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PHYTOLOGIA

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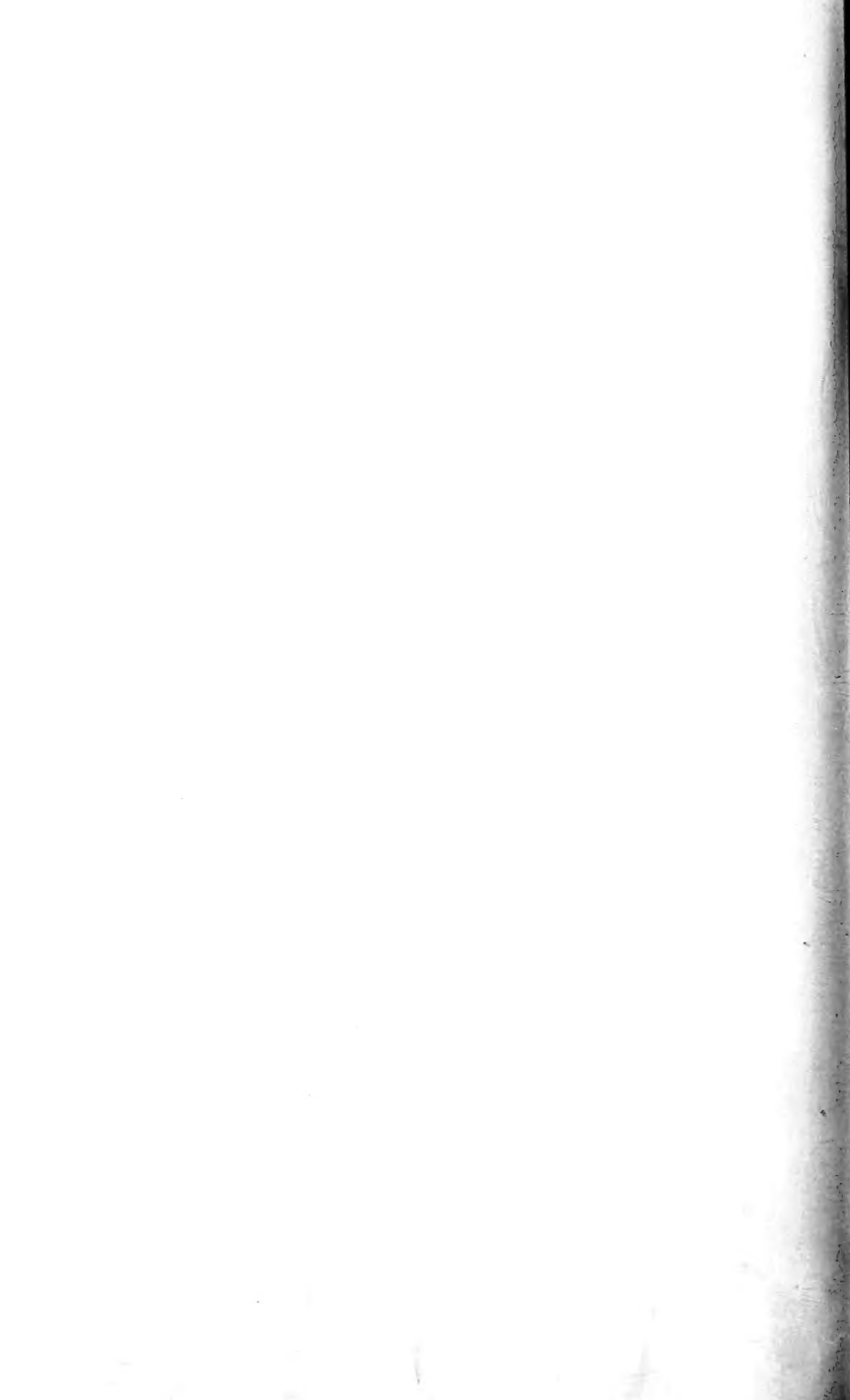
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NOMENCLATURAL NOTES FOR THE NORTH AMERICAN FLORA. II.

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ABSTRACT

Continuing with the "Nomenclatural notes for the North American Flora. I.," a second note in the series toward the advancement of our understanding of North American plants is presented here.

KEY WORDS: Floristics, nomenclature, North America, Aquifoliaceae, Asteraceae, Fabaceae, Polygonaceae, Rosaceae, Sapotaceae.

AQUIFOLIACEAE

In an earlier paper, we (Kartesz & Gandhi 1989) indicated that the name *Ilex ambigua* (Michaux) Torr. var. *monticola* (Gray) Wunderlin & Poppleton (Florida Scientist 40:10. 1977) was based on *I. monticola* Gray, a superfluous name. We also stated that Wunderlin & Poppleton attributed the name *I. amelanchier* M.A. Curtis var. *monticola* to "(Gray) Wood." This attribution could have been possible only on the belief that Wood had indeed cited Gray, however he did not. Hence, no parenthetical author should be cited for Wood's combination. Since Gray's epithet is superfluous, Gray must also not be cited as a parenthetical author for Wunderlin & Poppleton's combination. Although Wood's combination is in the protologue of Wunderlin & Poppleton's article, since Gray and Wood used two different types, we did not replace Gray's name by Wood for Wunderlin & Poppleton's varietal name.

After our publication appeared, R.P. Wunderlin informed us that it might be wise to invoke ICBN Art. 33.2, Ex. 6 and consider the citation of "Gray" (the parenthetical author for their new combination) as a bibliographical error for "Wood."

The involvement of two different types poses a problem to accept Wunderlin's statement. We brought to his attention that Wunderlin & Poppleton's protologue of *I. ambigua* var. *monticola* does not comment on the superfluous status of Gray's combination, *I. monticola*, and was in error in assuming that

Wood's variety was based on Gray's epithet. However, since Wunderlin emphasized that there was a bibliographical error in Wunderlin & Poppleton's new combination, we accept it. Accordingly, the correct citation is: *I. ambigua* var. *monticola* (Wood) Wunderlin & Poppleton.

ASTERACEAE

Gnaphalium.

J.C. Grierson (1971) noted that the type of the tropical weed commonly known as *Gnaphalium indicum* L., belongs to the genus *Helichrysum*. He therefore transferred this Linnaean epithet to *Helichrysum* and made the new combination: *H. indicum* (L.) Grierson. *Helichrysum indicum* is a South African species. With this disposition of the Linnaean *G. indicum*, Grierson assigned the combination *G. polycaulon* Pers. to the tropical weed previously known as "*G. indicum*."

Accordingly, the "*G. indicum* auct. non L." found in the New World must be called *G. polycaulon*. Probably unaware of Grierson's published work, a few modern authors, such as Liogier & Martorell (1982) and McVaugh (1984), have used the name "*G. indicum* L." However, McVaugh commented that he did not know whether his "*G. indicum*" is the same as *G. indicum* of Linnaeus.

Gnaphalium polycaulon is characterized as follows (from Grierson 1971): woolly annual, 10-25 cm tall; several or many stems arising from the base; leaves obovate, 1-4 cm long, 2-12 mm wide; heads 150 to 200 flowered (central bisexual flowers ca. 6); receptacle 1-1.3 mm wide; phyllaries acute, stramineous; pappus bristles separate at the base. The correct nomenclature is given below:

Gnaphalium polycaulon Pers., *Syn.* 2:421. 1807.

Gnaphalium indicum auct. non L.: Alain, *Fl. de Cuba* 5:257. 1962;
Liogier & Martorell, *Fl. Puerto Rico & Adj. Islands* 186. 1982;
McVaugh, *Flora Novo-Galiciana* 12:455. 1984.

Helianthus.

Helianthus rigidus (Cass.) Desf. (*Cat. Pl.*, ed. 3, 184. 1829) was based on *Harpalium rigidum* Cass. (*Bull. Sci. Soc. Philom. Paris* 141. Sep 1818). For *Helianthus rigidus* ssp. *rigidus*, Heiser (*Mem. Torrey Bot. Club* 22[3]:131-138. 1969) cited several synonyms, including *Helianthus diffusus* Sims (*Bot. Mag.* 45:2020. Oct 1818) and *Helianthus pauciflorus* Nutt. (*Gen.* 2:177. 3 Apr 1818). Clearly, *Helianthus pauciflorus* has priority over *Harpalium rigidum* and *Helianthus diffusus*; hence, the latter two cannot serve as basionyms. For the North American flora, we accept *Helianthus pauciflorus* Nutt. as the correct name.

Farwell (Amer. Midl. Naturalist 8:278. 1923) reduced *Helianthus subrhomboides* Rydb. to varietal status (*H. scaberrimus* Ell. var. *subrhomboides* [Rydb.] Farwell). Heiser treated the taxon as a subspecies (*H. rigidus* [Cass.] Desf. ssp. *subrhomboides* [Rydb.] Heiser). We follow Heiser in recognizing *H. subrhomboides* at subspecific rank. Since we recognize *H. pauciflorus* Nutt. as the earliest correct name in the *H. rigidus* complex, a new combination is proposed here.

***Helianthus pauciflorus* Nutt. ssp. *subrhomboides* (Rydb.) Kartesz & Gandhi, *comb. nov.* BASIONYM: *Helianthus subrhomboides* Rydb., Mem. New York Bot. Gard. 1:419. 1900. TYPE: UNITED STATES. Nebraska: Whiteman, Rydberg 1627.**

FABACEAE

Indigofera.

Indigofera keyensis Small is endemic to the Florida Keys. It is similar to *I. mucronata* Sprengel ex DC., which is a tropical American weed, common in northern South America. Isely (1982) commented that the "*Indigofera keyensis* of U.S. listings . . . is *I. mucronata*, constituting at best a weak variety," and accordingly he made a new combination: *I. mucronata* Sprengel ex DC. var. *keyensis* (Small) Isely. Unfortunately, *I. mucronata* DC. (published in 1825) is a later homonym of *I. mucronata* Lamarck (published in 1789), thus rendering Isely's new combination to be illegitimate as well.

McVaugh (1987) synonymized *Indigofera mucronata* DC. under *I. jamaicensis* Sprengel (published in 1826). Alternatively, de Kort & Thijssse (1984) placed both *I. jamaicensis* and *I. mucronata* DC. as synonyms of *I. trita* L. f. ssp. *scabra* (Roth) de Kort & Thijssse (based on *I. scabra* Roth 1821). Both *I. scabra* and *I. trita* are based on types from India, whereas both *I. jamaicensis* and *I. mucronata* are based on Jamaican types. Isely (pers. comm.) commented that de Kort & Thijssse's study of the American material of this complex was inadequate, and he declined to accept the name *I. trita* for the New World material. However, we accept the name *I. trita* for North America and propose the following new combination:

***Indigofera trita* L. f. var. *keyensis* (Small) Kartesz & Gandhi, *comb. nov.* BASIONYM: *Indigofera keyensis* Small, *Flora Florida Keys* 63,155. 1913. TYPE: UNITED STATES. Florida: Lower Metacumbe Key, Small 2570. *Indigofera mucronata* Sprengel ex DC. var. *keyensis* (Small) Isely, *Brittonia* 34:340. 1982.**

Zornia.

The combination *Zornia gemella* is often attributed to "(Willd.) Vogel." Vogel proposed this name in 1838 (Linnaea 12:61) and cited "*Hedys. gemellum* W. Hrb. 13777" as a synonym. Dr. Paul A. Fryxell brought to our attention that according to Willdenow Herbarium (1972), specimen no. 13778 is *Hedysarum gemellum*, whereas specimen no. 13777 is *H. conjugatum*. Although the name *H. gemellum* was the basis for the name *Z. gemella*, the former was not validly published. Vogel was probably the first to effectively publish it. Hence, the author citation for *H. gemellum* must be "Willd. ex Vogel, pro syn." (ICBN Art. 50A, Ex. 1). Since the name *H. gemellum* was only a manuscript name at the time Vogel proposed his *Z. gemella*, Willdenow must not be cited as a parenthetical author for the latter name. The correct citation for the name is *Z. gemella* Vogel.

POLYGONACEAE

Polygonum alaskanum.

Based on *Polygonum alpinum* All. var. *alaskanum* Small, at least two new combinations were made: *Aconogonum alaskanum* Sojak (Preslia 46:150. 1974) and *P. alaskanum* W. Wight ex Hultén (*Fl. Alaska & Yukon* 4:610. 1944). For these two combinations, Small has been generally cited as the parenthetical author.

With his original description of *Polygonum alpinum* var. *alaskanum*, Small cited the earlier legitimate name *P. alpinum* var. *lapathifolium* Cham. & Schlecht. as a synonym. As a consequence of citation of an earlier valid varietal name as a synonym, Small's varietal name became superfluous (ICBN Art. 63). Hence, Small must not be cited as the parenthetical author when the epithet is used in other combinations.

