MEXICAN "CACALIOID" GENERA ALLIED TO *SENECIO* (COMPOSITAE) [1]

By Richard W. Pippen [2]

Introduction

This paper represents an investigation of a geographically distinct group of North American species of Compositae occurring mainly in the highlands of Mexico. In the past these species have been considered part of the genera *Cacalia* (DeCandolle, 1838; Gray, 1883; Greenman, 1902), *Senecio* (Schultz 1845; Bentham & Hooker, 1873; Hemsley, 1881), and several distinct, smaller genera (Rydberg, 1924; Belcher, 1956; Cuatrecasas, 1960). In my study I worked out a taxonomic system for these species, then compared the species individually and as a group with superficially similar species of *Senecio*, and considered their relationships. It is now apparent that these species are generically distinct from *Senecio*, from the species in eastern North America and Asia usually referred to *Cacalia*, and also from the type-species of *Cacalia*; instead, four separate genera are represented—*Digitacalia*, *Odontotrichum*, *Pericalia*, and *Psacalium*.

The materials used in this study consisted primarily of specimens obtained from the following herbaria: Field Museum of Natural History, Chicago; Gray Herbarium of Harvard University, Cambridge, Massachusetts; Botanische Staatssammlung, München; University of Michigan, Ann Arbor; New York Botanical Garden, New York; University of Texas, Austin; and United States National Herbarium, Smithsonian Institution. I wish to express my gratitude to the curators of these herbaria who made these specimens available. Abbreviations of herbarium names used hereafter are those of Lanjouw and Stafleu (1964). The abbreviation "Field Mus. Neg." refers to Field Museum of Natural History negatives of a series of type photographs taken in European herbaria by J. F. Macbride during the period 1929 to 1939. "U. of MICH. Neg." refers to a collection of negatives of type specimens maintained at the University of Michigan Herbarium.

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Observations were made in the field, and preserved cytological materials and dried specimens were obtained during two seasons of field work in Mexico (in the summer and autumn of 1958, and the autumn of 1960), and from a survey trip through the southeastern United States in the summer of 1962.[3] Observations were also made of living plants grown from seeds and rootstocks in the University of Michigan Botanical Gardens.

All measurements were obtained from dried specimens. But flowering material of all the species was studied both in the dry state and after soaking, the latter state inducing no significant change in size. Dimensions of the heads include from the base of the phyllaries to the tip of the syngenesious anthers.

The chromosome counts were obtained by the standard aceto-carmine squash technique on pollen spore mother cells killed and fixed in Newcomer's solution. Except for *Odontotrichum decompositum* the chromosome numbers herein reported are new reports. Table 1 summarizes this information. Voucher specimens for these counts are listed in table 1 and also indicated with an asterisk (*) in the list of specimens examined under the species. Voucher specimens are preserved in the University of Michigan Herbarium.

For advice and assistance my sincere thanks and appreciation are extended to Dr. Rogers McVaugh, who initially called my attention to this problem and who collected specimens and cytological material for me on several occasions; to Dr. B. L. Turner, the University of Texas, for permitting me to cite unpublished chromosome counts from his cytological investigations of the Mexican composites; to the late Mr. N. Y. Sandwith, the Royal Botanic Gardens, Kew, who sent me special information regarding the type of *Cacalia cirsiifolia* Hook. & Arn.; to Dr. A. G. Norman, formerly Director of the University of Michigan Botanical Gardens, for the use of the facilities there for growing living plants; to Mr. J. R. Millar, formerly Chief Curator of the Herbarium, Field Museum of Natural History, for making available the botanical collections of Sessé and Mociño (then on loan to Chicago from Madrid); and to Dr. Charles Feddema, U.S. Forest Service Herbarium, for the line drawings of flower types.

Morphological Considerations

Although these species, previously referred to *Cacalia*, do apparently represent several genera, they have in common a number of morphological features and generalizations regarding these may be made. Except for *Digitacalia* (here described as new) all the genera in the

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TABLE 1.—*Meiotic chromosome counts of some species of Mexican cacalioids*

Species	Voucher Specimens [1]	Number
Digitacalia tridactylitis	McVaugh 21903	[3] 30
Odontotrichum amplum	Pippen 4	[2] 30
Odontotrichum brachycomum	McVaugh 21934	[3] 30
Odontotrichum cirsiifolium	Pippen 52	[2] 30
Odontotrichum decompositum	–	[4] 30
Odontotrichum multilobum	Pippen 30	[2] 30
Odontotrichum palmeri	Pippen 12	ca. [2] 25
Odontotrichum pringlei	Pippen 37	[2] 30
	McVaugh 21765	[3] 30
Odontotrichum sinuatum	Pippen 9	[3] 30
Pericalia michoacana	Pippen 63, 65	[2] 30
Pericalia sessilifolia	Pippen 61	[2] 30
Psacalium eriocarpum	Pippen 62	[2] 30
Psacalium holwayana	McVaugh 21953	[3] 30
Psacalium megaphyllum	Pippen 8	[3] 30
Psacalium peltatum v. *peltatum*	Pippen 49	[2] 30
Psacalium species	McVaugh 21913	[3] 30

[1] Voucher specimens retained in the Herbarium of the University of Michigan, Ann Arbor.

[2] Determined by Pippen.

[3] Determined by B. L. Turner, here published.

[4] Determined by Kruckeberg *in* Ornduff et al. 1963.

Senecioneae, including the cacalioid ones, are contrasted by Belcher (1956).

All of these species are herbaceous perennials, flowering from July to December. The perennial caudex and/or roots survive the dry season but the aerial portions wither soon after flowering. The first season of growth is strictly vegetative. A basal rosette of leaves forms in *Odontotrichum* and *Psacalium;* in *Digitacalia* and *Pericalia* a nonflowering, leafy stem develops. Flowering may occur during the second and succeeding years.

Leaves in all of the genera are petiolate (except certain specimens of *Pericalia sessilifolia*). The leaves are usually fleshy or coriaceous with prominently convex veins usually more pronounced on the abaxial surface. In several species of *Odontotrichum* (*O. pachyphyllum*, *O. platylepis*, and *O. amplum*) the two surfaces of the leaves are similar with the venation equally pronounced on both surfaces.

The leaf shapes and patterns of lobing are relatively constant, although wide ranges of variation may occur within the limits of some species (e.g., *Odontotrichum sinuatum*) and occasional parallel leaf forms between species (*O. silphiifolium* and *O. goldsmithii*). In general, however, each species may be recognized by a characteristic leaf shape

and pattern of lobing. The venation is mostly pinnate, subpalmate, or radiate (the latter in *Psacalium* only).

In *Odontotrichum* the form of the leaves exhibits a series ranging from entire or toothed (as in *O. amplum*, *O. pachyphyllum*, and *O. silphiifolium*) to lobed (*O. sinuatum*, *O. pringlei*, and *O. multilobum*) and pinnatisect (*O. decompositum*). This series in general parallels a reduction in the size of heads and size of inflorescence bracts.

The inflorescences are monochasial (Rickett, 1955) with at least 5 heads. They may be corymbose, paniculate, or less frequently racemose. The bracts subtending the branches of the inflorescence and the calyculate bracts are relatively constant within a species and either small, linear-subulate or larger and leafy. The leafy inflorescence bracts are usually vaginate or naviculate and clasping the stem or in some species, petiolate.

Heads are always discoid with perfect and fertile flowers. The size of the heads, as determined by the number of phyllaries and flowers, is relatively constant within each species.

The flowers are nearly white or cream colored, often with a greenish or purplish tint but never yellow or orange. The corolla tube is narrowly cylindrical and usually as long as or longer than the lobes of the limb. The limb is divided into 5 equal lobes that are usually free to the base of the limb or, in some species, connate for part of their length into an ampliate, campanulate, or funnelform throat. The throat is usually shorter than the lobes or, less frequently, as long as the lobes (longer than the lobes only in *Pericalia michoacana*).

This condition of the corolla is referred to as the "cacalioid condition" to distinguish it from that found in *Senecio* where the corolla throat is much longer than the lobes, the latter forming only five small, deltoid, ascending teeth above the throat—referred to as the "senecioid condition" (fig. 1).

The achenes vary from ellipsoid, obovoid and dorsally compressed, elliptic or ovate in cross section (*Odontotrichum* and *Psacalium*) to oblong, subcylindrical, and subterete in cross section (*Digitacalia* and *Pericalia*). The surface is usually narrowly striated or often prominently 10- to 12-ribbed. In several species the achenes are pubescent with simple unicellular hairs but none of the species has hygroscopic trichomes like those found on achenes of several species of *Senecio*.

The pappus consists of a single row of many, persistent (deciduous in *Odontotrichum cirsiifolium*), white or cream colored, stiff, barbellate, capillary bristles (as in most of the Senecioneae). They are usually as long as the corolla or occasionally much shorter and stiffer (*O. brachycomum* and *O. palmeri*), or even entirely lacking (*Psacalium calvum* and *P. nanum*).

A study of pollen grains of representative species (mounted in lactic

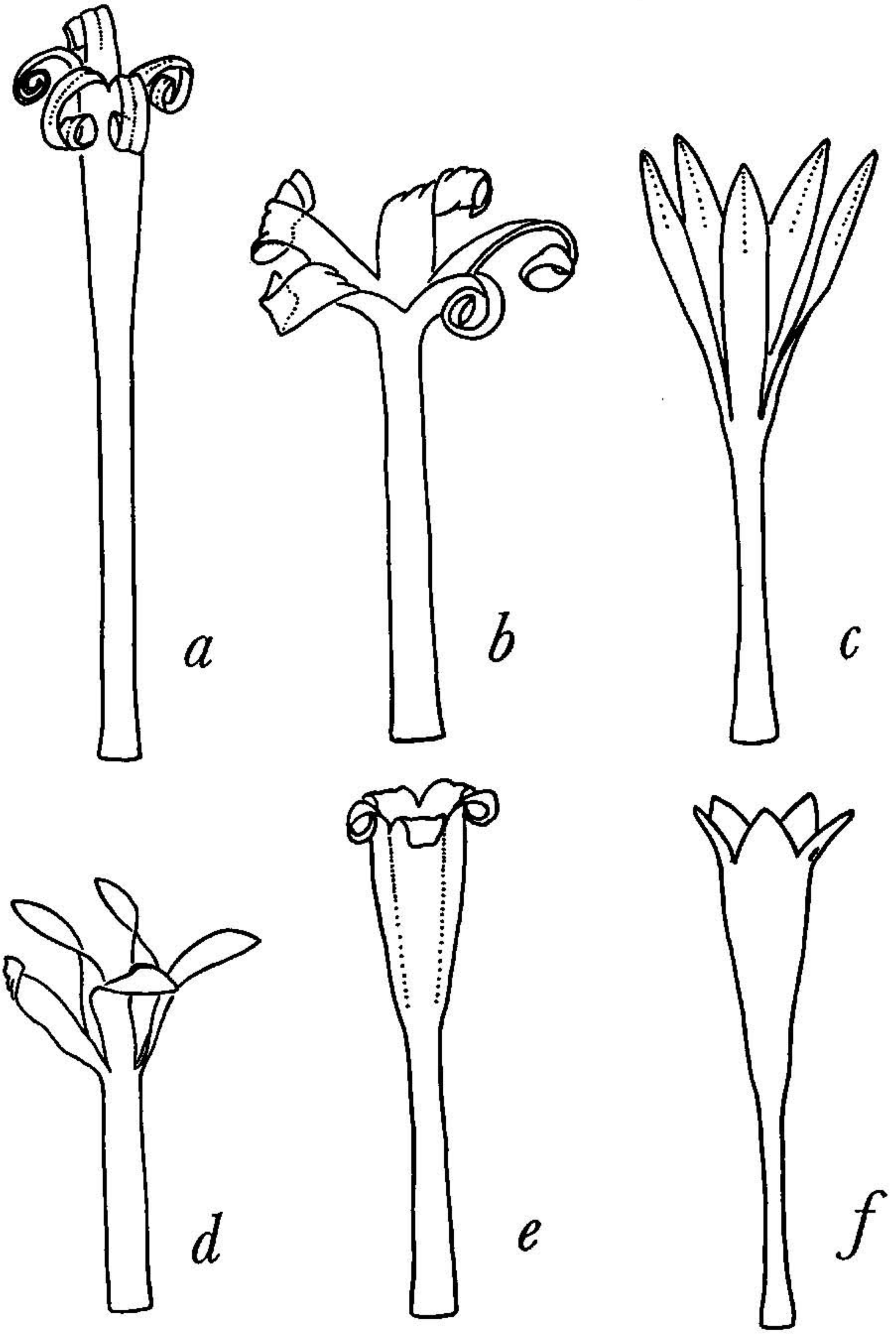

FIGURE 1.—Types of discoid corollas (all ×10): *a. Pericalia sessilifolia* (*Pippen* 64, MICH); *b. Psacalium peltatum* var. typ. (*Pippen* 49, MICH); *c. Odontotrichum sinuatum* (*Pippen* 22, MICH); *d. Digitacalia jatrophoides* (*L. C. Smith* 123, MICH); *e. Senecio angulifolius* (sect. *Palmatinervii*) (*McVaugh* 9949, MICH); *f. Senecio callosus* (sect. *Mulgedifolii*) (*Hurd* 36, MICH).

acid or Hoyer's medium) revealed a similarity in all four genera. The grains are spherical, tricolpate, 42–45 microns in diameter. The surface is ornamented with simple spines 7 to 9 microns long.

Several species exhibit various degrees of pubescence, the presence or absence of which on organs such as leaves, achenes, and phyllaries is relatively constant for each species. The trichomes are mostly nonglandular, conical-attenuate, white or hyaline, multicellular, frequently with purple crosswalls. They vary in length, number of cells, stiffness, and density. Occasionally the distal end of the hair is prolonged into a caudate tip as long as or longer than the body. A minute stipitate gland, ca. 0.5 mm. long, consisting of a stalk of several cells in a single row, topped with a multicellular, globose, purple gland occurs mixed among the longer, nonglandular hairs in several species of *Psacalium*.

Distribution and Ecology

The genera *Digitacalia*, *Odontotrichum*, *Pericalia*, and *Psacalium* are all endemic to Mexico, except that one species, *Odontotrichum decompositum*, extends northward into the mountains of southern Arizona. The species of all four genera are restricted mostly to the oak-pine zone, which is extensively developed in the higher mountain regions of Mexico. Within this zone the species of *Odontotrichum* and *Digitacalia* are usually associated with the grasslands or oak savannahs and *Pericalia* and *Psacalium* with the open oak-pine woods or their borders. But species of the different genera do not usually grow together in the same community.

The annual seasonal pattern in the oak-pine woodland zone is one of alternating wet and dry periods. The rainy season often begins in May and continues as late as October in certain areas, the peak reached during July and August. The dry season lasts from about mid-November until mid-May. The highest temperatures are usually reached during the months just prior to the peak of the rainy season, April through June (Contreras Arias, 1942). The active growing period corresponds to the rainy season with little plant growth during the dry season when the plants die or remain dormant.

Most of these taxa occur at altitudes between 1,000 and 3,000 meters, although a few specimens have been collected at elevations as low as 350 meters. These plants seem to thrive in disturbed secondary associations such as grazed grasslands, burned-over woodlands, or roadsides. Originally they probably grew along the margins of the oak-pine woods or in natural openings within the woods. The majority of the species grow in well-drained rocky, clay soils but a few species do well in poorly drained, similar soils.

The region of greatest concentration of these species corresponds closely to the Trans-Mexican volcanic belt (Clausen, 1959) or Neo-

volcanic Plateau (Raisz, 1959). This zone extends from the region of Orizaba, in Veracruz, through the region of Mexico City to western Michoacán, thence curving northward toward Guadalajara and again northwestward toward Tepic. In all directions away from this zone the number of species diminishes rapidly. Other centers of concentration for *Digitacalia*, *Odontotrichum*, and *Psacalium* are in southern Durango and central Oaxaca, in the latter region are several endemic taxa.

The general distributional patterns within Mexico are illustrated in figures 2 and 3.

Generic Relationships and Evolution

The genera *Digitacalia*, *Odontotrichum*, *Pericalia*, and *Psacalium* are apparently natural genera, possibly having closer relationships to separate elements within the genus *Senecio* than to each other. Still, these segregate cacalioid genera may be distinguished as a group from *Senecio* by a number of relatively constant characters if the characters are applied collectively (table 2). *Odontotrichum* is the largest genus in the complex. It may be distinguished from the other cacalioid genera by the subscapose habit, the erect, nonpeltate basal leaves, and

TABLE 2.—*Comparison of cacalioid genera and* Senecio

Cacalioid Genera	*Senecio*
(a) Heads always discoid, the flowers all regular and perfect.	(a) Heads radiate or discoid, the ray flowers pistillate; the discoid flowers regular and perfect.
(b) Corollas always creamy or nearly white, never yellow.	(b) Corollas mostly yellow or purple, occasionally creamy or nearly white.
(c) Corollas deeply lobed, the lobes extending to the base of the limb or connate into a throat rarely as long as the free lobes.	(c) Corollas mostly shallowly lobed, the lobes usually less than half as long as the throat.
(d) Achenes mostly obovate or ellipsoid, elliptic in cross section, less frequently cylindric and subterete in cross section; glabrous or pubescent, the hairs never hygroscopic.	(d) Achenes mostly cylindric, subterete in cross section; glabrous or pubescent, the hairs in many species hygroscopic.
(e) Involucre mostly campanulate or turbinate, less frequently cylindrical.	(e) Involucre cylindrical, less frequently campanulate or turbinate.
(f) Plants all herbaceous perennials.	(f) Plants annuals, biennials, herbaceous perennials, shrubs or trees.

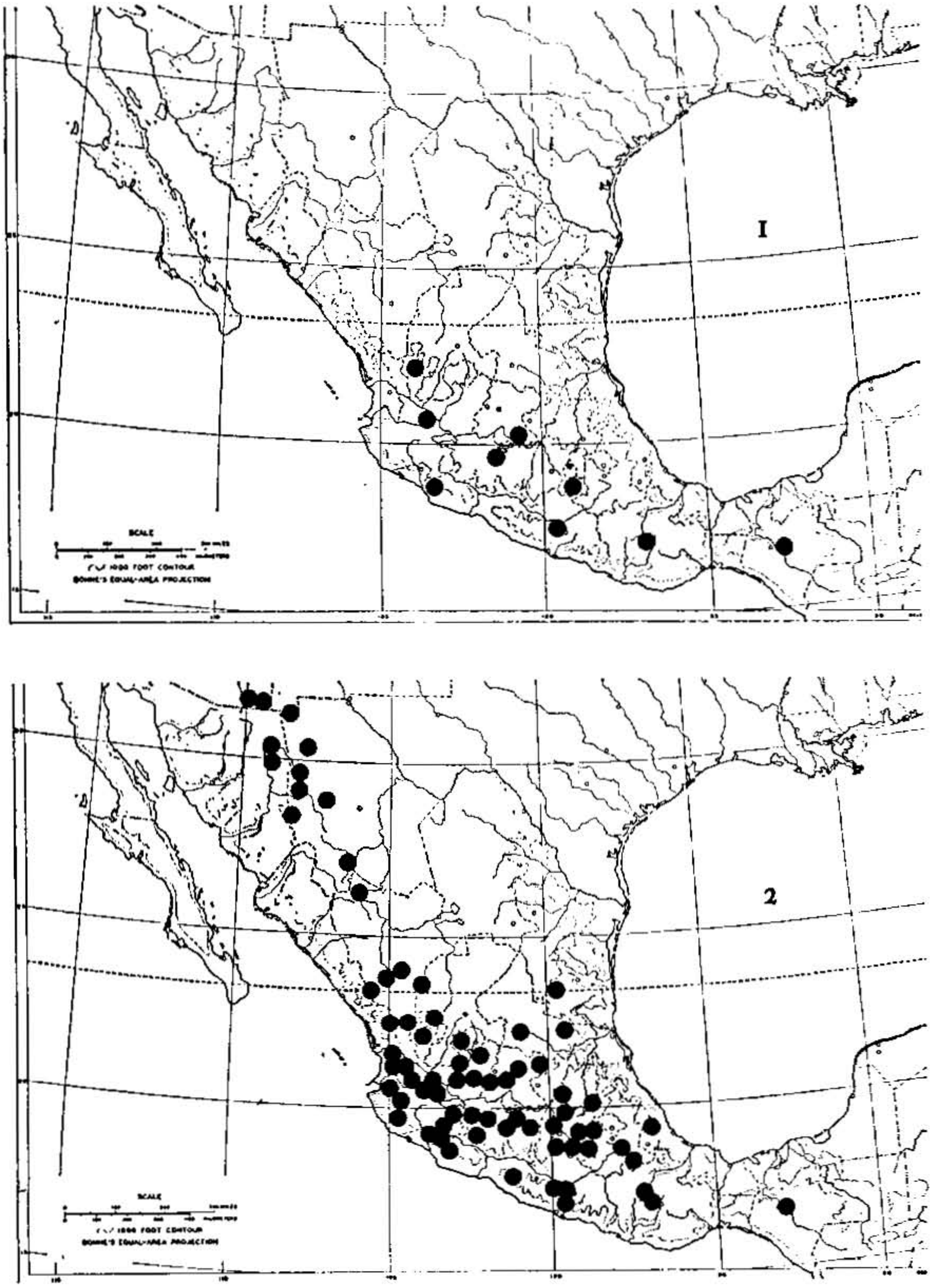

FIGURE 2.—Distribution maps of the Mexican cacalioid genera:
1. *Digitacalia*; 2. *Odontotrichum*.
●=Collection of one or more species.

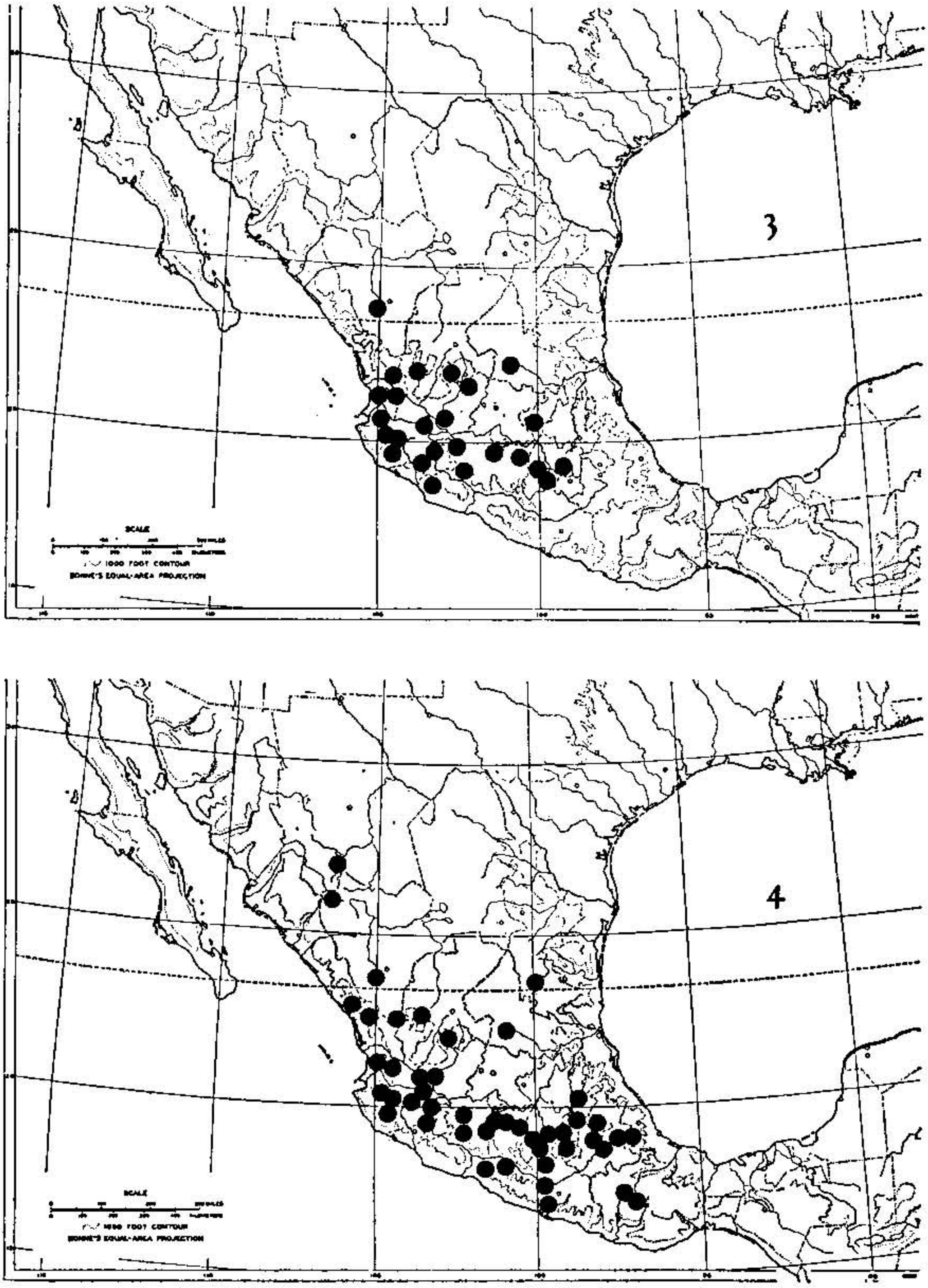

FIGURE 3.—Distribution maps of the Mexican cacalioid genera:
3. *Pericalia*; 4. *Psacalium*.
●=Collection of one or more species.

the corolla lobes free to the base of the limb (fig. 1). Taxa of this description apparently have no counterpart in *Senecio* unless it is in *S.* sect. *Mulgedifolii*. The species in this section have discoid heads usually of purple flowers (although some white-flowered forms do occur) but the corolla throat is much longer than the lobes, the lobes forming only five small, deltoid teeth above the throat (fig. 1). The leaves are mostly membranaceous, narrowly ovate or oblong, regularly callose-dentate, and often runcinate or lyrate-pinnatifid. Several of these species have been described as cacalias (sensu latu), e.g., *S. callosus* Greenm., *S. coulteri* Greenm., *S. runcinatus* Less., *S. purpurascens* Klatt, and *S. deformans* Klatt.

Psacalium is the most distinctive genus of the complex because of the centrally peltate leaves. It is further distinguished by the frequent occurrence of stipitate, glandular trichomes in the inflorescence and the fusion of the corolla lobes into a short throat ca. 1 mm. long (fig. 1). No group of species in *Senecio* is known to be comparable to the species of *Psacalium*, although several species in *S.* sect. *Palmatinervii* appear closely allied. *Senecio subpeltatus* Schultz Bip. and *S. cordobensis* Hemsl. have peltate leaves but the flowers are typically senecioid and the plants are woody shrubs. *Senecio angulifolius* DC. is similar in several respects to *P. peltatum;* the two have leafy inflorescence bracts, heads of approximately the same size, glandular-pubescent stems, and a chromosome number reported as $n=30$. However, *S. angulifolius* is a woody shrub, the leaves are not peltate, the heads are usually radiate (occasionally discoid), and the flowers are always yellow.

Since this group of senecios appears to be somewhat transitional between *Senecio* and *Psacalium*, it is possible that the latter was derived from an ancestral stock that also gave rise to species like those in *S.* sect. *Palmatinervii*.

In *Digitacalia* the plants are leafy stemmed and the upper leaves reduced but not bracteiform. There is neither a basal rosette of leaves nor subterranean tubercles. The corolla is mostly deeply cleft (fig. 1), but the achenes are subcylindric, subterete in cross section, and thus tending toward the senecioid type. *Senecio roldana* DC. and *S. jaliscana* S. Wats. resemble the species of *Digitacalia* in habit, although the leaves are less deeply lobed, but in floral characters they are distinctly senecioid; *S. jaliscana* has discoid heads of orange flowers and *S. roldana* radiate heads of yellow or white flowers. In both species the corollas are senecioid.

Conceivably *Digitacalia* may have been derived from the same ancestral stock that also gave rise to species in *Senecio* like those just discussed.

Finally, *Pericalia* is unique in the cacalioid complex because of its leafy-stemmed habit, the distal bracteiform leaves, the fleshy sub-

terranean tubercles, the numerous (8–15) calyculate bracts, and the well developed, long corolla throat with relatively long, recurved corolla lobes. This genus contains only two species and these have no apparent counterpart in *Senecio*. But *S. hartwegii* Benth. and *S. seemanii* Schultz Bip. (sect. *Palmatinervii*) have certain similarities in vegetative structure to the species of *Pericalia*, although the heads of these senecios are much smaller and distinctly senecioid.

A Central American species, *Senecio cooperi* Greenm. (sect. *Multinervii*), has disk florets similar to the discoid flowers of the cacalioid genera, with the corolla lobes much longer than the throat. The heads, however, are radiate, the flowers yellow, the phyllaries narrowly oblong and barely overlapping, and the leaves lyrate-pinnatifid. This combination of characters definitely associates the species with *Senecio*.

The hypothetical relationship of the cacalioid genera to each other and to the closely allied species of *Senecio* is summarized in figure 4.

It is also apparent that the Mexican cacalioid taxa are not the same as those in the eastern United States (*Cacalia* sect. *Conophora* DC.) or those in eastern Asia (*C.* sect. *Eucacalia* DC.). Further studies of these groups are necessary to determine their proper relationships and taxonomic position.

The 7 or 8 species usually referred to *Cacalia* sect. *Conophora* DC. form a natural group endemic to the eastern United States and southern Canada. These are easily distinguished from the taxa included in this paper as well as from *Senecio* by: The presence of a prolonged chaffy scale forming a beak up to two millimeters long in the center of the receptacle; the consistently small heads with 5 phyllaries and 5 or 6 flowers; the entire or dentate but not lobed, glabrous or glaucous leaves; and the haploid chromosome number of usually 25.

The 8 to 10 species that most earlier workers referred to *C.* sect. *Eucacalia* comprise a natural group mostly endemic to eastern Asia, with the exception of *C. suaveolens* L. which is found only in the eastern United States. These differ from the Mexican members of this complex in: The lack of tufts of hair at the base of the basal leaves; the narrowly paniculate inflorescence; the short corolla tube; and the throat of the corolla equaling or exceeding the corolla lobes in length.

