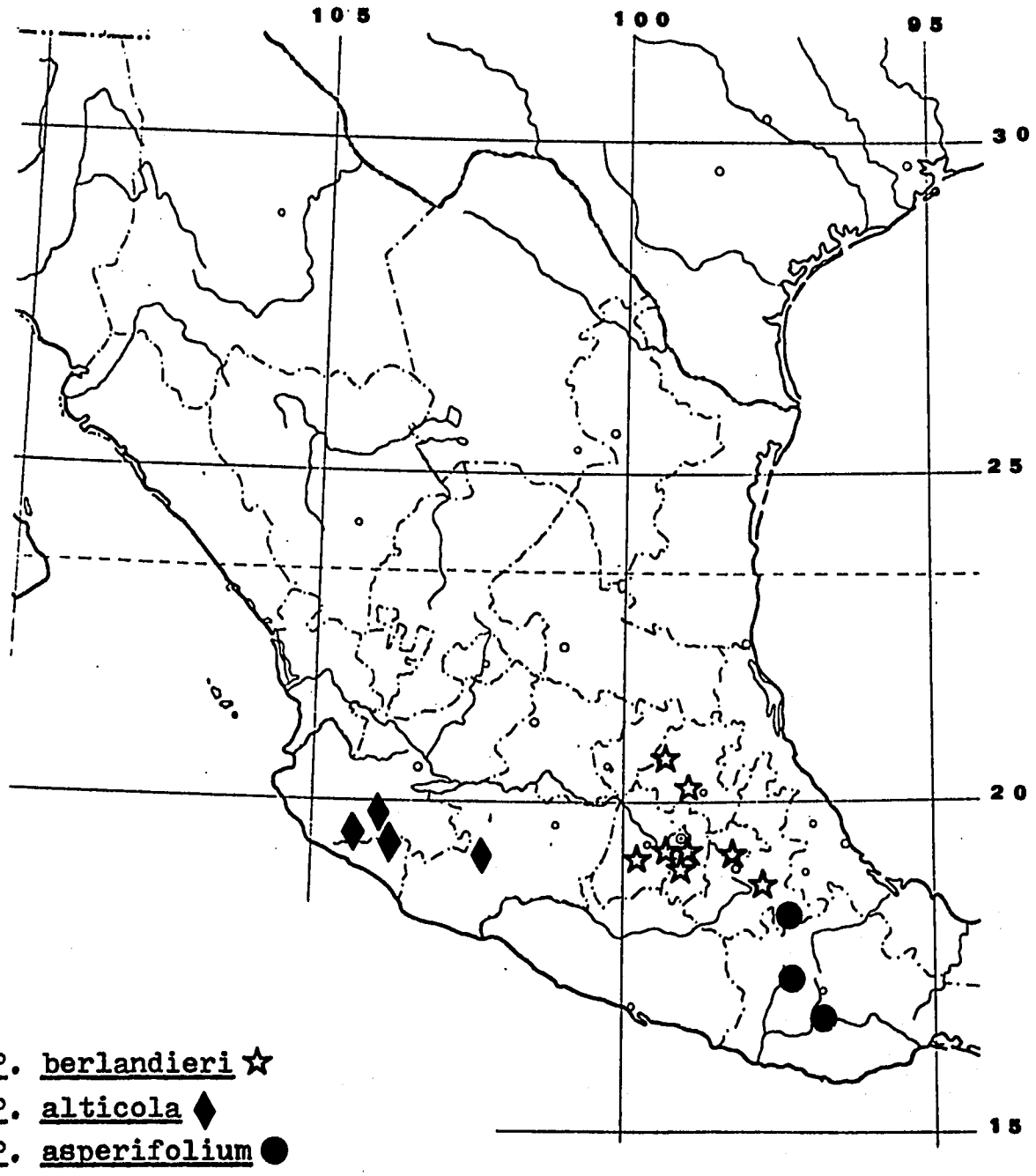
P. ghiesbreghtii ▲
P. pinetorum ☆

Map 4

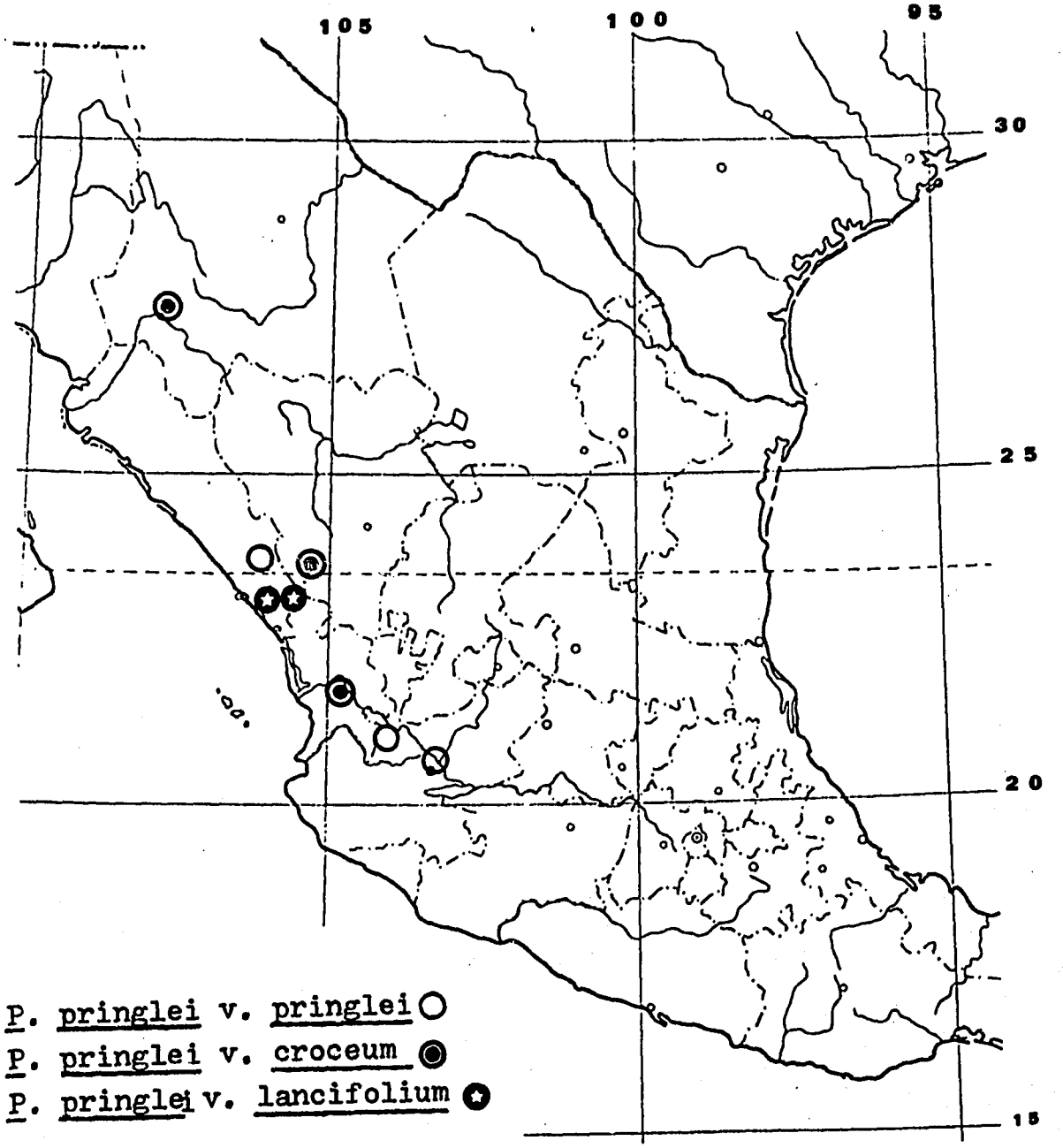


