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CONTENTS

- J.T. KARTESZ & K.N. GANDHI, Nomenclatural notes for the North American Flora. III 129
- T.M. BARKLEY, New taxa in *Senecio* from México 138
- B.L. TURNER, An overview of the Mexican genus *Digitocalia* (Asteraceae, Senecioneae) 150
- A. LOWRIE & S. CARLQUIST, A new species of tuberous *Drosera* from Western Australia 160
- G.L. NESOM, Taxonomy of *Erigeron bellidiastrum* (Asteraceae: Astereae), with a new variety 163
- B.L. TURNER, *Vernonia diazjunana* (Asteraceae, Vernonieae), a new species from Jalisco, México 169
- B.L. TURNER, A new species of *Neurolaena* from southern México 172
- R. JOHNSON & J. JOHNSON, *Polygonella polygama* (Vent.) Englem. & Gray, new to Louisiana 175
- R.R. ROSEMAN, New species, varieties, and combinations in *Bidens* sect. *Greenmania* (Asteraceae: Coreopsideae) 177
- T.E. MELCHERT, New names and combinations in *Cosmos* (Asteraceae: Coreopsideae) 189
- T.E. MELCHERT, *Cosmos caudatus* (Asteraceae: Coreopsideae) in México: a taxonomic reappraisal 200
- Contents continued on the inside cover.

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T.E. MELCHERT, New taxa and new combinations in <i>Thelesperma</i> (Asteraceae: Coreopsideae) from México	216
G.L. NESOM, Taxonomy of the <i>Erigeron pringlei</i> group (Asteraceae: Astereae)	227
Books received	236

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NOMENCLATRURAL NOTES FOR THE NORTH AMERICAN FLORA. III.

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ABSTRACT

Authorship of the following names is discussed: *Cyclosperrum leptophyllum*, *Helianthus pauciflorus* Nutt. ssp. *subrhomboideus*, and *Lomatium macrocarpum*. The names *Luzula multiflora* (Ehrh.) Hoffm. var. *kobayashii* (Satake) Samuelsson and *Viola bicolor* Pursh are accepted as being correct. The name ***Luzula multiflora* var. *contracta*** is validated by the provision of a Latin diagnosis. One new combination is proposed: ***Platanthera zothecina* comb. nov.**

KEY WORDS: Floristics, nomenclature, North America, Apiaceae, Asteraceae, Juncaceae, Orchidaceae, Violaceae.

INTRODUCTION

Continuing with the "Nomenclatural notes for the North American Flora. I and II" (Kartesz & Gandhi 1989a, 1989b), a third note in the series is presented here toward the advancement of our understanding of North American plants.

APIACEAE

Cyclosperrum leptophyllum

The name *Cyclosperrum leptophyllum*, for the pantropical, European weed, was proposed by Sprague (J. Bot. 61:131. 1823) as a new combination based on *Pimpinella leptophyllum* Pers. The authorship of this new combination has generally been attributed to "(Pers.) Sprague" (Liogier & Martorell 1982;

Howard 1989; Constance & Affolter 1990). When Sprague proposed the above combination, he stated that his new combination is for those "who follow Lagasca and Calestani in treating *Pimpinella leptophylla* Pers. as the type of an independent genus" (i.e., *Cyclospermum*). On the same page, Sprague chose to accept the name *Apium leptophyllum* and cited his new combination as a synonym for it. Since Sprague did not accept his new combination, he cannot be the author of the name (Art. 34.1; Greuter 1988). Therefore, the first to use and accept the new combination *C. leptophyllum* in publication, automatically validates it. In reviewing the pertinent literature, Britton & Wilson (1925) appear to have been the first to do so, and thus, validate the new combination. Although 102 years passed between the publications of Sprague and of Britton & Wilson, no earlier publication is known to have used the name; hence, we conclude that Britton & Wilson must be credited for the new combination. Regarding the authorship of the new combination *A. leptophyllum*, some workers (e.g., Constance & Affolter 1990) believe that F. Mueller must be credited as the combining author. However, Bentham (1863; p. 12) clearly stated that "I alone am therefore responsible for the details of this work." The bibliographical references are provided below:

Cyclospermum leptophyllum (Pers.) Sprague ex Britton & Wilson, Bot. Porto Rico 6:52. 1925. *Cyclospermum leptophyllum* (Pers.) Sprague, J. Bot. 61:131. 1823, (*nomen invalid.*). BASIONYM: *Pimpinella leptophylla* Pers., Syn. Pl. 1:324. 1805. *Apium leptophyllum* (Pers.) F. Muell. ex Benth., Fl. Australia 3:372. 1867.