The genus *Cacalia* proper, a small group of central European species typified by *C. alpina* L. (see discussion to follow) differs from the taxa discussed in this paper primarily as follows: The style branches are long-attenuate, the abaxial surface uniformly densely glandular-papillose; the corolla is usually 4-parted; the chromosome number is reported as $n=19$ (Langlet, 1936); and these taxa, under

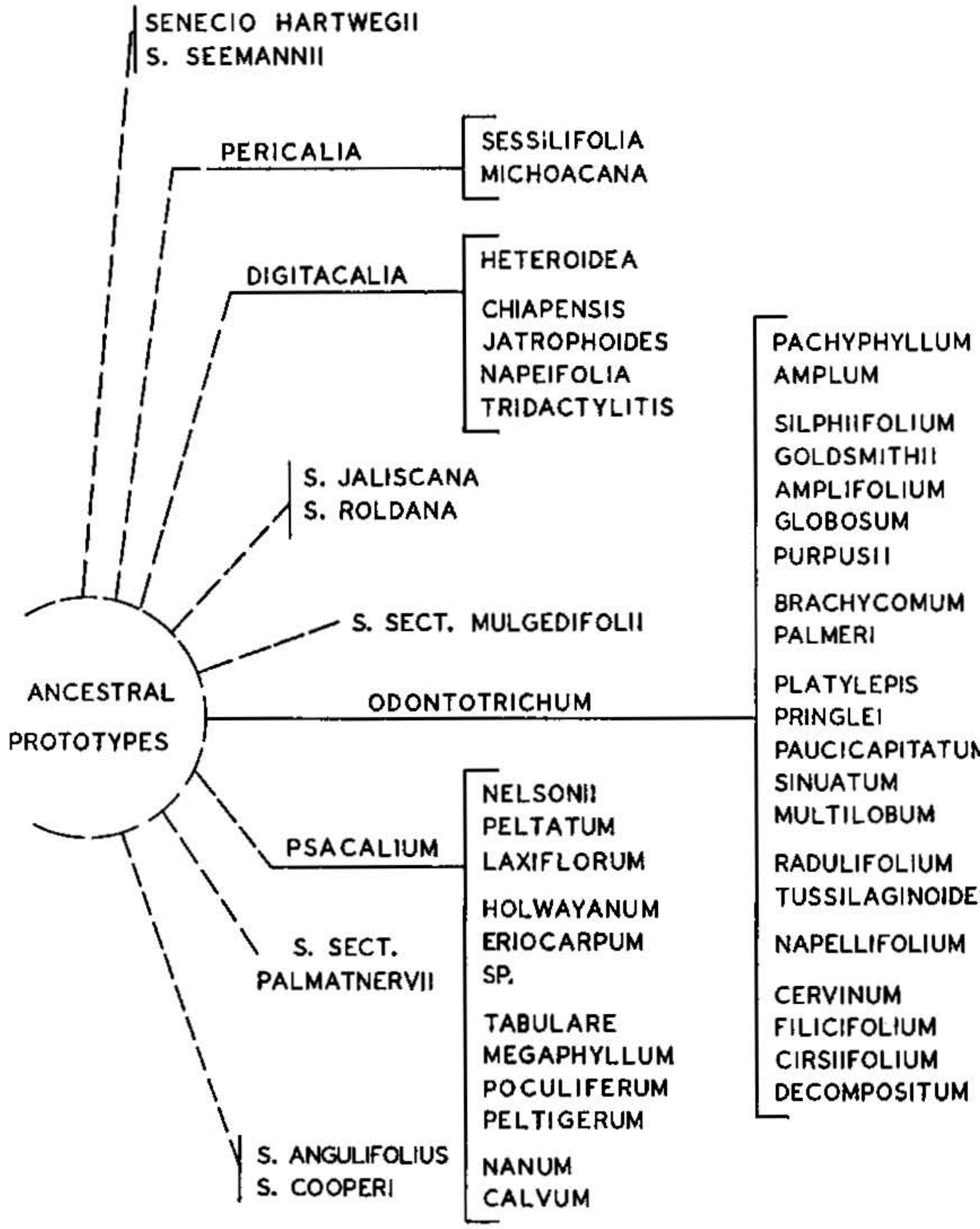

FIGURE 4.—Hypothetical relationships of the species of the cacalioid genera in Mexico to each other and to certain closely allied species of *Senecio*. Vertical gaps and positions represent relative morphological diversity among species and groups of species.

the name *Adenostyles*, have been referred to the tribe Eupatorieae (Hoffmann, 1890).

Nomenclature of *Cacalia*

One of the major points of difficulty concerning the generic nomenclature of the taxa considered in this paper as well as that of *Cacalia* has been the typification of the latter, since no type-species was designated by Linnaeus. The problem of the typification of *Cacalia* has

been reviewed several times (Rydberg, 1924; Hitchcock & Green, 1947; Shinners, 1950; Cuatrecasas, 1960) and therefore does not need to be repeated in detail here. It seems clear that *C. alpina* L. is the most logical lectotype of *Cacalia*. This species, named *C. alpina* by Linnaeus (1753), embodied the Linnaean and pre-Linnaean concept of *Cacalia* in that essentially all of the species of *Cacalia* described by the pre-Linnaean botanists (L'Obel, 1581; Clusius, 1601; Bauhin, 1623; Morison, 1699; Tournefort, 1700) actually represented the same species.

Linnaeus's concept of *Cacalia* was an inclusive one, and a number of the species he considered in this genus were transferred to other genera (Haworth, 1812; Cassini, 1816, 1826, 1827). Nomenclatural difficulty began when Cassini (1816) created a new genus, *Adenostyles*, for a small group of central European plants including *C. alpina* L. as the type-species. *Adenostyles* was actually superfluous when published since the name *Cacalia* should have been used for the genus containing *C. alpina*.

The name *Adenostyles* has been generally accepted (DeCandolle, 1838; Bentham and Hooker, 1873; Hoffmann, 1890; Hegi, 1917; Fiori, 1933) for *C. alpina* and four or five other species endemic to central Europe.

DeCandolle (1838) summarized the work of Cassini and the other post-Linnaean authors. He completely revised the cacalioid complex and in effect retypified *Cacalia*, although he designated no type-species. He divided *Cacalia* into four sections: *Eucacalia* and *Conophora* and two others that he considered doubtfully valid, *Aulacophora* and *Cissampelopsis* (the latter two comprised of several shrubby paleotropical yellow-flowered species now mostly referred to *Senecio*). In the emended genus *Cacalia*, he retained only three Linnaean species, *C. hastata* and *C. suaveolens* in *Eucacalia*, and *C. atriplicifolia* in *Conophora*. DeCandolle recognized Cassini's genus *Adenostyles*, thereby excluding from *Cacalia* the Linnaean type of the genus; he used the name *Psacalium* Cass. for the Mexican species with peltate leaves; and he referred to *Cacalia* various species now properly referred to the genera *Digitacalia*, *Odontotrichum*, *Pericalia*, and *Psacalium*.

In the sense of DeCandolle, therefore, *Cacalia* was to be typified by one of three Linnaean species (but not the logical generic type). It included a variety of species, occurring in Asia, eastern North America, and Mexico, that differed consistently from *Senecio* in a number of respects and was regarded by most authors (Gray, 1883; Hoffmann, 1890; Greenman, 1902; Fernald, 1950; Blake, 1960; Makino, 1958; Cronquist and Gleason, 1963) as comprising a single widespread genus. On the other hand, several authors (Schultz, 1845; Bentham & Hooker, 1873; Hemsley, 1881) did not accept the Candollean *Cacalia*,

preferring to relegate all of the species to *Senecio*. Some authors (e.g., Rydberg, 1924; Cuatrecasas, 1960) took the position accepted in this paper, that of recognizing several valid genera in the Candollean *Cacalia*.

Systematic Treatment

Key to Mexican "Cacalioid" Genera Allied to *Senecio*

1. Basal rosette present, the cauline leaves reduced upward, the uppermost usually bracteiform.
   2. Basal leaves centrally peltate . . . . . **4. Psacalium**
   2. Basal leaves not centrally peltate, the petiole attached to the blade at the edge (subpeltate in *O. radulifolium*) . . . . . **2. Odontotrichum**
1. Basal rosette lacking, the plants with only cauline leaves, the uppermost leaves reduced but not bracteiform.
   3. Plants with underground tubercles attached to the base of the stem; heads subtended by 8–15 linear bracts as long as or longer than the phyllaries. **3. Pericalia**
   3. Plants lacking underground tubercles; heads subtended by 3–5 subulate bracts shorter than the phyllaries . . . . . **1. Digitacalia**

1. Digitacalia

Digitacalia Pippen, gen. nov.

Plantae caulescentes, tuberculis subterraneis nullis, caulibus foliisque glabris vel pubescentibus, foliis omnibus caulinibus, alternis, numerosis, laminis profunde lobatis; inflorescentia corymbosa ampla 30 cm. longa vel longior; capitula numerosa, breves, corollis profunde 5-lobatis, lobis saepe basin versus connatis; achaenia oblonga, subteretia; pappus sordidus.

Typus: *Cacalia jatrophoides* H.B.K.

Perennial, leafy-stemmed herbs to 3 m. tall; roots fibrous, fleshy; stems annual, erect, stout, terete or less frequently angulate, glabrous or pubescent, not tuberculate at base; leaves cauline, not forming a basal rosette, alternate, numerous, uniformly distributed along the stem, not clustered toward the middle, the uppermost not bracteiform; blades shaped variously, deeply pinnately subpalmately lobed; inflorescence corymbose, large, at least 30 cm. long and broad, the branches subtended by small, linear-subulate or large, leafy bracts; heads many, small (except *D. heteroidea*), calyculate, the bracts 3–7, usually shorter than the phyllaries; involucre campanulate or turbinate, the phyllaries 5–8, biseriate appearing uniseriate, imbricate, the overlapped margins subscarious, the exposed surface glabrous or pubescent, the tips fringed with minute, nonglandular trichomes up to 0.3 mm. long; receptacle flat or nearly so, alveolate, not paleaceous; flowers all discoid, perfect, fertile; corollas glabrous, creamy or nearly white, occasionally greenish or purplish-tinted but never yellow, the

tube narrowly cylindrical, ca. 0.5 mm. in diameter, the limb divided into 5 equal, 3-nerved, narrowly triangular or linear, ascending or spreading lobes, the lobes free to the tube or connate into an ampliate throat up to 1.5 mm. long and broad; anthers 1.5–3 mm. long, exserted from the corolla throat, the bases rounded or slightly sagittate, the terminal appendages trullate or ovate, 0.5–0.7 mm. long; style branches 0.7–2 mm. long, slightly flattened, recurved or spreading, stigmatic over most of the abaxial surfaces, the adaxial surfaces glabrous or hispidulous below, the tips truncate, rounded or obtuse, fringed with unicellular, nonglandular "pollen producing" trichomes, unappendaged; achenes narrowly oblong, subterete in cross section, ribbed; pappus a single row of creamy white, stiff, barbellate, capillary bristles.

This genus differs from *Psacalium* and *Odontotrichum* in that the leaves are strictly cauline with no basal rosette formed and the achenes are essentially cylindrical. It differs from *Pericalia* in that the leaves are not concentrated toward the middle of the stem but more uniformly distributed, there are no underground tubercules and the corolla lobes are not recurved.

Key to Species of *Digitacalia*

1. Heads large, 1.5–2 cm. high at maturity; flowers 40 or more; corolla tube at least twice as long as the lobes . . . . . **2. D. heteroidea**
1. Heads small, 1 cm. high or less; flowers 13 or fewer; corolla tube and lobes about equal.
   2. Achenes pubescent; corollas short, 3–3.5 mm. long . . **1. D. chiapensis**
   2. Achenes glabrous; corollas 5–7 mm. long.
      3. Leaves 3-lobed, the lobes forming an angle, with the midrib, of less than 45 degrees . . . . . **5. D. tridactylitis**
      3. Leaves 5- to 7-lobed, the lobes or at least some of the lobes forming an angle with the midrib greater than 45 degrees.
         4. Phyllaries and flowers 5 or 6 per head . . . . . **4. D. napeifolia**
         4. Phyllaries 7; flowers 8–10 per head . . . . . **3. D. jatrophoides**

1. Digitacalia chiapensis (Hemsl.) Pippen, comb. nov.

Senecio chiapensis Hemsl. Biol. Centr. Amer. Bot. 2:238. 1881. Holotype: Chiapas & c., *Ghiesbreght* 537 (K, not seen; isotype GH!).

Cacalia chiapensis (Hemsl.) A. Gray, Proc. Amer. Acad. 19:53. 1883.

Odontotrichum chiapensis (Hemsl.) Rydb. Bull. Torrey Bot. Club 51:418. 1924.

Lower portion of plant not seen; stems terete, glabrous; leaves presumably all cauline, petiolate, oblong-ovate in outline, 10–14 cm. long, 9–14 cm. wide, pinnately veined; blades deeply pinnately 5-lobed ca. two-thirds the distance to the midrib, the lobes ovate or oblong-acute, 4–6 cm. long, 2–3 cm. wide, about half as wide as long, the lowermost pair of lobes rounded proximally or with two smaller deflected lobules, the margins entire, the abaxial surface

puberulent mostly along the veins, the adaxial surface glabrous; petioles short, to 4 cm. long, glabrous, terete; inflorescence broadly corymbose-paniculate, to 30 cm. long and broad, the branches glabrous, subtended by sessile, ovate bracts; calyculate bracts ca. 3, subulate, 1.5–2 mm. long; heads many, 7–8 mm. long; phyllaries (6 –) 8, glabrous, narrowly ovate, 3.5–5 mm. long, 1–1.5 mm. wide; flowers 9; corolla 3–3.5 mm. long, the tube 1.5–2 mm. long, the lobes linear or narrowly elliptic, 1.5 mm. long, spreading or reflexed, the throat none; anthers 1.5 mm. long; style branches 0.7–1 mm. long, the tips truncate or rounded with a terminal fringe of trichomes; mature achenes not seen, the immature achenes brown, sparsely pubescent; pappus bristles 2–3 mm. long, white.

DISTRIBUTION: Known only from Chiapas. Apparently flowering in the fall but the exact time not known.

This plant has been very poorly collected. It is known from only two collections in Chiapas, one is the type.

CHIAPAS: *Nelson* 3467 (GII, US).

2. Digitacalia heteroidea (Klatt) Pippen, comb. nov.

Senecio heteroideus Klatt, Leopoldina 24:125. 1888. Holotype: Mexico; between San Andrés and San Miguel, *Liebmann* 178 (C, not seen; tracing of type in Klatt's herb. GII!).

Cacalia laevigata Schultz Bip. Leopoldina 24:125. 1888, in synonymy.

Cacalia longipetiolata Rob. & Greenm. Amer. Journ. Sci. III. 50:157. 1895. Holotype: Oaxaca; Sierra de San Felipe, 7,000 ft., Oct. 10, 1894, *C. C. Pringle* 5828 (GII!).

Plants to ca. 2 m. (*Pringle* 6176) tall; lower portion of the plant not seen; stems glabrous, glaucous; leaves pubescent on both surfaces mostly along the veins, presumably all cauline, long-petioled, subpalmately veined with 5–7 principal veins, transversely broadly elliptic in outline, the larger leaves 6–13 cm. long from the basal sinus to the apex, 9.5–22 cm. wide; blades cordate-based, deeply subpalmately 5- to 7-lobed, the lobes oblong or triangular, the larger ones 5–6 cm. long, 1–3 cm. broad, the margins toothed or lobulate; petioles glabrous, terete, 8–12 cm. long; inflorescence paniculate corymbose, the major branches subtended by leafy, narrowly elliptic, petiolate bracts, 3–12 cm. long, 0.5–3 cm. broad, glabrous; pedicels 5–13 cm. long; calyculate bracts 5–7, subulate, 5–7 mm. long; heads 12–40, 16–18 (–20) mm. long; phyllaries 7 or 8, ovate, 11–12 (–14) mm. long, 3–4 (–6) mm. wide, glabrous; receptacle ca. 7 mm. across; flowers ca. 40; corolla 9–10.5 mm. long, the tube 5.5–6 mm. long, the throat short, campanulate, 1–1.5 mm. long, ca. 1.5 mm. across at the apex, the lobes 2–3 mm. long, narrowly triangular, 0.5 mm. wide, loosely reflexed; anthers 3 mm. long; style branches ca. 1 mm. long,

minutely hispid on the abaxial surface, the tips obtuse with a sparse, subterminal fringe of trichomes; mature achenes ellipsoid, 3.5–5.5 mm. long, 1.5 mm. wide, 1 mm. thick, glabrous, brown, with 10–12 prominent, paler ribs; pappus 7–8 mm. long, white.

DISTRIBUTION: Known only from central Oaxaca. Presumably flowering in September or October.

This species is placed in *Digitacalia* because its general habit is like that of the other species in this genus, although the inflorescence with few, large heads of 30 or more flowers is more like the species in *Pericalia*. It differs from *Pericalia* in the short corolla throat and the fewer calyculate bracts. *D. heteroidea* appears to be somewhat intermediate between this genus and *Pericalia*.

OAXACA: *Conzatti* 725 (GH); *Pringle* 6176 (GH, NY, US); *C. L. Smith* 287 (MICH, NY, US).

3. Digitacalia jatrophoides (H.B.K.) Pippen, comb. nov.

Cacalia jatrophoides H.B.K. Nov. Gen. et Sp. 4:169. 1820. (Folio ed. 4:132. 1820.) Holotype: Michoacán; nr Lake Cuitzeo, 900 hex., *Humboldt & Bonpland* 4298 (P, not seen; Field Mus. Neg. 37869!).

Senecio jatrophoides (H.B.K.) Schultz Bip. Flora 28:498. 1845.

Cacalia digitata Sessé & Moc. Pl. N. Hisp. ed. 1. 132. 1889. Lectotype without locality (presumably "in Purulandiri montibus") *Sessé & Moc.* 2826 (MA!; Field Mus. Neg. 42288).

Odontotrichum jatrophoides (H.B.K.) Rydb. Bull. Torrey Bot. Club 51:419. 1924.

Plants to 3 m. tall; stems to 1 cm. thick at the base, mostly hollow, often purplish, glabrous, glaucous; leaves sparsely pubescent on both surfaces mostly along the veins and margins, numerous, long-petiolate, subcircular in outline, 6–10 cm. long and broad, pinnate or subpalmately veined with 5–7 principal veins fused into a common trunk above the base of the blade; blades deeply 5- to 7-lobed, the lobes subpinnate or subpalmate, the central one larger, linear or narrowly ovate, 6–8 cm. long, 1–1.5 cm. wide, the margin subentire or distantly toothed (lobes occasionally larger and the leaves similar to those of *D. napeifolia*); petioles terete, glabrous, purplish, to 9 cm. long; inflorescence broadly corymbose, loose spreading, usually more than 30 cm. long and broad, the branches sparsely pubescent or tomentose, the proximal branches in the axils of the 3-lobed upper leaves, the distal branches subtended by petiolate, narrowly ovate bracts to 2 cm. long; calyculate bracts 3–7, subulate, 2–5 mm. long, heads many, 1–1.5 cm. long; phyllaries 7 or 8, narrowly ovate, 4–5.5 mm. long, 1–1.5 mm. wide, glabrous; flowers 8–10; corolla 6–8 mm. long, the tube greenish, 3–5 mm. long, the lobes 3 mm. long, 0.5 mm. wide, linear or narrowly elliptic, the throat none; anthers ca. 2 mm. long; style branches 1 mm. long, recurved, the tips rounded or obtuse with a subterminal fringe of trichomes; mature achenes narrowly oblong appearing subterete in cross

section, 4–5 mm. long, 1.5 mm. wide, glabrous, pale tan, strongly 10- to 12-ribbed; pappus 5–7 mm. long, creamy, becoming tawny in age.

DISTRIBUTION: Southern Zacatecas and Jalisco, eastward through Michoacán and Guanajuato and south to Oaxaca. Rocky places in highland pastures and grasslands. Flowering in July and August.

The specimens collected in Zacatecas and one from Oaxaca have much broader leaf lobes than the others. These leaf forms are similar to those of *D. napeifolia* DC., but these specimens are considered with *D. jatrophoides* because the floral characters are more like the latter.

GUANAJUATO: *Pringle* 4262 (GH, NY, US). JALISCO: *McVaugh* 17160 (MICH). MICHOACÁN: *Arsène*, s.n., Sept. 9, 1909 (US); *Pippen* 46 (MICH). OAXACA: *L. C. Smith* 123 (GH); *C. L. Smith* 388 (MICH, NY, US); *Pringle* 5741 (GH). ZACATECAS: *Rose* 3040 (GH, US).

4. Digitacalia napeifolia (DC.) Pippen, comb. nov.

Cacalia napeaefolia DC. Prod. 6:328. 1838. Holotype: Oaxaca; summit of San Felipe, in 183–, *Andrieux* 280 (G, not seen; Field Mus. Neg. 33809!).
Senecio napeaefolium (DC.) Schultz Bip. Flora 28:498. 1845.
Odontotrichum napeaefolium (DC.) Rydb. Bull. Torrey Bot. Club 51:418. 1924.

Plants to 2.5 m. tall (*Pringle* 4778); lower portion of the plant not seen; stems terete, purplish, sparsely pubescent; leaves presumably all cauline, numerous, petiolate, pinnately veined, oblong-ovate, 15–29 cm. long, 16–23 cm. wide, progressively smaller upward; blades deeply 5- to 7-lobed to within 0.5–1 cm. of the midrib, the lobes oblong-attenuate, narrowly ovate, to 14 cm. long, 4 cm. wide, the margins finely or coarsely toothed, the proximal pair of lobes usually deflected or at right angles to the midrib, the adaxial surface of the blade glabrous or sparsely pubescent mostly along the veins, the abaxial surface pale, sparsely pubescent or tomentose; petioles subterete, glabrous below becoming pubescent toward the blade; inflorescence corymbose, to 45 cm. long and broad, the branches tomentose, the proximal ones subtended by the uppermost leaves, the distal branches subtended by linear-subulate bracts, 1.5 cm. long; calyculate bracts subulate, 1.5–3 mm. long; heads many, 1 cm. long; phyllaries 5 (rarely 6), oblong or narrowly ovate, 3.5–5.5 mm. long, 1.5–2 mm. wide, glabrous or very sparsely puberulent; flowers 5 or 6; corolla 6–7 mm. long, the tube 3–3.5 mm. long, the lobes 3–4 mm. long, linear or narrowly elliptic, 0.5 mm. wide, the throat none; anthers 2–3 mm. long; style branches 1–2 mm. long, minutely hispid on the abaxial surface, the tips obtuse with a subterminal fringe of trichomes; mature achenes narrowly oblong, appearing subterete in cross section, 4–5 mm. long, 1–1.5 mm. wide, glabrous, purplish brown, strongly 10-ribbed; pappus 6–7 mm. long, creamy, becoming tawny in age.

DISTRIBUTION: Known mostly from central Oaxaca with one col-

lection from Michoacán. Openings in oak-pine woodlands. Flowering in September and October.

MICHOACÁN: *Hinton et al.* 12572 (MICH, NY). OAXACA: *McVaugh* 21823 (MICH); *Nelson* 1133 (GH, US); *Pringle* 4778 (GH, MICH, NY, US).

5. **Digitacalia tridactylitis** (Rob. & Greenm.) Pippen, comb. nov. PLATE 1

Cacalia tridactylitis Rob. & Greenm. Amer. Journ. Sci. III. 50:159. 1895. Holotype: Oaxaca; Sierra de San Felipe, 6,000 ft., Nov. 19, 1894, *C. G. Pringle* 5841 (GH!).

Odontotrichum tridactylitis (Rob. & Greenm.) Rydb. Bull. Torrey Bot. Club 51:419. 1924.

Plants to at least 2.5 m. tall; stems to slightly over 1 cm. thick at the base, angulate or terete, sparsely pubescent below becoming denser above; leaves cauline, numerous, pinnately veined, obtrullate or rhombic in outline, the larger ones 14–20 cm. long, from two-thirds as broad to as long as broad, sparsely pubescent adaxially, gray tomentose on the abaxial surface; blades deeply 3-lobed at least half way to the midrib, the lobes ovate, narrowly ovate or narrowly triangular, variable in size from 2- to 6-times longer than broad, the angle of the lateral lobes to the midrib less than 45 degrees, the margin of the lobes usually entire, occasionally toothed, the base of the blade decurrent along the petiole for a short distance; petioles 2–3.5 cm. long, triangular in cross section, pubescent; inflorescence corymbose, ca. 30 cm. long and broad, the branches tomentose, subtended by the uppermost cauline leaves; pedicels 3–7 mm. long; calyculate bracts 3–7, subulate, 1.5–3.5 mm. long; heads many, 9 mm. long; phyllaries 7 or 8, narrowly ovate, 3.5–4 (–5) mm. long, 1–1.5 mm. wide, glabrous; flowers (7–) 8–10; corolla 5–6 mm. long, the tube 2.5–3 mm. long, the throat usually obsolete or very short, 0.5 mm. long and wide, occasionally to 1.5 mm. long, ca. 1 mm. wide (*McVaugh* 21903), the lobes narrowly elliptic, 2–3 mm. long, 0.5 mm. wide; anthers 2–3 mm. long; style branches 1–1.5 mm. long, the tips rounded with subterminal fringe of trichomes; achenes narrowly oblong, appearing subterete or slightly compressed in cross section, 3.5–4 mm. long, ca. 1 mm. wide, glabrous, pale tan, 10- to 12-ribbed; pappus (3.5–) 4–5.5 mm. long, creamy, slightly clavate distally; chromosome number, $n=30$ (Turner, ined.).

DISTRIBUTION: Morelos, Oaxaca, and Guerrero. Growing in openings in the pine-oak zone. Flowering in October and November.

The specimens from Morelos tend to have deeper, more narrowly lobed leaves and less pubescence on the abaxial surface than the other specimens.

GUERRERO: *McVaugh* 21903* (MICH). MORELOS: *Pringle* 6164 (GH, MICH, NY, US); *Pringle* 9877 (GH, MICH, NY, US). OAXACA: *Nelson* 2080 (US); *C. L. Smith* 380 (MICH, NY); *L. C. Smith* 966 (GH).

2. *Odontotrichum*

Odontotrichum Zucc. Abhandl. Baier. Akad. Wiss. 1:311. 1832.

Perennial, subscapose herbs, 0.5–2 m. tall; roots fleshy, fibrous, caudex tough, to 5 cm. long, 3 cm. thick, the nodes and terminal buds densely covered with tufts of tawny, long, multicellular hairs; stems usually solitary, annual, erect, slender, terete or less frequently angulate, glabrous or pubescent; radical leaves forming a basal rosette of two to several, the petiole attached to the base of the blade, not centrally peltate; blades pinnately or subpalmately veined, variously lobed or occasionally subentire, glabrous or pubescent; cauline leaves similar to the basal but progressively smaller upward, the uppermost bracteiform; inflorescence paniculate or corymbose often pubescent but not glandular, the branches subtended by small, linear-subulate or large, leafy, often vaginate bracts; heads few to many, calyculate, the bracts usually 1–5, usually as long as or shorter than the phyllaries; involucre cylindrical, campanulate or turbinate, the phyllaries 5–17, imbricate, biseriate appearing uniseriate, the overlapped margins subscarious, the exposed surfaces glabrous or pubescent, the tips fringed with minute trichomes up to 0.3 mm. long; receptacle flat or nearly so, alveolate, occasionally sparsely pubescent, not paleaceous; flowers all discoid, perfect, fertile, 5–80 per head; corollas glabrous, creamy or nearly white, occasionally greenish or purplish tinted but never yellow, the tube narrowly cylindrical, ca. 0.5 mm. in diameter, the limb divided into 5 equal, 3-nerved, narrowly elliptic, narrowly triangular or linear, ascending or spreading, not recurved lobes, the lobes usually free to the tube, occasionally connate into a short, ampliate throat up to 1 mm. long; anthers 2–4 mm. long, exserted above the corolla, the bases rounded or slightly sagittate, the terminal appendages trullate or ovate, 0.5–0.7 mm. long; style branches 0.7–2 mm. long, slightly flattened, recurved or spreading, stigmatic on most of the abaxial surface, the adaxial surface glabrous or hispidulous below, the tips unappendaged, rounded or obtuse, fringed with minute, unicellular, nonglandular, "pollen producing" trichomes; achenes oblong, ellipsoid or obovoid, somewhat dorsally compressed, elliptic or broadly elliptic in cross section, glabrous or pubescent, striate or prominently 10- to 12-ribbed; pappus a single row of white or creamy, stiff, barbellate, capillary bristles; chromosome numbers 25, 30.

TYPE-SPECIES: *Odontotrichum cirsiifolium* Zucc.

This is the largest genus treated in this paper, with 21 species. It is distinguished from *Psacalium* by the lack of centrally peltate leaves, the blades being attached at their bases to the petiole. In most of the species the leaves are vertically oriented, standing erect.

Key to Species of *Odontotrichum*

1. Pappus short, 2 mm. long or less, about half as long as the corolla tube.
   2. Petioles flattened, winged, the margin up to 1 cm. wide; basal leaves lobed about one-half the distance to the midrib, lobes usually longer than broad . . . . . **3. O. brachycomum**
   2. Petioles subterete, not winged; basal leaves coarsely toothed or lobulate, but not lobed, lobules broader than long . . . . . **13. O. palmeri**
1. Pappus at least 3 mm. long, as long as or longer than the corolla tube.
   3. Basal leaves toothed or subentire, not lobed (some species with two auriculate basal lobes formed by the deeply cordate basal sinus).
      4. Inflorescence very compact, globose, 2.5–3 cm. long and broad; phyllaries 5 or 6 per head . . . . . **8. O. globosum**
      4. Inflorescence tightly or loosely corymbose, not globose, at least 4 cm. long and broad; phyllaries at least 7.
         5. Heads large with 30 or more flowers; phyllaries 13 or 14.
            6. Bracts subtending the involucre oblong or obovate, distally laciniate, 3 mm. wide; corolla tube 9–10 mm. long, twice as long as the lobes (5–6 mm. long); phyllaries 12–15 mm. long . . . . **1. O. amplum**
            6. Bracts subtending the involucre linear-subulate, tapering to a point distally; corolla tube 5–6 mm. long, slightly longer than the lobes (3.5–4 mm. long); phyllaries 7–9 mm. long . **12. O. pachyphyllum**
         5. Heads small with 15 or fewer flowers; phyllaries 8 or fewer.
            7. Basal leaves deeply cordate-based; petioles of the cauline leaves broadly leafy-margined, the base auriculate, clasping the stem; corolla tube 5–6 mm. long . . . . . **19. O. silphiifolium**
            7. Basal leaves truncate- or obtuse-based, rarely slightly cordate; petioles of the cauline leaves usually terete, the base dilated but not auriculate or clasping the stem (occasionally the petiole narrowly leafy-margined or the leaves sessile); corolla tube 3–4 mm. long.
               8. Plants 0.6 m. tall or less; basal leaves (including the petiole) 11–17 cm. long . . . . . **17. O. purpusii**
               8. Plants at least 1 m. tall; basal leaves (including the petiole) (15–) 20–39 cm. long.
                  9. Phyllaries 5 or 6; flowers 6 or 7; leaves sparsely puberulent. **9b. O. goldsmithii var. rowellii**
                  9. Phyllaries 7 or 8; flowers 9–13; leaves glabrous. **9a. O. goldsmithii var. goldsmithii**
   3. Basal leaves pinnately or subpalmately divided into several lobes, the lobes as long as broad or longer.
      10. Leaves deeply dissected or pinnatisect into linear segments, the ultimate segments linear or narrowly triangular, at least 5 times longer than broad.
         11. Median and distal cauline leaves broadly auriculate-based, the margin laciniate; proximal inflorescence bracts ovate, navicular, 1.5–3 cm. long, 2–3 cm. broad, the margin distally laciniate; pappus deciduous before maturity of the achenes . . . . **5. O. cirsiifolium**
         11. Median and distal cauline leaves often dilated at the base but not broadly auriculate-based or laciniate-margined; proximal inflorescence bracts linear subulate, up to 1.5 cm. long, 1 mm. wide or less; pappus persistent.
            12. Achenes glabrous.