P. klattianum ○
P. gracile ♦
P. gymnolomoides □
P. jalapanum ▲

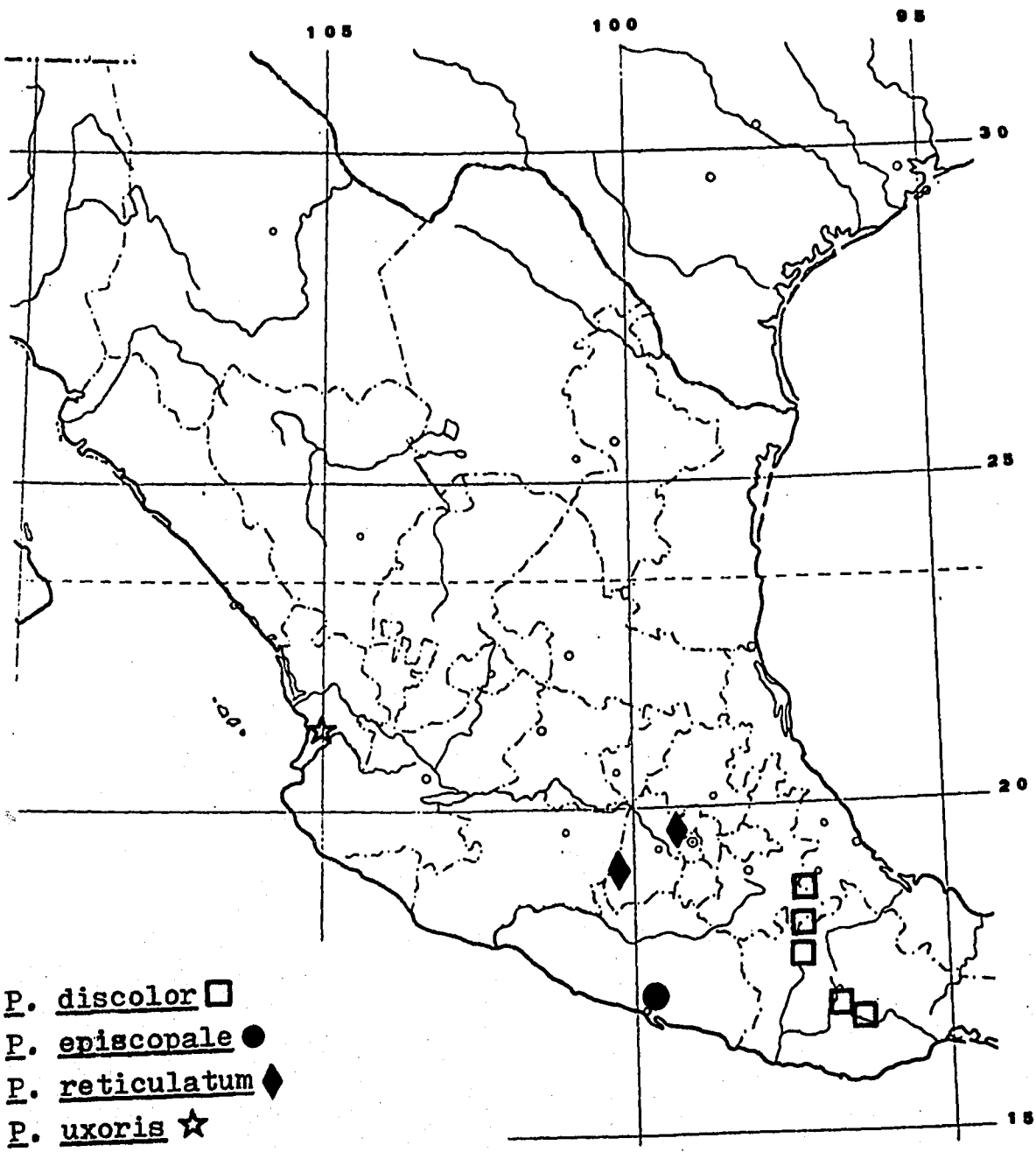