Polygonum douglasii.

The names *Polygonum douglasii* E. Greene and *P. engelmannii* E. Greene have equal priority (Bull. California Acad. Sci. 1:125-126. 1885). The former represents an entity that is relatively more robust than the latter and has a 3-5 mm long perianth, whereas in the latter taxon, the perianth is 1.5-2.5 mm long. The distinction of these two taxa is not always clear. C.L. Hitchcock (1964) remarked that *P. engelmannii* is close to *P. douglasii*. We recommend that *P. engelmannii* to be treated (at best) at an infraspecific rank. In this connection, a new combination is proposed here.

***Polygonum douglasii* E. Greene ssp. *engelmannii* (E. Greene) Kartesz & Gandhi, comb. nov. BASIONYM: *Polygonum engelmannii* E. Greene, Bull. California Acad. Sci. 1:125. 1885.**

ROSACEAE

Erythrocoma canescens E. Greene is characterized by leaves dentate at apex; bracteoles shorter than sepals; hypanthium hemispheric or sunken at the base in flower; styles elongating in fruit, plumose at the base, glabrous above, hardly geniculate. P.A. Rydberg (*North Amer. Fl.* 22:409. 1913) transferred this species to the genus *Sieversia* Willd.; however, in modern treatments, these two genera are considered as synonyms of the genus *Geum* L.

C.L. Hitchcock (1961; p. 113) treated *Erythrocoma canescens* as a synonym of *Geum triflorum* Pursh var. *ciliatum* (Pursh) Fassett. For the North American flora, we treat *E. canescens* as a variety of *G. triflorum*. This variety is differentiated from the var. *ciliatum*, with the latter characterized by its dissected leaves and by its bracteoles being longer than the sepals. The following new combination is proposed here:

***Geum triflorum* Pursh var. *canescens* (E. Greene) Kartesz & Gandhi, *comb. nov.* BASIONYM: *Erythrocoma canescens* E. Greene, *Leaf. Bot. Obs. & Crit.* 1:178. 1906.**

SAPOTACEAE

The genus *Sideroxylon* L. (*sens. strict.*) is characterized by having entire corolla lobes, whereas the genus *Bumelia* Sw. (*sens. strict.*) is characterized by 3 segmented corolla lobes. For the North American flora, we recognize *Sideroxylon* (*sens. lat.*), including *Bumelia* (based on priority) and propose the following new combinations.

Sideroxylon lanuginosum* Michaux ssp. *albicans* (Sarg.) Kartesz & Gandhi, *comb. nov.* BASIONYM: *Bumelia lanuginosa* (Michaux) Pers. var. *albicans* Sarg., *J. Arnold Arbor.* 2:168. 1921. TYPE: UNITED STATES. Texas: Victoria Co., 9 Apr 1915, *Sargent, s.n.

Sideroxylon reclinatum* Michaux ssp. *austrofloridense* (Whetstone) Kartesz & Gandhi, *comb. nov.* BASIONYM: *Bumelia reclinata* (Michaux) Vent. var. *austrofloridensis* Whetstone, *Ann. Missouri Bot. Gard.* 72:545. 1985. TYPE: UNITED STATES. Florida: Dade Co., 7 July 1984, *Whetstone 14459.

Sideroxylon reclinatum* Michaux ssp. *rufotomentosum* (Small) Kartesz & Gandhi, *comb. nov.* BASIONYM: *Bumelia rufotomentosa* Small, *Bull. New York Bot. Gard.* 1:440. 1900. TYPE: UNITED STATES. Florida: Tampa, May 1876, *Garber s.n.

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We thank Drs. Paul A. Fryxell (U.S.D.A. Scientist in collaboration with Texas A&M University) and Larry E. Brown (Houston Community College) for their valuable suggestions for the improvement of this manuscript. We also thank Dr. Richard P. Wunderlin (University of South Florida) for the clarification on the nomenclature of *Ilex ambigua* var. *monticola*. Interlibrary loan of the journal *Linnaea* from Duke University Library (pertaining to the name *Zornia gemella*) is appreciated. We thank Dr. Peter White, Director of the North Carolina Botanical Garden, for arranging the financial support to meet the cost of this publication.

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SIZE DISTRIBUTION AND DENSITY OF TREES IN BOGS AND PINE WOODLANDS IN WEST CENTRAL LOUISIANA

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ABSTRACT

Bogs and adjacent pine woods were sampled in the Kisatchie National Forest, Louisiana, to determine size and density of trees. There were more than three times as many trees in pine woods as in bogs, and the trees in pine woods were more than twice the diameter of those in bogs. The pine woods had little understory except a few shrubs; whereas the bogs had a dense species rich herbaceous ground cover.

KEY WORDS: Pitcher plant bog, *Sarracenia*, longleaf pine woods, *Pinus palustris*, Louisiana, Kisatchie National Forest.

INTRODUCTION

Little has been published regarding bogs west of the Mississippi delta (Allen, *et al.* 1988; Bridges & Orzell 1989; Nixon & Ward 1986; MacRoberts & MacRoberts 1988, 1990). To rectify this situation we have undertaken a number of descriptive studies of Louisiana pitcher plant bogs. In this paper we describe size distribution and density of trees in bogs and in adjacent pine woods, a subject about which the literature says little or nothing. Most papers dealing with the floristics or ecology of bogs give either a brief description that indicates that trees are scarce and stunted or a photograph that clearly shows that bogs are open habitat (*e.g.*, Wieder, *et al.* 1981). We know of only one paper that specifically addresses bog trees (Streng & Harcombe 1982). Our purpose is to quantify our impression of the low tree productivity of bogs.

STUDY SITE

Thirtyfive bogs are known to us in the Kisatchie District, Kisatchie National Forest, Natchitoches Parish, Louisiana. In October and November 1989, ten were selected on the basis of certain criteria that had no *a priori* relationship to the problem under investigation (see MacRoberts & MacRoberts 1988,

Table 1. Number of trees by species and their size in pine woods and bog habitat.

Species	No. in Bog	Average dbh (cm) (range)	No. in Pine Woods	Average dbh (cm) (range)
<i>Fagus grandifolia</i>	-	-	1	18
<i>Cornus florida</i>	-	-	1	3
<i>Ilex opaca</i>	-	-	1	3
<i>Acer rubrum</i>	-	-	8	4(2-11)
<i>Liquidambar styraciflua</i>	-	-	16	4(1-10)
<i>Pinus taeda</i>	4	2(1-3)	2	20(15-26)
<i>Pinus elliottii</i>	1	3	-	-
<i>Pinus palustris</i>	31	9(1-28)	89	21(1-40)

1990 and Smith 1988 for a description and definition of bog habitat). The ten bogs selected ranged in size from 0.2 to 2.5 ha and averaged about 1 ha, which is typical for bogs we have surveyed and have measured on the ground in this district ($n = 35$, mean = 0.9 ha, range = 0.1 to 4 ha). Elevation ranged from 80 to 90 m above sea level. Adjacent to each bog and upslope in the recharge area were extensive pine woods, a typical community in the uplands of west central Louisiana, in which *Pinus palustris* is the dominant tree (see Smith 1988 and Platt, *et al.* 1988 for habitat description).

METHODS

We ran a transect through each of the bogs as close to its center (its widest part) and for an equal distance into the adjacent upslope pine woods. The length of each transect depended on the size of the bog. The longest was 91 m; the shortest was 30 m. All were 3 m wide. We sampled equal areas along a straight line inside and outside each bog; *e.g.*, for a 90 m transect, 45 m was in the bog and 45 m was in the pine woods. The total area sampled was 2496 sq. m, half of which were in pine woods and half in bog. All trees over 1.5 m tall were identified and their dbh measured. The presence of shrubs and saplings and type of ground cover were also noted.

RESULTS

Table 1, Table 2, and Table 3 summarize our main findings. Figure 1 shows a typical pitcher plant bog in the study area.

There were 3.3 times as many trees in the pine woods ($n = 118$) as in the bogs ($n = 36$). This translates into one tree per 11 sq. m in pine woods and

Table 2. Tree size in bogs and in pine woods.

Diameter Class dbh (cm)	No. of Trees	
	Pine Woods	Bog
1 - 5	24	19
5 - 10	18	7
10 - 15	17	3
15 - 20	12	5
20 - 25	8	0
25 - 30	14	2
30 - 35	18	0
35 - 40	7	0

Table 3. Size of *Pinus palustris* in bogs and in pine woods.

Diameter Class dbh (cm)	No. of Trees	
	Pine Woods	Bog
1 - 5	4	14
5 - 10	14	7
10 - 15	16	3
15 - 20	9	5
20 - 25	8	0
25 - 30	13	2
30 - 35	18	0
35 - 40	7	0

one tree per 35 sq. m in bogs. The trees in the pine woods were on average more than twice the diameter (mean 16.8 cm dbh, range 1-40 cm, S.E.= 3.3) of those in bogs (mean 7.8 cm dbh, range 1-28 cm, S.E.= 2.5).

Species distribution also differed between bogs and pine woods. Inside the bogs, hardwoods over 1.5 m tall were infrequent and none occurred in the transects. In the pine woods, hardwoods were common.

In pine woods, there were 2.5 times as many pines as in bogs, and those in pine woods were more than twice the diameter of those in bogs.

The difference between the size class distribution of trees in bogs and in pine woods is significant at the .01 level (Student's *t*), and the difference between the class distribution of *Pinus palustris* in bogs and in pine woods is significant at the .05 level (Student's *t*).

Scattered in the bogs and adjacent pine woods were various small trees

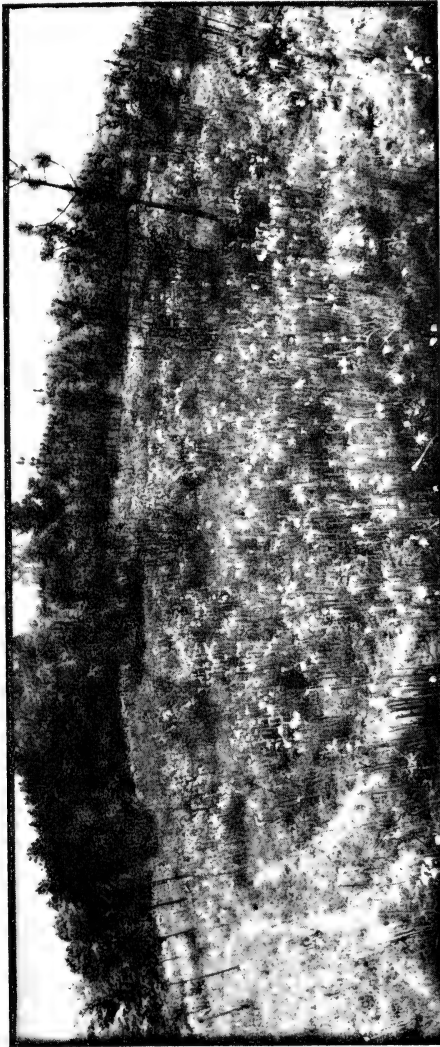


Figure 1. Kisatchie District pitcher plant bog. Note open habitat, scattered small pines, clumps of shrubs, and extensive spread of *Sarracenia alata*. Photo taken by Stan Carpenter on April 7, 1990 with a 120 degree panoramic camera.

and shrubs. Particularly common in bogs were those that prefer wet habitat. In the bog transects the following taxa occurred, often in mixed species tangles: *Myrica cerifera*, *Persea borbonia*, *Aronia arbutifolia*, *Viburnum nudum*, *Vaccinium corymbosum*, *Magnolia virginiana*, *Liquidambar styraciflua*, *Acer rubrum*, *Pinus* spp., At some bogs, some trees were large (e.g., magnolia), but these usually grew near the edge of the site.

In the pine woods transects, the following species occurred often in dense tangles: *Myrica cerifera*, *Persea borbonia*, *Magnolia virginiana*, *Acer rubrum*, *Liquidambar styraciflua*, *Vaccinium corymbosum*, *Ilex vomitoria*, *I. opaca*, *Cornus florida*, and *Pinus* spp.

The ground cover in bogs consisted of grasses, sedges, and various showy forbs. Bogs are among the most species rich habitats in North America (Walker & Peet 1983). Four Natchitoches Parish bogs, which ranged in size from 0.4 to 3 ha, averaged 101 species (MacRoberts & MacRoberts 1990). The ground cover in the pine woods is not species rich and consisted of a few species of grass and forbs and a thick accumulation of pine needles.