13. Leaves 3- to 4-pinnatisect; heads with 6–8 flowers and 5 or 6 phyllaries . . . . . **6. O. decompositum**
13. Leaves deeply dissected or pinnatifid with the primary divisions again 3- to 5-lobed but not cleft to the midrib; heads with 10 flowers and 8 phyllaries . . . . . **10. O. multilobum**

12. Achenes pubescent.
14. Heads with 12–25 flowers; phyllaries sparsely pubescent. **11. O. napellifolium**
14. Heads with 10 or fewer flowers; phyllaries glabrous.
15. Pappus 7 mm. long, about as long as the corolla (lobes plus tube); phyllaries 5 or 6 . . . . . **7. O. filicifolium**
15. Pappus 3.5–4 mm. long, about as long as the tube of the corolla; phyllaries 7. . . . . **4. O. cervinum**

10. Leaves shallowly or deeply lobed but not finely dissected or pinnatisect into linear segments, the ultimate segments triangular or deltoid, usually less than 3 times longer than broad.
16. Heads large, 1.5–2.5 cm. high with 40 or more flowers; corolla tube 7–10 mm. long, twice as long as the lobes.
17. Bracts subtending the involucre leafy, oblong or obovate, distally laciniate, 3–5 mm. wide; leaves and stem sparsely puberulent; basal leaves 18–75 cm. long and broad . . . . **15. O. platylepis**
17. Bracts subtending the involucre linear-subulate, simple, entire-margined, 1 mm. wide or less, not leafy; leaves and stem densely covered by an interwoven mass of gray white, long trichomes; basal leaves 14–16 cm. long, ca. 10 cm. wide. **14. O. paucicapitatum**

16. Heads small, 1–1.2 cm. high or less; flowers 14 or fewer; corolla tube about equaling the lobes (ca. 5 mm. long).
18. Achenes pubescent.
19. Basal leaves subpeltate, the petiole attached to the blade 2-10 (–30) mm. above the base, the blades 10–12 (–18) cm. long. **18. O. radulifolium**
19. Basal leaves attached at base to petiole, not peltate, the blades 20–30 cm. long.
20. Heads with 9–14 flowers and 7 or 8 phyllaries; cauline leaves reduced, bracteiform, narrowly ovate, laciniate-lobed, 8 cm. long or less, 1–3 cm. broad, the base not auriculate. **16. O. pringlei**
20. Heads with 5 or 6 flowers and 5 phyllaries; cauline leaves broadly ovate, leafy, auriculate-based, 11–20 cm. long, 11–20 cm. broad, the margin dentate or lobed . . **21. O. tussilaginoides**

18. Achenes glabrous.
21. Leaves shallowly lobed, the lobes as long as broad or broader (3–7 cm. broad), rounded at the tip, the margin regularly toothed; petiole of the cauline leaves leafy-margined, broadly ovate, auriculate-based; lower inflorescence bracts leafy, 4–9 cm. long, 1–3 cm. wide, ovate-naviculate . . . . **2. O. amplifolium**
21. Leaves deeply lobed, the lobes longer than broad (1–3 cm. broad), oblong or obovate, each of the lobes irregularly 3- to 5-lobed; petiole of the cauline leaves dilated or often clasping the stem but not broadly leafy-margined or auriculate-based; lower inflorescence bracts narrowly ovate or linear-subulate, 1–1.5 cm. long, 3 mm. wide . . . . . **20. O. sinuatum**

1. Odontotrichum amplum Rydb. Bull. Torrey Bot. Club 51:417. 1924. Holotype: Jalisco; road between Huejuquilla and Mesquitic [Mezquitic], Aug. 25, 1897, *J. N. Rose* 3575 (US!).

Plants 0.7–1 m. tall, glabrous; stem usually one, 5–8 mm. thick at the base, terete, glaucous; basal leaves 2 or 3, coriaceous, long-petioled, deltoid or transversely triangular, the apex rounded, 9–10 cm. long, (11–) 18–19 (–22) cm. wide; blades sagittate-based, coarsely dentate or lobulate, the teeth or lobules many, deltoid or 3-angled, 5–8 (–12) mm. long, 8–10 (–15) mm. wide, ciliate, the abaxial and adaxial surfaces very similar; petioles to 28 (–40) cm. long, terete; cauline leaves 5–6, the lowermost one-half to two-thirds as large as the basal ones and similar to them, the petiole proximally dilated, clasping the stem; upper cauline leaves gradually smaller upward, the petioles broadly leafy-margined, the uppermost forming leafy inflorescence bracts; inflorescence corymbose, 9–23 cm. long, 15–20 cm. broad, glaucous; pedicels 2–6 cm. long; calyculate bracts 3–5, leafy, 1–1.5 cm. long, 3–6 mm. wide, distally 5- to 9-toothed; heads 9–15, 18–25 mm. long; phyllaries 13 (–15), ovate or narrowly ovate, 12–15 mm. long, 4–5.5 mm. wide, glabrous; receptacle 10–12 mm. across; flowers 40–50 or more; corolla 14–16 mm. long, the tube 9–10 mm. long, ca. 0.5 mm. wide, the lobes oblong, acute-tipped, 5–6 mm. long, the throat none; anthers 3.5 mm. long; style branches 1.5 mm. long, the tips truncate with a terminal fringe of trichomes; mature achenes ellipsoid, somewhat dorsally compressed, 6–7 mm. long, 2 mm. wide, ca. 1.5 mm. thick, glabrous, tan, 20- to 22-ribbed; pappus creamy, 8–11 mm. long, chromosome number, $n=30$ (Pippen).

DISTRIBUTION: Western Aguascalientes and southwestern Zacatecas. Grazed grassland areas. Flowering in September.

Known only from four collections. This species is very similar to *O. pachyphyllum* but differs in having larger heads with more flowers and leafy calyculate bracts.

AGUASCALIENTES: *McVaugh & Koelz* 57 (MICH); *Pippen* 2, 3, 4 (MICH). ZACATECAS: *McVaugh* 17726 (MICH).

2. Odontotrichum amplifolium (DC.) Rydb. Bull. Torrey Bot. Club 51:416. 1924.
Cacalia amplifolia DC. Prod. 328. 1838. Holotype: Oaxaca; Sierra de San Felipe, on the summit, July 1832, *G. Andrieux* 293; (G, not seen; Field Mus. Neg. 33808!).
Senecio amplifolius (DC.) Schultz Bip. Flora 28:498. 1845.
Senecio rumicifolius Klatt, Leopoldina 24:126. 1888. Holotype: Mexico; Cumbre de Estepa, September 1842. *Liebmann* 237 (C, not seen; tracing of type in Klatt's Herb., GH!).
Cacalia rumicifolia Schultz Bip. Leopoldina 24:126. 1888, in synonymy.
Odontotrichum rumicifolium (Klatt) Rydb. Bull. Torrey Bot. Club 51:416. 1924.

Plants to 1.5 m. tall; stem 0.5–1 cm. thick at the base, terete arachnoid pubescent, the hairs multicellular, 0.5 mm. long, white, interwoven; leaves sparsely pubescent adaxially, densely pubescent abaxially; basal leaves 2–5, occasionally more, long-petioled, pinnately veined, ovate-cordate or oblong-cordate, (13–) 17–27 (–30) cm. long or longer, (12–) 13–19 (–24) cm. wide or wider, usually ca. two-thirds longer than wide; blades shallowly lobed, the lobes 12–16, rounded, usually broader than long, (1.5–) 3–4 (–5) cm. long, (2.5–) 3–5 (–7) cm. wide, each lobe often shallowly 2- to 3-lobed or coarsely toothed; petioles usually longer than the blade, 20–35 cm. long; cauline leaves 3 or more, the lowermost similar to the basal ones but the petiole leafy-margined and more dilated and clasping at the base; upper cauline leaves progressively smaller upward, the uppermost leaves bracteiform, forming leafy, ovate-naviculate inflorescence bracts, (3–) 4–9 cm. long, 1–3 cm. wide, distally toothed; inflorescence corymbose, (6–) 16–30 cm. long, 10–20 cm. broad, the branches tomentose; pedicels 0.5–1.5 cm. long; calyculate bracts 1–3, subulate, 3–6 mm. long; heads 50 to over 100, 6–10 mm. long; phyllaries 7 or 8 ovate or narrowly ovate, 4–5.5 mm. long, 1–2 mm. wide (specimens from Oaxaca with phyllaries 6–7 mm. long, 2–3 mm. wide), glabrous; flowers (8–) 10–13, corolla (5–) 6.5–7.5 mm. long, the tube (2.5–) 3.5–4 (–5.5) mm. long, the lobes linear, (2–) 3–3.5 mm. long, the throat none; anthers 2–3 mm. long; style branches 1–1.5 mm. long, hispid on the abaxial surface, the tips truncate or obtuse with a terminal or subterminal fringe of trichomes; mature achenes ellipsoid or obovoid (often the marginal ones falcate), 5–5.5 mm. long, 2–3 mm. wide, 1.5–2 mm. thick, glabrous, light brown, striate; pappus creamy, becoming fuscous with age, 4–6 mm. long.

DISTRIBUTION: Oaxaca, Guerrero, and México. Grassy openings in the oak-pine-fir woodlands. Flowering from August to October.

This species is closely related to *O. silphiifolium* and *O. goldsmithii*. The specimens from Guerrero and México differ from those in Oaxaca in that the size of the heads (phyllaries and flowers) tend to be smaller, the inflorescence more open and spreading, and the plants less pubescent.

DISTRITO FEDERAL: *Matuda* 26624 (NY). GUERRERO: *Sharp* 441465 (NY); *Nelson* 2243 (GH, US, this specimen has unusually large leaves); *Rzedowski* 15974, 16015 (MICH). MÉXICO: *Matuda* 27730, 29313, 29609 (NY); *Hinton, et al.* 8349 (MICH). OAXACA: *Purpus* 3139 (GH, NY, US); *Conzatti & Gonzalez* 397 (GH); *L. C. Smith* 124 (GH, this specimen has large cauline leaves and small inflorescence bracts); *Nelson* 1061 (US); *C. L. Smith* 391 (MICH, US); *McVaugh* 21824 (MICH).

3. Odontotrichum brachycomum (Blake) Rydb. Bull. Torrey Bot. Club 51:415. 1924.

Cacalia brachycoma S. F. Blake, Contr. Gray Herb. II. 52:58. 1917. Lectotype: Michoacán; wet ravines near Uruapan, 1,525 m., Nov. 13, 1905, *C. G. Pringle* 10126 (GH!).

Plants 1–2 m. tall; stems terete, 7–9 mm. thick at the base, densely villous below, becoming subglabrous upward, the hairs 0.5–1 mm. long; leaves minutely puberulent mostly along the veins and margins with short, white hairs ca. 0.25 mm. long; basal leaves 3 or 4, coriaceous, long-petioled, mostly deltoid or ovate, 13–19 cm. long or longer and broad, pinnately veined; blades sinuately lobed about one-half the distance to the midrib, the lobes 3–6 cm. long, 2–3.5 cm. wide at the base, each distally divided into 3 lobes, the secondary obes deltoid, 3-angulate, the base of the blade truncate, decurrent along the entire length of the petiole; petiole as long as or longer than the blade, 13–19 cm. long, leafy-margined, the margin up to 5 mm. wide on each side; cauline leaves 3 or 4, the lowermost usually smaller than the basal ones but similar (occasionally larger, more deeply dissected, up to 30 cm. long, 20 cm. wide), the petiole broadly leafy-margined, ovate, dentate, clasping the stem; upper cauline leaves progressively smaller upward, the uppermost bracteiform forming ovate, naviculate inflorescence bracts, 5–8 cm. long, 3–5 cm. wide; inflorescence corymbose, 13–28 cm. long and broad; pedicels to 1 cm. long; calyculate bracts 1–3, subulate, 1–2.5 cm. long, 1–5 mm. wide; heads 50–100, 10–12 mm. long; phyllaries 9, narrowly ovate or oblong, 6–7 mm. long, 1.5–2 mm. wide, glabrous; flowers 10–12 (–14); corolla 6–8 (–10) mm. long, the tube 3–4 mm. long, the lobes linear or narrowly elliptic, 3.5–4 (–6) mm. long, the throat none; anthers 2–3 mm. long; style branches 1 mm. long, the tips truncate with a terminal fringe of trichomes; mature achenes oblong or ellipsoid, (3.5–) 4–6 mm. long, 1 mm. wide, glabrous, brown, 10- to 12-ribbed; pappus 1.5–1.6 mm. long, about half as long as the tube of the corolla, creamy, the bristles unequal; chromosome number, $n=30$ (Turner, ined.).

DISTRIBUTION: Known only from the mountains of western central Michoacán. Grasslands, openings and wet ravines in the oak-pine-woodland zone. Flowering in October.

Blake cited both the *Pringle* 10126 collection at the Gray Herbarium and at the U.S. National Herbarium as the type. *Pringle* 10126 (GH) is chosen as the lectotype because it is annotated in what appears to be Blake's writing, and he was associated with the Gray Herbarium at the time this species was named.

As the name suggests this species has a very short pappus. In *Odontotrichum palmeri* the pappus is as short as in *O. brachycomum* but *O. palmeri* differs in having fewer phyllaries and flowers per head and toothed, but not lobed, basal leaves.

MICHOACÁN: *Hinton et al.* 12146 (MICH, this specimen has an unusually large leaf, NY, US); *Hinton et al.* 15288 (GH, NY, US); *Hinton et al.* 15624 (GH, NY, TEX, US); *King & Soderstrom* 4904 (MICH); *McVaugh* 21934, 21959 (MICH).

4. Odontotrichum cervinum Rydb. Bull. Torrey Bot. Club 51:420. 1924. Holotype: Nayarit; between Pedro Paulo and San Blascito, Aug. 4, 1897, *J. N. Rose* 1986 (US!).

Plants ca. 0.5 m. tall; stem slender, 3–4 mm. thick at the base, subglabrous proximally, becoming sparsely pubescent to tomentose to densely tomentose upward, the hairs white, multicellular; leaves glabrous, the abaxial surface paler; basal leaves 3–5, long-petioled, rhombic or ovate or subcircular in outline, the larger ones about 6–9 cm. long and wide, pinnately veined; blades deeply pinnately dissected into linear divisions, 3–4 mm. wide, the major divisions subdivided several times, the secondary divisions also subdivided; petioles 20–25 cm. long, slender, glabrous, purplish; cauline leaves 3 or 4, the lowermost similar to the basal ones; upper cauline leaves reduced, bracteiform, the uppermost forming inflorescence bracts; inflorescence corymbose, to 10 cm. long and broad, the branches tomentose; pedicels subtended by a linear-subulate bract to 1 cm. long; calyculate bracts linear-subulate, 4–6 mm. long; heads ca. 25 or fewer, 9–10 mm. long; phyllaries 7, oblong-ovate, 5–6 mm. long, 1.5–2.5 mm. wide, glabrous; flowers 8–10; corolla 7–8 mm. long, the tube 3.5–4 mm., the lobes 3.5–4 mm. long, linear or narrowly elliptic, the throat essentially none; anthers dark brown or black, 3 mm. long; style branches 0.7–1 mm. long, the tips truncate with a terminal fringe of trichomes; mature achenes not seen, the immature achenes greenish, sparsely pubescent with white hairs; pappus 3.5–4 mm. long, creamy.

DISTRIBUTION: Known only from Nayarit. Grasslands and borders of fields. Flowering in July.

This taxon is known only from one collection besides the type. It is unusual because of the small, almost subternate leaves. It is related to *O. filicifolium*.

NAYARIT: *McVaugh* 15313 (MICH).

5. Odontotrichum cirsiifolium Zucc. Abhandl. Baier. Akad. Wiss. 1:311. 1832. Holotype: A specimen of a garden plant grown from seeds sent by Karwinski from Mexico (M!; Mich. Neg. 1392). Not *Cacalia cirsiifolia* Hook. & Arn.

Cacalia cervariifolia ["cervariaefolia"] DC. Prod. 6:328. 1838. Holotype: Oaxaca; San Bartolo, *Andrieux* specimen in the DC. herb. (G, not seen; Field Mus. Neg. 28888!).

Senecio cervariaefolius (DC.) Schultz Bip. Flora 28:498. 1845.

Sciadoseris vaginata Kunze, Bot. Zeit. 349. 1851. Holotype: specimen grown in the gardens at Herb. Berol. (not seen).

Mesoneuris bipinnatifida A. Gray, Proc. Amer. Acad. 8:661. 1873. Holotype: Mountain region of Chiapas, *Ghiesbreght* 805 (GH!).

Odontotrichum bipinnatifidum (A. Gray) Rydb. Bull. Torrey Bot. Club 51:413. 1924.

Plants to 1.5 m. tall; stem 4–7 mm. thick at the base, arachnoid-pubescent or tomentose (often flocculent), the hairs white, to 2 mm. long or longer; leaves sparsely pubescent on the adaxial surface, densely pubescent on the abaxial surface; basal leaves 2 or 3, petiolate, elliptic or ovate in outline, 18–25 cm. long, 14–22 cm. wide, usually 2–5 (–10) cm. longer than wide; blades 2 or 3 times pinnatifid, the primary segments 17–21, narrow, opposite proximally becoming alternate distally, 8–12 cm. long, ca. 0.5 cm. wide at the base, each divided into 5–9 lobes, the secondary lobes often lobed or toothed, the ultimate segments narrowly triangular, ca. 1–2.5 cm. long, 1–3 (–7) mm. wide, the rachis narrowly leafy-margined, the margin ca. 1–3 mm. wide; petiole and midrib of the blade not clearly distinguished, the petiole 8–15 cm. long, often narrowly leafy-margined almost to the base, occasionally lobed; cauline leaves 2 or 3, the lowermost similar to the basal ones; upper cauline leaves progressively smaller upward, the bases broadly leafy-margined, auriculate and sheathing the stem, the blades pinnatisect or lobed; inflorescence corymbose, 20–30 cm. long, 10–20 cm. wide, the branches subtended by leafy, ovate-naviculate bracts, 1.5–3 cm. long, 1–2 cm. wide, distally laciniate; pedicels 1.5–4 cm. long; calyculate bracts linear, 3–5, up to 1 cm. long; heads (10–) 30–40 (–50), 10–12 mm. long; phyllaries 11–13, narrowly ovate, (5–) 6–7 (–9) mm. long, 2–3 mm. wide, glabrous; receptacle ca. 3 mm. across; flowers 20–30 (–40); corolla ca. 7 mm. long, the tube 3–3.5 mm. long, the lobes narrowly oblong, (3.5–) 4 (–5) mm. long, the throat none; anthers 3 mm. long; style branches 1–1.5 mm. long, hispid on the abaxial surface, the tips truncate or rounded with a subterminal or terminal fringe of trichomes; mature achenes obovoid, 5.5–6 mm. long, 2–3.5 mm. thick, glabrous (in specimens from Oaxaca and Chiapas) or pubescent with short, unicellular hairs (in specimens from México, Guerrero, and Michoacán), light brown; pappus creamy or tawny, 3–3.5 mm. long, the bristles stiff, deciduous; chromosome number, $n=30$ (Pippen).

DISTRIBUTION: Michoacán, México, Guerrero, and east to Chiapas. Habitat variable: roadside ditches, grasslands, and openings in the oak-woodlands. Flowering in August and September.

This species has two forms distinguished by the presence or absence of pubescence on the achenes and apparently by their somewhat distinct geographical ranges. The specimens from Oaxaca and Chiapas have glabrous achenes whereas those specimens from the north and west of Oaxaca have pubescent achenes. Since no other correlative differences are evident I do not feel that these forms are worth nomenclatural status.

CHIAPAS: *Ghiesbreght* 805 (NY, the leaves of this specimen are not as deeply dissected as the other specimens); *Nelson* 3117 (GH, US). GUERRERO: *Hinton et al.* 9435 (MICH, NY). MÉXICO: *Gilly et al.* 81 (MICH); *Hinton et al.* 8211 (MICH, NY); *Matuda* 28821 (NY); *Karwinski* s.n., September 1827 (M, probable parent of type of *Odontotrichum cirsiifolium* Zucc.). MICHOACÁN: *Pringle* 5272 (GH); *Pippen* 52* (MICH). OAXACA: *Pringle* 4984 (GH, NY, US); *Nelson* 1420 (US); *Galeotti* 2491 (US).

6. Odontotrichum decompositum (A. Gray) Rydb. Bull. Torrey Bot. Club 51:414. 1924.

Cacalia decomposita A. Gray, Pl. Wright. 2:99. 1853. Holotype: Sonora; mountains east of Santa Cruz, September 1851, *Charles Wright* 1286 (GH!).

Senecio grayanus Hemsl. Biol. Centr. Amer. Bot. 2:241. 1881. Name illegitimate.

Mesadenia decomposita (A. Gray) Standley, Contr. U.S. Nat. Herb. 19:749. 1915.

Plants up to 1–1.5 m. tall; stem slender, 3–5 mm. thick at the base, terete, densely pubescent below the lowest leaf with long, multicellular hairs in flocculent patches, becoming subglabrous or sparsely pubescent above the lowest leaf; leaves mostly glabrous or sparsely pubescent, the hairs multicellular, 0.4–1 mm. long, mostly along the veins and margins; basal leaves 2–4, long-petioled, pinnately veined, ovate or elliptic in outline, 20–30 cm. long, 12–27 cm. wide, about as wide as long or usually 2–5 cm. longer than wide; blades 3 or 4 times pinnatisect, the primary divisions 10–15 (–17), opposite below, becoming alternate distally, each 2 or 3 times pinnatisect, the ultimate segments narrowly triangular or narrowly oblong and acute-tipped or falcate, 0.5–2 cm. long, 2–5 mm. wide, the laminar portion of the blade reduced to a narrow margin ca. 1 mm. wide on each side of the main veins; petioles subterete or triangular in cross section, 17–25 cm. long, pubescent below becoming subglabrous or sparsely pubescent distally; cauline leaves 3 or 4, the lowermost one-half as large or as large as the basal ones and similar; upper cauline leaves reduced upward, bracteiform, 4–9 cm. long, 1–4 cm. wide, 1–3 times pinnatisect into linear segments, the uppermost cauline leaf bracts 1–6 cm. long, 5 mm. wide; inflorescence paniculate or corymbose, 11–20 cm. long, 12–22 cm. broad, the branches densely pubescent, the major branches subtended by narrowly ovate or linear-subulate bracts ca. 1.5 cm. long; pedicels 1–1.5 mm. long; calyculate bracts 1–3, 2–4 mm. long, linear-subulate; heads ca. 100 or fewer, 10–12 mm. long; phyllaries 5 or 6 (rarely 8), narrowly ovate, obovate or oblong-acute, (4–) 5–6 (–7) mm. long, (1–) 1.5–2 mm. wide, mostly glabrous or sparsely pubescent; receptacle 1.5 mm. across; flowers (5–) 6–7 (–8); corolla 7–8 (–9) mm. long, the tube 3.5–4 (–5) mm. long, the lobes linear-acute, 3.5–4 mm. long, 0.5 mm. wide, the throat none; anthers 2–3 mm. long; style branches 1–1.5 mm. long, the tips truncate or obtuse with a terminal

fringe of trichomes (or rarely a cluster of trichomes covering the entire tip); mature achenes ellipsoid, often falcate, 4–5 mm. long, 1.5–2 mm. wide, 1 mm. thick, glabrous, dark brown, contrasted with paler ribs, the ribs 15–18; pappus white or creamy, (4–) 5.5–6 (–7) mm. long; chromosome number, $n=30$ (Kruckeberg *in* Ornduff et al., 1963).

DISTRIBUTION: Northwestern Durango, northward into Sonora, Chihuahua, and Arizona. Its southern limit appears to be northern Durango as it has not been found farther south. Grasslands, pastures, and borders of oak-pine woodlands. Flowering in August and September.

This species is unusual because of its several times pinnatisect leaves which have the appearance of being compounded. Of the species of *Odontotrichum* growing in Mexico this one is the most northern in range, extending into southern Arizona.

Odontotrichum decompositum, or "Matarique," as it is called by the natives, is the only species of *Odontotrichum* of known economic importance. It is used medicinally in the treatment of diabetes and other ailments (Martínez, 1959).

ARIZONA: *Barkley* 14A624 (TEX); *Darrow et al.* 1235 (NY); *Eggleston* 10765 (US); *Blumer* 1378 (GH, NY, US); *Kruckeberg* 4644 (MICH); *Darrow*, s.n., July 4, 1937 (NY); *Harrison & Kearney* 6194 (US); 6045 (GH); *Kearney & Peebles* 10092 (US); *Goodding*, s.n., Aug. 28, 1912 (NY); *Goodding* 784 (GH, NY); *Jones* 25053 (GH, NY); *Palmer* s.n., July 1890 (GH, US); *Wilcox* s.n., in 1891 (US). CHIHUAHUA: *Gentry* 1959, 2815 (GH, US); *Hewitt* 68 (GH); *Knobloch* 1293 (MICH); Pringle 767 (GH, MICH, NY, US); *Mearns* 2219 (NY, US), 527, 531 (US, appear to be stunted plants, collected near the summit); *Muller* 3420 (GH); *Nelson* 6095 (GH, US); *Townsend & Barber* 158 (GH, NY, US); *Harde LeSueur* 145 (GH, TEX); *Tucker* 2456 (US); *Townsend* s.n., in 1909 (US); *Gentry* 536M (MICH). DURANGO: *Nelson* 4758 (NY, US). SONORA: *Phillips* 651 (GH, MICH); *White* 2741, 3289, 4353 (GH MICH).

7. Odontotrichum filicifolium Rydb. Bull. Torrey Bot. Club 51:414. 1924. Holotype: Nayarit; between Santa Gertrudis and Santa Teresa, Aug. 8, 1897, *J. N. Rose* 2101 (US!).

Plants up to at least 0.5 m. tall; stem glabrous proximally, sparsely pubescent to tomentose distally; leaves glabrous; basal leaves 2–4, long-petioled, pinnately veined, deltoid or ovate-cordate in outline, 4–5 cm. long and broad; blades deeply and finely dissected, the major divisions several, each divided into smaller segments or lobes, the ultimate segments narrow, linear-attenuate, laminar portion of the blade only a narrow margin, ca. 3–5 mm. wide on each side of the major veins; petioles slender, 11–12 cm. long; cauline leaves 3 or 4, the lowermost smaller than the basal ones but similar; upper cauline leaves bracteiform, dilated at the base, distally laciniate; inflorescence corymbose, the branches tomentose, subtended by narrowly ovate

bracts; calyculate bracts 2 or 3, linear-subulate, 2–4 mm. long; heads 15–25, about 10 mm. long; phyllaries 5 or 6, narrowly ovate, 6–7 mm. long, 2 mm. wide, glabrous; flowers 6–8; corolla ca. 7.5 mm. long, the tube 4 mm. long, the lobes 3.5 mm. long, the throat none; anthers ca. 3 mm. long; style branches 0.7–1 mm. long, hispid on the abaxial surface, the tips obtuse with subterminal fringe of trichomes; mature achenes not seen, the immature achenes densely villous; pappus fuscous, 7 mm. long.

DISTRIBUTION: Known only from the type specimen.

This taxon is quite similar to *Odontotrichum cervinum* and was collected in the same region. It differs from *O. cervinum* in having smaller heads and the larger leaves. Field observations and study of future collections may indicate that these two taxa should be considered as one species.

8. Odontotrichum globosum (Rob. & Fern.) Rydb. Bull. Torrey Bot. Club 51:418. 1924.

Cacalia globosa Rob. & Fern. Proc. Amer. Acad. 30:119. 1894. Holotype: Chihuahua; in a moist meadow, Guachuchic, June 25, 1892, *Hartman* 522 (GH!).

Odontotrichum scabrum Rydb. Bull. Torrey Bot. Club 51:416. 1924.

Cacalia pratensis Standl. Publ. Field Mus. Bot. 22:61. 1940. Holotype: Chihuahua; wet meadows near San Juanito, 2,430 m., July 26, 1937, *F. Shreve* 8031 (F!, isotype MICH!).

Odontotrichum pratense (Standl.) J. Cuatr. Brittonia 8:157. 1955.

Plants 0.5–0.7 (–1.2) m. tall; stem slender, 5 mm. thick or less at the base, mostly subglabrous below becoming sparsely pubescent to arachnoid-tomentose above; leaves glabrous or very sparsely puberulent mostly along the veins; basal leaves 2–4, long-petioled, pinnately veined, cordate or cordate-ovate, 4–7 (–8) cm. long and broad; blades shallowly dentate or entire, the teeth rounded or triangular, the margin of the blade ciliate; petioles glabrous, slender, 12–21 (–30) cm. long; cauline leaves 3 or 4, the lowermost similar to and as large as the basal ones; upper cauline leaves progressively smaller upward, the uppermost bracteiform, leafy, ovate, clasping the stem; inflorescence globose, very compact, 2.5–3 cm. long and broad, the branches arachnoid-tomentose; pedicels 5 mm. long or less; calyculate bracts 1–5, narrowly ovate or linear-subulate, 4–5 mm. long, 1 mm. wide or less; heads about 20, 7–10 mm. long; phyllaries 5 or 6, narrowly ovate or ovate, 5–7 mm. long, 1.5–2 mm. wide, glabrous; flowers (4–) 5–6 (–8); corolla 6–7 (–10) mm. long, the tube 3–3.5 (–5) mm. long, the lobes 3–3.5 (–5) mm. long, 0.5 mm. wide; anthers 2–3 (–3.5) mm. long; style branches ca. 1 mm. long, the tips truncate or obtuse with a subterminal fringe of trichomes; mature achenes pale brown, glabrous; pappus creamy, 3–3.5 (–5) mm. long.

DISTRIBUTION: Chihuahua and Durango. Wet marshy areas in pastured grasslands. Flowering in July and August.

This species is unique because of its habitat—most of the other species in this genus grow in dryer situations—and the very tightly globose inflorescence.

Comparison of the type of *Cacalia pratensis* Standl. with the type of *Odontotrichum globosum* indicates that they are definitely conspecific because they are similar in all respects.

Evidence of natural hybridization between *O. globosum* and *O. sinuatum* was observed by Dr. McVaugh in southern Durango in 1962 and a sampling of these populations was made (voucher specimens, *McVaugh* 21732–21739, MICH). The hybrid population showed various degrees of ecological and morphological intergradation between the two very dissimilar parents.

Odontotrichum scabrum, described by Rydberg from a specimen collected in 1897 (*Rose* 3471, US), is one of these intermediate hybrid forms, resembling *O. globosum* in leaf shape but with a more open inflorescence like *O. sinuatum*. It is not distinct enough to deserve nomenclatural status.

CHIHUAHUA: *Knobloch* 1273 (MICH); *Shreve* 8031 (US); *Gentry* 2785 (MICH, GH, isoparatype of *C. pratensis* Standl.). DURANGO: *Graham* 99 (MICH); *McVaugh* 21732, 21734–21739 (MICH, intermediate forms between *O. globosum* and *O. sinuatum*); *Pennell* 18532 (NY); *Nelson* 4769 (NY); *Rose* 3471 (US, holotype of *O. scabrum* Rydb.).