Map 5


105
100
95
30
25
20
15
P. berlandieri ☆
P. alticola ♦
P. asperifolium ●

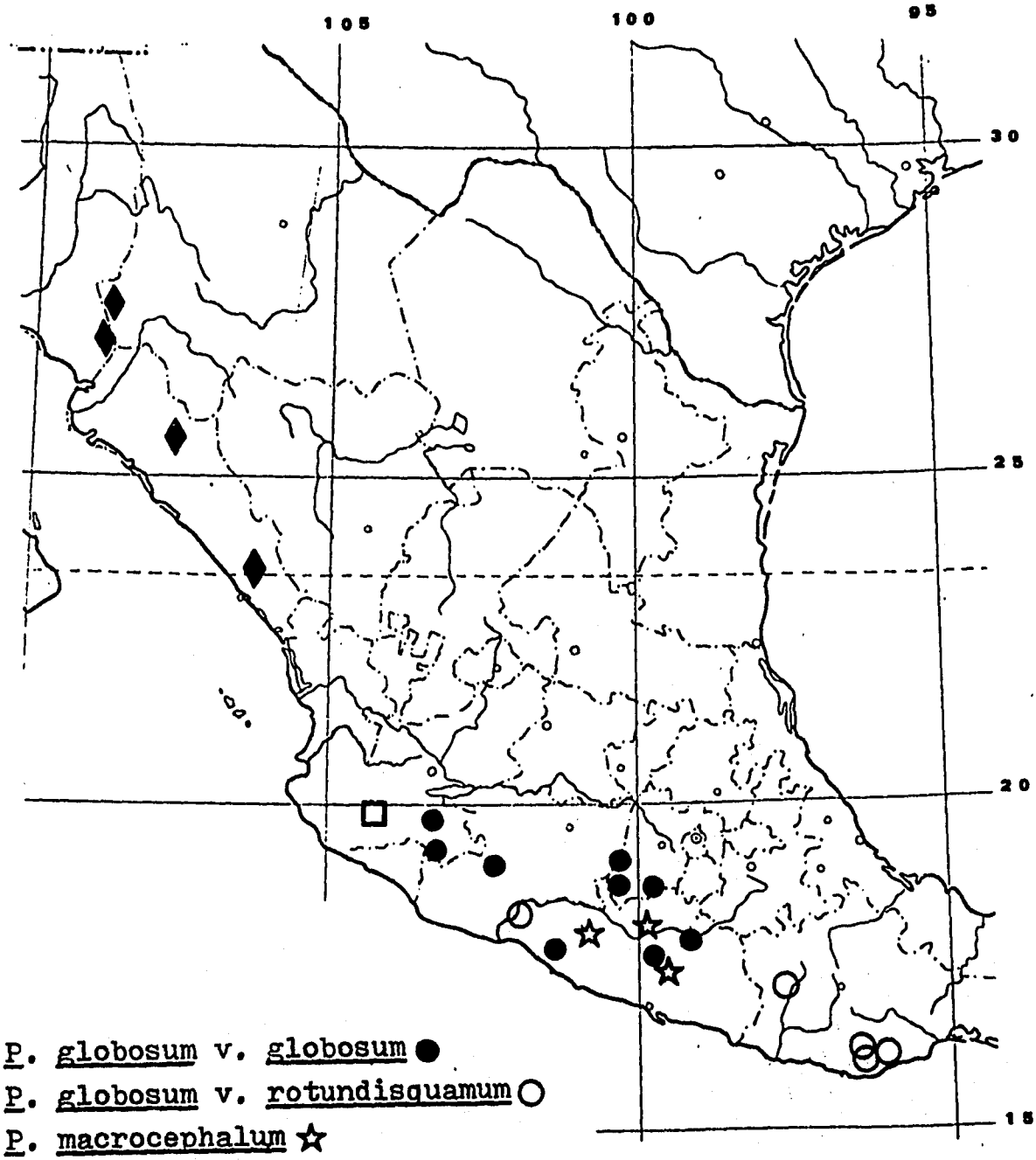
Map 6


105
100
95
30
25
20
15
P. pringlei v. pringlei
P. pringlei v. croceum
P. pringlei v. lancifolium