DISCUSSION

Streng (1979; Streng & Harcombe 1982) studied size distribution and spatial dispersion of trees in four habitats (meadows, savannas, baygalls, and pine woods) in the Big Thicket National Preserve in Texas, about 170 km SW of our study area. With minor differences, Streng's "meadow" corresponds to our "bog;" the pine woods in the two studies are the same habitat. Streng's findings are nearly identical to ours: bogs were open with a low density of widely scattered small trees (mainly *Pinus*), a paucity of tree species, and an extensive and diverse herbaceous layer; whereas pine woods had a high density of trees (again mainly *Pinus* but also hardwoods) and a variety of species, and little or no herbaceous understory. In short, woody plant growth is restricted in bogs while herbaceous growth is restricted in pine woods.

While the reasons for the differences in tree production in pine woods and bogs are not entirely clear, pyric and edaphic factors have been repeatedly suggested as important (Folkerts 1982; Nixon & Ward 1986). The edaphic conditions of bogs (high acidity, waterlogging, and low nutrient soil), retard the growth of trees, making the seedlings that do sprout extremely vulnerable to fire (Streng 1979; Streng & Harcombe 1982). Open habitat is conducive to extensive herbaceous plant growth that, in turn, creates the conditions for frequent fires. Pine woods, on the other hand, occur on less acidic, drier and deeper soils that are conducive to tree growth when fire exclusion occurs. Trees shade out the herbaceous understory. Bogs in Streng's area appeared to be self sustaining, as long as the natural fire rhythm was maintained. Her findings appear to apply to the Natchitoches bogs also.

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**TRIXIS ANOMALA (ASTERACEAE, MUTISEAE), A NEW SPECIES FROM
CHIAPAS, MÉXICO**

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ABSTRACT

Trixis anomala B. Turner, a new species from montane cloud forests of central Chiapas, México, is described and illustrated. It differs from all other North American species in possessing an anomalous involucre that is turbinate or subturbinate with 3-4 series of graduate involucre bracts, the inner of which is not clearly uniseriate.

KEY WORDS: *Trixis*, Mutiseae, Asteraceae, México.

Preparation of a treatment of *Trixis* for the Asteraceae of México (Turner & Nesom, in prep.) has revealed the following novelty. The specimens upon which the description is based were apparently not available to Anderson (1972) in her excellent monograph of the genus.

Trixis anomala B. Turner, *spec. nov.*, Figure 1. TYPE: MÉXICO. Chiapas: Cascada, near Siltepec, 1600 m, 1 Mar 1945, *Eizi Matuda 5184* (HOLOTYPE: LL!; Isotype: LL!).

Trixis silvaticae B.L. Robins. & Greenm. similis sed differt caulibus sine alis, involucre subturbinate 3-4 seriato bracteis gradatis abbreviatis, bracteis accessoriis multo redactis vel absentibus, et receptaculo glabro vel fere glabro.

Shrubs to about 3 m high. Stems terete, not winged, moderately to densely strigopuberulous. Leaves alternate, mostly 10-19 cm long, 3-5 cm wide; petioles mostly 5-10 mm long; blades relatively thin, ovate elliptical to elliptical obovate, widest at or near the middle, moderately white puberulous beneath, the margins minutely serrulate, the apices acute. Heads 8 to numerous, borne in an erect or ascending terminal capitulescence, the ultimate peduncles mostly 1-5 mm long. Involucres turbinate, 10-12 mm high, the bracts 3-4 seriate, graduate, the innermost not clearly in a single series. Accessory bracts 1-4, lanceolate, 1-3 mm long, grading into the involucre bracts proper. Receptacle

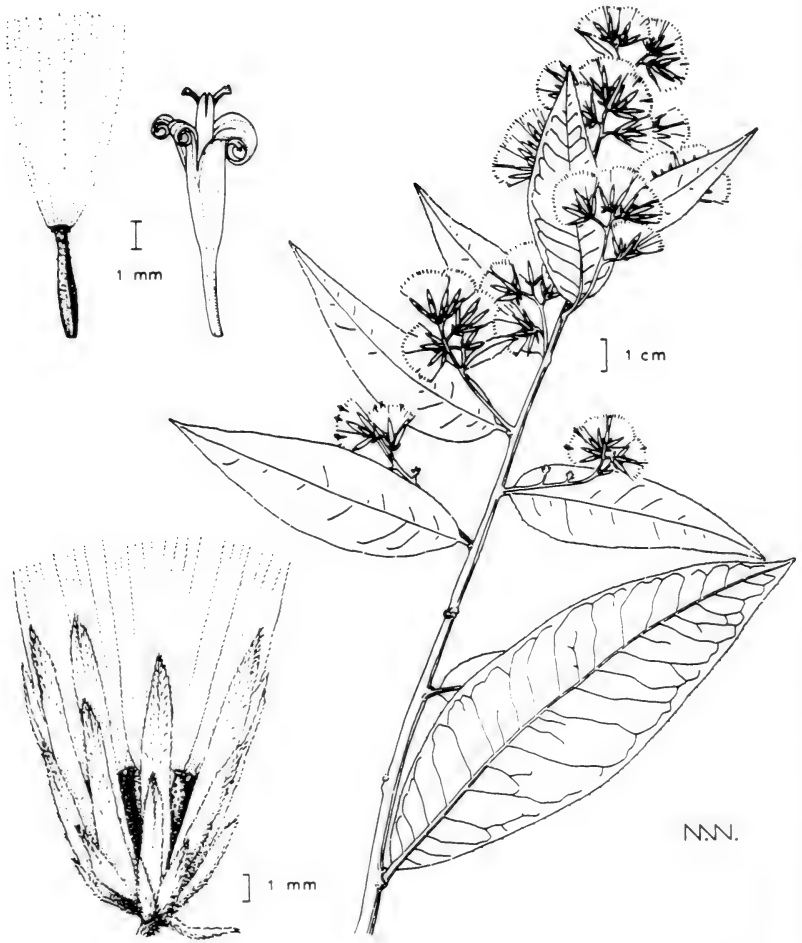


Fig. 1. *Trixis anomala*, from holotype

plane, ca. 1.5 mm across, epaleate, glabrous or nearly so (perhaps a smattering of scattered hairs). Florets 11-12 per head, the corollas seemingly yellow, glabrous, the peripheral florets with corolla tubes 5-6 mm long, the outer lips ca. 3 mm long, revolute at the apices. Achenes fusiform, ca. 6 mm long, gradually tapered from about the middle, moderately pubescent with both glandular and hispid hairs, the pappus of numerous tawny white bristles, 8-10 mm long.

ADDITIONAL SPECIMEN EXAMINED: MÉXICO. Chiapas: Mpio. Cintalapa, SE of Cerro Baul on the border with Oaxaca, 16 km NW of Rizo de Oro (a logging road to Colonia Figaroa), 1600 m, 21 Apr 1972, D.E. Breedlove 24759 (TEX).

The present species, because of its wingless stems, small receptacles and peripheral florets with small revolute outer corolla tips will key with difficulty to *Trixis parviflora* in Anderson's 1972 treatment of the genus. It differs markedly from that species, and all North American species, in possessing an involucre of 3-4 series of bracts, these markedly graduate (Figure 1, lower left), the inner series not clearly uniseriate (hence the specific name). Accessory bracts are much reduced and grade into the involucral bracts, the involucre as a whole much resembling that of the genus *Acourtia*. In all other characters, however, it is clearly a *Trixis*. Indeed, I originally identified the holotype as *T. nelsonii* or possible *T. silvatica*, the species to which it appears most closely aligned, having the general habit of these taxa, similar florets, but lacking the winged stems and markedly pubescent receptacles. And, of course, the involucre of both *T. nelsonii* and *T. silvatica* are markedly different in possessing non-graduate involucre with well developed subtending accessory bracts. *Trixis anomala* has about the same range as *T. silvatica* and *T. nelsonii*, all three confined to central Chiapas, but all markedly different among themselves. While the involucre is anomalous among the North American species, some of the species from South America have involucre which approach *T. anomala*, and the latter may relate to groups from that area.

ACKNOWLEDGMENTS

I am grateful to Guy Nesom for the Latin diagnosis and to him and Dr. Andrew McDonald for reviewing the manuscript. Ms. Nancy Webber provided the illustration.

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A CONSPECTUS OF *MACHAERANTHERA* (ASTERACEAE: ASTEREAЕ)

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ABSTRACT

A synopsis of *Machaeranthera* is presented with descriptions and keys where appropriate, synonymy, and discussion. The combination *Machaeranthera* subgenus *Sideranthus* (Nutt. ex Nees) R.L. Hartman is made. The following new sections or sectional combinations are recognized: *Machaeranthera* sections *Arida* R.L. Hartman, *Blepharodon* (DC.) R.L. Hartman, *Havardii* (R. Jackson) R.L. Hartman, *Sideranthus* (Nutt. ex Nees) R.L. Hartman, and *Stenoloba* R.L. Hartman. Other new combinations are: *Machaeranthera coloradoensis* (A. Gray) Osterh. var. *brandegei* (Rydb.) T.J. Watson ex R.L. Hartman, *M. viscida* (Wooton & Standley) R.L. Hartman, and *M. wigginsii* (S.F. Blake) R.L. Hartman. *Machaeranthera heterophylla* R.L. Hartman replaces *Haplopappus rhizomatus* M. Johnston which would become a later homonym if transferred to *Machaeranthera*.

KEY WORDS: Systematics, *Aster*, Asteraceae, Astereae, *Haplopappus*, *Machaeranthera*.

The preparation of the Asteraceae of México by B.L. Turner & G. Nesom has prompted the publication of the conspectus of *Machaeranthera* from my dissertation (Hartman 1976) to make available several new combinations and a new name. All taxa are included except where otherwise noted. Subsequent (to 1976) modifications to the classification are indicated and recent references provided where appropriate. A detailed revision of *Machaeranthera* section *Blepharodon* with supporting data for the classification of the genus will be published separately.

MACHAERANTHERA

Machaeranthera Nees, *Gen. Sp. Aster.* p. 224. 1832. TYPE SPECIES: *Machaeranthera tanacetifolia* (Kunth) Nees (For complete synonymy see Turner 1987). BASIONYM: *Aster tanacetifolia* Kunth, *Nov. Gen. Sp.* 4:95. 1820.

Plants herbaceous, taprooted annuals, biennials, or perennials 0.3-11.0 dm tall, glabrous or variously pubescent, often with a much branched caudex. Leaves alternate, simple, linear to broadly lanceolate, spatulate, or triangular with entire, serrate, or dentate margins or oblong to ovate in outline with deeply pinnatifid to bipinnatifid margins, the teeth or lobes often bristle tipped. Heads radiate or eradiate. Involucre depressed hemispheric to turbinate, 0.4-2.5 cm wide. Phyllaries in 2-10, usually graduated series, imbricate, linear to broadly oblong or lanceolate, the lower portion usually stiff, stramineous or purple tinged, the upper fifth to four-fifths herbaceous, often purple tinged, or with a green strip or rhombic patch, erect, spreading, or reflexed, obtuse to long attenuate, often bristle tipped. Receptacle flat or slightly convex, usually alveolate, nearly smooth or with scales to 3 mm long subtending the florets. Ray florets when present pistillate, fertile, ca. 15-60, the corollas yellow, white, pink to purple, or blue, rounded to bi- or tridentate at the apex. Disc florets perfect, fertile, ca. 30-150 or more, the corollas yellow, 5-merous, with a cylindrical tube gradually flaring into the limb, with erect or spreading, triangular lobes. Style branches of ray florets stigmatic along the entire margin; disc florets stigmatic along the lower margins with appendages broadly triangular to attenuate. Achenes linear to broadly obovate or narrowly cordate, smooth to prominently ribbed, thin to thick walled, glabrous to densely pubescent; ray achenes terete to 3 sided or laterally flattened. Pappus persistent, often reduced or lacking on the ray florets, the bristles filiform to subulate, scabrous, white to brownish, in 1-3 often weakly graduated series, dorsiventrally flattened near the base in some species. Chromosome number, $n = 2, 3, 4, 5, 8,$ or 9.

Machaeranthera, as delimited in this treatment, may be separated from related genera by the following combinations of characters. The blue and white rayed members are distinguishable from *Aster* by being mostly taprooted and by having one or more of the following features: bristly tipped phyllaries and/or spiny toothed or pinnatifid leaves; epappose ray florets; or linear to clavate achenes 3-6 mm long. They are most easily separated from *Xylorhiza* in that the taproot is not massive with copious periderm (Watson 1977). The yellow rayed members may be distinguished from related homochromous genera by the short, turbinate achenes (less than 3 mm long) and the gradually flaring (vs. abruptly dilated) disc corollas.