9. Odontotrichum goldsmithii (B. L. Rob.) Rydb. Bull. Torrey Bot. Club 51:416. 1924.

Cacalia goldsmithii B. L. Rob. Proc. Amer. Acad. 43:45. 1907.

Slender plants to 1 m. tall; stems up to 5 mm. thick at the base, mostly glabrous or sparsely pubescent above; leaves mostly glabrous or sparsely puberulent along the veins and margins; basal leaves 2 or 3, erect, long-petioled, pinnately veined, variable in shape from ovate to broadly ovate, 7–14 (–19) cm. long, 6–12 (–16) cm. wide, as long as wide to twice as long as wide; blades mostly truncate or obtusely based, occasionally slightly cordate, the margins sinuately double-dentate or lobulate, the teeth deltoid-rounded, in two alternating series of large and small respectively; petioles 8–14 (–20) cm. long, slender; cauline leaves ca. 3, the lowermost usually elliptic, as large as or one-half as large as the basal ones and similar; upper cauline leaves greatly reduced, the uppermost bracteiform, leafy, up to 6 cm. long, 0.5–1 cm. wide, the base of the petiole dilated; inflorescence loosely corymbose, 18–23 cm. long, 9–11 cm. broad, the branches densely pubescent, subtended by subulate or narrowly ovate bracts 1–3 cm. long, 1–5 mm. wide, smaller distally; pedicels 5–15 mm. long; calyculate bracts 3 or more, subulate, 1.5–4 mm.

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long; heads 50–75, 10–11 mm. long; phyllaries (5–) 7 or 8, usually ovate-oblong or narrowly ovate, 5–6 (–7) mm. long, (1–) 2–3 mm. wide, glabrous; receptacle up to 1.5 mm. across; flowers 7–13; corolla mostly 6–8 mm. long, the tube 3–4 mm., the lobes 3–4 (–7, *Hinton* 9202) mm. long, narrowly elliptic, strongly 3- (–5-) nerved; anthers 2–3 mm. long; style branches 1 mm. long, usually hispid on the abaxial surface, the tips truncate with a terminal fringe of trichomes; mature achenes ellipsoid, 4–5 mm. long, 2 mm. wide, ca. 1 mm. or less thick, brown, glabrous, 10- to 12-ribbed; pappus creamy white, becoming fuscous in age, 3.5–5 (–7) mm. long.

DISTRIBUTION: Eastern Jalisco to Michoacán and western Guerrero and México. Grasslands and pastures. Flowering in July (and August?).

This species is very closely related to *O. silphiifolium*, and further field and garden study may indicate that they should be considered as the same species. In the present treatment, however, they are recognized as two species with *O. goldsmithii* differing from *O. silphiifolium* in its slender, mostly glabrous habit, open, loose inflorescence with shorter heads, truncate or obtuse leaf bases, and smaller cauline leaves that are not auriculate-based.

Key to Varieties of *O. goldsmithii*

a. Heads with 5 or 6 phyllaries, 6 or 7 flowers; leaves sparsely puberulent.
9b. O. goldsmithii var. rowellii

a. Heads with 7 or 8 phyllaries, 9–13 flowers; leaves glabrous.
9a. O. goldsmithii var. goldsmithii

9a. Odontotrichum goldsmithii var. goldsmithii

Cacalia goldsmithii B. L. Rob. as to Holotype: Jalisco; Hacienda San Marcos, 350 m., July 12, 1905, *P. Goldsmith* 8 (GH!).

Phyllaries mostly 8; flowers 9–13 per head; basal leaves ovate or elliptic, glabrous, the blades truncate or obtuse-based, rarely cordate.

DISTRIBUTION: Jalisco, Michoacán, Guerrero (Mina Distr.), and México.

GUERRERO: *Hinton et al.* 9202 (MICH, NY, this specimen has larger heads than the other specimens). JALISCO: *McVaugh* 15460, 16132 (MICH). MÉXICO: *Hinton* 1266 (MICH); *Hinton et al.* 8066, 7984 (MICH, NY). MICHOACÁN: *Hinton et al.* 5078 (GH, NY, US).

9b. Odontotrichum goldsmithii var. rowellii Pippen var. nov. PLATE 2

A varietas goldsmithii floribus phyllariisque paucis, foliis radicalibus, puberulibus differt.

Heads with 5 or 6 phyllaries, 6 or 7 flowers; basal leaves ovate or narrowly ovate, the blades obtuse or cordate-based, sparsely puberulent.

HOLOTYPE: Guerrero; 1 mi. N. of Agua del Obispo, 3,300 ft., July 1, 1952, *C. M. Rowell, Jr.* 2991 (MICH!).

DISTRIBUTION: Known only from central Guerrero.

This variety is distinguished from the other in the smaller heads with fewer phyllaries and flowers and the somewhat puberulent leaves.

GUERRERO: *Wilkinson & Rowell* 3381 (MICH); *Rhymes & Rowell* 3886 (MICH); *Hicks & Rowell* 3604 (MICH); *Rzedowski* 16073 (MICH); *Sharp* 441431 (NY).

10. Odontotrichum multilobum Pippen, sp. nov. PLATE 3

Plantae tenues ca. 1 m. altae, caule foliisque glabris vel sparse pubescentibus, foliis radicalibus erectis, latis ellipticis 18–30 cm. longis 10–17 cm. latis, profunde pinnatifidis, segmentis principalibus 12–15 linearibus; petiola tenus glabra 10–30 cm. longa; folia culaine bractei, forma 1–2; inflorescentia corymbosa, 16–30 cm. long, 11–16 cm. lata-bracteis 10–20 mm. longis, linearis vel anguste triangularis; capitula 50–100, ca. 12 mm. longa; phyllaria 8, 5–6 (–7) mm. longa, 1.5–2 mm. lata, anguste ovata, glabra; flores 10, corollis 7 mm. longis, tubo lobisque 3.5 mm. longis, achaenis ellipsoidea vel obovata, (3–) 3.5–4 mm. longa, 1.5–2 mm. lata, glabra, pallide fulva; pappus sordidus (5–) 6 (–7) mm. longus.

Plants ca. 1 m. tall; stem and leaves glabrous or sparsely pubescent, becoming sparsely or densely pubescent in the inflorescence; flowering stem 4–6 mm. thick at the base; basal leaves 3 or 4, long-petioled, erect, pinnately veined, broadly elliptic in outline, 18–30 cm. long or longer, 10–17 cm. broad; blade deeply pinnatifid, the laminar portion narrow, ca. 3–6 mm. wide on each side of the vein, the primary lobes 12–15, linear, 7–11 cm. long, each divided into 3–5 major lobes, the secondary lobes either 1- to 2-lobed or coarsely toothed, the ultimate segments linear-acute; angle of the lobes with the midrib less than 90 degrees; petioles ca. 10–30 cm. long, mostly glabrous, triangular in cross section; cauline leaves 1 or 2, similar to the basal leaves but much smaller; inflorescence loosely corymbose, 16–30 cm. long, 11–16 cm. broad, the branches subtended by linear or narrowly triangular bracts 10–20 mm. long, 1–4 wide; calyculate bracts 3–5, subulate, 3–5 mm. long; heads 50–100, ca. 12 mm. long; phyllaries 8, narrowly ovate, 5–6 (–7) mm. long, 1.5–2 mm. wide, glabrous; receptacle 2 mm. across; flowers 10; corolla 7 mm. long, the lobes as long as the tube, 3.5 mm. long, linear, the throat none; anthers 3 mm. long; style branches 1 mm. long, the tips truncate or rounded with a subterminal fringe of trichomes; mature achenes (3–) 3.5–4 mm. long, ellipsoid or obovoid, 1.5–2 mm. wide, 1 mm. thick, glabrous, light brown, ca. 20-striate; pappus (5–) 6 (–7) mm. long, creamy or tawny; chromosome number, $n=30$ (Pippen).

HOLOTYPE: Jalisco; ca. 15 mi. SSE. of Autlán by way of Chante, oak-dominated slopes E. of Mamantlán, ca. 4,500 ft., Aug. 1, 1949, *R. L. & C. R. Wilbur* 2094 (MICH!).

The type specimen is somewhat smaller in stature than the other specimens of the same taxon, but it is representative.

This species is related to *O. pringlei* by the shape of the leaf, but differs in that the achenes are glabrous; and to *O. sinuatum*, differing in the more cylindrical heads, rather than turbinate, and in the lower pair of lobes on the leaves not deflected.

This species is sympatric with *O. pringlei* and *O. palmeri*, possibly intergrading with the latter. Two specimens from western Jalisco (*Pippen* 29, sheets 1 and 2, MICH) are intermediate between *O. multilobum* and *O. palmeri*, suggesting that hybridization may be occurring. At this locality both *O. multilobum* and *O. palmeri* as well as the intermediate forms were growing together, the latter plants mistaken for a third species at the time of collection. Future field studies and examination of additional material are necessary to determine if integration has occurred.

JALISCO: *Pippen* 25, 30*, 29 (possible hybrid between *O. multilobum* and *O. palmeri*), 40 (MICH).

11. Odontotrichum napellifolium (S. Schauer) Rydb. Bull. Torrey Bot. Club. 51:419. 1924.

Cacalia napellifolia S. Schauer, Linnaea 19:732. 1847. Holotype: Mexico; about 1840, *Aschenborn* 312 (B, not seen; tracing of type in Klatt's Herb., GH!).

Plants 0.5–0.6 m. tall; stem slender, 2–4 mm. thick at the base, densely pubescent below, becoming sparsely pubescent upward; leaves mostly glabrous, the margin ciliate; basal leaves 4–7, long-petioled, subpalmately veined with 5–7 principal veins, subcircular in outline, the base cordate, 2.5–5 cm. long from the basal sinus to the tip, 3–8 cm. wide; blades deeply lobed, the primary lobes 3–5 (–7), each deeply divided into 2 or 3 (–4) lobes, the secondary lobes again divided into 3–5 lobules, the ultimate segments narrowly triangular or deltoid, 3–10 mm. long, the proximal pair of lobes deflected, parallel to the petiole, the base of the blade decurrent on the petiole for a short distance; petioles 7–15 cm. long, slender; cauline leaves 1 or 2, the lowermost similar to the basal ones; upper cauline leaves bracteiform, reduced, 2–3 cm. long, 0.5–1 cm. wide, 5- to 7-lobed; inflorescence corymbose, the branches tomentose, the pedicels 0.5–3 cm. long; calyculate bracts about 3, subulate, ca. 4 mm. long; heads 5–8, 10–14 mm. long; phyllaries 10, narrowly ovate, 5–6 mm. long, 1.5–2 mm. wide, sparsely pubescent, the tips purplish; flowers 12–25; corolla 6–7 mm. long, the tube 3–3.5 mm. long; anthers 2.4–3 mm. long; style branches 0.7–1 mm. long, hispid on the abaxial

surface, the tips truncate or obtuse with a subterminal fringe of trichomes; mature achenes ellipsoid, 5 mm. long, 1.5 mm. wide, 1 mm. thick, pale tan or creamy, 10- to 12-ribbed, the ribs pubescent with ascending hairs; pappus creamy, 3–5 mm. long.

DISTRIBUTION: Guerrero and Hidalgo. Grasslands and openings in oak-pine woodlands. Flowering in June and July.

This taxon is distinct because of the small, deeply lobed basal leaves. It is closely related to *O. filicifolium* and *O. cervinum* but differs from both in the larger number of flowers per head.

GUERRERO: *Kubicek & Rowell* 3779 (MICH); *Rhymes & Rowell* 3896 (MICH). HIDALGO: *Pringle* 10024 (MICH, NY, TEX, US); *Salazar* s.n., Aug. 1, 1913 (US).

12. Odontotrichum pachyphyllum (Schultz Bip.) Rydb. Bull. Torrey Bot. Club 51:417. 1924.

Cacalia pachyphylla Schultz Bip. ex Seem. Bot. Voy. Herald. 310. 1856. Holotype: Northwestern Mexico; *Seemann* 1999 (K, not seen; MICH Neg. 6221).

Senecio sclerophyllus Hemsl. Biol. Centr. Amer. Bot. 2:247. 1881. Based on *Cacalia pachyphylla* Schultz Bip. not *S. pachyphyllos* Remy.

Plants 0.5–0.7 m. tall; stem 3–4 mm. thick at the base, pubescent, the hairs white, multicellular, often flocculent; leaves mostly glabrous or sparsely pubescent along the veins; basal leaves 2 or 3, coriaceous, long-petioled, reniform or rounded-deltoid, rarely subcircular in outline (6–) 8–10 (–11) cm. long from the basal sinus to the apex, (10–) 13–18 (–20) cm. wide, the tip broadly rounded, the base truncate or usually shallowly cordate; blades variable, shallowly repandly dentate or subentire, the teeth rounded or obtuse, the adaxial and abaxial surfaces very similar; petioles (4–) 8–18 (–35) cm. long; cauline leaves 2 or more, the lowermost smaller than the basal ones but similar; upper cauline leaves becoming bracteiform upward with the petiole broadly leafy-margined, clasping the stem; inflorescence corymbose, 7–20 cm. long, 7–15 cm. broad, the branches tomentose or villous (glabrous in the type and isotype); pedicels 2–6 cm. long; calyculate bracts 3–5, subulate, 9–13 mm. long, 1 mm. wide, sparsely pubescent; heads 9–15, 1–1.5 cm. long; phyllaries 13 or 14, narrowly ovate, 7–9 mm. long, 1–3 mm. wide, glabrous; flowers 30–35; corolla (7.5–) 8–10 mm. long, the tube (4–) 5–6 mm. long, the throat short, ampliate, up to 0.5 mm. long, 1 mm. wide at the apex, occasionally lacking, the lobes 3.5–4 mm. long; anthers 2–3 mm. long; style branches 1.5 mm. long, the tips truncate or obtuse with a terminal or subterminal fringe of trichomes; mature achenes ellipsoid or oblong, 4–5 mm. long, 2 mm. wide, 1.5 mm. thick, glabrous, brownish, 15- to 16-ribbed; pappus white or tawny, 6–8 mm. long.

DISTRIBUTION: Known only from southern Durango. Openings in pine-oak woodlands. Flowering in August and September.

The type is mostly glabrous with linear inflorescence bracts and large basal leaves with acute basal sinuses. These characteristics are somewhat different from the other specimens studied but the specimens are all similar enough in size of heads, number and size of flowers, texture and general shape of the leaves to be considered part of the same taxon.

This species is closely related to *O. amplum*, differing from it in having smaller heads with narrower inflorescence bracts and basal leaves rounded at the base.

DURANGO: *Gentry* 6969 (MICH, US); *McVaugh* 21659 (MICH); *Pennell* 18332 (NY); *Waterfall* 12668 (MICH); *McVaugh* 21731 (shows possible intergradation with *O. globosum*), 21729 (MICH); *Ownbey & Ownbey* 1874 (MICH, US); *Maysilles* 7784 (MICH). LOCALITY UNKNOWN: *Seemann* s.n. (probably isotype of *Seemann* 1999, GH).

13. Odontotrichum palmeri (Greene) Rydb. Bull. Torrey Bot. Club 51:417. 1924.

Cacalia palmeri E. L. Greene, Pittonia 1:219. 1888. Holotype: Jalisco; Río Blanco, in 1886, *E. Palmer* 168 (ND!, isotypes GH!, US!, NY!).

Plants 0.7–1 (–1.5) m. tall; stems 3–5 (–7) mm. thick at the base, sparsely or densely pubescent, rarely subglabrous, hairs 1.5–3 mm. long, stiff, white; leaves sparsely or densely pubescent, the pubescence denser on the abaxial surface; basal leaves 2–3 (–5), pinnately veined, coriaceous, broadly ovate or occasionally subcircular in outline, 9–17 (–23) cm. long and broad (broadest below the middle); blades coarsely dentate or shallowly lobulate, the lobules up to 1 cm. long, 2 cm. wide, each 3-angulate, mucronate; petioles (5–) 6–15 (–30) cm. long; cauline leaves several, the lowermost as large as or one-half as large as the basal ones and similar, the petiole dilated and clasping the stem at the base, often leafy-margined; upper cauline leaves reduced and bracteiform, the petiolar portion broadly leafy-margined and clasping the stem, the blade portion ovate, dentate; inflorescence corymbose, 9–12 (–18) cm. long, 10–15 cm. broad, the branches sparsely pubescent, the distal branches subtended by narrowly ovate or subulate bracts up to 1.5 mm. long, the proximal branches in the axils of the uppermost leaves; calyculate bracts usually 3, subulate, 5 mm. long or less; heads up to 100, ca. 1 cm. long; phyllaries 5 or 6 (–7), narrowly ovate, 5–7 (–8) mm. long, 1.5 (–3) mm. wide, glabrous or sparsely pubescent, tightly imbricated forming a narrow cylindrical involucre, the tips attenuate; receptacle often sparsely pubescent with long, mult cellular hairs; flowers 5 or 6 (–8); corolla 6.5–9 mm. long, the tube (3–) 3.5–4 mm. long, the lobes 3.5–5 (–5.5) mm. long, the throat none; anthers 2–3 mm. long; style branches 1–1.5 mm. long, the tips truncate or rounded with a terminal fringe of trichomes; mature achenes 3.5–4 mm. long, 1.5–2 mm. wide, ellipsoid, glabrous, prominently 10- to 12-ribbed, the ribs dark red purple, sharply contrasted

by pale golden-tan bands separating them; pappus creamy or white, (1–) 1.5 (–2) mm. long, about one-half as long as the corolla tube; chromosome number, n=about 25 (Pippen).

DISTRIBUTION: Southern Durango, Nayarit, Jalisco, and Michoacán. Common in grasslands, pastures, and borders of oak-pine woodlands. Flowering in August and September.

This species is similar to *O. brachycomum* in having an extremely short pappus but differs in having smaller heads with fewer flowers and phyllaries, and the leaves not lobed.

Rydberg described *Odontotrichum nephrophyllum* from a specimen collected in southern Durango (*Rose* 2248, US). It differs from *O. palmeri* in that the pappus is as long as the corolla tube and the petioles of the basal leaves are densely pubescent. Examination of future collections may indicate that this is distinct from *O. palmeri*, but at the present I do not feel that it is significantly different.

DURANGO: *Rose* 2248 (US). JALISCO: *Diguet* s.n., July 1912 (MICH); *Graham* 124 (MICH); *McVaugh* 20481, 12929 (MICH); *McVaugh & Koelz* 441 (MICH); *King* 3659 (MICH, NY, TEX, US); *Powell & Edmondson* 869 (TEX); *Pringle* 2304 (GH, NY, US); *Pringle* 11500 (GH, MICH, US); *Pippen* 10, 20, 27A, 32, 28 (MICH). MICHOACÁN: *Arsène* 5132 (GH, NY, US); *Feddema* 183 (MICH); *Leavenworth* 539 (NY, MICH); *Pippen* 43 (MICH); *McVaugh* 21960 (MICH). NAYARIT: *Feddema* 308 (MICH); *Pippen* 12* (MICH).

14. Odontotrichum paucicapitatum (Rob. & Greenm.) Rydb. Bull. Torrey Bot. Club 51:414. 1924.

Cacalia paucicapitata Rob. & Greenm. Amer. Journ. Sci. III. 50:158. 1895. Holotype: Oaxaca; Sierra de Clavellinas, 7,000 ft., Oct. 25, 1894, *C. G. Pringle* 6018 (GH!, isotypes GH!, US!).

Plants to 1 m. tall; caudex apparently fleshy, globose, at least 2 cm. long, 2.5 cm. wide; stem ca. 5 mm. thick at the base, densely covered with a flocculent interwoven mass of long, grayish-white hairs persisting through the inflorescence; leaves glabrous on the adaxial surface, the abaxial surface arachnoid or tomentose; basal leaves 2 or 3, petioled, pinnately veined, oblong in outline, 14–16 cm. long, ca. 10 cm. wide; blades deeply pinnately lobed, the primary lobes 9 or 10, at right angles to the axis but ascending distally, extending ca. four-fifths of the distance to the midrib, each irregularly 3- to 5-lobed; petioles 5–12 cm. long, slender; cauline leaves ca. 3, the lowermost about one-half as large as the basal ones and similar; upper cauline leaves reduced and bracteiform, 4–6 cm. long, ca. 1 cm. wide; inflorescence subracemose; pedicels (2–) 4–6 cm. long; calyculate bracts 3–5, linear-subulate, 1–2 cm. long; heads 5–7, 2–2.5 cm. long; phyllaries 12 or 13, oblong or narrowly ovate, 10–12 mm. long, 3–4.5 mm. wide, densely pubescent; flowers 40 or more; corolla 11–14 mm. long, the tube 7–10 mm. long, the throat narrowly campanulate, 1–1.5 mm. long, equally broad at the apex, the lobes ca. 3 mm. long,

linear; anthers 3 mm. long; style branches 1.5 mm. long, hispid distally on the abaxial surface, the tips truncate with a terminal fringe of trichomes; mature achenes ellipsoid, obovoid or 3-angulate, 5–6 mm. long, 2–3.5 mm. wide, 1.5 mm. thick, densely villous, the hairs ascending, grayish-white or creamy, up to 1 mm. long; pappus creamy, 7–8 mm. long, clavate distally.

DISTRIBUTION: Known only from the type specimens.

This species is most unusual because of the dense, grayish-white, flocculent pubescence covering the entire plant except the adaxial surface of the leaves. The leaves are very much like those of *O. sinuatum* but the heads are much larger and the flowers have a short, but evident throat. The apparently fleshy caudex is also unique.

15. Odontotrichum platylepis (Rob. & Seat.) Rydb. Bull. Torrey Bot. Club 51: 417. 1924.

Cacalia platylepis Rob. & Seat. Proc. Amer. Acad. 28:110. 1893. Lectotype: Jalisco; Río Blanco, October 1886, *E. Palmer* 689 (GH!).

Cacalia coriacea M. E. Jones, Extracts from Contr. West. Bot. 18:80. 1933. Holotype: Jalisco; Orendain, Nov. 28, 1930, *M. E. Jones* s.n. (POM, not seen; isotype GH!).

Plants to 1.5 m. tall; stem 6–12 mm. thick at the base, densely shaggy-villous below, becoming less dense upward; leaves sparsely pubescent mostly along the veins, the abaxial surface densely pubescent; basal leaves 3 or 4, long-petioled, erect, coriaceous, broadly ovate in outline, 18–35 (–75) cm. long and broad or slightly broader; blades deeply pinnately lobed two-thirds to three-fourths the distance to the midrib, the primary lobes ca. 11, the proximal pair (6–) 10–16 (–22) cm. long, 2–6 cm. wide at the base, the distal lobes progressively smaller upward, each lobe irregularly divided into 2–4 lobes, the major secondary lobes often again lobed, the ultimate segments triangular or deltoid or oblong-obtuse, the base of the blade decurrent on the petiole for a short distance forming a leafy margin, the abaxial and adaxial surfaces very similar; petioles 16–32 cm. long, triangular in cross section, densely pubescent below becoming sparsely pubescent distally; cauline leaves several, the lowermost smaller than the basal ones but similar; upper cauline leaves bracteiform, the petiolar portion leafy-margined, clasping the stem, the blade portion sinuately lobed, the uppermost forming inflorescence bracts, the larger ones 3–6 cm. long, 1.5–4 cm. wide, distally laciniate; inflorescence corymbose, 16–27 cm. long, 16–18 cm. broad, the branches sparsely or densely arachnoid pubescent, the hairs frequently with purple crosswalls; pedicels 1.5–3 (–9) cm. long; calyculate bracts 5–8, narrowly obovate, 1.5–2 cm. long, 5–10 mm. wide, laciniate-lobed; heads 15 or fewer, 1.5–2 cm. long; phyllaries 13 or 14 (–17), narrowly ovate or elliptic, 13–15 (–16) mm. long, 4–5 mm. wide, mostly glabrous, often sparsely puberulent;

receptacle to 1 cm. across; flowers 40–80 or more per head; corolla 13–15 (–16) mm. long, the tube 10–11 mm. long, the lobes (3.5–) 4–5 (–6) mm. long, the throat none; anthers 3.5–4 mm. long; style branches 1–1.5 mm. long, the tips truncate with a subterminal fringe of trichomes; mature achenes ellipsoid, 6–7 mm. long, 3 mm. wide, 1.5–2 mm. thick, pale with ca. 10 contrasting dark ribs, the intervals between the ribs pubescent with hyaline, ascending hairs; pappus white, (8–) 10–11 mm. long, clavate distally.

DISTRIBUTION: Mostly in the central grassland regions of Jalisco around Guadalajara and extending northward to Aguascalientes. Open, rocky grasslands, scrub and pastured areas. Flowering from mid-October to December, the flowers emitting an unpleasant odor.

In the original description two specimens were cited as syntypes: Jalisco; plains of Guadalajara, Nov. 26, 1888, *C. G. Pringle* 1816 (GH!) and Jalisco; Río Blanco, October 1886, *E. Palmer* 689 (GH!). The latter was designated the lectotype because it is a more complete specimen than *Pringle* 1816. The lectotype specimen consists of a basal leaf ca. 18 cm. long, a stem in three pieces, with 6 cauline leaves below the 8-headed inflorescence (Mich. Neg. 1253). There is also a second sheet at the Gray Herbarium (an isolectotype) that has a basal leaf ca. 28 cm. long, the base of the plant with the roots, and an inflorescence with ca. 15 heads, but no portion of the stem.

This species is spectacular because of its extremely large basal leaves, more than one-half meter long, that stand erect.

AGUASCALIENTES: *McVaugh & Koelz* 48 (MICH). JALISCO: *Jones* 27692 (NY); *Palmer* 689 (US, 3 sheets, isotypes); *McVaugh* 22123 (MICH); *Pringle* 1816 (US, 2 sheets, NY, MICH, isoparatypes); *Pringle* 9873 (GH, US, NY); *Safford* 1432 (US); *Jones* s.n., Nov. 27, 1930 (GH, isotype of *C. coriacea* Jones); *Pippen* 23, 58 (MICH); *Jony* s.n., in 1892 (US).

16. Odontotrichum pringlei (S. Wats.) Rydb. Bull. Torrey Bot. Club 51: 415. 1924. PLATE 4

Cacalia cirsiifolia Hook. & Arn. Bot. Beech. Voy. 436. 1841. Holotype: Nayarit; between Tepic and San Blas, *Sinclair* s.n., in Hooker Herb. (K, not seen; Mich. Neg. 623!). Not *Odontotrichum cirsiifolium* Zucc.

Senecio cirsiifolia (Hook. & Arn.) Schultz Bip. Flora 28:499. 1845.

Cacalia pringlei S. Wats. Proc. Amer. Acad. 25:156. 1890. Lectotype: Jalisco; grassy slopes of the barranca near Guadalajara, November 1888, *C. G. Pringle* 1749 (GH!).

Plants to 1.5 m. tall; stem 4–10 mm. thick at the base, densely villous, flocculent below the lowest leaf and sparsely puberulent or becoming glabrous above; leaves sparsely pubescent with 8- to 10-celled hairs 0.3–0.5 mm. long, slightly longer and denser along the veins and on the abaxial surface; basal leaves 2–4, erect, coriaceous, long-petioled, pinnately veined, oblong or elliptic in outline, 20–35 (–40) cm. long, 13–30 cm. wide, as long as broad to twice as long as

broad; blades deeply pinnately lobed, the primary lobes 10–16, (4–) 5–10 (–15) cm. long, 3–4 cm. wide at the base, each usually divided into 3 major lobes and 2 or 3 lesser lobules or teeth, the latter usually narrowly triangular, the secondary lobes triangular or 3-angulate or again divided into 2 or 3 triangular lobules, the lobes, including the proximal pair, forming an angle with the midrib of less than 90 degrees; blades obtuse or attenuate, not cordate at the base, decurrent along the petiole for 1–2 cm. below the proximal lobes; petioles 20–30 (–40) cm. long, triangular in cross section, villous proximally, becoming sparsely pubescent distally; cauline leaves 3–7, much reduced in size, bracteiform, the lowermost leaflike, sinuately lobed, the petiole dilated at the base and clasping the stem, up to 15 cm. long, 3 cm. broad; inflorescence loosely paniculate or corymbose, 18–25 cm. long, 16–20 cm. broad, the branches subglabrous to sparsely pubescent, subtended by narrowly ovate bracts (2–) 3–5 (–7) cm. long, 0.5–1.5 cm. wide; calyculate bracts 5–8, linear-subulate, 3.5–5.5 mm. long; heads ca. 100, 10–12 mm. long; phyllaries 7 or 8 (–9), ovate or elliptic, 5–7 mm. long, 2–3 (–4) mm. wide, glabrous; receptacle 1.5–2 mm. across; flowers 11–14; corolla 6–8 (–10) mm. long, the tube 3–4 (–5) mm. long, the lobes 3–4 (–5) mm. long, linear, the median nerve strong, the throat none; anthers 2–3 mm. long; style branches 1 (–1.5) mm. long, usually hispid on the abaxial surface, the tips truncate or obtuse with a subterminal or terminal fringe of trichomes; mature achenes ellipsoid (3–) 4–5 mm. long, 2 mm. wide, 1–1.5 mm. thick, pubescent with minute, creamy or tawny hairs between the ribs, the ribs about 20, darker than the area between the ribs; pappus (4–) 6–7 mm. long, white, the tips slightly clavate; chromosome number, $n=30$ (Pippen; Turner, ined.).

Two specimens were cited in the original description as syntypes: Jalisco; grassy slopes of the barranca near Guadalajara, November 1888, *C. G. Pringle* 1749 (GH) and 1811 (GH). *Pringle* 1749 is chosen as the lectotype because it is a more complete specimen.

DISTRIBUTION: Nayarit, Jalisco, and Colima. Grasslands, pastured areas, roadsides, and less frequently rocky slopes in oak-pine woodlands. Flowering from October to early December.

This species is closely related to *O. platylepis* and *O. sinuatum*, differing from the former in having smaller heads; from the latter in having pubescent achenes and differently shaped leaves. *Cacalia cirsiifolia* Hook. & Arn., known only from the very incomplete type specimen consisting of just a portion of the inflorescence and one upper cauline leaf, is undoubtedly conspecific with *O. pringlei* because of the similarity of the heads and the pubescent achenes.

COLIMA: *Palmer* 1234 (GH, NY, US). JALISCO: *McVaugh & Koelz* 1253, 1104 (MICH); *McVaugh* 13616, 21765* (MICH); *Pippen* 37*, 41, 59 (MICH); *Pringle*

1811 (US, isoparatype of *C. pringlei* S. Wats.); *Pringle* 11499 (GH, MICH, US). NAYARIT: *Ferris* 5881 (US); *Mexia* 845 (GH, US); *McVaugh & Koelz* 601 (MICH); *Palmer* s.n., Jan. 5–Feb. 6, 1892 (US); *Barclay* s.n. (GH, probably collected in late December 1837 at the same time and place as the type of *Cacalia cirsiifolia* Hook. & Arn., since Barclay and Sinclair were together at that time, attached to the H.M.S. *Sulphur* [McVaugh, manuscript ined.]).