Map 7

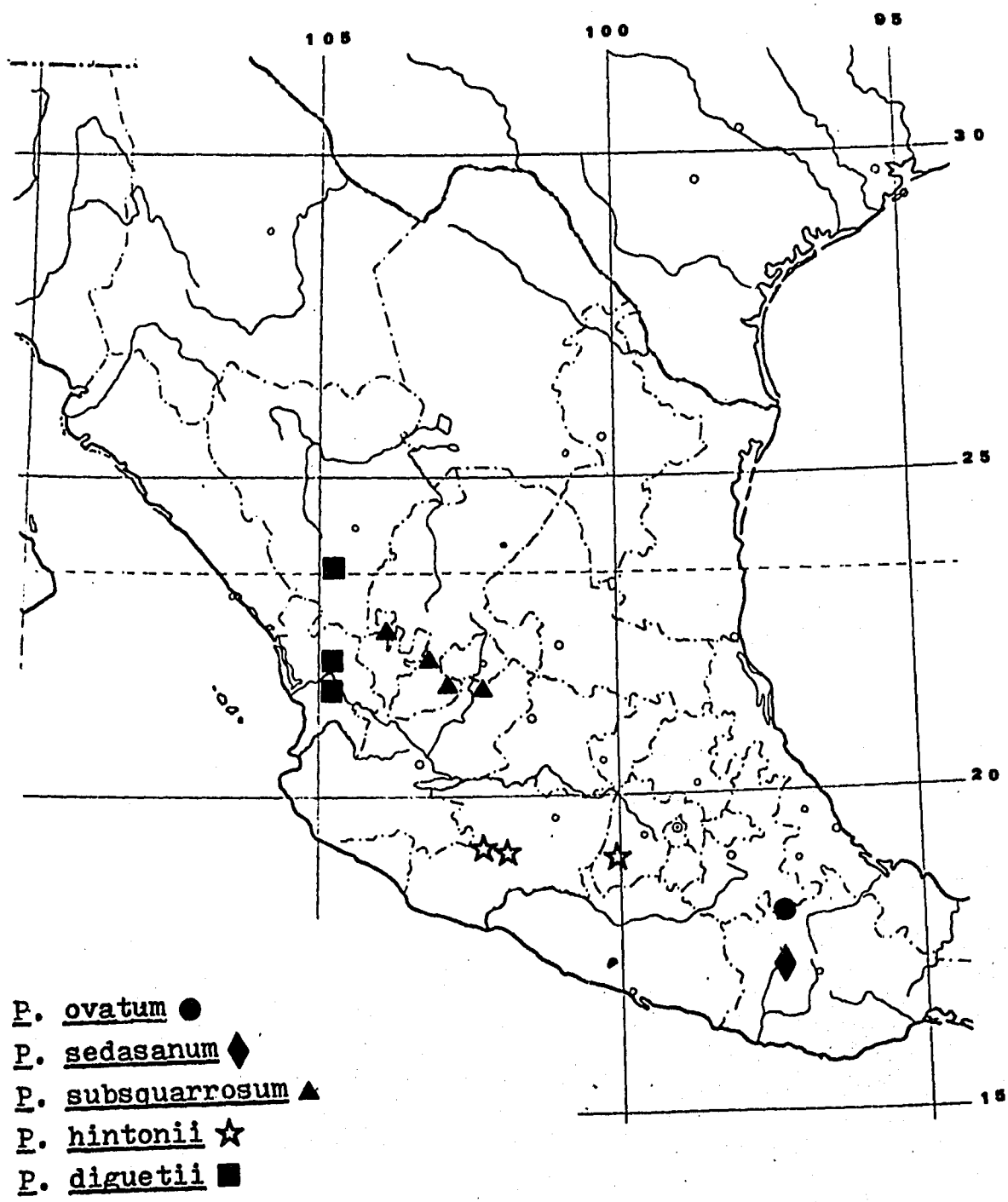

105
100
95
30
25
20
15
P. discolor
P. episcopale
P. reticulatum
P. uxoris

Map 8