Lomatium macrocarpum

Torrey & Gray (1840) described *Peucedanum macrocarpum* and attributed the name to Nuttall. They cited *Ferula macrocarpa* Hook. & Arn. (1839) with a "?" mark, in synonymy. Obviously, this citation has led some workers to believe that *Ferula macrocarpa* is the basionym for *P. macrocarpum*. Coulter & Rose (Contr. U.S. Natl. Herb. 7:217. 1900) transferred *P. macrocarpum* to the genus *Lomatium* and cited *P. macrocarpum* Nuttall (from Torrey & Gray), but did not make a reference to Hooker & Arnott.

Regarding Coulter & Rose's new combination (*Lomatium macrocarpum*), Hiroe (1979) cited "Hook. & Arn." as the parenthetical authors, rather than Torrey & Gray. It is possible that Hiroe assumed that Coulter & Rose indirectly cited Hooker & Arnott, by citing Torrey & Gray, who had mentioned Hooker & Arnott in synonymy. To help clarify the situation, we quote from Torrey & Gray: "We have described this plant from specimens collected by Mr. Nuttall. It may not be identical with *Ferula macrocarpa* H. & A." It is evident from the above statement that the type specimen for *Peucedanum*

macrocarpum is that of Nuttall (on deposit in PH, as per Coulter & Rose), but not that of *F. macrocarpa*. Thus, the name *P. macrocarpum* cannot be considered as a new combination, but rather a name dating from 1840. Hence, the correct author citation for *P. macrocarpum* is: Nutt. ex Torrey & A. Gray. Since Coulter & Rose did not refer to Hooker & Arnott, but rather cited *P. macrocarpum* Nutt. as the basionym, the correct author citation for *L. macrocarpum* is: "(Nutt. ex Torrey & A. Gray) Coult. & Rose."

Although *Ferula macrocarpa* is the oldest name in this species complex, it cannot be transferred to *Lomatium*, since it would create a later homonym of *L. macrocarpum* (Nutt. ex Torrey & A. Gray) Coult. & Rose.

Lomatium macrocarpum (Nutt. ex Torrey & A. Gray) Coult. & Rose, Contr. U.S. Natl. Herb. 7:217. 1900. *Peucedanum macrocarpum* Nutt. ex Torrey & A. Gray, *Fl. N. Amer.* 1:627. 1840.

Ferula macrocarpa Hook. & Arn., *Bot. Beechey Voy.* 348. 1839.

ASTERACEAE

Helianthus

The new combination *Helianthus pauciflorus* Nutt. ssp. *subrhomboideus* (Rydb.) Spring & E. Schilling (*Biochem. Syst. Ecol.* 18(1):22. Mar 1990) predates *H. pauciflorus* ssp. *subrhomboideus* (Rydb.) Kartesz & Gandhi (*Phytologia* 68(6):423. Jun 1990) and renders the latter to be superfluous. The March issue of *Biochemical Systematics & Ecology* was received in May 1990 at UNC-Botany Library, and by this time, our article in *Phytologia* was already in press. Nevertheless, we regret the oversight and correct the subspecies authorship to: (Rydb.) Spring & E. Schilling.

JUNCACEAE

Luzula multiflora complex

The epithet *contracta*, in the *Luzula multiflora* (Ehrh.) Lej. complex, most likely appeared first at the rank of forma, in the protologue of *L. multiflora* var. *frigida* (Buches.) Samuelsson (Hultén 1937; Pp. 134, 135). The epithet *contracta*, although effectively published, was invalid. Bocher (1938; p. 248), in his treatment of *L. frigida* (Buches.) Samuelsson, remarked that the var. *contracta* was the most widespread form. However, the name was not validated by him.