Key to the Subgenera and Sections of *Machaeranthera*

1. Ray florets white (sometimes yellowish when dry), pink, or purple (yellow in *M. heterophylla*, section *Blepharodon*, which grows in loose clumps with stems arising from short rhizomes, 2-3 mm thick, attached to a woody rootstock; W Nuevo León, México) or the heads eradiate (subgenus *Machaeranthera*) 2.
2. Pappus absent from ray florets, or if heads eradiate (*M. carnosa*) then flowering stems glabrous and glaucous, heads turbinate, and achenes oblong-fusiform, thin walled with 18-22 filiform nerves . 3.
3. Phyllaries in 2-3(-4) series of often nearly equal length, linear to lanceolate, 4-8 times as long as wide, the apices narrowly acute to acuminate; leaves on upper half of plant usually with entire margins; restricted mostly to grasslands or forests Section 5. *Psilactis*
- 3' Phyllaries in (3-)4-8 graduated series, broadly oblong, usually 2-4 times as long as wide, the apices broadly acute; leaves on the upper half of plant usually serrate to deeply lobed (often entire in *M. coulteri* from SW Sonora, México); restricted usually to desert regions Section 4. *Arida*
- 2' Pappus present on ray florets (often greatly reduced), or if heads eradiate (three species, section *Blepharodon*) then flowering stems pubescent, heads hemispheric to campanulate, and achenes broadly oblong to obovoid, thick walled with 6-16 wide ribs 4.
4. Achenes 3-6 mm long, the walls thin, flexible, smooth or obscurely nerved, glabrous to sparingly pubescent; pappus 5-8 mm long; leaves never pinnatifid; ray florets always present Section 3. *Hesperastrum*
- 4' Achenes 1.0-3.5 mm long, if greater than 2.5 mm long then the walls thick and bony, prominently nerved or ribbed, and moderately to densely pubescent; pappus 0.3-8.0 mm long; leaves often pinnatifid to deeply bipinnatifid; ray florets absent in some species 5.
5. Plants perennial with branching caudices (*Machaeranthera gymnocephala* taprooted, sometimes biennial, root crown little branched); pappus 3.5-8.0 mm long; receptacle with scales 0.3-1.5 mm long; leaves rarely pinnatifid, if with serrate or dentate margins the teeth usually tipped by bristles 1-4 mm long; ray florets absent in three species Section 2. *Blepharodon*

- 5' Plants taprooted annuals or short lived perennials (forming vegetative rosettes in *Aster blepharophyllus*); pappus 1.0-6.5 mm long; receptacle naked or essentially so; leaves often pinnatifid or bipinnatifid, if with toothed margins the teeth not terminated by prominent bristles (essentially entire with 8-20 prominent cilia, 0.4-0.8(-1.5) mm long, per side in *A. blepharophyllus*); ray florets present 6.
6. Leaves entire to lacinate, if deeply pinnatifid (*Machaeranthera arida*, *M. parviflora*) or bipinnatifid (*M. turneri*) then those on the upper parts of the stems less than 1.5 cm long with usually entire lobes; pappus of disc florets 2.5-4.5(-5.0) mm long; achenes thin walled with filiform nerves Section 4. *Arida*
- 6' Leaves deeply pinnatifid or more commonly bipinnatifid with irregularly toothed lobes, usually not markedly reduced above; pappus of disc florets 4.5-6.5 mm long; achenes thick walled with pronounced nerves or ribs Section 1. *Machaeranthera*
- 1' Ray florets yellow, always present; (rhizomes absent) (Subgenus *Sideranthus*) 7.
7. Achenes of disc florets broadly obovate to obscurely and narrowly cordate, the thick, bony walls with 10-12 prominent ribs, densely pubescent, the margins thickened; pappus 2-3 mm long, mostly of subulate, markedly dorsiventrally flattened bristles; plants annual; leaves deeply pinnatifid or bipinnatifid; restricted to the mountains of SW Chihuahua, México Section 8. *Stenoloba*
- 7' Achenes of disc florets oblong to narrowly obovate, the usually thin, flexible walls smooth or with 6-16 obscure ribs, glabrous to moderately pubescent, the margins not thickened; pappus 3.5-7.0 mm long, of filiform, only slightly flattened bristles; plants annual to perennial; leaves entire to bipinnatifid; occurring elsewhere 8.
8. Plants taprooted annuals; phyllaries obtuse to broadly acute, not bristle tipped; leaves serrate or dentate, the teeth blunt or terminating in a stiff callosity, not bristle tipped; achenes oblong or narrowly elliptic with 12-14 barely discernible nerves, sparsely pubescent; restricted to the lowlands of SE New Mexico and W Texas Section 7. *Havardii*
- 8' Plants perennials with much branched caudices, if taprooted annuals then phyllaries with narrowly acute to acuminate and prominently bristle tipped apices; leaves various, if serrate or dentate, the teeth bristle tipped; achenes elliptic to narrowly

obovate with 6-16 weak ribs, glabrous to moderately pubescent; widely distributed from Canada S to central México and the Cape region of Baja California Sur and adjacent islands Section 6. *Sideranthus*

MACHAERANTHERA Subgenus *MACHAERANTHERA* (Sections 1-5)

I. *Machaeranthera* subgenus *Machaeranthera*. (For complete synonymy see Turner 1987.)

Ray florets white (sometimes yellowish when dry), pink, or purple (yellow in *Machaeranthera heterophylla*, section *Blepharodon*) or the heads eradiate.

1. *Machaeranthera* section *Machaeranthera*. (For complete synonymy see Turner 1987.)

Plants taprooted annuals or biennials, 1-4 dm tall. Leaves deeply pinnatifid to bipinnatifid. Heads radiate. Involucre hemispheric to turbinate. Phyllaries in 4-7 graduated series, narrowly to broadly linear, the lower portion rigid, stramineous, with a midline, the upper fourth to three-fourths green, usually densely stipitate glandular, erect or more commonly widely divergent to reflexed, acute though usually abruptly acuminate to long attenuate. Receptacles alveolate with poorly developed scales. Ray florets usually intensely violet blue. Achenes slightly dimorphic, 2.4-3.2 mm long, narrowly obovate, flattened laterally, the walls moderately thick with 8-18 pronounced nerves or ribs, moderately pubescent; ray achenes rounded dorsally. Pappus similar in ray and disc florets, 4.5-6.5 mm long, white or tawny, the bristles filiform, not basally flattened, in 2-3 poorly defined series. Chromosome number, $n = 4$.

This section contains two species, both excellently treated by Turner (1987).

Machaeranthera tanacetifolia (Kunth) Nees, *Gen. Sp. Aster.* p. 225. 1832.

Machaeranthera tagetina E. Greene, *Pittonia* 4:71. 1899.

2. *Machaeranthera* section *Blepharodon* (DC.) R.L. Hartman, *comb. nov.* BASIONYM: *Haplopappus* section *Blepharodon* DC., *Prodr.* 5:346. 1836. TYPE SPECIES: *Aplopappus gymnocephalus* DC., *Prodr.* 5:346. 1836 (\equiv *Machaeranthera gymnocephala* [DC.] Shinn.).

Eriocarpum Nutt., Trans. Amer. Philos. Soc., ser. 2, 7:320. 1840.
 TYPE SPECIES: *Eriocarpum grindelioides* Nutt. (\equiv *Machaer-anthera grindelioides* [Nutt.] Shinn.). *Haplopappus* section *Eriocarpaea* Benth. & Hook., Gen. Pl. 2:254. 1873, based on *Eriocarpum* Nutt.

Machaeranthera series *Originales* Cronq. & Keck, Brittonia 9:237. 1957.
 TYPE SPECIES: *Machaeranthera blephariphylla* (A. Gray) Shinn.

Plants taprooted annuals, biennials, or perennials, 0.3-5.0 dm tall, often with a much branched caudex or in loose clumps with several short rhizomes, 2-3 mm thick, arising from a woody rootstock. Leaves serrate or dentate, the teeth usually bristle tipped, but entire or rarely pinnatifid in a few species. Heads radiate or eradiate. Involucre depressed hemispheric to campanulate. Phyllaries in 3-6 graduated series, linear to lanceolate, the lower portion thickened, stramineous, the upper half to one-fourth herbaceous or with a green or purple tinged strip or patch, stipitate glandular to canescent, erect to reflexed, obtuse to long attenuate and usually bristle tipped. Receptacle alveolate, with often lacerate scales 0.3-1.5 mm long. Ray florets white, pink, purple, or lavender when present (yellow in *Machaeranthera heterophylla*). Achenes slightly dimorphic, (1.0-)1.5-3.5 mm long, narrowly obovoid to oblong, the walls thick with 6-18, often prominent ribs, usually densely pubescent; ray achenes obscurely 3 sided; disc achenes compressed laterally. Pappus usually 3.5-8.0 mm long, white to tawny, the bristles dorsiventrally flattened basally, in 2-4 graduated series, the pappus of the ray florets often much reduced in size. Chromosome number, $n = 4$ or 8.

Section *Blepharodon* corresponds to series *Originales* of Cronquist & Keck (1957), a group to which they referred four species and one variety all of which I retain in section *Blepharodon*.

A key to the species of this section, full synonymy, species descriptions, geographical distributions, and detailed discussion of the phylogeny will be published separately.

Machaeranthera blephariphylla (A. Gray) Shinn., Field & Lab. 18:38. 1950.

Machaeranthera coloradoensis (A. Gray) Osterh., Torreya 27:64. 1927.
 var. *coloradoensis*.

Machaeranthera coloradoensis (A. Gray) Osterh. var. *brandegei* (Rydb.) T.J. Watson ex R.L. Hartman, *comb. nov.* BASIONYM: *Xylorhiza brandegei* Rydb., Bull. Torrey Bot. Club 32:124. 1905, non *Aplopappus brandegei* A. Gray, *Syn. Fl. N. Amer.* 1(2):132. 1884. TYPE: U.S.A. Colorado: San Juan Pass [may refer to area now known as Spring Creek Pass, W.A. Weber, pers. comm.], 1875, *T.S. Brandegei 1165* (HOLOTYPE: GH; Isotypes: NY!, UC!).

- Machaeranthera crutchfieldii* B. Turner, *Phytologia* 26:116. 1973.
- Machaeranthera grindelioides* (Nutt.) Shinn., *Field & Lab.* 18:40. 1950.
var. *grindelioides*.
- Machaeranthera grindelioides* (Nutt.) Shinn. var. *depressa* (Maguire)
Cronq. & Keck, *Brittonia* 9:237. 1957.
- Machaeranthera gymnocephala* (DC.) Shinn., *Field & Lab.* 18:40. 1950.
- Machaeranthera gypsophila* B. Turner, *Phytologia* 26:117. 1973.
- Machaeranthera heterophylla*** R.L. Hartman, *nom. nov.* Based on
Haplopappus rhizomatus M. Johnston, *Rhodora* 63:177. 1961, non
Machaeranthera rhizomata Nelson & J.F. Macbr., *Bot. Gaz.* (Craw-
fordsville) 62:148. 1916. TYPE: MÉXICO. Nuevo León: Saltillo-
Matehuala hwy., 8 km N of jct. of the side road to Galeana, 8 Oct
1959, *J. Graham & M.C. Johnston 4203* (HOLOTYPE: TEX!).

This species was placed in section *Sideranthus* by Hartman (1976) largely because of the yellow ray florets (vs. white, pink, purple, or lavender, when present, in section *Blepharodon*). According to Ray Jackson (pers. comm.; Bundrant 1987), *Machaeranthera heterophylla* crosses readily with members of section *Blepharodon* and the offspring have high seed set and meiotic regularity indicating the lack of major structural differentiation. After a re-evaluation of the fruit and vegetative morphology, I concur with Jackson on its placement in section *Blepharodon*.

- Machaeranthera johnstonii* (S.F. Blake) B. Turner, *Amer. J. Bot.* 60:837.
1973.
- Machaeranthera restiformis* B. Turner, *Amer. J. Bot.* 60:836, f. 1-5.
1973.

3. *Machaeranthera* section *Hesperastrum* A. Gray, *Proc. Amer. Acad. Arts* 6:539. 1865. TYPE SPECIES: *Machaeranthera shastensis* A. Gray, *Proc. Amer. Acad. Arts* 6:539. 1865. (\equiv *Machaeranthera canescens* [Pursh] A. Gray var. *shastensis* [A. Gray] B. Turner) (For complete synonymy see Turner 1987).