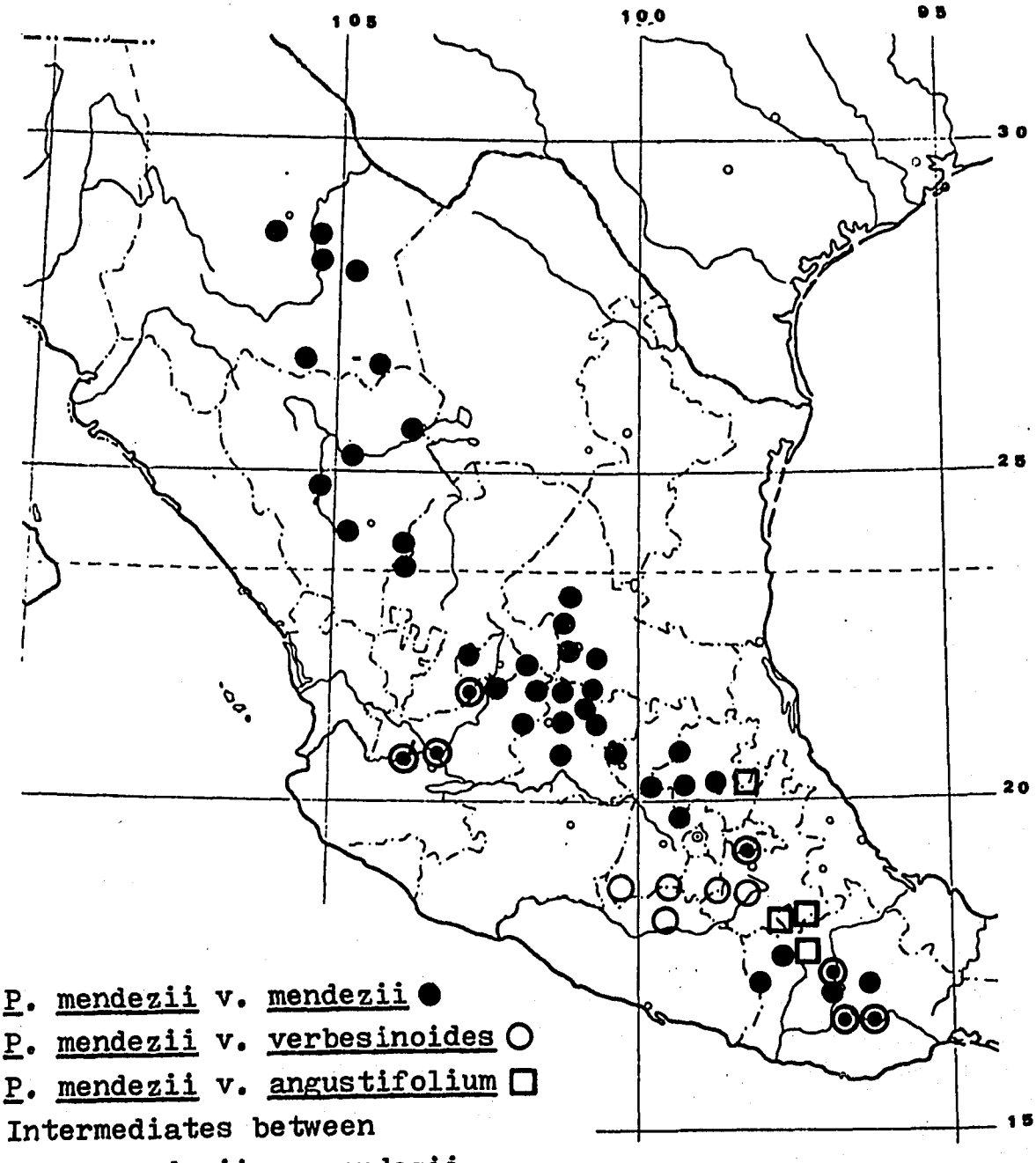


P. globosum v. globosum ●
P. globosum v. rotundisquamum ○
P. macrocephalum ☆
P. stenophyllum ♦
P. wilburorum □