Bocher (1950; p. 11) stated that there was "no description of the variety *contracta* available." Likewise, Scoggan (1957) stated that "Var. *contracta* Sam. is the form represented in Manitoba, . . . , this entity was never officially described." Although Bocher used the name *Luzula multiflora* ssp. *frigida* (Buches.) Krecz. var. *contracta* Samuelsson and included it in a key on p. 17, no Latin diagnosis was provided, which is a requirement for validation of names published after 1 Jan 1935 (Art. 36.1). The same situation exists in Bocher, *et al.* (1957; 1968) and in Porsild (1957). Hence, to this date, the varietal name remains invalid for the lack of a Latin diagnosis. We provide a Latin diagnosis under the varietal epithet *contracta* for its validation.

For the North American flora (north of México), we assign the following to the *L. multiflora* complex.

Luzula multiflora (Ehrh.) Lej., *Fl. Env. Spa.* 1:169. 1811.

Luzula multiflora (Ehrh.) Lej. ssp. *frigida* (Buch.) Krecz., *Bot. Zur.* 12:490. 1928. BASIONYM: *Luzula campestris* (L.) DC. var. *frigida* Buch., *Oestr. Bot. Z.* 48:284. 1898. *Luzula multiflora* var. *frigida* (Buch.) Samuelsson in Hultén, *Fl. Aleut. Isl.*, ed. 1. 125. 1931.

Luzula multiflora (Ehrh.) Lej. ssp. *multiflora* var. *multiflora*. BASIONYM: *Juncus campestris* L. var. *multiflorus* Ehrh., *Beitr. Naturk.* 5:14. 1790. *Juncus multiflorus* (Ehrh.) Hoffm., *Deutschl. Fl.*, rev. ed. 1:169. 1800. *non* Retz. 1795.

Luzula multiflora (Ehrh.) Lej. ssp. *multiflora* var. *contracta* Samuelsson *ex* Kartesz & Gandhi, var. *nov.* LECTOTYPE: t. 2, f. 2. in T.W. Bocher, *Contr. Fl. Pl. Geog. W. Greenland II.* 1950.

L. multiflorae (Ehrh.) Lej. var. *frigidae* (Buch.) Samuelsson similis sed differt inflorescentia capituli solitarii, aut si capitula plures. nunc uno plerumque ementi super cetera. Plantae caespitosae; culmi castanei rigidi validique; folia comparata angusta, planae trichomatibus candidis molibusque secus margines; capitula fusca, globularibusque; segmenta perianthiorum 2.5-3.5 mm longa; fructus quam periantha fere longiores; semina 1.1-1.4 mm longa. (Latin translation is based on Bocher's [1950] and Porsild's [1957] treatment of this taxon.)

Plants tufted; culms dark brown, stout and stiff; leaves flat with soft white hairs along the margins; inflorescence of a solitary dark reddish brown globular head or if of several heads, then one (head) usually projecting above the others; perianth segments 2.5-3.5 mm long; fruits almost as long as perianth; seeds 1.1-1.4 mm long.

Luzula multiflora (Ehrh.) Lej. ssp. *multiflora* var. *kjellmannioides* Taylor & MacBryde, *Canad. J. Bot.* 56:191. 1978. *Luzula kjellmanniana* auct. non Miyabe & Kudo, 1913. *Luzula multiflora* var. *kjellmanniana* sensu Samuelsson in Hultén, *Fl. Aleut. Isl.*, ed. 1. 127. 1937. (excl. type).

Luzula multiflora (Ehrh.) Lej. ssp. *multiflora* var. *kobayasii* (Satake) Samuelsson in Hultén, *Fl. Aleut. Isl.*, ed. 1. 126. 1937. BASIONYM: *Luzula kobayasii* Satake var. *kobayasii*, automatically created by *L. kobayasii* var. *minor* Satake, 1932.