17. Odontotrichum purpusii (Greenm.) Rydb. Bull. Torrey Bot. Club 51:418. 1924.

Cacalia purpusii Greenm. Univ. Calif. Publ. Bot. 4:95. 1910. Holotype: Puebla; Cacalote, August 1909, *C. A. Purpus* 3845 (F!, isotype NY!).

Plants to 0.6 m. tall, pubescent with white, stiff, multicellular hairs; stem slender, ca. 3 mm. thick at the base; basal leaves 2–4, pinnately veined, petioled, subcoriaceous, ovate or broadly elliptic, to 8 cm. long, 6 cm. wide, the margin of the blade doubly dentate with two alternating series of large and small teeth, respectively, the base of the blade truncate or obtuse; petioles terete, 3–9 cm. long, about as long as the blade; cauline leaves ca. 4, the lowermost smaller than the basal ones but similar to them; upper cauline leaves reduced, bracteiform; inflorescence compact or spreading, corymbose, 3–14 cm. long, 3–19 cm. broad, the branches arachnoid-pubescent or tomentose, subtended by linear-subulate bracts ca. 5 mm. long; calyculate bracts 3–7, linear-subulate, 3–4 mm. long; heads 15–30, 10–12 mm. long; phyllaries 7 or 8, oblong or ovate, 5.5–7 mm. long, 1.5–2 mm. wide, glabrous; flowers 10–13, corolla ca. 7 mm. long, the tube (3.5–) 4 mm. long, the lobes (3–) 3.5 mm. long; anthers 2.5 mm. long; style branches 1.5 mm. long, the tips truncate with a terminal fringe of trichomes; mature achenes oblong, ca. 3.5 mm. long, 1 mm. wide, glabrous, brown; pappus 4–6 mm. long, creamy or tawny.

DISTRIBUTION: Puebla and Oaxaca. Known only from three collections. Flowering in June to August.

This taxon is quite closely related to the *O. silphiifolium-goldsmithii* group but is much smaller and does not occur within the present known geographical range of either of the others. When more material of this taxon becomes available and can be studied it may indicate that *O. purpusii* should not be considered as a distinct species. It is considered distinct here because of the general small habit, distinct geographical distribution, and lack of correlative evidence to combine it with any other taxon.

OAXACA: *Conzatti* 4015 (US); *Conzatti & Gonzales* 1237 (GH, this specimen has no leaves).

18. Odontotrichum radulifolium ["radulaefolium"] (H.B.K.) Rydb. Bull. Torrey Bot. Club 51:415. 1924.

Cacalia radulifolia ["radulaefolia"] H.B.K. Nov. Gen. et Sp. 4:169. 1820. (Folio ed. 4:132. 1820). Holotype: Guanajuato; between the village of Temascatio and Guanajuato, no date, 1050 hex., *Humboldt & Bonpland* s.n. (P, not seen; Field Mus. Neg. 37875!).

Senecio radulaefolius (H.B.K.) Schultz Bip. Flora 28:498. 1845.
Cacalia schaffneri A. Gray, Proc. Amer. Acad. 19:53. 1883. Lectotype: near San Luis Potosí in 1876, *Schaffner* 294 (GH!).
Odontotrichum schaffneri (A. Gray) Rydb. Bull. Torrey Bot. Club 51:415. 1924.

Plants to 1.5 m. tall; entire plant pubescent except the phyllaries, the hairs white, 5- to 7-celled; stem 3–5 (–8) mm. thick at the base, green or purplish; basal leaves 2 or 3, long-petioled, pinnately veined, ovate-cordate or subcircular in outline, (6–) 10–12 (–18) cm. long, (8–) 12–14 (–22) cm. wide, usually 3–5 cm. broader than long or as long as broad, subpeltate, the petiole attached to the blade 2–10 (–30) mm. above the base; blades pinnately lobed three-fifths to four-fifths the distance to the midrib, the primary lobes 7–9 (–11), each divided into usually 3 (2–5) lobes, the secondary lobes often lobed, 3-angulate or coarsely dentate, the lowermost pair of primary lobes deflected, parallel to the petiole; petioles (7–) 12–21 (–30) cm. long; cauline leaves 2–4, the lowermost about as large as the basal ones and similar, but the base of the petiole more dilated and often leafy-margined; upper cauline leaves progressively smaller upward, bracteiform, auriculate-based, elliptic or ovate, distally sinuately 7- to 9-lobed; inflorescence loosely corymbose, (3–) 12–30 cm. long and broad, the branches subtended by linear-subulate bracts (5–) 7–10 mm. long; calyculate bracts 3–5, subulate, 2–5 mm. long; heads (25–) 50–75, 10–11 mm. long; phyllaries 5, oblong or narrowly ovate, 5–7 mm. long, 1–2 (–3) mm. wide, glabrous; flowers 5 or 6; corolla 6.5–7.5 mm. long, the tube 3–3.5 (–4) mm. long, the throat very short, ampliate, 0.5–0.7 mm. long, 0.7–1 mm. wide at the apex, the lobes 3–3.5 mm. long; anthers 2–3 mm. long; style branches 1–1.5 mm. long, hispid on the abaxial surface, the tips truncate or obtuse with a subterminal fringe of trichomes; mature achenes ellipsoid, 4 mm. long, 1.5 mm. wide, brown, ca. 14-ribbed, pubescent, the hairs 0.5 mm. long, greenish or tawny; pappus creamy or fuscous, 4–5.5 mm. long.

DISTRIBUTION: Sinaloa, Durango, San Luis Potosí and Guanajuato to Tamaulipas. Grassy openings in oak-pine woodlands and pastures. Flowering in July and August.

Comparison of the type specimen of *Cacalia schaffneri* A. Gray with the photograph of the type of *C. radulifolia* H.B.K. and the similarity of the original descriptions of these two taxa indicate that they are conspecific, even though the subpeltate condition of the leaves was not mentioned in the original description of *C. radulifolia*. Gray mentioned in his description of *C. schaffneri* that possibly this was the little known *C. radulifolia* of H.B.K. This is the only species of *Odontotrichum* with subpeltate leaves.

DURANGO: *Graham* 100 (MICH); *Feddema* 1821 (MICH); *Maysilles* 7587 (MICH). GUANAJUATO: *Kenoyer* 2110, 2300 (GH); *Schumann* 148 (US). SAN

LUIS POROSÍ: *Manning & Manning* 53560 (GH); *Mickel* 501, 561 (MICH); *Parry & Palmer* 543 (NY); *Pringle* 3566 (GH, US); *Pringle* 4095 (NY, US); *Schaffner* 294 (NY, US, isotype of *C. schaffneri* A. Gray; the US specimen also bears the number 724 assigned to the sheet by A. Vigener who purchased many of the Schaffner collections [J. Rzedowski, pers. comm.!). SINALOA: *Powell & Edmondson* 929 (MICH, TEX). NUEVO LEON: *Meyer & Rogers* 2608 (MICH) TAMAULIPAS: *Stanford, Retherford & Northcraft* 818 (GH); *Stanford, Taylor, & Lauber* 2421 (MICH, NY, TEX, US).

19. Odontotrichum silphiifolium (Rob. & Greenm.) Rydb. Bull. Torrey Bot. Club 51:416. 1924.

Cacalia silphiifolia Rob. & Greenm. Amer. Journ. Sci. III. 50:158. 1895. Holotype: México; Sierra de las Cruces, Aug. 21, 1892, *C. G. Pringle* 5251 (GH!).

Plants to ca. 1.5 m. tall; roots exuding an amber-colored fluid when cut; stem 1–1.5 cm. thick at the base, subglabrous or puberulent upward; leaves minutely puberulent especially along the veins; basal leaves 2 or 3, erect, long-petioled, pinnately veined, ovate-cordate, (13–) 15–20 (–45) cm. long from the tip to the basal sinus, (11–) 14–21 cm. wide, usually 2–4 cm. longer than wide, occasionally as wide as long; blades sinuately double-dentate, the teeth in two alternating series of large and small, respectively, the base of the blade cordate or sagittate, rarely truncate, the basal lobes 4–7 cm. long, 5–9 cm. wide, rounded; petioles (15–) 20–30 cm. long; cauline leaves 2–4, the lowermost similar to the basal ones but smaller, occasionally deltoid and truncate-based with the petiolar portion broadly leafy-margined, auriculate-based and clasping the stem; upper cauline leaves smaller, bracteiform; inflorescence tightly corymbose, usually 6–11 cm. long and broad, occasionally up to 28 cm. long, ca. 20 cm. broad, the branches tomentose, subtended by linear or narrowly ovate bracts 1.5 cm. long, 1 mm. wide; pedicels 0.3–3 cm. long; calyculate bracts 1–5, linear-subulate, (3.5–) 5–7 mm. long; heads 50–75; 10–15 mm. long; phyllaries 8, narrowly ovate or ovate, (6–) 7–8 mm. long, 1.5–2 (–3) mm. wide, glabrous; flowers 9–13; corolla 8.5–9 (–11) mm. long, the tube 5 (–6) mm. long, the lobes 3.5–4 (–5) mm. long, the throat none; anthers 2–3 mm. long; style branches 1–1.5 mm. long, the tips truncate with a sparse terminal fringe of trichomes; mature achenes ellipsoid, 4–5.5 mm. long, 1.5–2 mm. wide, 1–1.5 mm. thick, glabrous, light brown, inconspicuously 16- to 18-ribbed; pappus creamy, (5–) 7–8 mm. long.

DISTRIBUTION: Michoacán, east to México and Hidalgo, south to Morelos. Grasslands, pastures, borders, and openings in oak woodlands. Flowering in August and September.

This species is very closely related to *O. goldsmithii* and may be distinguished from it by its coarser habit, larger, puberulent, cordate leaves and more compact, tight inflorescence with larger heads.

DISTRITO FEDERAL: *Matuda* 19184 (US). HIDALGO: *Rose et al.* 9187 (GH, NY, US). MÉXICO: *Matuda* 19417 (NY); Pringle 6453 (GH, MICH, NY, US). MICHOACÁN: *King* 3615 (MICH, NY, TEX, US); *Pippen* 54 (MICH). MORELOS: *Moore* 3421 (GH); *Orcutt* 3746 (GH, US); *Rose & Hay* 5311 (GH, US); *Pringle* 9080 (GH, US).

20. Odontotrichum sinuatum (Cerv.) Rydb. Bull. Torrey Bot. Club 51:415. 1924.

Cacalia sinuata Cerv. *in* Llave & Lex. Nov. Veg. Desc. fac. 1:29. 1824. Holotype: Distrito Federal; mountains of the desert of San Angel, near Mexico City, *Cervantes* s.n. (not seen).

Senecio albo-lutescens Schultz Bip. Flora 28:498. 1845. Based on *Cacalia sinuata* Cerv. not *S. sinuatus* H.B.K.

Senecio calophyllus Hemsl. Biol. Centr. Amer. Bot. 2:237. 1881. Name illegitimate.

Slender plants to 1.5 (–2) m. tall; stem 4–6 mm. thick at the base, light green, pubescent below becoming subglabrous above; leaves sparsely puberulent, mostly along the veins and margins; basal leaves 3–5 (–7), erect, long-petioled, oblong-cordate in outline, (8–) 12–19 cm. long, (8–) 12–17 cm. wide, usually 2–3 cm. longer than broad or as long as broad; blades deeply lobed to within 1–3 cm. of the midrib, the primary lobes 8–11 (–13), 1–3 cm. broad at the base, mostly at right angles to the midrib, each lobe distally divided into 3 major secondary lobes and 2 or 3 lesser lobules or coarse teeth, the proximal pair of primary lobes usually deflected, more or less parallel to the petiole; petioles 10–40 cm. long, usually longer than the blade, slender, glabrous, green, often mottled with purple; cauline leaves 3–5 or more, the lowermost similar to the basal ones and about one-third as large, the petiole more clasping at the base; upper cauline leaves greatly reduced, bracteiform, the petiolar portion leafy-margined and clasping the stem, distally lobed; inflorescence corymbose (10–) 15-27 cm. long, (6–) 12–21 cm. broad, the branches sparsely to arachnoid-pubescent, subtended by narrowly ovate bracts 1–1.5 cm. long, 3 mm. wide, occasionally larger; pedicels 3–5 mm. long; calyculate bracts 3–7, linear-subulate, 3–7 mm. long; heads 75–100, 10–12 mm. long; phyllaries mostly 8 (7–9), elliptic or narrowly ovate, 5–6 (–7) mm. long, 2–3 mm. wide, glabrous, receptacle often slightly pubescent, up to 2 mm. across; flowers (9–) 10–11 (–13); corolla 6–7 mm. long, the tube 3–3.5 (–4) mm. long, the lobes 3–3.5 mm. long with a strong median nerve; anthers 2–3 mm. long; style branches 1–1.5 mm. long, the tips truncate with a terminal fringe of trichomes; mature achenes ellipsoid, 3.5–4 mm. long, 1.5–2 mm. wide, ca. 1–1.5 mm. thick, glabrous, light brown, ca. 20–striated; pappus white, 4–5.5 (–7) mm. long; chromosome number, $n=30$ (Turner, ined.).

DISTRIBUTION: From southern Chihuahua south and east to México. Common in grasslands, pastures, and borders of oak-pine

woodlands, occasionally in poorly drained areas. Flowering from August to October.

This is one of the most common species in western and central Mexico and exhibits considerable morphological variation. The basal leaves on the same plant as well as within the same population may vary in size, shape, and depth of lobing.

The holotype of this species has not been located. McVaugh and Rzedowski searched in Mexico City and McVaugh in Madrid but no Cervantes specimen was located. It is possible that no type specimen exists, as few other La Llave and Lexanza specimens are known. The original description, however, is sufficiently diagnostic to accept this name.

AGUASCALIENTES: *McVaugh & Koelz* 49 (MICH); *Pippen* 1, 7 (MICH). DISTRITO FEDERAL: *Bourgeau* 716 (GH, US); *Smyth* 172 (US). DURANGO: *Gould* 8989 (MICH); *King* 3734 (NY, TEX); *McVaugh* 21733 (MICH, part of hybird population between *O. sinuatum* and *O. globosum*); *Maysilles* 7572, 7793, 7880, 8448, (MICH), 8485 (MICH, NY); *Palmer* 651 (GH, NY, US); *Powell & Edmondson* 948 (TEX); *Gentry* 8562 (MICH). GUANAJUATO: *Duges* 451 (GH). JALISCO: *Hartweg* 125 (GH, NY); *McVaugh* 12810 (MICH); *McVaugh & Koelz* 276 (MICH); *Pippen* 9*, 22, 57 (MICH). MÉXICO: *Maluda* 19706, 21808, 26882 (NY); *Pippen* 56 (MICH); *Pringle* 4272, 9875 (GH, NY, US); *Rose & Painter* 7808 (GH, US). MICHOACÁN: *Arsène* 5740 (US); *Feddema* 10 (MICH); *Pippen* 45, 50 (MICH). PUEBLA: *Arsène* 93A, 334, 93, 1181 (US). WITHOUT LOCALITY: *Vischer* 58 (NY).

21. Odontotrichum tussilaginoides (H.B.K.) Rydb. Bull. Torrey Bot. Club 51:416. 1924.

Cacalia tussilaginoides H.B.K. Nov. Gen. et Sp. 4:168. 1820. (Folio ed. 4:132. 1820.) Holotype: Hidalgo; Real del Monte, 1420 hex., no date, *Humboldt & Bonpland* s.n. (P, not seen; Field Mus. Neg. 37878!).

Senecio tussilaginoides (H.B.K.) Schultz Bip. Flora 28:498. 1845. Not *S. tussilaginoides* Walt. 1788.

Senecio farfarus Hemsl. Biol. Centr. Amer. Bot. 2:239. 1881. Based on *Cacalia tussilaginoides* H.B.K., not *S. tussilaginoides* Walt. 1788.

Cacalia ampullacea Greenm. Proc. Amer. Acad. 34:577. 1899. Holotype: Hidalgo; Sierra de Pachuca, 9,000 ft., July 17, 1898, *C. G. Pringle* 1617 (GH!).

Odontotrichum ampullaceum (Greenm.) Rydb. Bull. Torrey Bot. Club 51:416. 1924.

Roots and lower portion of the stem not seen; erect herbs up to 1.3 m. tall (acc. *Balls* 5428); stem pubescent; leaves puberulent on the adaxial surface, the abaxial surface gray-tomentulose, the tomentum often flocculent; basal leaves presumably 2 or more, pinnately veined, ovate-cordate in outline, 20–30 (–35) cm. long from the apex to the basal sinus, 17–35 cm. wide, usually 2–4 cm. longer than broad or occasionally as broad as long; blades lobed one-half the distance to the midrib (at least on the distal portion of the blade), the primary lobes 10–12, 5–6 (–14) cm. long, 4–5 (–11) cm. broad at the

base, each sinuately and irregularly divided into at least 3 lobes, the secondary lobes usually coarsely dentate; petioles at least as long as the blades, usually longer (to 0.5 m.); lower cauline leaves not seen; upper cauline leaves leafy, bracteiform, ovate, naviculate, clasping the stem, 11–20 cm. long, 10–12 cm. wide, the margin toothed or sinuately lobed; inflorescence tightly corymbose, 17 (–21) cm. long, 12–17 cm. broad, the branches tomentose, the lowermost branches in the axils of the uppermost leaves, the distal branches subtended by linear-subulate bracts 1.5–4 cm. long, 1–2 (–4) mm. wide; calyculate bracts 4 or 5, linear-subulate, 3–5 mm. long; heads 100 or more, 7–10 mm. long; phyllaries 5, narrowly ovate, 5–7 mm. long, 1.5–2 (–3) wide, glabrous, often purplish; flowers 5 or 6, corolla 6–7 mm. long, the tube 3–3.5 mm. long, the lobes 3–3.5 mm. long, the throat none; anthers 2 (–2.5) mm. long; style branches 1 mm. long, hispid on the abaxial surface, the tips truncate or obtuse with a subterminal fringe of trichomes; mature achenes not seen, immature achenes 3.5–4 mm. long, pale tan, densely pubescent; pappus creamy or tawny, 4–5 (–7) mm. long.

DISTRIBUTION: Known only from Hidalgo and Veracruz. In wet mountain meadows. Flowering in August (?) (Kunth stated in the description that the plants flowered in May. The specimens I have examined flowered in August). This is one of the few species of *Odontotrichum* found in eastern Mexico.

This species is somewhat similar to *O. amplifolium*, differing mostly in the smaller heads with fewer flowers and the pubescent achenes. Comparison of the description and type specimen of *Cacalia ampullacea* Greenm. with the description and type photograph of *O. tussilaginoides* indicates that they are conspecific because of their similarity in appearance and their many common characters. Greenman apparently reached this conclusion after the publication of *C. ampullacea* because the type specimen is annotated as *C. tussilaginoides* H.B.K., in what appears to be Greenman's writing.

HIDALGO: *Rose & Hay* 5574 (US); *Rose & Painter* 6738 (GH, US); *Pringle* 9868 (GH, NY, US). VERACRUZ: *Balls* 5428 (US).

3. *Pericalia*

Pericalia (Cass. Dict. Sci. Nat. 48: 459. 1827, not validly published) Rydb. Bull. Torrey Bot. Club 51: 376. 1924.

Perennial, leafy-stemmed herbs, 1.5–2 m. tall; roots fibrous, fleshy; stems usually solitary, erect, annual, terete to often 6- to 8-angulate distally, pubescent or glabrous, tuberculate at base, the clustered subterranean tubercles each up to 2.5 cm. thick, 5 cm. long, pubescent with minute, multicellular, tan hairs; leaves cauline, not forming a basal rosette, succulent when fresh, coriaceous when dry, petiolate or

sessile, alternate, clustered toward the middle of the stem but continuing upward to the inflorescence, becoming smaller and widely separated distally, not usually becoming bracteiform; inflorescence paniculate or corymbose; heads usually few, nodding, 15–20 mm. long, subtended by 10–15, linear or narrowly triangular, calyculate bracts as long as or longer than the phyllaries and loosely surrounding them, especially in bud; involucre campanulate to turbinate, the phyllaries subequal, biseriate appearing uniseriate, imbricate, the overlapped margins subscarious, the exposed surfaces glabrous, the tips fringed with minute trichomes up to 0.3 mm. long; receptacle flat or nearly so, alveolate, not paleaceous; flowers all discoid, perfect, fertile, 25–50 or more per head; corollas glabrous, creamy or nearly white but never yellow, the tube narrowly cylindrical, ca. 0.5 mm. in diameter, the limb divided into 5, equal, narrowly triangular, 3-nerved, recurved lobes connate into a campanulate throat, 2–5 mm. long, as long as or twice as long as the lobes; anthers 3–4 mm. long, exserted beyond the corolla throat, the bases rounded or slightly sagittate, the terminal appendages trullate, rounded or ovate, 0.5–0.7 mm. long; style branches 1–2 mm. long, slightly flattened, recurved, the stigmatic area covering most of the adaxial surface, the abaxial surface glabrous or hispidulous below, the unappendaged tips truncate, to obtuse, fringed with nonglandular "pollen-producing" trichomes; achenes narrowly cylindrical, subterete in cross section, glabrous, purplish brown, 10-ribbed; pappus creamy or white, distally clavate.

TYPE SPECIES: *Pericalia sessilifolia* (Hook & Arn.) Rydb.

Cassini suggested that *Cacalia cordifolia* H.B.K. should be considered as either a separate genus or subgenus under the name *Pericalia* but he did not validly publish the name as either. DeCandolle cited *Pericalia* as a synonym of *C. cordifolia* H.B.K. and Rydberg used *Pericalia* as a genus in 1924.

Microscopic examination of freehand sections of the unique tubercles revealed their stemlike nature by the presence of discrete collateral vascular bundles. The parenchyma cells contain needle-shaped crystals. The tubercles function not only in storage but also in vegetative reproduction, since in some circumstances they give rise to new flowering stems.

Key to Species of *Pericalia*

1. Flowers 40–50 per head; lobes of the corolla as long as the throat, 2–3 mm. long; leaves broadly ovate or elliptic, the margin coarsely toothed or lobulate, the lobules broader than long . . . . . **2. P. sessilifolia**
1. Flowers 25–35 per head; lobes of the corolla less than half as long as the throat, 1–1.5 mm. long, the throat 4–5 mm. long; leaves deltoid or subcircular, 3- to 7-lobed, the lobes longer than broad . . . . . **1. P. michoacana**

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1. Pericalia michoacana (B. L. Rob.) Rydb. Bull. Torrey Bot. Club 51:377. 1924. PLATE 5

Cacalia michoacana B. L. Rob. Proc. Amer. Acad. 43:46. 1907. Holotype: Michoacán; Uruapan, on pine covered crater cone, 1,680 m., Oct. 31, 1905, *C. G. Pringle* 10117 (GH!).

Cacalia trigonophylla S. F. Blake, Journ. Wash. Acad. 19:280. 1929. Holotype: Jalisco; San Sebastian, trail to mine La Sabala, Feb. 10, 1927, *Ynex Mexia* 1656 (US!).

Slender herbs 0.6–1.5 (–2) m. tall; underground tubercles 1.5–2.5 cm. thick, to 5 cm. long; stem 2–5 (–7) mm. thick at the base, greenish, often mottled with purple, glabrous to sparsely or densely pubescent proximally, becoming glabrous and often glaucous above; leaves 10–15 or more, long-petioled, subpalmately veined with 3–5 principal veins with the central vein stronger, densely to sparsely pubescent to glabrous; blades variable in shape from subcircular-cordate-based with 5–7 deltoid or triangular lobes, to broadly deltoid-hastate with 3 major, narrowly triangular lobes, 4–7 (–10) cm. long from the basal sinus to the tip, 5.5–10 (–16) cm. wide, usually 2–3 cm. wider than long, progressively smaller upward, the margins minutely or coarsely dentate; petioles 5–10 (–15) mm. long, purplish; inflorescence racemose or paniculate, 10–20 cm. long, 8–12 cm. broad or larger, the distal branches subtended by linear-subulate bracts 1–1.5 cm. long, the proximal branches often in the axils of the uppermost leaves; pedicels 2–5 (–7) cm. long; calyculate bracts 10–15, linear or narrowly triangular, 4–5 (–7) mm. long; heads mostly 6–12 (–50), nodding, 15–20 mm. long; phyllaries (10–) 12 or 13, narrowly ovate or narrowly oblong, (7–) 10–13 mm. long, 1–2 mm. wide; receptacle 4–5 mm. across; flowers 25–35; corolla 9–12.5 mm. long, the tube (3.5–) 4–4.5 (–5.5) mm. long, the throat funnelform or campanulate, 4–5.5 mm. long, 1.5 mm. wide at the apex, the lobes 1–1.5 mm. long, triangular, strongly recurved; anthers 3.5–4 mm. long; style branches ca. 1.5 mm. long, the tips truncate or rounded with a sparse subterminal fringe of trichomes; achenes narrowly oblong or narrowly obovoid, terete in cross section, 2.5 mm. long, 0.5 mm. thick, glabrous, dark brown with 10 pale ribs; pappus (8–) 9–10 (–11) mm. long, white, slightly clavate distally; chromosome number, $n=30$ (Pippen).

DISTRIBUTION: From northwest Jalisco eastward to México. Growing mostly on rocky slopes in oak-pine woods. Flowering in November and December.

The specimens examined show a wide range of variation in leaf shape and pubescence between the two extreme forms described above. Some correlation between leaf shape and pubescence is apparent since the plants with 5- to 7-lobed leaves tend to be more pubescent and those plants with 3-lobed leaves tend to be glabrous and glaucous. A specimen from eastern Jalisco (*McVaugh & Koelz* 435) has more

rounded lobes than the other specimens. Despite these variations all of these specimens form only one taxon.

Comparison of the types of *Pericalia michoacana* and *Cacalia trigonophylla* and examination of a large sample of these taxa indicate that they are conspecific. They have the same number of phyllaries and flowers in a head and the morphological structure of the flowers is the same. The only observable difference is in the pubescence and the number of lobes. Blake based *C. trigonophylla* on a collection in which the leaves were 3-lobed and subglabrous. No geographical or ecological differences are noticed between these two extremes in vegetative form and therefore no nomenclatural status is given to these variations.

JALISCO: *Mexia* 1656 (US, MICH, isotypes of *C. trigonophylla* Blake); *McVaugh* 14290, 21355, 14136, 14093, 22071 (MICH); *Pippen* 26, 38, 63*, 65* (MICH); *McVaugh & Koelz* 435 (MICH). MÉXICO: *Hinton et al.* 2755 (US), 4993 (NY, US); *Moore & Cetto* 5469 (MICH). MICHOACÁN: *Hinton et al* 12718, 13469 (MICH, NY); *Pringle* 10117 (US, isotype).

2. Pericalia sessilifolia (Hook. & Arn.) Rydb. Bull. Torrey Bot. Club 51:376. 1924.

Cacalia cordifolia H.B.K. Nov. Gen. et Sp. 4:168. t. 360. 1820. Holotype: México; Santa Rosa, *Humboldt & Bonpland* s.n. (P, not seen; Field Mus. Neg. 37865!), not *Cacalia cordifolia* L.f.

Cacalia sessilifolia Hook. & Arn. Bot. Beech. Voy. 436. 1841. Holotype: Nayarit; between San Blas and Tepic, in 1837, *Sinclair* s.n. in Hooker Herb. (K, not seen; MICH Neg. 621!).

Senecio ovatifolius Schultz Bip. Flora 28:498. 1845. Based on *Cacalia cordifolia* H.B.K. not *S. cordifolius* L.f.

Senecio beecheyanus Schultz Bip. Flora 28:499. 1845. Based on *Cacalia sessilifolia* Hook. & Arn. Name illegitimate.

Senecio cardiophyllus Hemsl. Biol. Centr. Amer. Bot. 2:237. 1881. Based on *Cacalia cordifolia* H.B.K. Name illegitimate.

Senecio sessilifolius (Hook. & Arn.) Hemsl. Biol. Centr. Amer. Bot. 2:247. 1881. Based on *Cacalia sessilifolia* Hook. & Arn.

Cacalia nutans Sessé & Moc. Pl. N. Hisp. ed. 1. 132. (Fl. Mex. ic. ined. 145; Field Mus. Neg. 30705!) 1889. Lectotype: Without locality (presumably "in humidis unbrosisque Tepalpae circuitibus prope Mexicanum"), *Sessé & Moc.* 1488 or 2822! (both numbers appear on the specimen), Field Mus. Neg. 42285.

Pericalia ovatifolia (Schultz Bip.) Rydb. Bull. Torrey Bot. Club 51:377. 1924.

Plants 0.5–1.5 (–1.8 m., *Balls* 5575) m. tall; tubercles 2–2.5 cm. thick, to 5 cm. long; entire plant glabrous and glaucous, often sparsely pubescent when young; stems 3–9 mm. thick at the base; leaves 10–15, petiolate or sessile, subpalmately veined with often 3 principal veins, the central one usually dominant; blades cordate-based, broadly ovate or broadly elliptic, the larger ones 4–13 cm. long from the basal sinus to the apex, 5–12 (–14) cm. wide, usually 1–3 cm. wider than long (often as long as wide to 1½ times longer than wide), the margin

variable from subentire to dentate to 9- to 14-lobulate, the lobules, when present, usually broader than long; petioles (when present) subterete, purplish green, 3–9 cm. long; inflorescence corymbose or paniculate, 10–30 cm. long, 7–18 cm. broad, the proximal branches often in the axils of the distal leaves, the other branches subtended by subulate or narrowly ovate bracts 7–10 mm. long, 1 mm. wide; pedicels (2–) 3–6 (–9) cm. long; calyculate bracts 10–16, linear or narrowly triangular, 6–11 mm. long; heads 6–15 (–20), 15–20 mm. long; phyllaries 12–14 (–15), narrowly ovate or narrowly triangular, (9–) 11–14 mm. long, 2–3 mm. wide, greenish or purplish; receptacle ca. 7 mm. across; flowers 40–50 or more; corolla (7–) 8–12 (–13) mm. long, the tube (3.5) 4–5 (–7) mm. long, the throat 2–3 mm. long, 1–1.5 mm. across at the top, the lobes about as long as the throat, 1.5–3 mm. long, strongly recurved; anthers 3–3.5 (–4) mm. long; style branches 1–1.5 (–2) mm. long, recurved; mature achenes oblong or ellipsoid, subterete in cross section, 3.5 mm. long, 1–1.5 mm. wide, ca. 0.5–1 mm. thick, glabrous, purplish brown, 10-ribbed; pappus white (7–) 8–10 mm. long, distally clavate; chromosome number, $n=30$ (Pippen).

DISTRIBUTION: Durango, Nayarit, and Jalisco, east to Michoacán and México. Common on rocky slopes in the oak-pine woodlands. Flowering in September and October.

Comparison of *Cacalia cordifolia* H.B.K. and *P. sessilifolia* (Hook. & Arn.) Rydb. indicate that they are conspecific. They differ only in the presence or absence of the petiole. Several specimens from Nayarit have both sessile and petiolate leaves on the same plant. The heads, flowers, and other morphological characters are similar. The sessile-leaved plants are apparently vegetative variations that occur several times within the range of the petiolate forms. This difference is not significant enough for nomenclatural status.