Plants taprooted annuals to short lived perennials, 0.2-10.0 dm tall. Leaves entire to coarsely serrate or dentate, the teeth bristle tipped in a few species. Heads radiate. Involucre turbinate to depressed hemispheric. Phyllaries in 3-10 graduated series, linear subulate to broadly oblong, lower portion usually thickened, stramineous, upper third to two-thirds green, or purple tinged, cinereous to densely stipitate glandular, erect to reflexed, obtuse to acuminate or long attenuate, not prominently bristle tipped. Receptacles alveolate, with

poorly developed scales mostly less than 0.3 mm long. Ray florets white to dark blue or purple. Achenes monomorphic, mostly 3-6 mm long, linear to clavate, often asymmetrical, often markedly flattened laterally, walls thin, smooth or obscurely nerved, glabrous to sparingly pubescent. Pappus similar in ray and disc florets, mostly 5-8 mm long, white or tawny, bristles filiform, not basally flattened, in 2-3 poorly defined series. Chromosome number, $n = 4$ (or 5, but probably based on erroneous counts; see Turner 1987).

In the reconstitution of *Machaeranthera* by Cronquist & Keck (1957), members of this section were treated in series *Variabiles*. I made no attempt to provide a taxonomic treatment of this extremely complex section (Hartman 1976). An excellent revision was published by Turner (1987) to which the reader is referred. He recognized 16 varieties distributed among three species as opposed to 11 species and 5 varieties listed by Cronquist & Keck.

4. *Machaeranthera* section *Arida* R.L. Hartman, *sect. nov.* TYPE SPECIES: *Machaeranthera arida* B. Turner & D. Horne.

Machaeranthera section *Psilactis* affinis sed phyllariis 4-6 seriatis inaequalibus late oblongis saepe 2-4-plo longioribus quam latoribus, apicibus late acutis et foliis saepe serratis vel profunde pinnatisectis differt.

Taprooted annuals or rarely short lived perennials, 1-4(-10) dm tall (rhizomatous, forming vegetative rosettes in *Aster blepharophyllus*). Leaves entire, dentate, lacerate to deeply pinnatifid or bipinnatifid. Heads usually radiate. Involucre depressed hemispheric to turbinate. Phyllaries in 4-8 graduated series, broadly oblong to lanceolate, lower portion usually stramineous, often with a midline, upper third to half dark green to purple tinged, often densely stipitate glandular, usually erect or occasionally spreading to reflexed, usually obtuse to broadly acute, or in inner series often acuminate, not bristle tipped. Receptacle indistinctly alveolate, naked or essentially so. Ray florets light to dark blue (absent from *Machaeranthera carnosa*). Achenes monomorphic, 1.5-2.8(-3.2) mm long, narrowly oblong, only slightly compressed laterally, the walls thin with 10-22 filiform nerves, moderately to densely pubescent. Pappus of disc florets 2.5-4.5(-5.0) mm long, white, bristles filiform, not basally flattened or only slightly so. in 2-3 poorly defined series, those of ray florets well developed or lacking. Chromosome number, $n = 5$.

Three members of section *Arida* traditionally have been placed in *Psilactis* A. Gray. Turner & Horne (1964) reduced *Psilactis* to a section of *Machaeranthera*, in part because the diagnostic feature of *Psilactis*, i.e. absence of a pappus on ray florets, segregated in a Mendelian fashion in *M. coulteri*. Furthermore, they noted the strong morphological resemblance of *M. coulteri* and *M. arida* to *M. parviflora*, a taxon which was placed with *M. tanacetifolia* and *M. tagetina* in series *Verae* by Cronquist & Keck (1957). *Machaeranthera*

parviflora, which constitutes my fourth member of section *Arida*, would not have been placed in what had been the genus *Psilactis*, because of the pappus on ray florets. Interestingly, plants of this species from Valencia and Bernalillo counties, New Mexico, N and W to SW Colorado, SE Utah, and E Arizona have epappose rays.

The four species placed in section *Arida* are diploid with a chromosomal base of $x = 5$, synthesize 7-O-glycosides of apigenin and luteolin as leaf flavonoids, and have phyllaries in 4-6 graduated series, broadly oblong; and dark green to purple tinged in upper third to half. The five members retained in section *Psilactis* are diploid with chromosome numbers of $n = 3, 4, \text{ or } 9$, synthesize 3-O-glycosides of kaempferol and quercetin, and have phyllaries in 2-3 series of nearly equal length or somewhat graduated, linear to narrowly lanceolate, green, and herbaceous throughout (Hartman 1976).

The following key is based in part on data in Turner (1986) and Nesom (1990).

1. Ray achenes with prominent pappus (heads eradiate in *M. carnosa*) .. 2.
 2. Leaves entire to toothed 3.
 3. Heads eradiate *M. carnosa*
 - 3' Heads radiate 4.
 4. Plants annual; leaf margin entire and glabrous or with 1-8 teeth/side, each spinulose tipped; involucre hemispheric, 10-16 mm wide; phyllaries linear lanceolate to oblong lanceolate, narrowly acute to acuminate or attenuate *M. riparia*
 - 4' Plants perennial, rhizomatous, forming vegetative rosettes; leaf margin essentially entire with 8-20 prominent cilia/side; involucre turbinate, 5-8 mm wide; phyllaries oblong ovate to obovate, broadly acute to short acuminate *Aster blepharophyllus*
 - 2' Leaves, at least some, pinnatifid to bipinnatifid 5.
 5. Receptacle diameter 8-11 mm; phyllary tips spreading to reflexed *M. turneri*
 - 5' Receptacle diameter 2-7 mm; phyllary tips mostly appressed *M. parviflora*
- 1' Ray achenes epappose (except in occasional plants) 6.
 6. Mid-stems essentially glabrous or with few sessile glands 7.
 7. Leaves deeply pinnatifid; restricted to SW Colorado, N New Mexico, SE Utah, and E Arizona *M. parviflora*

- 7' Leaves entire or toothed; restricted to SW Sonora,
México *M. coulteri*
- 6' Mid-stems densely glandular pubescent 8.
8. Involucre 3-6 mm high, 5-10 mm wide; mid-stems densely glandular, also with longer, crisp, eglandular trichomes interspersed; occurring in S Nevada, S California, S Arizona, and N Sonora, México *M. arida*
- 8' Involucre 6-8 mm high, 10-15 mm wide; mid-stems densely glandular, eglandular trichomes none; occurring in N Baja California Sur and adjacent W Sonora *M. crispa*

Machaeranthera arida B. Turner & D. Horne, Brittonia 16:324. 1964.

TYPE: U.S.A. California: San Bernardino Co., Mesquite Valley, 2.8 km SW of Kingston, 15 May 1941, *C.B. Wolf 10695* (HOLOTYPE: DS!; Isotypes: NY!, TEX!, UC).

Machaeranthera arizonica R. Jackson & R. Johnson, Rhodora 69: 476, f. 1. 1967. TYPE: U.S.A. Arizona: Pima Co., low, rocky hillsides and sandy soil around Quitobaquito Springs, 31 Mar 1962, *R.C. Jackson & R.R. Johnson 3043-1* (HOLOTYPE: KANU!; Isotypes: ARIZ, KANU! [2 sheets]).

Machaeranthera ammophila Rev., Bull. Torrey Bot. Club 97:172. 1970. TYPE: U.S.A. Nevada: Nye Co., on the W edge of Ash Meadows, 0.5 km W of Carson Slough, 21 Aug 1968, *J.L. Reveal & N.H. Holmgren 1882* (HOLOTYPE: US!; Isotypes: GH!, NY! [2 sheets]).

Machaeranthera arizonica was based on specimens from Quitobaquito Springs, Arizona which had been treated under *M. arida* (Turner & Horne 1964). The two species were said to differ in a number of quantitative features of ray and disc florets (Jackson & Johnson 1967), but overlap of statistical ranges for measurements is considerable for nearly all the characters. Consequently, separation of the two would require calculation of statistical means. Since delimitation of taxa is based on morphological gaps, not statistical means, this is a very unrealistic approach in systematics. Further, since other collections from the type locality of *M. arizonica* are essentially identical to *M. arida*, the two are here considered conspecific.

According to Ray Jackson (pers. comm.), "the type of *M. arizonica* is a woody-based perennial" [which is true] "found on a rocky area about the hillside origin of Quitobaquito Springs," and

"the last time I was there, new parking lot construction had apparently introduced what appeared to be *M. arida* around the parking lot and catchment pound below." This may be the case. Alternatively, after studying a number of specimens of *M. arida* from the vicinity of the Springs and elsewhere, I hypothesize the following. In this portion of the geographical range, this taxon may become perennial and even have a woody taproot. Upon germination and during initial flowering, usually in March, the leaves, especially on the lower half of the plant, are finely pinnatifid and mostly 1.5-4.0 cm long. With time and favorable growing conditions the leaves which persist, or those on subsequent growth, are merely toothed, xerophytic in adaptation, and mostly 0.3-1.2 cm long. One plant (Hartman & Chiang C. 4366; RM) of *M. arida* which was cultivated for two seasons at the Desert Botanical Garden, Phoenix, Arizona, with only occasional watering, made this transition.

Reveal & Cronquist (Reveal 1970) considered *Machaeranthera ammophila* to be a member of series *Variabiles* (\equiv section *Hesperastrum*) and most closely allied to *M. leucanthemifolia*, even though it keys to *M. parviflora* of series *Verae* (here treated in section *Arida*) in the revision of *Machaeranthera* by Cronquist & Keck (1957). I have examined the type material and find that it differs in no important features from *M. arida* and therefore consider them conspecific. Apparently, Reveal & Cronquist failed to note the epappose ray florets which are characteristic of most members of this section and of section *Psilactis*.

Machaeranthera coulteri (A. Gray) B. Turner & D. Horne, *Brittonia* 16:322. 1964. BASIONYM: *Psilactis coulteri* A. Gray, *Mem. Amer. Acad. Arts*, ser. 2, 4:72. 1849. TYPE: MÉXICO. Sonora: probably the vicinity of Guaymas, *T. Coulter 295* (HOLOTYPE: GH!).

Machaeranthera crispa (Brandege) B. Turner & D. Horne, *Brittonia* 16:321. 1964. BASIONYM: *Psilactis crispa* Brandege, *Proc. Calif. Acad. Sci.*, ser. 2, 2:169. 1889. TYPE: MÉXICO. Baja California Sur: "alkaline soil, San Joaquin, San Ignacio," 1 Apr 1889, *T.S. Brandege s.n.* (HOLOTYPE: UC; Isotypes: GH!, PH [photo, RM!], US!).

This species was thought to be restricted to the N half of Baja California Sur, but it is common in W Sonora, México (Hartman 1976). Many of these collections were interpreted by Turner (1986) as intermediates between *Machaeranthera coulteri* and *M. arida*. Based on my circumscription of the taxa, *Machaeranthera arida*

occurs in S Nevada, S Arizona, S California and N Sonora, México, S to near El Desemboque. In Sonora, *M. crispa* ranges in a strip 10-30 km wide from the vicinity of Bahía Kino to about 60 km SE of Guaymas. The geographical separation of the two taxa, as currently documented, is approximately 100 km. *Machaeranthera coulteri* is found in an area from 50 km N to 55 km SE of Guaymas and is sympatric with *M. crispa*.

From the material studied by Turner (1986 and subsequently) justifying the transfer of *Machaeranthera arida* to a variety of *M. coulteri* because of putative hybridization between the two, 19 sheets were sent for re-evaluation of my taxonomic treatment. Two were *M. coulteri* (in agreement with annotations by Turner), eight were *M. arida* (also in agreement), but nine were *M. crispa* as I define it. This last group was annotated by Professor Turner as *M. coulteri* vars. *coulteri* (2 sheets) or *arida* (2 sheets) or as intermediates (4 sheets). Four of these (Hartman, et al. 3517, LL, as *M. coulteri* var. *arida*; Hartman, et al. 3516, 2 sheets, LL, as intermediate; Powell & Averett 1524, LL, intermediate) are very similar in leaf morphology and other features to specimens of *M. crispa* from Baja California Sur and I am convinced that they are conspecific. The other specimens which I place in *M. crispa* have leaves which appear to be adapted to more xerophytic conditions (thicker texture, more uniformly toothed, reduced size). Some are from the vicinity of the good *M. crispa* mentioned above, while the remainder were collected near Guaymas. As I believe is true of *M. arida*, I hypothesize that due to yearly fluctuations in precipitation, the variation is due to phenotypic plasticity.