Luzula kobayasii Satake var. *minor* Satake, *Bot. Mag. (Tokyo)* 46:186. 1932. *Luzula multiflora* var. *minor* (Satake) Taylor & MacBryde, *Canad. J. Bot.* 56:191. 1978.

ORCHIDACEAE

Platanthera

L. Higgins & S. Welsh (in Welsh, *Great Basin Naturalist* 46:259. 1986) described a new orchid species, endemic to Utah: *Habenaria zothecina* Higgins & Welsh. From their treatment, it is clear that both authors recognize the genus *Habenaria* Willd. *sens. lato*, which includes several generic segregates, such as *Coeloglossum* Hartman, *Piperia* Rydb., and *Platanthera* L.C. Rich. C. Luer (1975), in his treatment of United States orchids, remarked as follows: "No true *Habenaria* is found north of the southeasternmost region of the US ..." What have been known as habenarias from other regions of the U.S., were assigned to the genus *Platanthera* by him. We summarize his assessment of these two genera below.

Habenaria: primarily tropical in distribution; tubers or corms present; leaves more than 2; flowers small; corolla lip often tripartite into linear divisions; stigmatic processes conspicuous.

Platanthera: mostly temperate in distribution; generally stem tubers or corms absent; leaves 1 or more; flowers small or medium sized; corolla lip entire, divided, or fringed; stigmatic processes absent, rudimentary, or inconspicuous.

Weber (1989) transferred *Habenaria zothecina* to the genus *Limnorchis* Rydb. and made a new combination. Luer treated *Limnorchis* as a section of *Platanthera*. For the North American flora, we follow Luer's treatment, and thus transfer Higgins & Welsh's species to *Platanthera*, and propose the following new combination.

Platanthera zothecina (Higgins & Welsh) Kartesz & Gandhi, *comb. nov.*
 BASIONYM: *Habenaria zothecina* Higgins & Welsh in Welsh, Great
 Basin Naturalist 46:259. 1986. *Limnorchis zothecina* (Higgins & Welsh)
 W.A. Weber, Phytologia 67(6):427. 1989.

VIOLACEAE

Viola bicolor

For the American representative of the Old World pansy group of violets, Greene (Pittonia 4:9. 1899) proposed the name *Viola rafinesquii* to replace the name *V. tenella* Raf. (Amer. M. Mag. 4:191. 1819, *non* Poir. 1810). Greene cited two other synonyms: *V. arvensis* sensu Ell. (1817), *non* Murray (1770) and *V. bicolor* Pursh (1814). Greene considered Pursh's name to be a later homonym of Gilibert (1782).

Although Greene's rejection of *Viola bicolor* Pursh and *V. tenella* Raf. was appropriate at his time, his rejection of *V. bicolor* does not conform with the present International Code of Botanical Nomenclature (ICBN). Gilibert did not consistently employ the Linnaean system of binary nomenclature for species in his works. As per ICBN Art. 23.6C, epithets in such works must be rejected. Example 11 of this article, cites Gilibert's *Fl. Lit. Inch.* (1781) for rejection. The invalidity of names in Gilibert's Floras of Lithuania was also explicitly demonstrated by McVaugh (1949).

Since *Viola bicolor* Gilibert does not have nomenclatural standing, it does not render *V. bicolor* Pursh a later homonym. In this connection, Dr. L.E. Brown brought to our attention, Shinnery's 1961 publication on the nomenclature of *V. bicolor*. Shinnery indicated that Hoffmann (1804; p. 170) described *V. bicolor* in the protologue of *V. tricolor* L. Shinnery believed that the name "*V. bicolor* Hoffm." was validly published and concluded that it renders *V. bicolor* Pursh to be a later homonym. Shinnery, therefore accepted the name *V. rafinesquii* and also mentioned that the name "*V. bicolor* Hoffm." was not listed in *Index Kewensis*. It has not been listed in *Index Kewensis* to date.

On verification, we found that Hoffmann (1804) numbered each of his accepted taxa, which has been a widespread custom of various workers both historically and presently. With reference to the genus *Viola*, we found nine species numbered. Although eight of these nine species were described in Linnaeus' *Species Plantarum*, only three species were referred to Linnaeus by Hoffmann; for the remaining five species, such as *Viola tricolor* (number 9), Hoffmann did not cite Linnaeus in reference.