Map 9

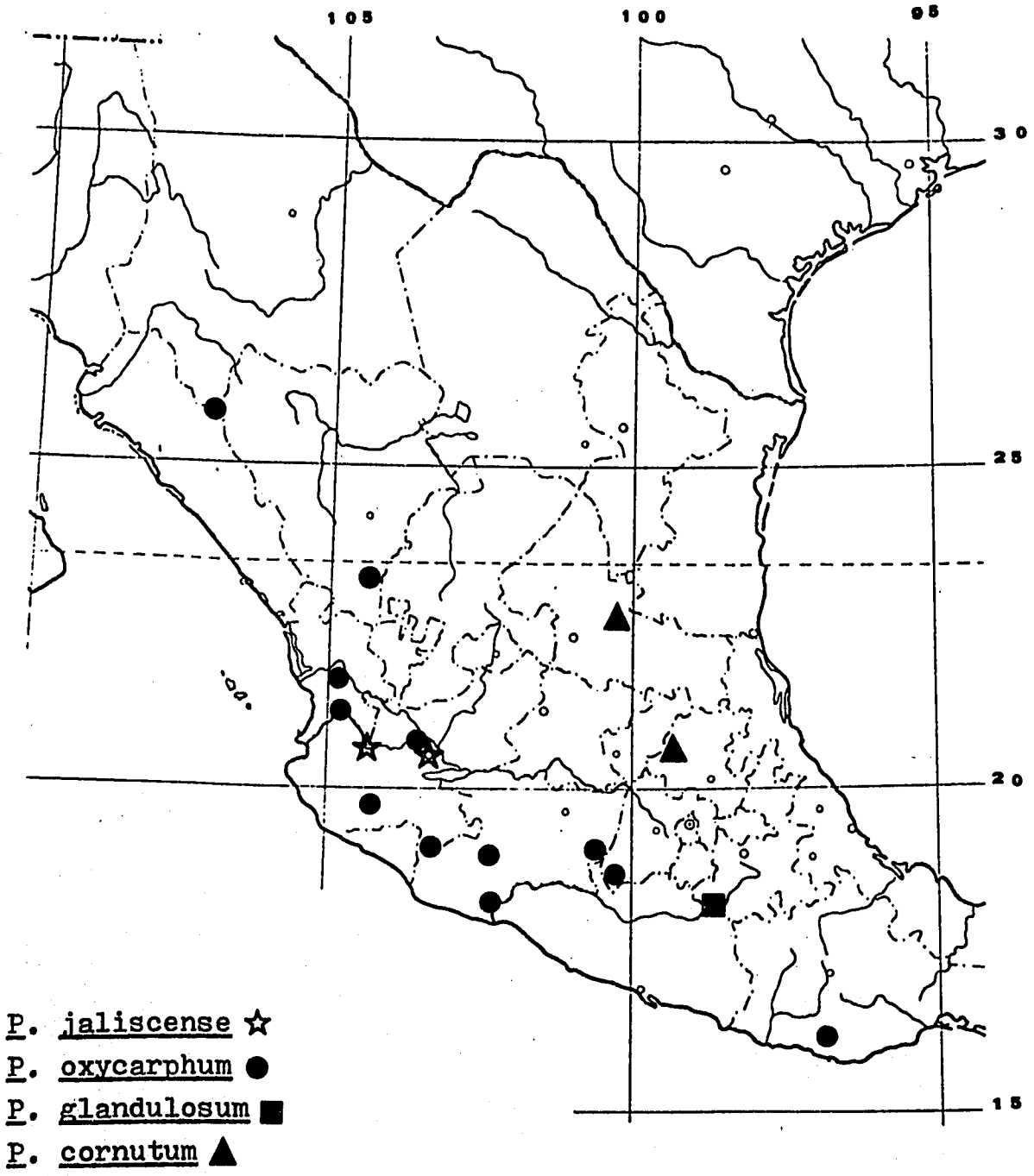

105
100
95
30
25
20
15
P. ovatum ●
P. sedasanum ♦
P. subsquarrosum ▲
P. hintonii ☆
P. diguetii ■