Machaeranthera parviflora A. Gray, *Pl. Wright*. 1:90. 1852. TYPE: U.S.A. Texas: "collected in expedition from W Texas to El Paso, N. Mex.," May-Oct 1849, *C. Wright* 271 (HOLOTYPE: GH!; Isotypes: NY!, US [photo, RM!]). *Aster parviflorus* (A. Gray) A. Gray in W.H. Brewer & S. Watson, *Bot. California* 1:322. 1876, non Nees, *Syn. Aster. Herb.* p. 29. 1818, nec. Darl., *Fl. Cestr.* p. 446. 1826. *Aster parvulus* S.F. Blake in Tidestrom, *Contr. U.S. Natl. Herb.* 25:563. 1925, based on *Machaeranthera parviflora* A. Gray.

Machaeranthera tanacetifolia (Kunth) Nees var. *pygmaea* A. Gray, *Pl. Wright*. 2:74. 1853. TYPE: U.S.A. New Mexico: near El Paso, 1851, *C. Wright* 1395 (HOLOTYPE: GH!; Isotypes: NY!, US [photo, RM!]). *Aster tanacetifolia* Kunth var. *pygmaeus* (A. Gray) A. Gray, *Syn. Fl. N. Amer.* 1(2):206. 1884. *Machaeranthera pygmaea* (A. Gray) Wootton & Standley, *Contr. U.S. Natl. Herb.* 16:189. 1913.

To these four species, which constituted section *Arida* sensu Hartman (1976), I would add the following taxa which are poorly known biosystematically.

Aster blepharophyllus A. Gray, *Pl. Wright.* 2:77. 1853, non *Machaeranthera blephariphylla* (A. Gray) Shinn., *Field & Lab.* 18:38. 1950, based on *Aplopappus blephariphyllus* A. Gray. TYPE: U.S.A. New Mexico: Hidalgo Co., Las Playas Springs, 7 Oct 1851, *C. Wright 1164* (LECTOTYPE: to be designated elsewhere, GH!, MO!, NY [photo, RM!], PH [photo, RM!], US [photo, RM!]).

Nesom, *et al.* (1990) are transferring this taxon to *Machaeranthera*, providing a new name to avoid a later homonym, and designating the lectotype. This taxon is unusual as it shares several morphological features (examples noted above in the key to the subgenera and sections) with section *Blepharodon*. Likewise, restriction site analysis of chloroplast DNA by Morgan & Simpson (1990) indicate that it is a member of that section. Conversely, probing with a ribosomal DNA gene intimated that it may not be a member of section *Blepharodon*. It is possible that *Aster blepharophyllus* was formed via hybrid speciation at the diploid level between members of sections *Arida* and *Blepharodon*.

Machaeranthera carnosus (A. Gray) Nesom, *Phytologia* 67:439. 1989. BASIONYM: *Linosyris carnosus* A. Gray, *Pl. Wright.* 2:80. 1853. TYPE: MÉXICO. Sonora: "low, subsaline valley, west of Chiricahui Mountains," Sep 1851, *C. Wright 1187* (HOLOTYPE: GH; Isotypes: PH [photo, RM!], US [2 sheets; photos, RM!]). *Aster carnosus* (A. Gray) A. Gray *ex* Hemsley, *Biol. Cent.-Amer., Bot.*, 2:120. 1881, non *Aster carnosus* Gilib., *Fl. Lit. Inch.* 1:214. 1781. *Leucosyris carnosus* (A. Gray) E. Greene, *Fl. Francisc.* 384. 1897.

Bigelovia intricatus A. Gray, *Proc. Amer. Acad. Arts* 17:208. 1882. TYPE: U.S.A. California: Mohave Desert, at Lancaster Station, *C.C. Parry s.n.* (HOLOTYPE: GH). *Aster intricatus* (A. Gray) S.F. Blake, *J. Wash. Acad. Sci.* 27:378. 1937.

Nesom (1989) transferred this taxon to *Machaeranthera* on account of its similarities to *M. riparia* and *Aster blepharophyllus*. I suggested this disposition following the rediscovery of *A. blepharophyllus* after observing the strong resemblance among these three species. Previously it had been treated by Sundberg (1986) as *Leucosyris carnosus*.

Machaeranthera riparia (Kunth) A.G. Jones, Syst. Bot. 8:85. 1983.
 BASIONYM: *Aster riparius* Kunth, Nov. Gen. Sp. 4:92. 1820.
 TYPE: MÉXICO: A.J.A. Bonpland 4308 (HOLOTYPE: P [photo, RM!]; Isotypes B, MSC).

Aster sonorae A. Gray, Smithsonian Contr. Knowl. 5(6):76. 1853.
 TYPE: U.S.A. "S. Arizona, west of the Chiricahua Mountains,"
 Sep 1851, C. Wright 1169 (HOLOTYPE: GH!; Isotypes: CGE,
 PH [photo, RM!], US [photo, RM!]). *Machaeranthera sonorae*
 (A. Gray) Stucky, Amer. J. Bot. 65:132. 1978.

This species hybridizes naturally with *M. parviflora* along the margin of Lordsburg Playa near Lordsburg, Hidalgo Co., New Mexico (Hartman, pers. observ.; W.L. Wagner, pers. comm., Wagner 3457, 3461). The two taxa also were successfully crossed artificially by Stucky & Jackson (1975).

Machaeranthera turneri Arnold & R. Jackson, Syst. Bot. 3:209. 1978.
 TYPE: MÉXICO. Chihuahua: 5.4 km N of Meoqui, along hwy. 45,
 1 Aug 1964, R.C. Jackson 4005 (HOLOTYPE: TTC).

Hartman (1976) noted that plants of *Machaeranthera parviflora* from W Texas, S New Mexico, and S Arizona are fairly uniform with receptacles (measured after achenes have fallen and phyllaries are reflexed) 2-3 mm in diameter, pappus of ray florets about half the length that of disc florets, and phyllaries with appressed apices. But these features show a clinal change with populations in the southern portion of the range (W central Coahuila and E central Chihuahua) having receptacles 8-11 mm in diameter, pappi often of nearly equal lengths on ray and disc florets, and squarrose phyllaries. The southern populations would represent *M. turneri*. A more detailed study with intensive fieldwork is needed to determine whether these two names indeed apply to extremes of a cline or whether they represent good species.

5. *Machaeranthera* section *Psilactis* (A. Gray) B. Turner & D. Horne, Brittonia 16:321. 1964. BASIONYM: *Psilactis* A. Gray, Mem. Amer. Acad. Arts, ser. 2, 4:71. 1849. TYPE SPECIES: *Psilactis asteroides* A. Gray, Mem. Amer. Acad. Arts, ser. 2, 4:72. 1849 (\equiv *Machaeranthera boltoniae* [E. Greene] B. Turner & D. Horne), non *Machaeranthera asteroides* (Torrey) E. Greene, Pittonia 3:63. 1892.

Plants taprooted annuals to short lived perennials (rhizomatous with fibrous roots and stoloniform offsets in *Machaeranthera odysseus*), 3-11 dm tall.

Leaves entire, rarely coarsely serrate (the short-persisting lower cauline and especially basal leaves often toothed to shallowly pinnatifid). Heads radiate. Involucre broadly turbinate to hemispheric. Phyllaries often stipitate glandular, in 2-4 series of nearly equal length or slightly graduated, linear to narrowly lanceolate, green and herbaceous throughout or, especially in inner series, with stiff, white to stramineous margins in lower third, apices erect, obtuse to acute or short acuminate. Receptacles indistinctly alveolate, without scales. Ray florets white to blue or violet. Achenes essentially monomorphic, 1-2 mm long (dimorphic in *M. heterocarpa*, disc achenes to 2.9 mm long), oblong or narrowly obovate, only slightly flattened laterally, walls thin with 4-10 filiform nerves (14-18 ribs in *M. heterocarpa*), moderately pubescent or glabrous. Pappus of ray florets absent, of disc florets 2-4 mm long, white bristles filiform, not basally flattened, apparently in one series. Chromosome number, $n = 3, 4, \text{ or } 9$.

The following key is based in part on data from Hartman & Lane (1987), Nesom (1990), Turner (1972), and Turner & Horne (1964). At the time this manuscript was being completed, I had only a limited selection of specimens of these taxa available for study. The remainder were on loan to TEX/LL where David Morgan was completing a detailed study of this section.

1. Ligules of ray florets 2.5-4.0 mm long; involucre 2.4-4.0 mm tall, 3-4 mm wide *M. brevilingulata*
- 1' Ligules of ray florets 5-14 mm long; involucre (4-)5-10 mm tall, 5-20 mm wide 2.
2. Plants rhizomatous with fibrous roots and stolon like offsets; stems monocephalous; basal leaves entire *M. odysseus*
- 2' Plants taprooted; stems usually all erect, with few to many heads; basal leaves, if present, entire or commonly toothed 3.
3. Involucre broadly turbinate, 5-7 mm wide, enclosing 30-75(-90) florets, phyllaries 0.5-0.7 mm wide 4.
4. Plants biennial or short lived perennial; base of cauline leaves mostly rounded to auriculate clasping; disc achenes thinly puberulent, fusiform to oblanceoloid, 1.4-2.0(-2.2) mm long, 7-9 ribbed; restricted to W Texas and N México *M. tenuis*
- 4' Plants annual; base of cauline leaves slightly, if at all, tapered; disc achenes glabrous or essentially so, irregularly oblanceoloid, 2.5-2.9 mm long, 14-18 ribbed; restricted to gulf coastal Texas *M. heterocarpa*
- 3' Involucre hemispheric, 6-20 mm wide, enclosing 75-200 florets, phyllaries 0.75-2.10 mm wide 5.

5. Ligules of ray florets 5-7 mm long, 0.8-1.0 mm wide, uppermost leaves not markedly ampliate at the base; lower leaves and stem pubescent with short, appressed, eglandular hairs *M. boltoniae*
- 5' Ligules of ray florets (6-)7-14 mm long, 1.0-1.8 mm wide; uppermost leaves markedly ampliate at base; lower leaves and stem pubescent with glandular hairs 6.
6. Uppermost leaves narrowly ampliate, scarcely cordate; involucre 10-14 mm wide, phyllaries 4-6 mm long; disc corollas 3.2-4.2 mm long; pappus 2.6-3.2 mm long *M. mexicana*
- 6' Uppermost leaves broadly ampliate, nearly cordate; involucre 16-20 mm wide, phyllaries 6-8 mm long; disc corollas 4.5-5.0 mm long; pappus 4.0-4.5 mm long *M. gentryi*

Species retained in this section *sensu* Turner & Horne (1964) are listed below. See that publication for complete synonymy.

- Machaeranthera boltoniae* (E. Greene) B. Turner & D. Horne, Brittonia 16:328. 1964. BASIONYM: *Aster boltoniae* E. Greene, Pittonia 3:248. 1897. TYPE: U.S.A. Texas: El Paso Co., El Paso, 12 Sep 1884, *M.E. Jones 4207* (one of two specimens cited: NDG, NY [photo, RM!]).
- Machaeranthera brevilingulata* (Schultz-Bip. *ex* Hemsley) B. Turner & D. Horne, Brittonia 16:324. 1964. BASIONYM: *Psilactis brevilingulata* Schultz-Bip. *ex* Hemsley, *Diagn. Pl. Nov. Mexic.* 2:34. 1879. TYPE: MÉXICO: about Tacubaya, Sep 1854, *W. Schaffner 211* (HOLOTYPE: K; Isotype: GH!). *Aster brevilingulatus* (Schultz-Bip. *ex* Hemsley) McVaugh, *Contr. Univ. Michigan Herb.* 9:362. 1972.
- Machaeranthera gentryi* (Standley) R. Jackson *ex* B. Turner, *Phytologia* 25:57. 1972. BASIONYM: *Aster gentryi* Standley, *Field Mus. Nat. Hist., Bot. Ser.* 22:60. 1940. TYPE: MÉXICO. Chihuahua: Río Mayo, Memelichi, elev. 2250 m, 15 Sep 1936, *H.S. Gentry 2728* (HOLOTYPE: F; Isotype: US!).
- Machaeranthera mexicana* B. Turner & D. Horne, Brittonia 16:330. 1964. TYPE: MÉXICO. México: ca. 35 km W of Toluca along hwy. 15, 3 Aug 1960, *R.M. King 3595* (HOLOTYPE: TEX!; Isotypes: MICH, NY! [2 sheets], US [photo, RM!]).
- Machaeranthera tenuis* (S. Watson) B. Turner & D. Horne, Brittonia 16:326. 1964. BASIONYM: *Psilactis tenuis* S. Watson, *Proc. Amer.*

Acad. Arts 26:139. 1891. TYPE: MÉXICO. Nuevo León: Sierra Madre, near Monterrey, 15 Jun 1888, *C.G. Pringle 2238* (HOLOTYPE: GH!).