It is clear from Hoffmann's work that the type font of the descriptions of all accepted taxa was slightly larger than the type font of the subsequent

discussion portions. In the last two paragraphs of the protologue of *Viola tricolor*, Hoffmann included the names *V. bicolor* and *V. arvensis*. He neither cited authorship of these two names nor numbered them, but he did provide descriptions. The smaller type font used for *V. bicolor* is suggestive of a discussion, whereas the relatively larger type font used for *V. arvensis* is suggestive of the description of an accepted taxon. We are not certain whether Hoffmann was aware of "*V. bicolor* Gilib." and *V. arvensis* Murr. (1770). If Hoffmann intended to describe *V. arvensis* as a new species, then there is the possibility that he inadvertently failed to number it. However, in the past (Bentham 1892; Jackson 1895), *V. arvensis* was treated as a synonym, as a form, or as a variety of *V. tricolor*. With reference to *V. bicolor*, Persoon (1805) proposed the new combination: *V. tricolor* var. *bicolor* Pers., which was based on *V. bicolor* Hoffm., whereas Jackson mentioned *V. bicolor* as being a synonym of *V. tricolor*.

Since Hoffmann did not number the name *Viola bicolor*, its inclusion in the protologue of *V. tricolor* could be interpreted as being a described name in synonymy (*pro syn.*; Rec. 50A) or as a provisional name (Art. 34.1), or both; however, none of these can be considered as valid publication. Hence, we conclude that neither Gilibert nor Hoffmann validly published the name *V. bicolor*. Persoon's (1805) usage of this epithet at varietal status does not alter the nomenclature. Until it can be shown that someone validly used the name *V. bicolor* prior to Pursh, we should continue to accept *V. bicolor* Pursh to be the correct name for the species. With this disposition, we accept the name *V. bicolor* Pursh and provide the following references.

Viola bicolor Pursh, *Fl. Sept. Amer.* 175. 1814, non Gilib. (1781 [*nom. rej.*]), nec Hoffm. (1804 [*pro syn.* and/or provisional name: *nom. invalid*]). *Viola rafinesquii* E. Greene, *Pittonia* 4:9. 1899. *Viola kitaibeliana* Roemer & Schult. var. *rafinesquii* (E. Greene) Fernald, *Rhodora* 40:443. 1938.

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NEW TAXA IN *SENECIO* FROM MÉXICO

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ABSTRACT

The following new taxa are described from México: *Senecio guerrensis* sp. nov., *S. venturae* sp. nov., *S. praecox* (Cav.) DC. var. *tzimolensis* var. nov., and *S. durangensis* Greenm. var. *atrapiculatus* var. nov..

KEY WORDS: *Senecio*, Asteraceae, México, systematics.

Preparation of the treatment of *Senecio* for the forthcoming book on the Asteraceae of México, by B.L. Turner & Guy Nesom, has shown the existence of four previously undescribed taxa. The four are known to me only from the collections that are cited here.

Senecio guerrensis and *S. venturae*, both described below, are referable to Group 5c, Streptothamni-Pentacalia, in the scheme of Barkley (1985). The segregate genus *Pentacalia* Cassini was resuscitated for the group by H. Robinson & Cuatrecasas (1978). The group includes about 130 species, most of which are Andean, with about 15 in Central America, and five in México. The Mexican species are all epiphytic or semi-epiphytic woody vines or leaning subshrubs in cloud forest communities. Apparently, they are inconspicuous except when in flower, and flowering may not occur every year. Herbarium specimens seldom have mature, filled achenes. The group clearly needs revision, but with the Central American and Mexican species merely an appendage on the Andean group, the project becomes formidable.

Senecio guerrensis T.M. Barkley, sp. nov. Figure 1. TYPE: MÉXICO.