This species is a victim of nomenclatural rules. Since *Cacalia cordifolia* H.B.K. was superfluous when published because of the earlier *C. cordifolia* L. f., a different taxon, the next oldest valid name for this taxon is *Cacalia sessilifolia* [*Pericalia sessilifolia* (Hook. & Arn.) Rydb.]. This is unfortunate since the petiolate-leaved plants are by far more common than the sessile-leaved forms.

AUGUASCALIENTES: *McVaugh & Koelz* 147 (MICH); *Pippen* 5 (MICH). DISTRITO FEDERAL: *Balls* 5575 (US); *Bourgeau* 715 (GH); *Pringle* 7983 (GH); *Lyonnet* 194 (GH, NY, US); *Purpus* 5625 (GH, NY, US). DURANGO: *Gentry* 6968 (GH, MICH, US); *McVaugh* 21658 (MICH); *Maysilles* 7579 (MICH); *Pennell* 18345 (NY, all of the specimens from Durango are of slightly smaller stature with more, smaller leaves). GUANAJUATO: *Duges* 481 (GH, US). JALISCO: *McVaugh* 13559, 13625, 17118, 17183, 18121 (MICH); *McVaugh & Koelz* 920 (MICH); *Mexia* 1450 (US); *Palmer* 576 (GH, NY, US); *Pippen* 17, 18, 31, 33, 34, 61*, 64 (MICH); *Pringle* 1736 (GH, MICH, NY, US), 9869 (GH, NY, US), 11497 (GH, MICH, US); *Safford* 1451 (US); *Rose* 2828 (GH, US). MÉXICO: *Matuda* 21825

(NY). MICHOACÁN: *Arsène* s.n., Sept. 11, 1909, Sept. 14, 1911, 5729, 7347 (US); *Feddema* 161 (MICH); *Pippen* 51 (MICH). NAYARIT: *Feddema* 381, 1345 (MICH): *McVaugh & Koelz* 479, 792, 656 (MICH); *Mexia* 635 (US); *Ortega* 5727 (US); *Palmer* 1832 (GH, NY, US); *Pippen* 13, 15 (MICH). QUERETARO: *Matuda* 29787 (NY). SAN LUIS POTOSÍ: *Palmer* 47 (GH, NY, US); *Parry & Palmer* 541 (GH, US); *Schaffner* 255, 33 or 37? (GH).

Three specimens in the herbarium at the University of Michigan do not fit precisely into either of the above taxa, *P. sessilifolia* or *P. michoacana*. Two of these, *McVaugh* 13469 and 13825 (from northeast slopes of the Nevado de Colima, below Canoa de Leoncito, 2,250–2,550 m.), have leaves similar to *P. michoacana* in that they are subcircular, 7-lobed, and pubescent, but they are about 0.5 times larger with much longer petioles and the inflorescence has larger heads with more flowers. The phyllaries are finely pubescent with fuscous hairs and the heads are subtended by about 15 calyculate bracts as wide as but longer than the phyllaries.

These specimens may represent a different species but, because of the paucity of material available and its rather close similarity to *P. michoacana*, I will only mention their existence for the present.

The third nonconforming specimen, *McVaugh* 13862 (Sierra de Manantlán, 15–20 miles southeast of Autlán, near Asseradero El Cuartón, 2,500 m.), differs from the above in that the leaves are less deeply lobed, less pubescent, and the trichomes are mostly restricted to the leaf margins; the phyllaries are glabrous, the subinvolucral bracts no longer than the phyllaries and somewhat narrower. This specimen approaches *P. sessilifolia* but differs in the longer petioles, the more subcircular than ovate, 7-lobed leaves, and the presence of pubescence. Future collections and field observations in this region will be necessary to properly interpret this specimen.

4. Psacalium

Psacalium Cass. Dist. Sci. Nat. 43:461. 1826.

Perennial, subscapose herbs, 0.1–3 m. tall; roots fleshy, fibrous; caudex tough, to 5 cm. long, 3 cm. thick, the nodes and terminal buds densely covered with masses of tawny, multicellular hairs, 1–2 cm. long; stems usually solitary, annual, erect, slender or stout, usually terete, glabrous or pubescent; radical leaves forming a basal rosette of two to several, centrally peltate with several principal radiating veins, each pinnately subdivided, the blades variously lobed, rarely subentire, mostly pubescent; cauline leaves alternate, progressively smaller upward, the uppermost bracteiform, usually nonpeltate with a broad leafy-margined petiole and palmately 3- to 7-lobed blade; inflorescence paniculate or corymbose, the branches often stipitate glandular, with minute, multicellular glands, 0.5 mm.

long, subtended by small, linear-subulate or large, leafy, often vaginate bracts; heads few to many, calyculate, the bracts 3–5, as long as the phyllaries or shorter (longer in *P. peltatum*); involucre campanulate, turbinate or less frequently cylindrical, the phyllaries 5–17, subequal, biseriate appearing uniseriate, the overlapped margins subscarious, the exposed surfaces pubescent or glabrous, the tips fringed with minute trichomes up to 0.3 mm. long; receptacle flat or nearly so, alveolate, not paleaceous, occasionally sparsely pubescent; flowers all discoid, fertile, 5–80 per head; corollas glabrous, creamy or nearly white, occasionally greenish or purplish tinted but never yellow, the tube narrowly cylindrical, 0.5 mm. in diameter, the limb divided into 5, equal, narrowly-triangular, 3-nerved, ascending or spreading, not recurved lobes, connate into a short, ampliate or campanulate throat, about 1 mm. long, 1–1.5 mm. wide (or occasionally lacking), the lobes longer than the throat and as long as to one-half as long as the tube; anthers 2–4 mm. long, exserted beyond the corolla throat, rounded or slightly sagittate at the base, the terminal appendages trullate or ovate 0.5–0.7 mm. long; style branches 0.7–2 mm. long, slightly flattened, recurved or spreading, the stigmatic surface covering most of the adaxial surface, the abaxial surface glabrous or hispidulous below, the unappendaged tips truncate to obtuse with a fringe of nonglandular "pollen producing" trichomes; achenes obovoid or ellipsoid, somewhat compressed and elliptic or broadly elliptic in cross section, glabrous or pubescent, striate or prominantly 10- to 12-ribbed; pappus a single row of white or creamy, stiff, barbellate, capillary bristles (lacking in *P. nanum* and *P. calvum*); chromosome number, $n=30$.

TYPE SPECIES: *Psacalium peltatum* (H.B.K.) Rydb.

This genus is easily recognized by the peltate basal leaves and is the only genus discussed here with stipitate glandular pubescence in addition to the usual nonglandular trichomes.

Key to Species of *Psacalium*

1. Inflorescence and upper portion of stem minutely stipitate glandular; plants also pubescent with nonglandular hairs.
   2. Achenes pubescent.
      3. Corolla tube about twice as long as the lobes, 6–7 mm. long; heads nodding, about 40 or fewer; pappus 9–10 mm. long . . . . **3. P. holwayanum**
      3. Corolla tube about the same length as the lobes, 3.5–4 (–5) mm. long; heads erect, 50 or more; pappus 6–7 mm. long . . . **2. P. eriocarpum**
   2. Achenes glabrous.
      4. Flowers 5–6 per head; phyllaries 5, mostly glabrous or very sparsely pubescent . . . . . **11. P. tabulare**
      4. Flowers 8 or more per head; phyllaries at least as numerous as the flowers, densely pubescent.

5. Basal leaves lobed one-half or less the distance to the center; phyllaries (7–) 8; flowers 8–10; bracts subtending the phyllaries either 3–5 and one-half as long as the phyllaries, or 1 or 2 and as long as the phyllaries.
6. Lobes of the leaves 4 or 5; leaves 5–6 cm. in diameter, pubescent on the adaxial surface; phyllaries subtended by 1 or 2 bracts as long as or longer than thep hyllaries. . . . . **4. P. laxiflorum.**
6. Lobes of the leaves 6 or 7; leaves 20–30 cm. in diameter, glabrous on the adaxial surface; phyllaries subtended by 3–5 bracts about one-half as long as the phyllaries . . . . . **12. P.** species
5. Basal leaves lobed about two-thirds the distance to the center; phyllaries (8–) 12–15; flowers 20 or more; bracts subtending the phyllaries 3 or 4, longer than the phyllaries . . . . . **8. P. peltatum**

1. Inflorescence and upper portion of the stem lacking stipitate glands; plants pubescent with nonglandular trichomes or glabrous.
7. Plants with fleshy underground tubers attached to the caudex.
8. Pappus present, 4–6 mm. long; flowers 5–8; phyllaries 5; plants 0.5 m. tall or taller . . . . . **9. P. peltigerum**
8. Pappus lacking; flowers 10 or 11; phyllaries 7; plants up to about 15 cm. tall . . . . . **6. P. nanum**
7. Plants lacking underground tubers.
9. Pappus lacking; achenes obovoid, 10–12 mm. long, 5–6 mm. wide; leaves deeply and finely dissected almost to the center, the major segments again divided, the ultimate segments linear . **1. P. calvum**
9. Pappus present; achenes ellipsoid, up to 7 mm. long, 2 mm. wide; leaves lobed as deep as three-fourths the distance to the center, not deeply and finely dissected.
10. Phyllaries densely pubescent.
11. Bracts subtending the phyllaries 3 or 4, longer than the phyllaries; phyllaries 8–10; flowers 12 or 13; receptacle naked, not pubescent. **8. P. peltatum**
11. Bracts subtending the phyllaries 3–5, less than half as long as the phyllaries; phyllaries 5; flowers 5 or 6; receptacle sparsely pubescent. **5. P. megaphyllum**
10. Phyllaries glabrous or very sparsely pubescent.
12. Phyllaries 9–10 mm. long; achenes glabrous; leaves pubescent, densely so on the abaxial surface.
13. Phyllaries 5; flowers 5 or 6; ranging from Veracruz west to Michoacán . . . . . **11. P. tabulare**
13. Phyllaries 8 or 9; flowers 10–12; known only from central Oaxaca. **7. P. nelsonii**
12. Phyllaries 5–7 mm. long; achenes pubescent; leaves glabrous or sparsely pubescent along the veins on the abaxial surface. **10. P. poculiferum**

1. Psacalium calvum (Brand.) Pippen, comb. nov.

Cacalia calva Brand. Univ. Calif. Publ. Bot. 4:193. 1911. Holotype: Puebla; Cerro de Gavilan, August 1900, *C. A. Purpus* 4113 (UC, not seen; isotypes GH!, US!).

Odontotrichum calvum (Brand.) Rydb. Bull. Torrey Bot. Club 51:420. 1924.

Lower portion of the plant not seen; plants ca. 0.5 m. tall; stem and leaves densely pubescent to tomentose; flowering stem terete;

basal (?) leaves 2 or 3, long-petioled, peltate, subcircular in outline, 12–14 cm. in diameter; blades deeply dissected into 6–8 divisions extending almost to the center, the major divisions several times subdivided, the ultimate divisions narrow, linear; petioles slender, 20–25 cm. long; cauline leaves reduced and bracteiform; inflorescence corymbose, the branches subtended by linear-subulate bracts to 1 cm. long; heads about 20; phyllaries 12, narrowly ovate, 8 mm. long, 1 mm. wide; flowers 12–14; corolla about 7–8 mm. long (flower measurements from the original description), the tube 3–4 mm. long, the throat ca. 0.5 mm. long, 0.5–1 mm. across at the apex, the lobes 4 mm. long; anthers about 3 mm. long; style branches recurved, hirtellous; mature achenes obvoid, 10–12 mm. long, 5–6 mm. wide, glabrous, pale brown; pappus lacking entirely.

DISTRIBUTION: Known only from the type specimens.

The specimens examined lacked adequate flowering material, and the poorly preserved leaves made it difficult to determine whether or not they were peltate.

The most unusual features of this species are the extremely large, obovoid achenes and lack of a pappus. Field examinations and study of material collected in the future may indicate a change in the taxonomic position of this taxon.

2. Psacalium eriocarpum (S. F. Blake) Blake Journ. Wash. Acad. Sci. 28:492. 1938.
Cacalia eriocarpa S. F. Blake Journ. Wash. Acad. Sci. 129. 1929. Holotype: Jalisco; Arroyo de Santa Gertrudis, San Sebastian, steep slopes in open pine and oak woods, 1,500 m., Jan. 21, 1927, *Ynez Mexia* 1539 (US!).

Slender plants up to 1.3 m. tall, stems 5–10 mm. thick at the base, purplish green, sparsely or densely pubescent with long, multicellular, stiff, attenuate-tipped hairs, 1–1.5 mm. long, and with multicellular, stipitate glands, 0.5 mm. long; leaves hirsute with nonglandular hairs like those on the stem, the pubescence denser on the adaxial surface; basal leaves 2 or 3, long-petioled, centrally peltate, subcircular in outline, 15–25 (–30) cm. in diameter, the venation radiate with 10 or 11 principal veins; blades shallowly lobed one-third the distance to the center of the blade or less, the lobes 8–10, 1.5–2 times broader than long, each 3-angulate or subdivided into 2 or 3 smaller lobules, the margins spinulose-toothed or entire, the center of the blade flat, not depressed; petioles 15–30 cm. long, slender; cauline leaves 1 or 2, greatly reduced, bracteiform, inflorescence paniculate, usually 30 cm. long or longer, 10–15 cm. broad, the branches subtended by narrowly triangular bracts 3–7 mm. long, 1 mm. wide; pedicels 3.5–5 (–9) mm. long, calyculate bracts 3–5, subulate, 2–5 mm. long; heads 50–70 (–90), 1.2–1.5 cm. long; phyllaries 5 or 8, narrowly ovate or elliptic, (6–) 7–8 (–9) mm. long, 1–3 mm. wide, purplish tipped, pubescent, occasionally sparsely stipitate glandular; flowers 6 (when 5 phyllaries)

or 9–11 (when 8 phyllaries); corolla about 8–9 mm. long, the tube (3.5–) 4 (–5) mm. long, the throat short, campanulate, about 1 mm. long and broad, the lobes about as long as the tube, 3–4 (–5) mm., narrowly triangular; anthers 3–4 mm. long; style branches 1.5–2 mm. long, the abaxial surface hispidulous, especially distally, the tips rounded or obtuse with a sparse subterminal fringe of hairs; mature achenes not seen, the immature achenes pale green, densely villous; pappus (5.5–) 6–7 (–8) mm. long, white; chromosome number, $n=30$ (Pippen).

DISTRIBUTION: Western Jalisco. Mostly in pine and, less frequently, oak woodlands. Flowering mid-November to December.

This species has two forms: the more common form has small heads with 5 phyllaries and 6 flowers, the other has larger heads with 8 phyllaries and 9–11 flowers. These two forms are similar in all other aspects, including range. The larger headed form is known only from an area in between the known populations of the smaller headed form. These forms are not given nomenclatural status. This species is closely related to *P. holwayanum* but differs from it in the smaller heads, erect inflorescence, and less deeply lobed leaves.

JALISCO: *McVaugh* 13954, 14287, 13684, 14165 (MICH); *McVaugh & Koelz* 919 (MICH); *Pippen* 36, 62*, 66, 67 (MICH).

3. Psacalium holwayanum (B. L. Rob.) Rydb. Bull. Torrey Bot. Club 51:372. 1924.

Cacalia holwayana B. L. Rob. Proc. Amer. Acad. 43:45. 1907. Holotype: Michoacán; Uruapan, Oct. 11, 1899, *E. W. D. Holway* 2617 (GH!).

Psacalium langlassei Rydb. Bull. Torrey Bot. Club: 51:376. 1924. Holotype: Guerrero; Sierra Madre, in 1898, *E. Langlassé* 576 (US!).

Plants up to 1 m. tall; stems 3–5 mm. thick at the base, densely pubescent with stiff, white hairs up to 2 mm. long, 12- to 20-celled, and also with 6-celled stipitate glands, 0.1–0.2 mm. long, abundant distally; leaves sparsely or densely pubescent with stiff, nonglandular hairs only; basal leaves 2 or 3, long-petioled, peltate, subcircular in outline, (9–) 12–14 (–26) cm. in diameter, the venation radiate with 8 principal veins; blades lobed about one-third the distance to the center, the lobes 7 or 8, 2.5–4 cm. long, 3–6 cm. wide, each one 3-angulate or divided into 2 or 3 smaller secondary lobes, the margins irregularly and sparsely toothed; petioles (9–) 10–18 (–32) cm. long, terete; cauline leaves 2 or 3, similar to the basal ones but smaller, 1–5 cm. in diameter, the uppermost subpeltate with petioles 1–5 (–10) cm. long; inflorescence thyrsiform, 16–30 cm. long, 14–16 cm. broad, the branches pubescent and stipitate glandular like the stem, subtended by either linear bracts 1–2 cm. long, 1 mm. wide or occasionally spathulate bracts, 3-toothed at the tip; pedicels 5–15 mm. long;

calyculate bracts 3–5, subulate, 4–7 mm. long; heads about 40 or fewer, nodding, 1.5–3 cm. long; phyllaries 8, narrowly ovate, 9–13 mm. long, 1.5–3 mm. wide, purplish, pubescent with glands and sparsely hirsute with nonglandular, long, stiff hairs; receptacle 3–3.5 mm. long; flowers 10 or 11; corolla 10–11 mm. long, the tube 6–7 mm. long, the throat short, campanulate, ca. 1 mm. long, 1.5–2 mm. across, the lobes 3–3.5 (–5, *Pringle* 13294) mm. long, linear, 0.5 mm. wide, anthers 3.5–4 mm. long; style branches 1.5–2 (–3) mm. long, hispid on the abaxial surface, the tips truncate with a terminal fringe of trichomes; mature achenes 5–6 mm. long, 1.5 mm. wide, 0.5–0.7 mm. thick, oblong, or ellipsoid, pale, densely pubescent with unicellular, adpressed, ascending hairs; pappus 9–10 mm. long, white; chromosome number, $n=30$ (Turner, ined.).

DISTRIBUTION: Known from west central Michoacán eastward to México and from one collection in Guerrero. Mostly in pine woodlands. Flowering mid-November to December.

An isoparatype, *Langlassé* 576 (US), was described by Rydberg as *Psacalium langlassei*, because the leaves were less deeply lobed. Comparison of this specimen with the type and other specimens of *P. holwayanum* indicates that they are conspecific because they are similar in all characters except leaf lobes. The specimen Rydberg examined was merely less deeply lobed.

GUERRERO: *Langlassé* 576 (GH, paratype of *C. holwayana*, isotype of *P. langlassei*). MÉXICO: *Gilly* 5 (MICH); *Matuda* 30015 (NY). MICHOACÁN: *King & Soderstrom* 4890 (MICH); *Pringle* 13297 (GH, US), 13672 (GH, paratype; US), 13979 (GH, MICH, US); *McVaugh* 21953* (MICH).

4. Pascalium laxiflorum Benth. Pl. Hartw. 41. 1841. Holotype: Michoacán; Morelia, pine woods, in 1836, *Hartweg* 318 (K, not seen; Field Mus. Neg. 37949!).

Senecio moreliae Hemsl. Biol. Centr. Amer. Bot. 2:243. 1881. Based on *Psacalium laxiflorum* Benth. not *S. laxiflorum* Viv.

Slender plants 6–7 cm. tall; stems 3–4 mm. thick at the base, pubescent with multicellular stiff hairs, 1–1.5 mm. long, and minute, 2- to 3-celled stipitate glands ca. 0.1 mm. long, most abundant distally; leaves pubescent on the adaxial surface with nonglandular hairs, subglabrous abaxially; basal leaves 2 or 3, petiolate, peltate, subcircular in outline, 5–6 cm. in diameter, the venation radiate with 5 principal veins; blades lobed about one-half the distance to the center, the lobes 4 or 5, 1–2 cm. long and broad or occasionally 1.5–2 times broader than long, each slightly 3-angulate, the tips rounded or obtuse, the margins mucronulate-toothed, the sinuses broadly rounded; petioles 6–8 cm. long, terete; cauline leaves usually 2, the lowermost similar to the basal ones, the upper one nonpeltate, 2.5–4 cm. long, 1–2 cm. wide with the petiolar portion leafy-margined,

ovate, the blade portion 3-lobed; inflorescence paniculate, 16–26 cm. long, 11–12 cm. broad, the branches pubescent and stipitate glandular like the stem, subtended by narrowly ovate or ovate bracts 2–2.5 cm. long, 0.5–1 cm. wide progressively smaller upward, the bracts glandular on the adaxial surface, glabrous abaxially; pedicels 5–10 mm. long; calyculate bracts 1–2, subulate, 8–10 mm. long; heads 30 or fewer, 14–15 mm. long; phyllaries 8, narrowly ovate, (6–) 7–8 mm. long, 1.5–3 mm. wide, purplish, densely stipitate glandular; flowers 8; corolla 8–9 mm. long, the tube 5–5.5 mm. long, the throat ampliate, 0.5 mm. long, 0.7–1 mm. wide, the lobes 3–3.5 mm. long, linear; anthers 3 mm. long; style branches 1.5 mm. long, hispid on the abaxial surface, the tips truncate or rounded with a terminal or subterminal fringe of trichomes; mature achenes not seen, immature achenes glabrous, striate; pappus 6–7 mm. long, white.

DISTRIBUTION: Known only from the type collection and one collection from southern Durango (*Rose* 2337, GH, US). In pine-woodlands. Flowering in August.

This species has smaller leaves than the other members in the section, and they tend to be 4-lobed and somewhat cross shaped. It is related to *P. holwayanum* and *P. eriocarpum*.

5. Psacalium megaphyllum (Rob. & Greenm.) Rydb. Bull. Torrey Bot. Club 51: 374. 1924. PLATE 6

Cacalia megaphylla Rob. & Greenm. Amer. Journ. Sci. III. 50:157. 1895. Holotype: Jalisco; on hillside near Guadalajara, Oct. 10, 1889, *C. G. Pringle* 2490 (GH!).

Cacalia obtusiloba Rob. & Greenm. Amer. Journ. Sci. III. 50:158. 1895. Holotype: Oaxaca; Sierra de San Felipe, 6,000 ft., Nov. 17, 1894, *C. G. Pringle* 5840 (GH!).

Psacalium obtusilobum (Rob. & Greenm.) Rydb. Bull. Torrey Bot. Club 51:374. 1924.

Stout plants to 3 m. tall; entire plant pubescent, the pubescence denser in the inflorescence and on the abaxial surface of the leaves, the hairs 0.5–0.7 mm. long, 5- to 15-celled, white; stem to 2 cm. thick at the base; basal leaves 3 or 4, long-petioled, peltate, subcircular in outline, 30–60 cm. in diameter, the venation radiate with 5–7 principal veins; blades lobed one-half to two-thirds the distance to the center, the primary lobes 5–7, 7–15 cm. long from the base of the sinus to the distal edge, 5–7 cm. wide at the base, each usually divided into 3 lobes, the secondary lobes (5–) 7–10 cm. long, 3–5 cm. wide at the base, each divided into several smaller, triangular lobules 1–3 cm. long, the margins coarsely toothed, the center of the blade depressed; petioles 25–80 cm. long, terete, purplish green; cauline leaves 5–7 or more, the lowermost usually smaller than the basal ones but similar to them, 30–35 cm. in diameter, the upper cauline leaves progressively smaller upward, subpeltate or nonpeltate, the

uppermost 8–15 cm. long, 10–20 cm. wide, palmately 3- to 5-lobed, the petioles 3–7 cm. long; inflorescence broadly paniculate-corymbose, to 1.5 m. high, ca. 1 m. broad, the proximal branches in the axils of the uppermost leaves, the distal branches subtended by ovate bracts 2–5 cm. long, 3–7 mm. wide; pedicels about as long as the phyllaries; calyculate bracts 3–5, subulate, 1.5–2 mm. long; heads at least 150, 10–12 mm. long; phyllaries 5, narrowly elliptic or narrowly ovate, (5.5–) 7–8 (–10) mm. long, (1.5–) 2–3 mm. wide, densely white puberulent; receptacle sparsely pubescent with filiform, multicellular hairs; flowers 5 (–6); corolla 6–8 mm. long, the tube 3–4 mm. long, the throat 0.5 mm. long and broad (or occasionally lacking), the lobes narrowly triangular, 2.5–4 (–5.5) mm. long, reflexed; anthers 2–3.5 mm. long; style branches 1–1.5 mm. long, the abaxial surface hispid, denser distally, the tips obtuse with a sparse terminal fringe of trichomes; mature achenes oblong or ellipsoid, 5–5.5 mm. long, 1.5–2 mm. wide, 1 mm. thick, pale green, glabrous, 15- to 20-ribbed; pappus 4–5 (–7) mm. long, white; chromosome number, $n=30$ (Turner, ined.).

DISTRIBUTION: From Zacatecas southeast to Oaxaca. Common, at least in western Mexico, in rocky grasslands, roadsides, and grazed areas. Flowering in September and October.

This species is striking because of its very large size and especially its extremely large basal leaves, depressed in the center. Most existing herbarium specimens do not adequately represent the species because even one leaf is larger than the average herbarium sheet.

Robinson and Greenman in describing *Cacalia megaphylla* and *C. obtusiloba* stated that the latter differed from the former in having smaller heads and more rounded basal leaf lobes. Comparison of the types of these two species, however, indicates that they are conspecific because of several common characters: Number of phyllaries and flowers, pubescence of phyllaries, leaves and stem, general habit, and leaf shape (the latter somewhat variable).

AGUASCALIENTES: *McVaugh & Koelz* 39 (MICH); *Pippen* 8* (MICH). GUERRERO: *McVaugh* 21897, 21910 (MICH); *Moore* 5119 (MICH). JALISCO: *McVaugh* 13321 (MICH); *Pippen* 16, 24, 39 (MICH). MÉXICO: *Hinton* 2200 (US), 2355 (NY); *Matuda* 26572 (NY). MICHOACÁN: *Arsène* 2386 (US); *Hinton et al.* 13480, 15629 (MICH, NY); *Pippen* 47 (MICH); *McVaugh* 21928 (MICH). MORELOS: *Pringle* 6165 (GH, NY, US). NAYARIT: *Mexia* 877 (GH, MICH, US). PUEBLA: *Arsène & Nicholás* 334 (US); *Arsène*, s.n., November 1908 (US). ZACATECAS: *McVaugh* 17650 (MICH).

6. Psacalium nanum Pippen, sp. nov. PLATES 7, 8

Plantae nanae usque ad 12 cm. altae, tuberibus pluribus, carnosis, fusiformibus, subterraneis, caulibus hirsutis scaposis, foliis radicalibus peltatis, suborbicularibus, usque ad 5 cm. diametro, profunde 7-

lobatis, supra hirsutis, subtus glabris, petiolis tenuibus 5–10 cm. longis hirsutis; inflorescentia corymbosa, 2–3 cm. longa latasque, bracteis foliosis, trullatus, usque ad 2 cm. longis; capitula usque ad 25, ca. 7 mm. longa; phyllaria 8, elliptica 3.5–4.5 mm. longa, glabra; flores 10–11, corollis 3.5–4 mm. longis, tubo 1.5–2 mm. longo, lobis 2–3 mm. longis; achaenia matura non visi; pappus nullus.

Plants scapose, up to 12 cm. tall with several fleshy, elongate, fusiform tubers attached to the caudex beneath the soil; stems, petioles, and adaxial surface of the leaves hirsute with tawny multicellular hairs to 1.5 mm. long, the abaxial surface of the leaves glabrous; stems slender, 2 mm. thick at the base; basal leaves 7–15, long-petioled, centrally or subcentrally peltate, subcircular in outline, to 5 cm. across, the venation radiate with 7 principal veins; blades deeply lobed one-half to two-thirds the distance to the center of the blade, the primary lobes 7, each divided into 3 major lobes and 2 or 3 lesser lobules, the secondary lobes often again lobed, the ultimate segments triangular, mucronate; petioles slender, 5–10 cm. long; inflorescence corymbose, 2–3 cm. long and broad, tightly compact, the primary branches subtended by petiolate, leafy bracts up to 2 cm. long, the blade portion obtrullate; pedicels mostly glabrous; calyculate bracts usually 3, subulate, up to 1.5 mm. long; heads 25 or fewer, about 7 mm. long; phyllaries 7, elliptic, 3.5–4.5 mm. long, 0.7–1 mm. wide, glabrous; flowers 10 or 11; corolla, 0.7–1 mm. wide, elliptic, strongly 3-nerved, the throat none; anthers 2 mm. long; style branches 0.7 mm. long, hispid on the abaxial surface, the tips truncate or rounded with a terminal or subterminal fringe of trichomes; mature achenes not seen, the immature achenes brown, glabrous, 10-ribbed; pappus entirely lacking.

HOLOTYPE: Guerrero; Teitepec (Mina Distr.). Open stunted pine forest, on mossy rocks, 3,600 m. (acc. to the label), July 17, 1939, *G. B. Hinton et al.* 14464 (US!, isotypes MICH!, NY!).

DISTRIBUTION: Known only from the type collection. Flowering in July.

This species has affinities with both *P. peltigerum* (through the underground tubers) and *P. calvum* (through the lack of a pappus). The small size makes this species unique in this genus.

7. Psacalium nelsonii Rydb. Bull. Torrey Bot. Club 51:374. 1924. Holotype: Oaxaca; vicinity of Cerro de San Felipe, 9,500–11,000 ft., in 1894, *E. W. Nelson* 1111 (US!).

Roots, base of plant and stem below the inflorescence not seen; leaves, presumably basal, petioled, peltate, subcircular in outline, 30–35 cm. in diameter, the venation radiate with 7 or 8 principal veins; blades lobed about one-half the distance to the center of the blade, slightly longer than wide, each divided into 2 or 3 secondary lobes

which are obtusely deltoid, mucronate-tipped, the adaxial surface pubescent with multicellular hairs up to 1.5 mm. long, the abaxial surface gray-tomentose; cauline leaf (only one seen) similar to the basal leaves but subpeltate, the petiole attached 2–3 mm. above the base of the blade, the blade 8-lobed; inflorescence paniculate, at least 35 cm. long, 15 cm. broad, the branches purple-tomentose, the tomentum denser toward the heads, the branches subtended by leafy bracts, 4–10 cm. long, obovate, palmately 3- to 7-lobed or subentire; calyculate bracts about 5, linear-subulate, 4–5 mm. long; heads many, about 12 mm. long; phyllaries 8 or 9, elliptic, narrowly ovate or oblong, 10 mm. long, 2–3 mm. wide, glabrous, purplish tinted; flowers mostly immature, 10–12; corolla about 7 mm. long, purplish tinted when dry, the tube 3.5–4 mm. long, the throat 0.5–1 mm. long, 1–1.5 mm. broad, the lobes 3 mm. long; anthers 2–3 mm. long; style branches 1.5 mm. long; mature achenes not seen, the immature achenes glabrous; pappus white, about 5 mm. long.

DISTRIBUTION: Known only from the type specimen. Flowering time unknown.

The type collection consists only of a basal leaf and a portion of the inflorescence. It is apparently related to *P. peltatum* because of the leafy inflorescence bracts, the number of phyllaries and flowers, and the glabrous achenes. It differs from *P. peltatum* because of the glabrous phyllaries, short subinvolucral bracts, tomentose condition of the leaves, and the outline of the basal leaves. This specimen appears to be significantly different from any of the known species of *Psacalium* and therefore I have followed Rydberg in recognizing it as a distinct species, despite the incomplete condition of the type specimen.