To these five taxa I would add the following, which are less well known biosystematically.

Machaeranthera heterocarpa R.L. Hartman & Lane, *Brittonia* 39:253. 1987. TYPE: U.S.A. Texas: San Patricio Co., Welder Wildlife Refuge, ca. 2.4 km E of headquarters, 20 Oct 1973, *R.L. Hartman 3785* (HOLOTYPE: RM!; Isotypes: NY!, TEX!).

Machaeranthera odysseus Nesom, *Syst. Bot.* 3:218. 1978. TYPE: MÉXICO. Nuevo León: Cerro Peña Nevada, ca. 5 km NE of mountain locally known as Picacho Onofre or 35 km ENE of Doctor Arroyo, 28 Jul 1977, *G.L. Nesom R585* with C. Wells (HOLOTYPE: US [photo, RM!]; Isotypes: ENCB, GH, LL, MEXU, NCU, RM!, TTC, US! [photo, RM]).

This section is diverse chromosomally. It appears to be based on $x = 4$, as three taxa have $n = 4$. *Machaeranthera heterocarpa* with $n = 3$ is likely derived through descending aneuploidy from *M. tenuis*, the taxon with which it was long confused, or a common ancestor (Hartman & Lane 1987). There is no published chromosome count for *M. gentryi*, which is known only from the type. It is most similar to the taxa (especially *M. mexicana*) with $n = 4$. Finally, two species, *M. brevilingulata* and *M. odysseus*, appear anomalous, having a haploid number of $n = 9$. Based on general morphology and chromosome number, it is quite likely that *Aster pauciflorus* Nutt., which was treated as the sole member of *Aster* subgenus *Almutaster* by Sundberg (1986), belongs with the latter two taxa. Further study will be necessary to confirm this disposition (Semple & Hartman, unpubl.). Interestingly, *A. pauciflorus* (as *A. hydrophyllus* E. Greene) and *A. riparius* (\equiv *M. riparia*) were crossed by Stucky & Jackson (1975) to *M. parviflora* of section *Arida*. Consequently, it is possible that none of the species used in the intergeneric crossing portion of their study on DNA content and chromosome evolution in Astereae was from outside the natural circumscription of *Machaeranthera* sections *Arida* and *Psilactis* (Semple & Hartman, unpubl.).

MACHAERANTHERA Subgenus *SIDERANTHUS* (Sections 6-8)

- II. *Machaerantha* subgenus *Sideranthus* (Nutt. ex Nees) R.L. Hartman, *comb. nov.* BASIONYM: *Sideranthus* Nutt. ex Nees in Wied-Neuw., *Reise Nord-America* 2:440. 1841. *Dieteria* subgenus *Sideranthus* (Nutt. ex Nees) Nutt., J. Acad. Nat. Sci. Philadelphia, ser. 2, 1:177. 1848. TYPE SPECIES: *Dieteria spinulosa* (Pursh) Nutt., Trans. Amer. Philos. Soc., ser. 2, 7:301. 1840 (\equiv *Machaerantha pinnatifida* [Hook.] Shinn.).

Ray florets yellow, always present.

6. *Machaerantha* section *Sideranthus* (Nutt. ex Nees) R.L. Hartman, *comb. nov.* BASIONYM: *Sideranthus* Nutt. ex Nees in Wied-Neuw., *Reise Nord-America* 2:440. 1841. TYPE SPECIES: *Dieteria spinulosa* (Pursh) Nutt. *Dieteria* section *Sideranthus* (Nutt. ex Nees) Nutt. ex Walp., *Repert. Bot. Syst.* 2:587. 1843.

Plants taprooted annuals, biennials, or perennials, sometimes with a much branched caudex, 0.3-7.0 dm tall. Leaves entire, serrate, dentate, or pinnatifid to deeply bipinnatifid, teeth or lobes usually bristle tipped, often markedly so. Heads radiate. Involucre broadly turbinate to depressed campanulate. Phyllaries in 4-8 graduated series, linear to narrowly oblong, lower portion rigid, light green to stramineous, upper half to fifth with a green patch or strip (sometimes blackish near apex), usually pubescent, often with glandular trichomes, erect to squarrose, obtuse to acuminate, usually tipped by a stiff and often pronounced bristle. Receptacles usually alveolate, scales poorly developed or to 3 mm long. Ray florets yellow. Achenes often dimorphic, 1.5-3.2 mm long, elliptic to narrowly obovate, walls thin with 6-16 nerves or weak ribs, glabrous to moderately pubescent; ray achenes usually rounded on dorsal edge, often asymmetrical, and slightly shorter; disc achenes flattened laterally. Pappus 3.5-6.0 mm long, white to tawny, bristles slightly to moderately dorsoventrally flattened basally, in 2-4 markedly graduated series; pappus of ray florets sometimes reduced in length. Chromosome number, $n = 2, 3, 4, \text{ or } 8$.

1. Plants annual with herbaceous stems; involucre eglandular2.
2. Leaves with entire margins, not bristle lined, or lower cauline and basal ones tridentate or sometimes pinnatifid; restricted to Sierra San Pedro Mártir, NE Baja California, México *M. wigginsii*
- 2' Leaves uniformly spinulose toothed or lobed, bristles usually 1.5-3.0 mm long; phyllaries (except innermost series) tipped by bristles usually 0.6-1.5 mm long; occurring elsewhere *M. gracilis*

- 1' Plants perennial, stems with woody bases; involucre glandular 3.
3. Bracts of upper peduncles imbricate and grading into phyllaries; stems nearly leafless above base *M. juncea*
- 3' Bracts few and not grading into phyllaries; stems leafy or leaves reduced near the inflorescence 4.
4. Phyllaries strongly squarrose in upper half; leaves thickish, usually oblanceolate to spatulate with bluntly dentate to subentire margins; restricted to Cape region of Baja California Sur and adjacent islands *M. arenaria*
- 4' Phyllaries with appressed to spreading apices; leaves thin, usually oblong to lanceolate with prominent teeth or lobes; found throughout much of SW Canada, W United States, and N half of México *M. pinnatifida*

This section contains five species following the transfer of *Machaeranthera heterophylla* to section *Blepharodon* (see above).

Machaeranthera arenaria (Benth.) Shinn., Field & Lab. 18:40. 1950.
 BASIONYM: *Aplopappus arenarius* Benth., Bot. Voy. Sulphur p. 24. 1844. TYPE: MÉXICO. Baja California Sur: Cabo San Lucas, 1841, R.B. Hinds s.n. (HOLOTYPE: K; Isotype: DS! as photo).

Machaeranthera gracilis (Nutt.) Shinn., Field & Lab. 18:41. 1950.
 BASIONYM: *Dieteria gracilis* Nutt., J. Acad. Nat. Sci. Philadelphia, ser. 2, 1:177. 1848, non *Aster gracilis* Nutt., Gen. N. Amer. Pl. 2:158. 1818. TYPE: U.S.A. New Mexico: near Santa Fe, W. Gambel s.n. (HOLOTYPE: GH!; Isotype: K). *Aplopappus gracilis* (Nutt.) A. Gray, Mem. Amer. Acad. Arts, ser. 2, 4:76. 1849. *Aster dieteria* Kuntze, Revis. Gen. Pl. 1:315. 1891, based on *Dieteria gracilis* Nutt. *Eriocarpum gracile* (Nutt.) E. Greene, Erythea 2:190. 1894. *Sideranthus gracilis* (Nutt.) Nelson, Bot. Gaz. (Crawfordsville) 37:266. 1904.

Haplopappus ravenii R. Jackson, Amer. J. Bot. 49:123. 1962.
 TYPE: U.S.A. Arizona: Yavapai Co., near Johnson Wash, ca. 16 km S of the Verde River, 8 Jun 1959, R.C. Jackson 2680 (HOLOTYPE: KANU!).

This species is treated in the broad sense to include the $n = 4$ *Haplopappus ravenii* in addition to the $n = 2$ and 3 chromosomal races. According to Jackson (1962; 1971), the $n = 4$ race can be distinguished from the other two on the basis of floret and phyllary morphology. The former is said to possess fewer and shorter pappus

bristles, shorter achenes, and phyllaries that are covered by stiffer and more erect trichomes. I have been unable to make this distinction with confidence. It is true that *H. ravenii* (based on specimens from its described geographic range, but not confirmed by chromosome counts) has phyllaries with trichomes which are often sparse and ascending to spreading versus more numerous, generally appressed, and longer. Unfortunately, in surveying several hundred sheets of *Machaeranthera gracilis* sensu lato, approximately twenty percent showed intermediacy in this character. Formal recognition of the $n = 4$ race has been questioned by Cronquist (1971) and others.

Machaeranthera juncea (E. Greene) Shinn., Field & Lab. 18:40. 1950. BASIONYM: *Aplopappus junceus* E. Greene, Bull. Calif. Acad. Sci. 1:190. 1885. TYPE: U.S.A. California: San Diego Co., Cleveland, M.K. Curran s.n. (HOLOTYPE: NDG). *Eriocarpum junceum* (E. Greene) E. Greene, Erythea 2:108. 1894. *Sideranthus junceus* (E. Greene) Davidson & Moxley, Fl. S. California p. 377. 1923.

Machaeranthera pinnatifida (Hook.) Shinn., Sida 1:295. 1964. BASIONYM: *Diplopappus pinnatifidus* Hook., Fl. Bor.-Amer. 2:22. 1834. TYPE: CANADA. Saskatchewan: Rocky Mountains near Jasper's Lake, T. Drummond s.n. (HOLOTYPE: K?; Isotype: NY [photo, RM!]).

For complete synonymy and a taxonomic treatment of this polymorphic species, the reader is referred to Turner & Hartman (1976). A total of seven varieties distributed between two subspecies are recognized. They often intergrade in areas of sympatry.

Machaeranthera wigginsii (S.F. Blake) R.L. Hartman, *comb. nov.* BASIONYM: *Haplopappus wigginsii* S.F. Blake, Proc. Biol. Soc. Wash. 48:169. 1935. TYPE: MÉXICO. Baja California: Sierra San Pedro Mártir, 18 Sep 1930, I.L. Wiggins & D. Demaree 4914 (HOLOTYPE: US!).

This species, which is restricted to the Sierra San Pedro Mártir of NE Baja California, is most closely related to *Machaeranthera gracilis*.

7. *Machaeranthera* section *Havardii* (R. Jackson) R.L. Hartman, *comb. nov.* BASIONYM: *Haplopappus* section *Havardii* R. Jackson, Univ. Kansas Sci. Bull. 46:479. 1966. TYPE SPECIES: *Haplopappus havardii* Waterf.

Plants taprooted annuals, 1.5-4.5 dm tall. Leaves serrate or dentate, often coarsely so, teeth blunt or terminating in stiff callosities, not bristle tipped. Heads radiate. Involucre broadly turbinate. Phyllaries in 5-7 graduated series, linear to narrowly oblong, lower portion rigid, stramineous, upper fifth to half with green patch or strip, densely glandular, erect, obtuse to acute. Receptacles alveolate, with scales to 0.4 mm long. Ray florets yellow. Achenes essentially monomorphic, 2.5-3.0 mm long, oblong or narrowly elliptic, sometimes slightly asymmetrical, flattened laterally, walls thin with 12-14 nerves, sparsely pubescent. Pappus similar in ray and disc florets, 5-7 mm long, white, bristles filiform, not basally flattened, in 2-3 poorly defined series. Chromosome number, $n = 4$.

Machaeranthera viscida (Wooton & Standley) R.L. Hartman, *comb. nov.* BASIONYM: *Sideranthus viscidus* Wooton & Standley, Contr. U.S. Natl. Herb. 16:180. 1913. TYPE: U.S.A. New Mexico: Eddy Co., near Hope, 3 Aug 1905, *E.O. Wooton s.n.* (HOLOTYPE: US [photo, RM!]). *Haplopappus viscidus* (Wooton & Standley) S.F. Blake, J. Wash. Acad. Sci. 28:486. 1938.

Haplopappus havardii Waterf., Rhodora 45:352. 1943. TYPE: U.S.A. Texas: Culberson Co., 13.6 km E Van Horn, *U.T. Waterfall 4153* (HOLOTYPE: GH; Isotypes: ARIZ!, MO, NY!). *Machaeranthera havardii* (Waterf.) Shinn., Field & Lab. 18:40. 1950.

A species restricted to Chaves, Eddy, and Lea counties, New Mexico and Culberson, Ector, and Hudspeth counties, Texas. Until recently (Jackson 1969) it was usually called *Machaeranthera havardii* (or *Haplopappus havardii*) but this name is a synonym of *M. viscida*, an earlier name that had been "misplaced" in synonymy under the very different *H. spinulosus* (\equiv *M. pinnatifida*) by Hall (1928).