Guerrero: Arbusto trepador, flores amarillas, barranca húmeda con vegetación de bosque de *Quercus*, *Abies* y *Pinus*, Aserradero Agua Fría, Municipio de Tlacotepec, alt. 2700 m, 11-IV-1963, (J.) Rzedowski 16525 (HOLOTYPE: MICH; Xerocopies: KSC, TEX).

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Figure 1. *Senecio guerrerensis* - holotype.

Senecioni parasitico Hemsl. similis, sed capitulis discoideis bractearum conspicuarum foliacearum calyculo provisio diversis.

Weakly ligneous vine, upper stem and peduncles with abundant, loose pubescence of white, crinkled hairs to 0.5 mm long, at least some of which have a few darkened crosswalls, and with scattered short, curly multicellular hairs with dark crosswalls. Leaves apparently subcoriaceous or subturgid when fresh, lanceolate, the well developed ones with blade 10-12 cm long and 3-4 cm wide, tapering to an acute-acuminate apex, weakly rounded to acute at the base, margin entire or nearly so, slightly revolute, sometimes with a few scattered marginal hairs, petiole unwinged, 1-2 cm long. Inflorescence a terminal, pyramidal cluster of several rounded or subcorymbiform cymes of (8)10-12 heads each, ultimate pedicels 4-5 mm long; heads discoid; principal involucre bracts 8, ca. 7 mm long and 1.5-2 mm wide, loosely subtended by 3-5(7) leafy subcalyculate bracts, 5-7(8) mm long and 1.3-2 mm wide; disk florets 10-13, bisexual, corolla 7-10 mm long, clearly divisible into a limb, throat, and corolla lobes, the lowest 1-1.5 mm of the limb conically expanded downward, the corolla lobes nearly 2 mm long; receptacle with low chartaceous ridges among the achenes. Achenes glabrous, (no mature ones seen); pappus of abundant capillary bristles, extending 5-7 mm beyond the involucre.

Senecio guerrensis superficially resembles *S. parasiticus* Hemsl. in habit and gross aspect, but it differs from the latter and other species of Group 5c in having conspicuous, foliaceous calyculate bracts subtending each head, and in having strictly discoid heads. It occurs in an area where no other member of the group is presently known. It is known to me from only the type specimen.

The specific epithet is derived from the name of the state, Guerrero.

Senecio venturae T.M. Barkley, *sp. nov.* Figure 2. TYPE: MÉXICO. Veracruz: Planta herbácea trepadora; flor amarilla, olor agradable, escasa, bosque de encino, ladera de cerro, El Carrizal, Municipio de Ishuacan de los Reyes, alt. 2230 m, 11-XI-1971, *F. Ventura A. 4493* (HOLOTYPE: MICH; Isotypes: CAS, KANU, UMO).

Senecioni morazensi Greenm. similis, sed involucri bracteis separatis flosculisque uniuscujusquam capituli 20 vel minus numerosis abstans.

Subligneous vine, glabrous or nearly so, except for scattered short, brownish hairs on the upper branches, and especially on the pedicels in the inflorescence. Leaves coriaceous, the blade lanceolate to ovate or elliptic-ovate, 4-6(7) cm long and 2-4 cm wide, ca. 2X longer than wide, variously acute to subacuminate at the apex, gently tapering at the base to an unwinged petiole 1-1.5(+) cm long, margin entire or slightly wavy, venation pinnate, the midrib



Figure 2. *Senecio venturae* - holotype.

prominent but the lateral veins obscure. Inflorescence a terminal paniculiform or thyriform cluster of several corymbiform cymules, each cymule with 5-10 heads; heads radiate; principal involucre bracts 8, clearly separate from each other, 5-6 mm long and 2 mm wide; calyculate bracts few, narrow, 1-1.5 mm long; ray florets (4)5, pistillate, the ligule prominent, yellow, ca. 5 mm long; disk florets 16-20, bisexual; receptacle with prominent ridges among the achenes, the margin of the ridges dentate with some of the teeth extended into hairlike projections 0.5-1 mm long. Achenes apparently glabrous, (no mature ones seen); pappus of abundant, long capillary bristles, exceeding the involucre by 2-3 mm.