Map 10

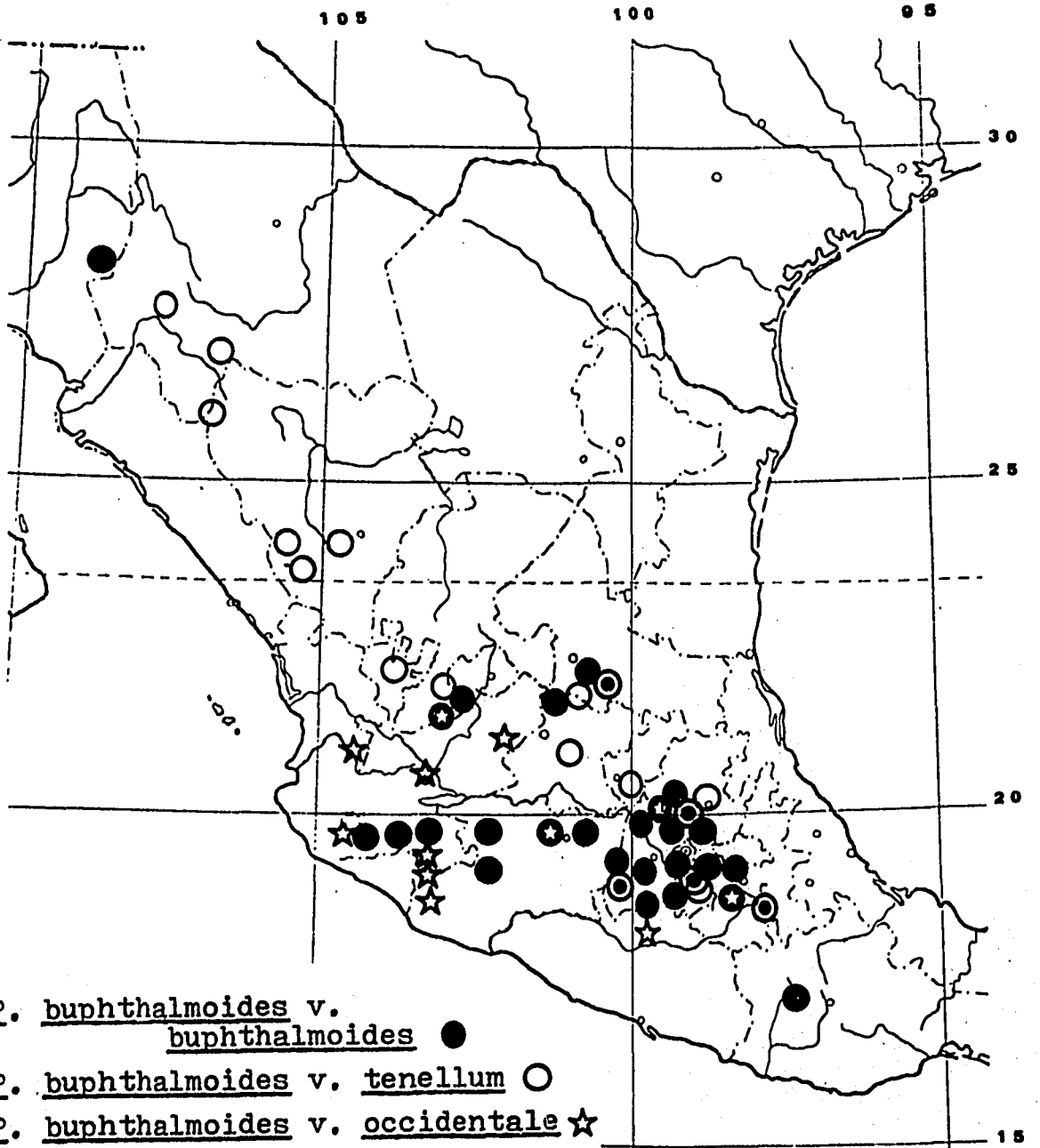


P. mendezii v. mendezii ●
P. mendezii v. verbesinoides ○
P. mendezii v. angustifolium □
Intermediates between
P. mendezii v. mendezii
and
P. mendezii v. verbesinoides ◉

Map 11


105
100
95
30
25
20
15
P. jaliscense ☆
P. oxycarphum ●
P. glandulosum ■
P. cornutum ▲

Map 12



P. buphthalmoides v. buphthalmoides ●

P. buphthalmoides v. tenellum ○

P. buphthalmoides v. occidentale ☆

Intermediates between P. buphthalmoides v. buphthalmoides and P. buphthalmoides v. occidentale ◉

Intermediates betwwen P. buphthalmoides v. buphthalmoides and P. buphthalmoides v. tenellum ◎