8. Psacalium peltatum (H.B.K.) Cass. Dict. Sci. Nat. 43:461. 1826.

Cacalia peltata H.B.K. Nov. Gen. et Sp. 4:170. t. 361. 1820. (Folio ed. 4:133. 1820.)

Senecio peltiferus Hemsl. Biol. Centr. Amer. Bot. 2:245. 1881. Based on *Cacalia peltata* H.B.K., not *S. peltatus* DC.

Plants up to 2.5 m. tall; stems and leaves sparsely to densely pilose or hirsute with multicellular, conical-attenuate nonglandular hairs, 0.5–2 mm. long, the crosswalls often purple, the stems also occasionally densely covered with minute, multicellular stipitate glands, 0.3–0.5 mm. long, (lacking in var. *peltatum*); stems stout, terete; basal leaves 3 or 4, long-petioled, peltate, subcircular in outline, 10–30 (–65) cm. in diameter, the venation radiate with 6–8 principal veins; blades deeply lobed about two-thirds the distance to the center, the primary lobes 7–9, each sinuately 5- to 7-lobed, the distal secondary lobes often larger than the others, again lobed or 3-angulate; lowermost cauline leaves similar to the basal ones and about as large; upper cauline

leaves progressively smaller upward, subpeltate, the uppermost non-peltate with leafy-margined petioles, the blade palmately 3- to 5-lobed; inflorescence racemose, paniculate or corymbose, the branches densely stipitate-glandular, subtended by sessile, leafy bracts, ovate or narrowly ovate, less often linear; heads 10–100, 1.5–2.5 cm. long, phyllaries 8–10 or 12–14, pubescent; the involucre subtended by 3 or 4 narrowly ovate or linear bracts longer than the phyllaries; flowers 12–20 (–40); corolla about 9–14 mm. long, the tube 6–10 mm. long, the throat ampliate, 0.5 mm. long, 1–1.5 mm. broad, the lobes narrowly triangular, 3–4 mm. long; anthers 3–3.5 (–4) mm. long; style branches 1.5–2 mm. long, recurved, hispid on the abaxial surface, the tips truncate or obtuse with a sparse subterminal fringe of trichomes; mature achenes oblong or ellipsoid, 5.5–7 mm. long, 1–1.5 mm. wide, 0.7–1 mm. thick, glabrous, creamy, multistriate; pappus 6–8 (–9) mm. long, white.

This is a variable and complex species usually distinguished by the sessile, elliptic or lobed inflorescence bracts, the 3 or 4 long, calyculate bracts subtending the phyllaries, the creamy, glabrous achenes, and the usually deeply lobed basal leaves.

Within this complex are three smaller groups, recognized as varieties, which seem to maintain themselves both morphologically and geographically.

Of several other specimens that are apparently a part of this complex, two are quite similar to var. *conzattii* and are discussed with that taxon. Another specimen is unique (Guerrero, between Petlacala and Buenavista, *G. B. Hinton* 14877, MICH, NY) and is from a poorly explored region where no specimens of *P. peltatum* have been collected. This specimen has much less deeply lobed leaves with much broader lobes than *P. peltatum* but with an inflorescence like var. *peltatum*, except it is glandular-pubescent. More material from this region as well as field observations will be necessary to determine the best taxonomic position of this plant.

Key to Varieties of *Psacalium peltatum*

1. Stem and inflorescence glandular pubescent, the glands stipitate, 0.5 mm. long; plants also pubescent with long, stiff, nonglandular hairs.
   2. Heads few, ca. 10, 2–2.5 cm. long; calyculate bracts 15–17 (–25) mm. long; pappus bristles 7–9 mm. long; flowering in September and October.
      8c. P. peltatum var. conzattii
   2. Heads many, at least 50, ca. 1.5 cm. long; calyculate bracts 20–35 mm. long, pappus bristles 6–7 mm. long, flowering in July and August.
      8b. P. peltatum var. adenophorum
1. Stem and inflorescence lacking stipitate glands but sparsely to densely hirsute or pilose with nonglandular hairs . . . **8a. P. peltatum var. peltatum**

8a. Psacalium peltatum var. peltatum

Cacalia peltata H.B.K. as to holotype: Michoácan; in woods around Pázcuaro [Pátzcuaro], 1130 hex., *Humboldt & Bonpland* 4346 (P, not seen; Field Mus. Neg. 378731).

Cacalia peltata var. *coulteri* Greenm. Proc. Amer. Acad. 40:51. 1904. Lectotype: Hidalgo (Veracruz on the label); Real del Monte, *Th. Coulter* 420 (GH!).

Psacalium coulteri (Greenm.) Rydb. Bull. Torrey Bot. Club 51:373. 1924.

Psacalium argutum Rydb. Bull. Torrey Bot. Club 51:373. 1924. Holotype: San Luis Potosí, in 1879, *J. G. Schaffner* 725 (NY!).

Stems and leaves sparsely or densely pilose or hirsute with non-glandular, multicellular trichomes, 0.5–2 mm. long, the stem and inflorescence not stipitate glandular; basal leaf lobes (7–) 10–12 (–20) cm. long, 3–5 cm. wide at the base, the sinuses obtuse or broadly rounded; petioles (10–) 20–40 cm. long, the petiole of the lowermost cauline leaf more dilated than those of the basal leaves, and leafy-margined; inflorescence paniculate or corymbose, about 1 m. long and broad, the leafy bracts ovate, 3–4 (–7) cm. long, 2–3 cm. broad, occasionally 3-lobed near the distal end; calyculate bracts narrowly ovate or ovate, (11–) 12–17 (–25) mm. long, one of these usually broader than the others surrounding the same head; heads many, ca. 15 mm. long; phyllaries 8–10, narrowly ovate, 10–12 (–15) mm. long, 2–3 mm. wide, pubescent but not stipitate glandular; flowers 12–17 (–20); corolla 8.5–10.5 mm. long, the tube (5.5–) 6–7 mm. long, the lobes 3–3.5 mm. long, 1 mm. wide; anthers 3.3–5 mm. long, pappus 7–8 mm. long; chromosome number, $n=30$ (Pippen).

DISTRIBUTION: From southern Chihuahua south through Durango to Jalisco, eastward across the Trans-Mexican volcanic belt in Michoacán and México to Puebla. Grassland openings and borders of the pine woodlands. Flowering September and October.

The pubescence varies from sparsely short puberulent to densely pilose or villous. Greenman distinguished the villous specimens as var. *coulteri*. Apparently this was the only character used and it does not appear to be consistent or correlated with any other characters, therefore, I have not recognized the var. *coulteri*.

Rydberg distinguished *Psacalium argutum*, a group of specimens from San Luis Potosí, as differing from *P. peltatum* by the presence of longer calyculate bracts and more sharply pointed basal leaf lobes. Although such a tendency is noted in these specimens, it is neither consistent nor restricted to this region. There are no other significant differences in these specimens and I have not supported this separation.

CHIHUAHUA: *Gentry, Correll, & Arguelles* 18016 (US). DURANGO: *Nelson* 4954 (NY, US); *Pennell* 18343 (NY); *Iberra Garcia* 414 (US). DISTRITO FEDERAL: *Matuda* 26175, 26632 (NY). HIDALGO: *Pringle* 9870 (GH). JALISCO: *McVaugh* 13821 (MICH). MÉXICO: *Hinton* 1908 (US); *Matuda* 28343, 29483, 29591 (NY); *Rose & Painter* 7939 (GH, US, paratypes of v. *coulteri* Greenm.); *Lyonnet* 3122

(US). MICHOACÁN: *Nelson* 6582 (GH, NY, US); *Pippen* 44, 49*, 53 (MICH); *Pringle* 3340 (GH, NY, US); *Seler* 1259 (GH, NY, US). MORELOS: *Lyonnet* 794 (US); *Pringle* 9871 (GH, MICH, NY, US). PUEBLA: *Beaman* 3619 (TEX); *Purpus* 3038 (NY, US). SAN LUIS POTOSÍ: *Schaffner* 294 (GH); *Parry & Palmer* 543 (GH, NY, US). TLAXCALA: *Sharp & Hernández X.* 44508 (NY). VERACRUZ: *Sealon* s.n., August 1891 (GH, paratype of v. *coulteri* Greenm.).

8b. Psacalium peltatum var. adenophorum S. F. Blake, Journ. Wash. Acad. Sci. 32:150. 1942. Holotype: Nuevo Leon: Municipio de Rayones, upper west slopes of Sierra de Cebolla, above 2,750 m., Aug. 21, 1939, *C. H. Muller* 2911 (US!).

Plants ca. 1.5 m. tall; stems and leaves sparsely or densely pilose or hirsute with multicellular, nonglandular hairs, the stem and inflorescense also densely covered with minute stipitate glands; stem 5–9 mm. thick at the base; leaves similar to those of the typical variety; inflorescence paniculate or corymbose, ca. 30 cm. long, 11–17 cm. broad, the bracts up to 6 cm. long, 1.5 cm. broad; calyculate bracts 2.0–3.5 cm. long, 3–10 mm. wide; heads ca. 40, about 2 cm. long; phyllaries (8–) 12 or 13, narrowly ovate, (10–) 15–16 mm. long, 2–3 mm. wide; flowers ca. 20; corolla 13–14 mm. long, the tube (7–) 9–10 mm. long, the lobes ca. 4 mm. long; anthers 3–3.5 mm. long; mature achenes not seen; pappus 6–7 mm. long.

DISTRIBUTION: Known only from the southern region of Nuevo Leon and Tamaulipas. Flowering in July and August.

This taxon is known from only one collection in addition to the type (Tamaulipas: *Stanford, Taylor, & Lauber* 2535, NY, TEX, US). The longer subinvolucral bracts and presence of stipitate glands separate it most easily from the typical variety. Time of flowering and geographical range separate it from var. *conzattii*.

8c. Psacalium peltatum var. conzattii (Rob. & Greenm.) Pippen, comb. nov.

Cacalia peltata var. *conzattii* Rob. & Greenm. Proc. Amer. Acad. 32:49. 1896. Lectotype: Oaxaca; Sierra de San Felipe, 10,000 ft., Dec. 13, 1895, *C. G. Pringle* 6238 (GH!).

Psacalium conzattii Rydb. Bull. Torrey Bot. Club 51:372. 1924.

?*Psacalium mollifolium* S. F. Blake, Journ. Wash. Acad. Sci. 28:491. 1938. Holotype: Guerrero; Taxco, Aug. 12, 1937, *Ruth Q. Abbott* 353 (GH!).

Plants usually 1 m. tall or less; stems and leaves sparsely or densely pilose or hirsute with nonglandular trichomes, these especially dense on the abaxial surface of the leaves, the stem and inflorescence also densely stipitate-glandular; stem 4–10 mm. thick at the base; basal leaves subcircular, 14–25 cm. in diameter; blades deeply lobed usually more than three-fourths the distance to the center, the primary lobes 4–10 cm. long, 2–4 cm. wide at the base; inflorescence subpaniculate 10–20 (–30) cm. long, 11–16 cm. broad, the branches subtended by bracts about 3 cm. long, 0.7–1.5 cm. wide; calyculate bracts narrowly elliptic, 15–17 (–25) mm. long, 1–2.5 mm. wide; heads usually 10

(–30), 2–2.5 cm. long; phyllaries 12–15, narrowly ovate, 12–15 (–18) mm. long, 2–3 (–4) mm. wide, pilose with nonglandular hairs, stipitate-glandular; flowers (20–) 25–40; corolla 10–12 mm. long, the tube (6–) 7–8 (–9) mm. long, the lobes 3.5–4 mm. long, 1 mm. wide; anthers 3–3.5 (–4) mm. long; mature achenes 6–7 mm. long, 1–1.5 mm. wide, ca. 10-ribbed; pappus 7–8 (–9) mm. long.

DISTRIBUTION: Known mostly from central Oaxaca and questionably from Guerrero and Durango. Openings in pine woodlands. Flowering in September and October.

Two specimens were cited in the original description as syntypes: Oaxaca; Cerro de San Felipe, 9,000 ft., Nov. 29, 1895, *C. Conzatti* 27 (GH!), Dec. 13, 1895, *C. G. Pringle* 6238 (GH!). Despite the fact the taxon was named for Conzatti, possibly indicating his specimen as the lectotype, *Pringle* 6238 is a more complete and more representative specimen and is thus a better choice for the lectotype.

Two specimens have been studied that are obviously closely related to this taxon but differ in certain respects. One specimen (15 mi. W. of El Salto, *U. T. Waterfall* 12688, MICH) has heads and stipitate glands like var. *conzattii* but the leaves are smaller with obovate lobes; most significant is its occurrence in Durango which is quite far from Oaxaca. Such a separation in range is difficult to explain if this specimen is a part of this taxon.

The other specimen (Guerrero: Taxco, *Ruth Q. Abbott* 353, GH) was the basis of *Psacalium mollifolium* S. F. Blake. It differs from var. *conzattii* in that the basal leaves are lobed less than half the distance to the center and the abaxial surface is densely tomentose. The inflorescence is similar to var. *conzattii*, including the long calyculate bracts. These differences do not appear significant enough to give this specimen nomenclatural status; at least not until field observations and study of future material can be made.

OAXACA: *Pringle* 6238 (US, isotype); *Camp* 2401 (NY); *McVaugh* 21826 (MICH).

9. Psacalium peltigerum (Rob. & Seat.) Rydb. Bull. Torrey Bot. Club 51:374. 1924.

Cacalia peltigera Rob. & Seat. Proc. Amer. Acad. 28:111. May 13, 1893.

Plants up to 1.5 m. tall with several fleshy underground tubers up to 5 cm. long, 3 cm. thick attached to the caudex; stems 5–12 mm. thick at the base, mostly glabrous or sparsely hirsute; leaves sparsely or densely pubescent with stiff, white hairs up to 1 mm. long; basal leaves 2 or 3, long-petioled, peltate, subcircular in outline, (10–) 20–30 cm. in diameter, the venation radiate with 7–9 (–12) principal veins; blades angulate or lobed one-third to four-fifths the distance to the center, the primary lobes 9–11, each divided into 2 or 3 major lobes and several lesser lobules, the secondary lobes usually lobed or coarsely

toothed, or if the blade angulate the margins mucronate-tipped; petioles 29–30 cm. long, pubescent proximally, becoming glabrous toward the blade; cauline leaves 3 or 4, the lowermost similar to the basal ones but smaller; upper cauline leaves progressively smaller upward, either nonpeltate with the blades 3- to 7-palmately lobed or remaining peltate and angulate, not lobed; inflorescence mostly corymbose, 9–30 cm. long and broad, the branches subtended by linear-subulate bracts, 1.5–2 cm. long, 1–2 mm. wide; pedicels 1–2 cm. long; calyculate bracts 3–5, subulate, 2 (–5) mm. long; heads many, 12–15 mm. long; phyllaries 5, narrowly oblong, narrowly elliptic, or occasionally spathulate, (6–) 7–8 (–10) mm. long, 1–2 mm. wide, glabrous; receptacle 1–1.5 mm. across; flowers 5 or 6; corolla 9–10 mm. long, the tube (3.5–) 4–5 mm. long, the lobes as long as the tube or slightly longer, narrowly elliptic, the throat none; anthers 3–3.5 mm. long, style branches 1–1.5 mm. long, distally hispid on the abaxial surface, the tips truncate or rounded with a subterminal or terminal fringe of trichomes; mature achenes ellipsoid, 4–5.5 mm. long, 1.5–2 mm. thick, glabrous, tan, prominently 10-ribbed; pappus (4–) 5–5.5 (–6) mm. long, creamy or tawny.

This species is easily distinguished by the presence of fleshy subterranean tubers. Microscopic examination of freehand sections reveals that these tubers are modified stems with discrete vascular bundles. Druse-shaped crystals were found in the parenchyma cells. In greenhouse-grown plants these tubers formed during the first season of growth and persisted through the dormant period. There is no evidence that they function in vegetative propagation as do the tubercles in the genus *Pericalia*.

Three varieties are recognized and may be separated primarily by the outline of the basal leaves and geographical distribution. These three varieties exhibit an interesting range in leaf shapes from almost entire (var. *hintonii*), to broadly lobed (var. *laxilobum*), to deeply linear-lobed, the lobes five times longer than broad (var. *peltigerum*).

Key to Varieties of *Psacalium peltigerum*

1. Basal leaves angulate, not lobed, the margin with mucronate tips; stem hirsute . . . . . **9b. P. peltigerum var. hintonii**

1. Basal leaves lobed at least half the distance to the center, the margins toothed, the teeth triangular, not mucronate; stems mostly glabrous or very sparsely hirsute.

2. Lobes of the basal leaves extending two-thirds to four-fifths the distance to the center of the blade, 1–2 cm. wide at the base, much longer than broad, the ultimate segments of the lobes narrowly triangular or linear-attenuate, about 5 times longer than wide; stem glabrous.

9a. P. peltigerum var. peltigerum

2. Lobes of the basal leaves extending less than one-half the distance to the center of the blade, 5–7 cm. wide at the base, about as long as wide, the ultimate segments of the lobes obtusely deltoid or triangular, about as long as broad; stem hirsute at least on the proximal half.
9c. P. peltigerum var. latilobum

9a. Psacalium peltigerum var. peltigerum

Cacalia peltigera Rob. & Seat. as to Holotype: Jalisco; bluff of the barranca near Guadalajara, Sept. 14, 1891, *C. G. Pringle* 5154 (GH!).

Blades of the leaves deeply lobed two-thirds to four-fifths the distance to the center, the primary lobes 9–11, 1–2 cm. wide at the base, much longer than wide, each subdivided into 2 or 3 major lobes and several lesser lobules, the secondary lobes usually lobed or coarsely toothed, the ultimate segments narrowly triangular or linear-attenuate, ca. 5 times longer than wide.

DISTRIBUTION: Central and western Jalisco. In the dry grasslands around Guadalajara and the pine woodlands to the west. Flowering in July and August.

In the original description two specimens were listed as syntypes: Jalisco; Río Blanco, July 1886, *E. Palmer* 171 (GH!); bluff of the barranca near Guadalajara, Sept. 14, 1891, *C. G. Pringle* 5154 (GH!). *Pringle* 5154 is chosen as the lectotype because it is more complete. The name was published in a paper concerning plants discovered by Pringle, and this specimen is annotated in what appears to be Robinson's writing.

The leaves of this variety exhibit considerable latitude in shape and lobing, but are always deeply lobed with the ultimate segments very narrow. The inflorescence is more elongate and broader than in the other varieties.

JALISCO: *Pringle* 4627, 9872 (GH, NY, US); *King* 3656 (MICH, NY, TEX, US); *McVaugh* 18603, 15094, 20280 (MICH); *Wilbur & Wilbur* 1996 (US).

9b. Pscalium peltigerum var. hintonii Pippen, var. nov. PLATE 9

Varietas peltigera foliis profunde lobatis, caule glabro, inflorescentia majore differt.

Plants to ca. 0.5 m. tall; stems hirsute with multicellular white hairs to 2 mm. long; blades of the basal leaves shallowly 9- to 11-angled but not lobed, the margin mucronate-toothed; upper cauline leaves similar to but smaller than the lower ones; inflorescence tightly corymbose, 10 cm. long and broad (those examined not mature).

HOLOTYPE: México; Carboneras, Toma, July 21, 1935, *G. B. Hinton et al.* 7966 (MICH!, isotype NY!).

DISTRIBUTION: Known only from the type collection.

The floral characters are similar to var. *peltigerum* and the plants have similar fleshy subterranean tubers. They differ in that the leaves are angulate, not deeply lobed, and the stem is hirsute. Field obser-

vations and study of future material may indicate that var. *hintonii* deserves specific rank, but for the present it is considered only as a variety.

9c. Psacalium peltigerum var. latilobum Pippen var. nov. PLATE 10

Varietas peltigera foliorum lobis longioribus quam latioribus, caule glabro differt.

Plants to ca. 0.5 m. tall; stems sparsely pubescent; blades of the basal leaves lobed less than one-half the distance to the center, the primary lobes 10 or 11, 5–7 cm. wide at the base and equally long, the lobes subdivided into 2 or 3 secondary lobes, obtusely triangular or deltoid, about as broad as long; margins of the lobes coarsely, triangular-toothed; inflorescence corymbose, tightly compact, ca. 9 cm. long and broad (inflorescence not fully matured).

HOLOTYPE: Guerrero; 1½ miles W. of Omiltemi, 7,800 ft., June 11, 1953, *T. W. McCorcle & C. M. Rowell, Jr.* 3453 (MICH, sheet 1!; isotype, sheet 2!).

DISTRIBUTION: Known only from the type collection.

10. Psacalium poculiferum (S. Wats.) Rydb. Bull. Torrey Bot. Club 51:375. 1924.

Slender herbs ca. 1 m. tall; roots exuding a reddish-orange sap when cut; stems 4–7 mm. thick at the base, densely puberulent proximally becoming subglabrous upward and again puberulent in the inflorescence; leaves glabrous or sparsely puberulent mostly along the veins with 6- to 10-celled hairs ca. 0.5 mm. long; basal leaves 2 or 3, long-petioled, centrally or subcentrally peltate, subcircular in outline, 15–25 (–60) cm. in diameter; blades lobed one-third to two-thirds the distance to the depressed center, the primary lobes 7 or 8 (–10), 4–8 cm. wide at the base, usually 2–3 cm. longer than broad, each divided into 2 or 3 secondary lobes or merely triangulate, the margins irregularly toothed; petioles 15–30 (–40) cm. long, terete, slender, usually sparsely pubescent; cauline leaves 3 or 4, the lowermost similar in size and shape to the basal ones except the petiole leafy-margined and dilated at the base; cauline leaves progressively smaller upward; the uppermost bracteiform, nonpeltate, the petiolar portion leafy-margined, auriculate-based, the blade portion 5- to 7-lobed; inflorescence paniculate or corymbose, 12–30 cm. long and broad, the lower branches in the axils of the upper leaves; pedicels tomentose; calyculate bracts 3, subulate, about 1 mm. long (or lacking); heads about 100, 9–10 mm. long; phyllaries 3–5 (usually 4), varying on the same plant, elliptic or obovate, (4–) 5–6 (–7) mm. long, 1–3 mm. wide, glabrous, the tips purplish; flowers 3–5, opposite the phyllaries; corolla 6–8 mm. long, the tube as long as the lobes, 3–4 mm., the lobes linear, 0.5 mm. wide, the throat none; anthers 2–3 mm. long;

style branches ca. 1 mm. long, the tips truncate or rounded with a terminal or subterminal fringe of trichomes; mature achenes oblong or narrowly ellipsoid, 5 mm. long, 1–1.5 mm. wide, pubescent with fuscous, unicellular hairs; pappus (3.5–) 5–6 (–8) mm. long, creamy.

DISTRIBUTION: Western Jalisco to Nayarit, north to Sinaloa. Rocky, grass-oak dominated slopes and pastured areas. Flowering in mid-July and August.

This species is unusual because of the very small heads with mostly 4 phyllaries and flowers. It is closely related to *P. tabulare* but differs in its sparser pubescence and smaller heads. Both, however, have similar leafy, auriculate-based, cauline leaves.

JALISCO: *Pippen* 19, 21, 27, 60 (MICH); *Pringle* 9874, 4414 (GH, NY, US); *Wilbur & Wilbur* 2017, 2166 (MICH, US). NAYARIT: *Rose* 1935 (GH, US); *King* 3677 (MICH, NY, TEX, US); *Pippen* 11 (MICH); *McVaugh* 16406, 18838 (MICH). SINALOA: *Ortega* 7146 (US, the leaf of this specimen is somewhat atypical but this inflorescence is very similar to *P. poculiferum*).

11. Psacalium tabulare (Hemsl.) Rydb. Bull. Torrey Bot. Club 51:375. 1924.

Senecio tabularis Hemsl. Biol. Centr. Amer. Bot. 2:248. 1881. Holotype: Veracruz; valley of Orizaba, Escamella, Aug. 16, 1866, *Bourgeau* 2926 (K, not seen; isotypes GH! and C, Field Mus. Neg. 22631!).

Cacalia tabularis (Hemsl.) A. Gray, Proc. Amer. Acad. 19:52. 1883.

Plants up to 2 m. tall (*Balls* 5350); stems at least 7 mm. thick at the base, purplish, densely pubescent; leaves sparsely pubescent on the adaxial surface, densely pubescent on the abaxial surface, the hairs multicellular, 1–1.5 mm. long, 15- to 20-celled; basal leaves 2–4, long-petioled, peltate, subcircular in outline, 16–27 (–60, *Balls* 5350) cm. in diameter, the venation radiate with 8 principal veins; blades lobed about half way to the center, the primary lobes 7 or 8, 5–8 cm. long and broad, each usually divided into 3 triangular secondary lobes, 1–2.5 cm. long, 2–3 cm. broad, the margins coarsely deltoid-toothed; petioles up to 35 cm. long, terete, pubescent; cauline leaves 2–4; the lowermost subcentrally peltate, the blades broadly ovate or subcircular, 14–16 cm. long, 15–17 cm. wide, palmately 6- to 7-lobed, the petioles attached to the blade about 3 cm. above the base, leafy-margined, auriculate-based; uppermost cauline leaves sessile, auriculate-based, 3-lobed distally; inflorescence paniculate, 30–40 cm. long, 8–30 cm. broad, the branches often sparsely stipitate glandular, subtended by narrowly triangular bracts 1–5 cm. long, 0.3–1 cm. wide; pedicels 5–10 mm. long, with 2–5 subulate bracts, 2–6 mm. long; heads 75 to over 100, about 12 mm. long; phyllaries 5, narrowly ovate, 9–10 mm. long, 2–3 mm. broad, mostly glabrous or occasionally sparsely pubescent; receptacle 1.5 mm. across; flowers 5, opposite the phyllaries; corolla 7–9 mm. long, the tube (3.5–) 4–5 mm. long, the throat campanulate 0.5–1 mm. long and wide, the lobes 3 mm. long, linear; anthers 3 mm. long; style branches 1–1.5 mm. long, hispid on the abaxial

surface, the tips truncate or obtuse with a terminal or subterminal fringe of trichomes; mature achenes narrowly ellipsoid, 5–5.5 mm. long, 1.5 mm. wide, 1 mm. or less thick, glabrous, pale, about 18-ribbed; pappus (5.5–) 6–7 mm. long, white.

DISTRIBUTION: Known mostly from western Veracruz and eastern Puebla and one specimen collected in Michoacán. Openings in oak-pine woodlands. Flowering from August to October.

This species is very closely related to *P. poculiferum*, but differs in that the heads always have 5 phyllaries and flowers, and glabrous achenes.

Some of the specimens examined are sparsely stipitate-glandular on the inflorescence branches but this is not constant in this species.

PUEBLA: *Purpus* 5630 (GH, NY, US). MICHOACÁN: *Pippen* 55 (MICH). VERACRUZ: *Balls* 5350 (US); *Muller* s.n., August 1843 (NY); *Sharp* 44823 (NY).

12. Psacalium species

Plants to about 1 m. tall; stems slender, to 5 mm. thick at the base, subscapose, densely hirsute below with white, nonglandular multicellular hairs up to 1 mm. long, distally sparsely hirsute with nonglandular hairs as well as minutely stipitate glandular; leaves glabrous on the adaxial surface, sparsely pubescent along the veins on the abaxial surface; basal leaves 2 or 3, long-petioled, peltate, subcircular in outline, 20–30 cm. across, venation radiate with about 8 principal veins; blades lobed one-third to one-fourth (rarely one-half) the distance to the center of the blade, the primary lobes 6 or 7, 5–8 cm. wide at the base about as long as wide, each usually divided into 3, triangular attenuate-tipped secondary lobes; petioles slender, to 30 cm. long, pubescent; cauline leaves 1 (or 2), similar to the basal leaves but much smaller; inflorescence paniculate, ca. 35 cm. long, 25 cm. broad, the branches densely stipitate-glandular, subtended by petiolate, leafy bracts, the blade to 6 cm. long, elliptic, entire or palmately 3- to 5-lobed; pedicels purple, to 3 cm. long; calyculate bracts 3–7, subulate, 4–5 mm. long; heads few, immature; phyllaries (7 or) 8, oblong or elliptic, ca. 10 mm. long, 2–3 mm. wide, hirsute, occasionally sparsely glandular; flowers ca. 9, achenes glabrous; pappus white, chromosome number, $n=30$ (Turner, ined.).

DISTRIBUTION: Known only from Guerrero. Flowering probably in November.

These specimens appear to be somewhat intermediate between *Psacalium eriocarpum* and *P. holwayanum*. They differ from both of these species by the glabrous achenes, the leafy inflorescence bracts, the mostly glabrous basal leaves, as well as the distinct geographical range.

These specimens probably represent either a distinct species or a variety of one of the above. The material examined was immature

and could not be studied thoroughly. Perhaps after future collections have been studied and field observations made it will be possible to assign a name.

GUERRERO: *McVaugh* 21913* (MICH); *Sharp* 441496 (NY).

Doubtful Names and Excluded Taxa

Cacalia albicans Sessé & Moc. Fl. Mex. ed. 2. 180. 1894. Known only from the type description. This cannot be associated with any species of the genera discussed in this paper. According to the description the leaves are lanceolate and sinuately pinnatifid and therefore this probably should be referred to *Senecio*.

Cacalia amplexicaulis Schultz Bip. ex Klatt, Leopoldina 24:125, in synonymy, 1888. Listed as a synonym of *Senecio bracteatus* Klatt.

Cacalia berlandieri DC. Prod. 6:328. 1838. =**Senecio desortum** Hemsl. (Biol. Centr. Amer. Bot. 2:239. 1881).

Cacalia calotricha S. F. Blake, Contr. Gray Herb. II. 52:58. 1917. This should be referred to *Senecio*. The structure of the corolla is similar to that of *S. angulifolius* in that the throat is longer than the recurved lobes. The plant is apparently a shrub. It is known only from the type.

Cacalia eriopoda Schultz Bip. ex Klatt, Leopoldina 24:125, in synonymy, 1888. Listed as synonym of *Senecio eriopodus* Klatt.

Cacalia guatemalensis Standl. & Steyermark, Publ. Field Mus. Bot. 23:99. 1944. This should probably be referred to *Senecio* sect. *Mulgedifolii* since the description states that the flowers are purple and the inflorescence is glandular pubescent. This species is not a *Psacalium*, as suggested by Cuatrecasas (Brittonia 8:157. 1955) since, according to the description, the leaves are not peltate.

Cacalia incana Sessé & Moc. Pl. N. Hisp. ed. 1. 132. 1889. A later homonym of *C. incana* L., 1753.

Cacalia liebmannii Schultz Bip. ex Klatt, Leopoldina 24:125, in synonymy, 1888. Listed as a synonym of *Senecio liebmannii* Buchinger.

Cacalia lyrata Sessé & Moc. Pl. N. Hisp. ed. 1. 131. 1889. Known only from the type description. This is probably referable to *Senecio* sect. *Mulgedifolii* because, according to the description, the flowers are purple and the leaves are lyrate-pinnatifid.

Cacalia macrophylla Sessé & Moc. Pl. N. Hisp. ed. 1. 132. 1889. Later homonym of *Cacalia macrophylla* Bieb. 1808.