Paratypes: (All from MÉXICO). Oaxaca: Alturas de San Bernardino, Distrito de Teotitlán, alt. 2300 m, 10-XII-1907, *C. Conzatti 2085* (F, MO). Veracruz: Pequeña cañada entre Tonalco y Oxtlapa, Municipio Xico, alt. 2500 m, 8-X-1986, *M. Cházaro y Paty Hernández 4039* (KSC, WIS); Barranca del Alto Pixquiac, Municipio Las Vegas, alt. 2650 m, 26-XII-1988, *M. Cházaro y Paty Hernández de Ch. 5774* (WIS).

Two collections from Chiapas are included here provisionally, for they clearly resemble *S. venturae*, but revisionary studies of the Chiapas-Guatemala material may eventually indicate otherwise: Chiapas: North slope of Cerro Mozotal near summit, Municipio Motozintal de Mendoza, elev. 2900-3000 m, 31 Jan 1982, *D.E. Breedlove & F. Almeda 58206* (CAS); 3-4 km W of El Porvenir along road from Huixtla to Siltepec, Municipio of El Porvenir, elev. 2800 m, 17 Jan 1973, *D.E. Breedlove & A.R. Smith 31764* (CAS, MO).

Senecio venturae encompasses materials that have been referred variously to *S. parasiticus*, *S. morazensis* Greenm., *S. magistri* Standl. & L.O. Williams, and *S. phorodendroides* L.O. Williams. As conceived here, *Senecio venturae* is similar to *S. morazensis*, which is based on a type collection from Depto. Morazan, Honduras. However, *S. venturae* differs in aspect from *S. morazensis*. In addition, *S. venturae* has 8 separate involucre bracts and 20 or fewer disk florets, while *S. morazensis* has 8-11 involucre bracts, with some of them fused together, and more than 20 disk florets. *Senecio venturae* differs from the typical concept of *S. parasiticus* in having conspicuous ray florets.

The specific epithet honors F. Ventura A., a noted collector of the Mexican flora, who collected the type material.

***Senecio praecox* (Cav.) DC. var. *tzimolensis* T.M. Barkley, var. nov.** Figure 3 and Figure 4. TYPE: MÉXICO. Chiapas: Thick stemmed shrub 6 feet tall, tropical deciduous forest, 15 km south of Comitán on road to Tzimol and Tuxtla Gutiérrez, Municipio of Tzimol, elev. 1200 m, 20 Mar 1981, *D.E. Breedlove 50226* (HOLOTYPE: CAS).

Senecioni praecoci (Cav.) DC. *varietatibus praecoci et morelensis* (Miranda) McVaugh similis, sed foliorum dentibus abbreviatus

CALIFORNIA ACADEMY
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OF SCIENCES



HERBARIUM OF KANSAS STATE UNIVERSITY
MANHATTAN, KANSAS
Senecio praecox var. *tzimolensis* J. M. Coulter
n. sp.
ANNOUNCED BY J. M. Coulter 1920

PLANTS OF CHIAPAL, MEXICO

Flowers yellow.
Thick stemmed shrub 6 feet tall.
Tropical Deciduous Forest, 15 km south
of Comitán on road to Tzamal and
Tuxtla Gutiérrez, Municipio of
Tzamal, Elevation 1200 m

D. E. Bredlove 50226 20 March 1981

Figure 3. *Senecio praecox* var. *tzimolensis* - holotype, with flowers present.

CALIFORNIA HERBARIUM
No. 65657
OF SPECIES



Senecio praecox Meyer

Senecio praecox Meyer
var. tzimolensis
D. F. Howell et al. 1970

Figure 4. *Senecio praecox* var. *tzimolensis* - paratype, with leaves present.

2-4 mm longis, necnon ramis superioribus glabritis simulac capitulorum disci flosculis 6-10 diversa.

Senecio praecox (Cav.) DC. is a seasonally deciduous, rubbery stemmed shrub or small tree that is referable to Group 6, *Pittocaulon*, of *Senecio* in the scheme of Barkley (1985) or to the segregate genus *Pittocaulon* of Robinson & Brettell (1973). It is the only representative of Group 6 south of the Straits of Tehuantepec. Three varieties of *S. praecox* are recognized, and var. *tzimolensis* is distinguished by the characters noted in the key.