8. ***Machaeranthera*** section *Stenoloba* R.L. Hartman, *sect. nov.* TYPE SPECIES: *Machaeranthera stenoloba* (E. Greene) Shinn.

A *Machaeranthera* section *Sideranthus* acheniis disci late obovatis vel leviter angustaque cordatis parietibus crassis costis prominentibus in quoque facie 5-6, dense pubescentibus marginibus incrassatis, pappo 2-3 mm longis pro parte maxima setis subulatis valde dorsiventraliter complanatus.

Plants taprooted annuals or possibly biennials, (1-)2-4 dm tall. Leaves deeply pinnatifid with linear to subulate lobes tipped by weak seta, often

bipinnatifid on lower part of plant. Heads radiate. Involucre depressed hemispheric. Phyllaries in 4-5 weakly graduated series, narrowly to broadly linear, lower portion rigid, stramineous, with a midline, upper half to two-thirds green or purple tinged, densely stipitate glandular, spreading to reflexed, long attenuate. Receptacles alveolate, with scales less than 0.2 mm long. Ray florets yellow. Achenes dimorphic, ca. 2.5-3.0 mm long, broadly obovate to obscurely and narrowly cordate, usually symmetrical, walls thick, with 10-12 prominent ribs, densely pubescent, margins markedly thickened; ray achenes wedge shaped in cross section; disc achenes compressed laterally. Pappus similar in ray and disc florets, 2-3 mm long, tawny, bristles subulate to filiform, in 3-5 graduated series, markedly dorsiventrally flattened basally. Chromosome number, $n = 4$ (Ralston, *et al.* 1989; G. Brown, unpubl.).

Machaeranthera stenoloba (E. Greene) Shinn., *Field & Lab.* 18:40. 1950. BASIONYM: *Eriocarpum stenolobum* E. Greene, *Erythea* 2:109. 1894. TYPE: MÉXICO. Chihuahua: Sierra Madre, sandy flats, Arroyo Ancho, 16 Oct 1887, *C.G. Pringle 1903* (HOLOTYPE: NDG; Isotypes: GH!, NY!, PH!). *Haplopappus stenolobus* (E. Greene) H.M. Hall, *Publ. Carnegie Inst. Wash.* 389:65. 1928.

Aplopappus tenuilobus A. Gray *ex* E. Greene, *Erythea* 2:109. 1894, *pro syn.*, *non* A. Gray, *Proc. Amer. Acad. Arts* 21:385,432. 1886.

This very distinctive and showy species is restricted to the mountains of SW Chihuahua, México, having been collected only a few times and apparently rare (G.L. Nesom, pers. comm.).

EXCLUDED SPECIES

Haplopappus brickellioides S.F. Blake, *Proc. Biol. Soc. Wash.* 35:173. 1922. Type: U.S.A. Nevada: Nye Co., Sheep Mountain, Ash Meadows, May-Oct 1898, *J.A. Purpus 6022* (HOLOTYPE: US [photo, RM!]; Isotypes: NY [photo, RM!], UC!).

Hall (1928) included this species in *Haplopappus* section *Blepharodon*, but Jackson (1968) has shown that its affinities are with *Haplopappus* section *Hazardia* or the genus *Hazardia* (Clark 1979).

Machaeranthera aurea (A. Gray) Shinn., *Field & Lab.* 18:41. 1950. \equiv *Haplopappus aureus* A. Gray, *Mem. Amer. Acad. Arts*, ser. 2, 4:76. 1849. Type: U.S.A. Texas: Harris Co.?, low prairies near Houston, Sep-Oct, *C. Wright s.n.* (HOLOTYPE: GH!; Isotypes: PH!, US!).

This species is a member of the "Phyllocephalus" group of *Haplopappus*; see discussion below.

Machaeranthera annua (Rydb.) Shinn., Sida 1:378. 1964. \equiv *Haplopappus annuus* (Rydb.) Cory, Rhodora 38:407. 1936. BASIONYM: *Sideranthus annuus* Rydb., Bull. Torrey Bot. Club 31:653. 1904, new name for *Aplopappus rubiginosus* Torrey & A. Gray in A. Gray, *Syn. Fl. N. Amer.* 1(2):130. 1884, non Torrey & A. Gray, *Fl. N. Amer.* 2:240. 1842. TYPE: U.S.A. Texas: *T. Drummond 110* (HOLOTYPE: GH; Isotype: NY [photo, RM!]).

This species is a member of the "Phyllocephalus" group of *Haplopappus*; see discussion below.

Machaeranthera kingii (D. Eaton) Cronq. & Keck, Brittonia 9:239. 1957. \equiv *Aster kingii* D. Eaton, *Botany Fortieth Parallel* 5:141,142, pl. 16. 1871. TYPE: U.S.A. Utah: above Cottonwood Canyon, Wasatch Mountains, 2748 m, Aug 1869, *S. Watson 507* (HOLOTYPE: YU?; Isotypes: NY [photo, RM!], US [photo, RM!]).

Machaeranthera kingii (D. Eaton) Cronq. & Keck var. *barnebyana* Welsh & Goodrich, Brittonia 33:299,300. 1981. \equiv *Aster kingii* D. Eaton. TYPE: U.S.A. Utah: Millard Co., Canyon Mountains, Eightmile Creek, 11 km WNW from Scipio, 2350 m, 12 Aug 1980, *S. Goodrich 14929* (HOLOTYPE: BRY; Isotypes: GH, NY, RM!, UC, US [photo, RM!], USFS!, UT, UTC).

Machaeranthera cognata (H.M. Hall) Cronq. & Keck, Brittonia 9:239. 1957. \equiv *Xylorhiza cognata* (H.M. Hall) T.J. Watson (see Watson 1977, for a revision of *Xylorhiza*).

Machaeranthera frutescens (S. Watson) Cronq. & Keck, Brittonia 9:239. 1957. \equiv *Xylorhiza frutescens* (S. Watson) E. Greene, Pittonia 3:48. 1896 (see Watson 1977).

Machaeranthera glabriuscula (Nutt.) Cronq. & Keck, Brittonia 9:239. 1957. \equiv *Xylorhiza glabriuscula* Nutt., Trans. Amer. Philos. Soc., ser. 2, 7:297. 1840 (see Watson 1977).

Machaeranthera glabriuscula (Nutt.) Cronq. & Keck var. *confertifolia* Cronq., Leaf. W. Bot. 10:11. 1963. \equiv *Xylorhiza confertifolia* (Cronq.) T.J. Watson (see Watson 1977).

Machaeranthera glabriuscula (Nutt.) Cronq. & Keck var. *villosa* (Nutt.) Cronq. & Keck, Brittonia 9:239. 1957. \equiv *Xylorhiza glabriuscula* Nutt. var. *glabriuscula* (see Watson 1977).

Machaeranthera orcuttii (Vasey & Rose) Cronq. & Keck, *Brittonia* 9:239. 1957. \equiv *Xylorhiza orcuttii* (Vasey & Rose) E. Greene, *Pittonia* 3:48. 1896 (see Watson 1977).

Machaeranthera phyllocephala (DC.) Shinn., *Field & Lab.* 18:40. 1950. \equiv *Haplopappus phyllocephalus* DC., *Prodr.* 5:347. 1936. TYPE: MÉXICO. Tamaulipas: between San Fernando and Matamoros, 1832, *J.L. Berlandier* 2278 (HOLOTYPE: G [photo, RM!]; Isotypes: G, K, NY [photo, RM!]).

This species is a member of the "Phyllocephalus" group of *Haplopappus*; see discussion below.

Machaeranthera phyllocephala (DC.) Shinn. var. *megacephala* (Nash) Shinn., *Field & Lab.* 18:40. 1960. \equiv *Haplopappus phyllocephalus* DC. BASIONYM: *Eriocarpum megacephalum* Nash, *Bull. Torrey Bot. Club* 23:107. 1896. TYPE: U.S.A. Florida: Manatee Co., S shore of Sneed's Island, near mouth of Manatee River, 21-23 Aug 1895, *G.V. Nash* 2492 (HOLOTYPE: NY!: Isotypes: G, GH, K, NDG, PH [photo, RM!], US [photo, RM!]).

This species is a member of the "Phyllocephalus" group of *Haplopappus*; see discussion below.

Machaeranthera tortifolia (Torrey & A. Gray) Cronq. & Keck, *Brittonia* 9:239. 1957. \equiv *Xylorhiza tortifolia* (Torrey & A. Gray) E. Greene, *Pittonia* 3:48. 1896 (see Watson 1977).

Machaeranthera tortifolia (Torrey & A. Gray) Cronq. & Keck var. *imberbis* Cronq., *Leaf. W. Bot.* 10:12. 1963. \equiv *Xylorhiza tortifolia* (Torrey & A. Gray) E. Greene var. *imberbis* (Cronq.) T.J. Watson (see Watson 1977).

Machaeranthera venusta (M.E. Jones) Cronq. & Keck, *Brittonia* 9:239. 1957. \equiv *Xylorhiza venusta* (M.E. Jones) A.A. Heller, *Muhlenbergia* 1:8. 1900 (see Watson 1977).

Machaeranthera wrightii (A. Gray) Cronq. & Keck, *Brittonia* 9:239. 1957. \equiv *Xylorhiza wrightii* (A. Gray) E. Greene, *Pittonia* 3:47. 1896 (see Watson 1977).

The "Phyllocephalus" group of *Haplopappus* currently is under study by Hartman and Lane (Hartman & Lane 1984; Lane 1982; Lane & Hartman 1984; Lane & Hartman 1985; Lane, *et al.* 1987). It is part of an $x = 6$ chromosomal line which includes *Isocoma*, *Stephanodoria*, *Grindelia*, *Xanthocephalum*, *Olivaea*, *Prionopsis*, probably *Pyrrocoma* and *Oonopsis*, and perhaps *Xylorhiza*. In addition to the common chromosomal base, most of these genera share a

suite of characters including goblet shaped disc corollas, deltate style branch appendages, and corolla epidermal cells that are only 3 to 4 times longer than wide and have broad longitudinal ridges and transverse endwalls. The relationship of a subset of these genera is supported by a recent analysis of chloroplast DNA restriction site mutations (Nesom, *et al.* 1990). Furthermore, hybridization studies by Jackson & Dimas (1981) indicate that the "Phyllocephalus" group is closely related to, if not congeneric with, *Isocoma* (or *Haplopappus* section *Isocoma*).

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CORRECTIONS AND ADDITIONS

1. Volume 67, issue 1, page 107, DOMINICA for DOMINICAN REPUBLIC in title and type citation; Dominica for Hispaniola in abstract (see page 146 of volume 68).
2. Volume 67, issue 6, page 468, first line, second paragraph, Sida for Side.
3. Volume 67, issue 6, page 479, last line, 4th paragraph; described for describes.
4. Volume 67, issue 6, page 512, publication dates are for issues of volume 67 not 66.
5. Volume 68, issue 1, page 28, first line of fourth paragraph should read:
Cupressus chengiana Hu var. *jiangeensis* (Zhao) Silba "Jiange Cypress"
6. Volume 68, issue 1, page 32, first line of first full paragraph should read:
Falcatifolium usan-apuensis de Laubenfels & Silba, *spec. nov.*
7. Volume 68, issue 1, page 37, first line of first paragraph should read:
Larix griffithiana (Lindl. & Gord.) Carrière var. *speciosa* (Cheng & Law) Silba,
8. Volume 68, issue 1, page 45, last line of fifth paragraph, substitute 5349 for 4055.
9. Volume 68, issue 1, page 46, fourth line of fourth paragraph, substitute 22671 for 2267.
10. Volume 68, issue 1, page 46, first line of eighth paragraph should read:
Picea wilsonii Masters var. *watsoniana* (Mast.) Silba, *stat. nov.* "Watson Spruce"
11. Volume 68, issue 1, page 60, first line of last paragraph should read:
Pinus radiata D. Don var. *cedrosensis* (Howell) Silba, *stat. nov.* "Cedros Pine"
12. Volume 68, issue 3, cover, insert:

B.L. TURNER, An overview of the *Brickellia lemmonii* (Asteraceae: Eupatorieae) complex (including *B. conduplicata*). 160

Corrected versions of the cover were mailed to subscribers along with issue 5.
13. Volume 68, issue 4, page 270, *guadalupense* should read *guadalupensis*.
14. Volume 68, issue 5, page 340, *Cirsium horridulum* is a separate entry from *Borrchia frutescens*.

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