Cacalia pallescens Schultz Bip. ex Klatt, Leopoldina 24:126, in synonymy, 1888. Listed as a synonym of *Senecio pallescens* Klatt. Rydberg transferred this species to *Odontotrichum* based on a tracing in Klatt's herbarium.

Cacalia parasitica Schultz Bip. Bot. Zeit. 15:759. 1857. According to Greenman (Contr. U.S. Nat. Herb. 23:1635. 1924) this is *Senecio parasiticus* Greenm. It is a shrub. No specimens have been seen by me.

Cacalia peltata Sessé & Moc. Pl. N. Hisp. ed. 1. 132. 1889. A later homonym of *Cacalia peltata* H.B.K. [*Psacalium peltatum* (H.B.K.) Cass.]

Cacalia pinnatifida Sessé & Moc. Pl. N. Hisp. ed. 1. 132. 1889. A later homonym of *C. pinnatifida* L., 1767. The description and photograph of the type (an illustration) indicate that this is probably *Odontotrichum amplifolium* (DC.) Rydb.

Cacalia prenanthoides H.B.K. Nov. Gen. et Sp. 4:167. 1820. =**Erechtites valerianaefolia f. prenanthoides,** Belcher (Ann. Mo. Bot. Gard. 43:30. 1956).

Cacalia purpurascens Schultz Bip. ex Klatt, Leopoldina 24:126, in synonymy, 1888. Listed as a synonym of *Senecio purpurascens* Klatt.

Cacalia pudica Standl. & Steyermark, Publ. Field Mus. Bot. 23:255. 1947. This is not in any of the genera herein considered, because the flowers are purple and the throat of the corolla is much longer than the lobes. It is more closely related to *Senecio* Sect. *Mulgedifolii.*

Cacalia runcinata H.B.K. Nov. Gen. et Sp. 4:168. 1820. =**Senecio roseus** Schultz Bip. (Flora 28:498. 1845).

Cacalia runcinata Less. Linnaea 5:162. 1830. =**Senecio coulteri** Greenm. (Ann. Mo. Bot. Gard. 1:272. 1914).

Cacalia sarracenica Sessé & Moc. Fl. Mex. ed. 2. 180. 1894. A later homonym of *Cacalia sarracenica* L., 1753.

Cacalia sinuata Sessé & Moc. Pl. N. Hisp. ed. 1. 1889. A later homonym of *Cacalia sinuata* Cerv. 1824 [*Odontotrichum sinuatum* (Cerv.) Rydb.].

Cacalia spathulata Sessé & Moc. ex D. Don, Trans. Linn. Soc. 16:250. 1833. =**Chaptalia nutans** (according to Blake).

Cacalia subdecurrens Schulz Bip. ex Klatt, Leopoldina 24:125, in synonymy, 1888. Listed as a synonym of *Senecio deformis* Klatt.

Cacalia suffulta Greenm. Proc. Amer. Acad. 32:310. 1897. This probably should be referred to *Senecio.* It is not a member of the genera herein discussed, because the flowers are bright orange, the throat of the corolla is longer than the lobes, and the achenes have hygroscopic trichomes.

Cacalia tepicana M. E. Jones, Contr. West. Bot. 15:156. 1929. =**Senecio hartwegii** Benth. according to Blake (Contr. U.S. Nat. Herb. 29:136. 1945).

Cacalia toluccana DC. Prod. 6:328. 1838. =**Senecio callosus** Schultz Bip. according to Greenman (Ann. Mo. Bot. Gard. 1:271. 1914).

Cacalia tuberosa Sessé & Moc. Pl. N. Hisp. ed. 1. 132. 1889. A later homonym of *Cacalia tuberosa* Nutt. 1818.

Cacalia viscosa Sessé & Moc. Pl. N. Hisp. ed. 1. 132. 1889. Known only from the type description which states that it is a shrub; therefore, it is most probably not a species in the genera discussed in this paper.

Odontotrichum delphinifolium Rydb. Bull. Torrey Bot. Club 51:419. 1924. Rydberg saw only the type specimen which was in fruit. This species has since been collected in flower. It is not an *Odontotrichum,* because the inflorescence has only one large head, yellow radiate flowers, and no pappus. This taxon should probably be referred to the *Heleneae.*

Odontotrichum liebmannii (Buchinger) Rydb. Bull. Torrey Bot. Club. 51:419. 1924. Rydberg transferred this species from *Senecio* on the strength of a tracing of a leaf in the Klatt Herbarium at the Gray Herbarium. I have seen no specimens and cannot associate the description or the tracing of Klatt's with any species of the genera of this paper (see *C. liebmannii* Schultz Bip. above).

Psacalium thyrsoideum DC. Prod. 6:335. 1838. Known only from the type description. It was questionably published by DeCandolle as a *Psacalium*. Thus far the description has not been matched with any other cacalioid species. The type specimen is probably in Prague and must be examined before the position of this taxon can be determined.

Collections Cited Excluding Types

(Abbreviations: D.=Digitacalia; O.=Odontotrichum; Pe.=Pericalia; Ps.=Psacalium.)

ARSÈNE, G.

s.n. Nov. 1908, Ps. megaphyllum
s.n. Sept. 9, 1909, D. jatrophoides
s.n. Nov. 4, 1909, Pe. sessilifolia
s.n. Sept. 14, 1911, Pe. sessilifolia
93. O. sinuatum
93a. O. sinuatum
334. O. sinuatum
1181. O. sinuatum
2386. Ps. megaphyllum
5132. O. palmeri
5729. Pe. sessilifolia
5740. O. sinuatum
7347. Pe. sessilifolia

ARSÈNE, G., & NICOLAS, BRO.

334. Ps. megaphyllum

BALLS, EDWARD K.

5299. Ps. peltatum v. peltatum
5333. O. amplifolium
5350. Ps. tabulare
5428. O. tussilaginoides
5575. Pe. sessilifolia

BARCLAY

s.n. O. pringlei

BARKLEY, FRED A.

14A624. O. decompositum

BEAMAN, JOHN

3619. Ps. peltatum v. peltatum

BLUMER, J. C.

1378. O. decompositum

BOURGEAU

715. Pe. sessilifolia
716. O. sinuatum
2926. Ps. tabulare

CAMP, W. H.

2401. Ps. peltatum v. conzattii

CONZATTI, C.

715. D. heteroidea
4015. O. purpusii

CONZATTI, C., & GONZALEZ, V.

397. O. amplifolium
1237. O. purpusii

DARROW, R.

s.n. July 4, 1937, O. decompositum

DARROW, R., PHILLIPS, & PULTZ

1235. O. decompositum

DODDS, DONALD, & SIMPSON, ROBT. F.

32. Pe. michoacana

DIGUET, L.

s.n. July 1912, O. palmeri

DUGES, A.

451. O. sinuatum
481. Pe. sessilifolia

EGGLESTON, W. W.

10765. O. decompositum

FEDDEMA, CHARLES

10. O. sinuatum
161. Pe. sessilifolia
183. O. palmeri
308. O. palmeri
381. Pe. sessilifolia
1345. Pe. sessilifolia

FERRIS, ROXANA S.

5881. O. pringlei

GALEOTTI, H.

2491 bis. O. cirsiifolium

GENTRY, HOWARD S.

536M. O. decompositum
1959. O. decompositum

2815. O. decompositum
6968. Pe. sessilifolia
6969. O. pachyphyllum
8562. O. sinuatum

GENTRY, HOWARD S., CORRELL, & ARGUELLES

18016. Ps. peltatum v. peltatum

GHIESBREGHT

805. O. cirsiifolium

GILLY, C. L., SR.

5. Ps. holwayanum

GOLDMAN, E. A.

132. O. sinuatum

GODDING, L. N.

s.n. Aug. 28, 1912, O. decompositum
784. O. decompositum

GOULD, FRANK W.

8989. O. sinuatum

GRAHAM, SHIRLEY

94. O. sinuatum
99. O. globosum
100. O. radulifolia
124. O. palmeri

HARTWEG

125. O. sinuatum

HEWITT, W. P.

68. O. decompositum

HINTON, G. B.

1266. O. goldsmithii v. goldsmithii
1908. Ps. peltatum v. peltatum
2200. Ps. megaphyllum
2355. Ps. megaphyllum
2487. Ps. holwayanum
2755. Pe. michoacana
4993. Pe. michoacana
7984. O. goldsmithii v. goldsmithii
8066. O. goldsmithii v. goldsmithii
8211. O. cirsiifolium
8349. O. amplifolium
9202. O. goldsmithii v. goldsmithii
9436. O. cirsiifolium
12146. O. brachycomum
12572. D. napeifolia
12718. Pe. michoacana
13463. O. amplifolium
13469. Pe. michoacana
13480. Ps. megaphyllum
14464. Ps. nanum
14877. Ps. peltatum v. peltatum
15078. O. goldsmithii v. goldsmithii
15288. O. brachycomum
15624. O. brachycomum
15629. Ps. megaphyllum

IBARRA GRACIA, P.

407. O. globosum
414. Ps. peltatum v. peltatum

JONES, MARCUS E.

25053. O. decompositum
27692. O. pringlei

JONY, P.

s.n. in 1892. O. platylepis

KEARNY, T. H., & HARRISON, G. J.

6045. O. decompositum
6194. O. decompositum

KEARNY, T. H., & PEEBLES

10092. O. decompositum

KENOYER, L. A.

2110. O. radulifolium
2330. O. radulifolium

KING, ROBERT M.

3615. O. silphiifolium
3656. Ps. peltigerum v. peltigerum
3659. O. palmeri
3677. Ps. poculiferum
6737. O. sinuatum

KING, ROBERT M., & SODERSTROM, T. R.

4904. O. brachycomum

KNOBLOCH, I. W.

1273. O. globosum
1293. O. decompositum

KRUCKEBERG, A. R.

4644. O. decompositum

LEAVENWORTH, WM. C.

539. O. palmeri

LESUEUR, HARDE

145. O. decompositum

LYONNET, E.

194. Pe. sessilifolia
794. Ps. peltatum v. peltatum
3122. Ps. peltatum v. peltatum

MANNING, W. E. & M. S.

53560. O. radulifolium

MATUDA, E.

19148. O. silphiifolium
19417. O. silphiifolium
19706. O. sinuatum
21808. O. sinuatum
21825. Pe. sessilifolia
26175. Ps. peltatum v. peltatum
26572. Ps. megaphyllum
26632. Ps. peltatum v. peltatum
26882. O. sinuatum
27730. O. amplifolium
28343. Ps. peltatum v. peltatum
28821. O. cirsiifolium
29313. O. amplifolium
29483. Ps. peltatum v. peltatum
29591. Ps. peltatum v. peltatum
29609. O. amplifolium
29787. Pe. sessilifolium
30015. Ps. holwayanum

MAYSILLES, JAMES

7579. Pe. sessilifolia
7587. O. radulifolium
7752. O. sinuatum
7755. Pe. sessilifolia
7784. O. pachyphyllum
7793. O. sinuatum
7880. O. sinuatum
8448. O. sinuatum
8485. O. sinuatum

McVAUGH, ROGERS

12810. O. sinuatum
12929. O. palmeri
13321. Ps. megaphyllum
13559. Pe. sessilifolia
13616. O. pringlei
13625. Pe. sessilifolia
13684. Ps. eriocarpum
13821. Ps. peltatum v. peltatum
14093. Pe. michoacana
14136. Pe. michoacana
14165. Ps. eriocarpum
14287. Ps. eriocarpum
14290. Pe. michoacana
14390. Pe. michoacana
15094. Ps. peltigerum v. peltigerum
15313. O. cervinum
15460. O. goldsmithii v. goldsmithii
16132. O. goldsmithii v. goldsmithii
16406. Ps. poculiferum
17118. Pe. sessilifolium
17160. D. jatrophoides
17183. Pe. sessilifolia
17650. Ps. megaphyllum
17726. O. amplum
18121. Pe. sessilifolia
18603. Ps. peltigerum v. peltigerum
18838. Ps. poculiferum
20280. Ps. peltigerum v. peltigerum
20481. O. palmeri
21355. Pe. michoacana
21658. Pe. sessilifolia
21659. O. pachyphyllum
21729. O. pachyphyllum
21731. O. pachyphyllum
21732. O. globosum
21733. O. sinuatum
21734–39. O. globosum x O. sinuatum
21765. O. pringlei
21823. D. napeifolia
21824. O. amplifolium
21826. Ps. peltatum v. conzattii
21897. Ps. megaphyllum
21903. D. tridactylitis
21910. Ps. megaphyllum
21928. Ps. megaphyllum
21934. O. brachycomum
21953. Ps. holwayanum
21960. O. palmeri
21964. O. brachycomum

McVAUGH, R., & KOELZ, W.

39. Ps. megaphyllum
48. O. platylepis
49. O. sinuatum
57. O. amplum
147. Pe. sessilifolia
276. O. sinuatum
435. Pe. michoacana
441. O. palmeri
479. Pe. sessilifolia
601. O. pringlei
656. Pe. sessilifolia

792. Pe. sessilifolia
919. Ps. eriocarpum
920. Pe. sessilifolia
1104. O. pringlei
1253. O. pringlei

MEXIA, YNEZ

635. Pe. sessilifolia
845. O. pringlei
877. Ps. megaphyllum
1450. Pe. sessilifolia
1656. Pe. michoacana

MEARNS, EDGAR A.

531. O. decompositum
2219. O. decompositum

MEYER, F. G., and ROGERS, D. J.

2608. O. radulifolium

MICKEL, JOHN T.

501. O. radulifolium
561. O. radulifolium

MOORE, H. E., JR.

3421. O. silphiifolium
5119. Ps. megaphyllum

MOORE, H. E., JR. & CETTO, M.

5469. Pe. michoacana

MULLER, C. H.

3420. O. decompositum

MÜLLER, F.

s.n. in 1853. Ps. tabulare
1619. O. silphiifolium

NARVAEZ MONETS, M., & SALAZAR, A. E.

557. O. platylepis

NELSON, E. W.

1061. O. amplifolium
1133. D. napeifolia
1420. O. cirsiifolium
2080. D. tridactylitis
2243. O. amplifolium
3117. O. cirsiifolium
3467. D. chiapensis
4758. O. decompositum
4759. O. globosum
4954. Ps. peltatum v. peltatum
6582. Ps. peltatum v. peltatum

OWNBEY, GERALD B., & OWNBEY, FINDLEY

1874. O. pachyphyllum

ORCUTT, C. R.

3746. O. silphiifolium

ORTEGA, JESUS G.

5727. Pe. sessilifolia
7146. Ps. poculiferum

PALMER, EDWARD

s.n. July 1890. O. decompositum
s.n. 1892. O. pringlei
47. Pe. sessilifolia
168. O. palmeri
576. Pe. sessilifolia
651. O. sinuatum
689. O. platylepis
1234. O. pringlei
1832. Pe. sessilifolia

PARRY & PALMER

541. Pe. sessilifolia
543. O. radulifolium
543. Ps. peltatum v. peltatum

PENNELL, FRANCIS W.

18332. O. pachyphyllum
18343. Ps. peltatum v. peltatum
18345. Pe. sessilifolia
18582. O. globosum

PHILLIPS, EDWIN A.

651. O. decompositum

PIPPEN, RICHARD W.

1. O. sinuatum
2. O. amplum
3. O. amplum
4. O. amplum
5. Pe. sessilifolium
6. Ps. peltatum v. peltatum
7. O. sinuatum
8. Ps. megaphyllum
9. O. sinuatum
10. O. palmeri
11. Ps. poculiferum
12. O. palmeri
13. Pe. sessilifolia
15. Pe. sessilifolia
16. Ps. megaphyllum
17. Pe. sessilifolia
18. Pe. sessilifolia
19. Ps. poculiferum
20. O. palmeri
21. Ps. poculiferum
22. O. sinuatum
23. O. platylepis

24. Ps. megaphyllum
25. O. multilobum
26. Pe. michoacana
27a. O. palmeri
27. Ps. poculiferum
28. O. palmeri
29. O. cf. palmeri
30. O. multilobum
31. Pe. sessilifolia
32. O. palmeri
33. Pe. sessilifolia
34. Pe. sessilifolia
36. Ps. eriocarpum
37. O. pringlei
38. Pe. michoacana
39. Ps. megaphyllum
40. O. multilobum
43. O. palmeri
44. Ps. peltatum v. peltatum
45. O. sinuatum
46. D. jatrophoides
47. Ps. megaphyllum
48. Pe. sessilifolia
49. Ps. peltatum v. peltatum
50. O. sinuatum
51. Pe. sessilifolia
52. O. cirsiifolium
53. Ps. peltatum v. peltatum
54. O. silphiifolium
56. O. sinuatum
57. O. sinuatum
58. O. platylepis
59. O. pringlei
60. Ps. poculiferum
61. Pe. sessilifolia
62. Ps. eriocarpum
63. Pe. michoacana
64. Pe. sessilifolia
65. Pe. michoacana
66. Ps. eriocarpum
67. Ps. eriocarpum

POWELL, A. M., & EDMONDSON, J.

869. O. palmeri
929. O. radulifolium
948. O. sinuatum

PRINGLE, C. G.

767. O. decompositum
1736. Pe. sessilifolia
1811. O. pringlei
1816. O. platylepis
2304. O. palmeri
3340. Ps. peltatum v. peltatum
3566. O. radulifolium
4095. O. radulifolium
4262. D. jatrophoides
4274. O. sinuatum
4414. Ps. poculiferum
4672. Ps. peltigerum v. peltigerum
4778. D. napeifolia
4785. O. amplifolium
4984. O. cirsiifolium
5272. O. cirsiifolium
5741. D. jatrophoides
6018. O. paucicapitatum
6164. D. tridactylitis
6165. Ps. megaphyllum
6176. D. heteroidea
6238. Ps. peltatum v. conzattii
6453. O. silphiifolium
7983. Pe. sessilifolia
9080. O. silphiifolium
9868. Ps. tussilaginoides
9869. Pe. sessilifolia
9870. Ps. peltatum v. peltatum
9871. Ps. peltatum v. peltatum
9872. Ps. peltigerum v. peltigerum
9873. O. platylepis
9874. Ps. poculiferum
9875. O. sinuatum
9877. D. tridactylitis
10024. O. napellifolium
10117. Pe. michoacana
10126. O. brachyconum
11497. Pe. sessilifolia
11499. O. pringlei
11500. O. palmeri
13297. Ps. holwayanum
13672. Ps. holwayanum
13979. Ps. holwayanum

PURPUS, CARL A.

3038. Ps. peltatum v. peltatum
3139. O. amplifolium
3845. O. purpusii
4113. Ps. calvum
5625. Pe. sessilifolia
5630. Ps. tabulare

ROSE, J. N.

1935. Ps. poculiferum
1986. O. cervinum
2101. O. filicifolium
2248. cf. O. palmeri
2337. Ps. laxiflorum

2828. Pc. sessilifolia
3040. D. jatrophoides
3471. O. globosum x O. sinuatum
3575. O. amplum
7808. O. sinuatum

ROSE, J. N., & HAY, ROBERT

5311. O. silphiifolium
5547. O. tussilaginoides

ROSE, J. N., & PAINTER, J. H.

6738. O. tussilaginoides
7939. Ps. peltatum v. peltatum

ROSE, J. N., ET AL.

9187. O. silphiifolium

ROWELL, CHESTER M., JR.

3387. O. goldsmithii v. rowellii
3604. O. goldsmithii v. rowellii
3779. O. napellifolium
3886. O. goldsmithii v. rowellii
3896. O. napellifolium

RZEDOWSKI, J.

15974. O. amplifolium
16015. O. amplifolium
16073. O. goldsmithii v. rowellii

SAFFORD, WILLIAM E.

1432. O. platylepis
1451. Pc. sessilifolia

SALAZAR, F.

s.n. Aug. 1, 1913. O. napellifolium

SCHAFFNER, J. G.

s.n. Sept. 1955. Pc. sessilifolia
255. Pc. sessilifolia
294. O. radulifolium
294. Ps. peltatum v. peltatum

SCHUMANN, W.

148. O. radulifolium

SEATON, HENRY

s.n. in 1891. Ps. peltatum v. peltatum

SEEMANN

s.n. O. pachyphyllum

SELER, ED.

1259. Ps. peltatum v. peltatum

SHARP, A. J.

44508. Ps. peltatum v. peltatum
441431. O. goldsmithii v. rowellii
441465. O. amplifolium

SHREVE, FORREST

8031. O. globosum

SMITH, CHARLES L.

287. D. heteroidea
380. D. tridactylitis
387. D. heteroidea
388. D. jatrophoides

SMITH, LUCIUS C.

123. D. jatrophoides
124. O. amplifolium
966. D. tridactylitis

SMYTH, E. G.

172. O. sinuatum

STANFORD, RETHERFORD, & NORTHCRAFT

818. O. radulifolium

STANFORD, TAYLOR, & LAUBER

2421. O. radulifolium
2535. Ps. peltatum v. adenophorum

TOWNSEND, C. H. T.

s.n. in 1909. O. decompositum

TOWNSEND, C. H. T., & BARBER, C. M.

158. O. decompositum

TUCKER, J. M.

2456. O. decompositum

VISCHER

14. Pc. sessilifolia
58. O. sinuatum

WATERFALL, U. T.

12668. O. pachyphyllum

WHITE, STEPHEN S.

2741. O. decompositum
3289. O. decompositum
4353. O. decompositum

WILBUR, R. L. & C. R.

2017. Ps. poculiferum
2166. Ps. poculiferum

WILCOX, TIMOTHY E.

s.n. in 1891. O. decompositum

WRIGHT, CHARLES

1286. O. decompositum

PLATES

Digitacalia tridactylitis (Rob. & Greenm.) Pippen (type, *Pringle* 5841, GH).

PLANTS OF GUERRERO, MEXICO

Odontotrichum goldsmithii var. *rowellii* Pippen, var. nov. (type, *Rowell* 2991, MICH).

Odontotrichum multilobum Pippen, sp. nov. (type, *Wilbur* 2094, MICH).

Odontotrichum pringlei (S. Wats.) Rydb. (lectotype, *Pringle* 1749, GH).

Pericalia michoacana (B. L. Rob.) Rydb. (type, *Pringle* 10117, GH).

U. OF MICH.
NEG. 1283

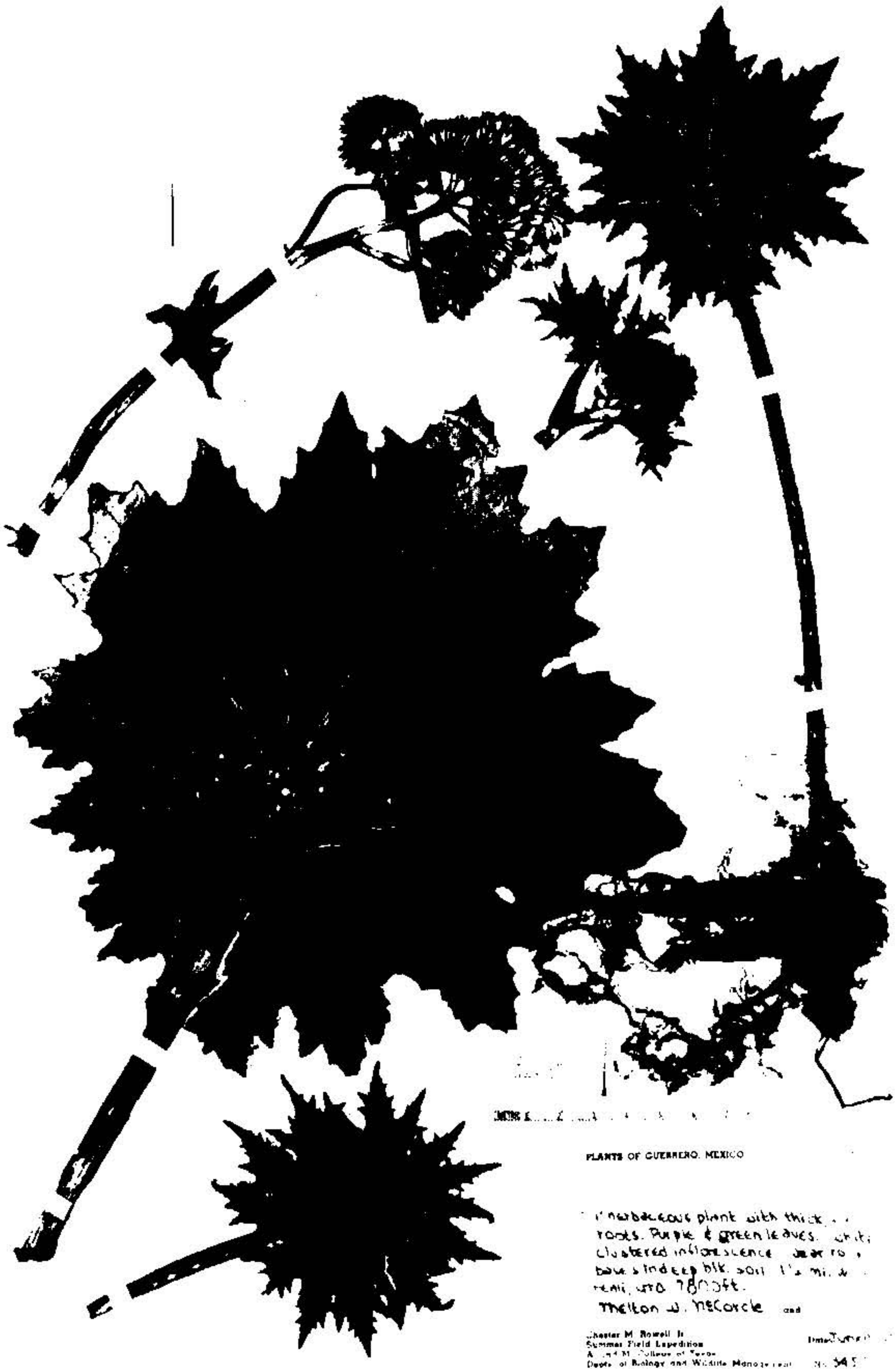
Type of the petiole. Hilk.

Psacalium megaphyllum (Rob. & Greenm.) Rydb. (type, *Pringle* 2090, GH).

Psacalium nanum Pippen, sp. nov. (type, *Hinton* 14464, US).

Enlargement of *Psacalium nanum* Pippen, sp. nov. (type, *Hinton* 14464, US).

Psacalium peltigerum var. *hintonii* Pippen, var. nov. (type, *Hinton 7966*, MICH).



Psacalium peltigerum var. *latilobum* Pippen, var. nov. (type, *McCorcle* and *Rowell* 3453, MICH).

Literature Cited

BAUHIN, GASPARD (CASPER)
1623. Theatri Botanici. Basil.

BELCHER, R. O.
1956. A revision of the genus *Erechtites* (Compositae) with inquiries into *Senecio* and *Arrhenechtites*. Ann. Mo. Bot. Gard. 43:1–85.

BENTHAM, G., and HOOKER, J. D.
1873. Genera Plantarum. London.

BLAKE, S. F.
1960. Compositae, pp. 829–971. *In* Kearney and Peebles, Arizona Flora, ed. 2. Univ. California Press. Berkeley.

CASSINI, H.
1816. *Adenostyles in* Dict. Sci. Nat. (Paris) 1 (Suppl.):59.
1826. *Psacalium in* Dict. Sci. Nat. (Paris) 43:461.
1827. *Cacalia in* Dict. Sci. Nat. (Paris) 48:459.

CLAUSEN, R. T.
1959. *Sedum* of the Trans-Mexican volcanic belt. Ithaca.

CLUSIUS, CAROLUS (CHARLES DE L'ECLUSE)
1601. Rariorum plantarum historiae. (Lib. 1–3); (Lib 4–5) Antwerp.

CONTRERAS ARIAS, A.
1942. Mapa de las Provincias Climatologicas de la República Mexicana. Secretaria de Agricultura y Fomento. Dirección de Geografía, Meterología y Hidrología. Instituto Geográfico, Mexico.

CRONQUIST, A., and GLEASON, H. H.
1963. Manual of vascular plants.

CUATRECASAS, J.
1955. A new genus and other novelties in Compositae. Brittonia 8:151–163.
1960. Studies on Andean Compositae—IV. Brittonia 12:182–195.

DECANDOLLE, A. P.
1838. Prodromus systematis naturalis 6:327–336.

FERNALD, M. L.
1950. Gray's manual of botany, ed. 8.

FIORI, A.
1933. Flora Italiana. Mariano Ricci. Firenze.

GRAY, A.
1883. Contributions to North American botany. I. Characters of new Compositae with revisions of certain genera and critical notes. Proc. Amer. Acad. 19:1–96.

GREENMAN, J. M.
1902. Monographie der nord- und central-amerikanischen Arten der Gattung *Senecio* I. Bot. Jahrb. Engler 32:1–33.

HAWORTH, A. H.
1812. Synopsis plantarum succulentarum. London.

HEGI, G.
1917. Illustrierte Flora von Mittel-Europa 6 (1):403–407. Munchen.

HEMSLEY, W. G.
1881. Biologia Centrali-Americana Bot. 2:235–247. London.

HITCHCOCK, A. S., and GREEN, M. L.
1947. Supplement species lectotypicae generum Linnaei. Brittonia 6:114–118.
HOFFMANN, O.
1890. Compositae *in* Engler and Prantl., Die natürlichen Pflanzenfamilien 4 (5):225–272. Leipzig.
LANGLET, O. F. J.
1936. Några Bidrag till Kännedomen om Kromosomtalen inom Nymphaeaceae, Ranunculaceae, Polemoniaceae och Compositae. Svensk. Bot. Tidsk. 30:288–294.
LANJOUW, J., and STAFLEU, F. A.
1964. Index Herbariorum. Part 1. The Herbaria of the world, ed. 5. International Bureau for Plant Taxonomy and Nomenclature. Utrecht.
LINNAEUS, C.
1753. Species Plantarum. Stockholm.
L'OBEL, MATTHIAS DE
1581. Plantarum seu stirpium icones. Antwerp.
MAKINO, T.
1958. An illustrated flora of Japan. Tokyo.
MARTINÉZ, M.
1959. Plantes Medicinales de Mexico, ed. 4. Ediciones Botas. Mexico D. F.
MORISON, R.
1699. Plantarum historiae. Jacob Bobart. Oxford.
ORNDUFF, R., ET AL.
1963. Chromosome numbers in Compositae. III. Senecioneae. Amer. Journ. Bot. 50:131–139.
RAISZ, E.
1959. Landforms of Mexico (map, privately published). Cambridge.
RICKETT, H. W.
1955. Materials for a dictionary of botanical terms. III. Inflorescences. Bull. Torrey Bot. Club. 82:419–445.
RYDBERG, P. A.
1924. Some senecioid genera. Bull. Torrey Bot. Club 51:369–378, 409–420.
SCHULTZ, C. H.
1845. Ueber einige mit *Senecio* zu verbindende Gattungen. Flora 28:497–498.
SHINNERS, L. H.
1950. The Texas species of *Cacalia*. Field and Lab. 18:79–83.
TOURNEFORT, J. P.
1700. Institutiones rei herbariae. (*Cacalia* on 1:451.). Paris.

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