Key to Varieties of *Senecio praecox*

1. Leaves obscurely dentate with a few scattered, shallow teeth 2-4 mm long, ray florets (3)5, disk florets 6-10, upper branches glabrous or nearly so; Chiapas var. *tzimolensis* T.M. Barkley
- 1' Leaves with prominent triangular lobes 10-20 mm long; Oaxaca and northward.
 2. Upper branches glabrous or nearly so except for scattered small tufts of white hairs in and near axils; ray florets 5, disk florets (12)15-20; leaf venation prominently palmate var. *praecox*
 - 2' Upper branches, especially at the base of the inflorescence, densely light brownish pubescent; ray florets (2)3(5), disk florets 6-10; leaf blades with lowermost lateral veins not prominent, thus the venation obscurely palmate var. *morelensis* (Miranda) McVaugh

Paratypes: (All from MÉXICO). Chiapas: Shrub 6 feet tall, tropical deciduous forest with *Frazinus*, *Erythroxyton*, *Lonchocarpus*, *Bursera*, *Ficus*, and *Clusia*, 15 km south of Comitán on road to Tzimol and Tuxtla Gutiérrez, Municipio of Tzimol, elev. 1200 m, 19 Nov 1980, *D.E. Breedlove & F. Almeda 47605* (CAS); Shrub 4 feet tall, (data otherwise identical), 21 April 1981, *D.E. Breedlove 51027* (CAS).

The holotype, collected in March, is in flowering condition (Figure 3). The paratype *Breedlove & Almeda 47605*, collected in November, has fully developed leaves (Figure 4). The other paratype, *Breedlove 51027*, is in flowering condition.

The varietal epithet is derived from the locality where the plant was collected.

Senecio durangensis Greenm. var. *atrapiculatus* T.M. Barkley, var. nov.
Figure 5. TYPE: MÉXICO. Durango: Open places in pine woods in felsitic region atop the Sierra Madre Occidental, 13 1/2 miles west-southwest of El Salto, elev. about 8900 ft, 14 Nov 1965, Arthur Cronquist 10599 (HOLOTYPE: NY; Isotypes: CAS, GH, KANU, KSC, MICH, TEX, WIS).

Senecioni durangensis Greenm. varietati *durangensis* similis, sed foliis profunde lobatis et bracteis involucri calyculique apice nigris diversa.

Senecio durangensis Greenm. is a perennial herb or weak subshrub to 12 dm tall in the mountains of southwestern Chihuahua and Durango, of apparent affinity with the more northern *S. eremophilus* Rich. It is referable to Group 11c, Triangulares, of *Senecio* in the scheme of Barkley (1985). Two varieties are recognized as follows, and var. *atrapiculatus* is distinguished by the characters noted in the key.

Key to Varieties of *Senecio durangensis*

1. Midcauline leaves mostly < 6 cm long and 3 cm wide overall, some merely dentate and not deeply dissected; principal involucre bracts obscurely if at all black tipped; calyculate bracts reduced and inconspicuous; Sierra de Mohinora of southwestern Chihuahua, and extreme northern Durango, just south of Hidalgo de Parral, Chihuahua . . . var. *durangensis*
- 1' Midcauline leaves 5-10 cm long and 2-4 cm wide overall, all deeply lobed; principal involucre bracts and calyculate bracts with prominent black tips; southern Durango, vicinity of Las Adjuntas and El Salto . . . var. *atrapiculatus* T.M. Barkley

Paratypes: (All from MÉXICO). Durango: México Hwy 40, 2 miles W of Las Adjuntas, elev. ca. 8500 ft, 7 Nov 1964, David Flyr 270 (TEX); along Hwy 40, 73.0 mi W of the junction of Hwy 40 and Hwy 45 in Durango, just E of Las Adjuntas, under pines and cypresses, amongst boulders, 27 Sept 1984, Scott Sundberg & Matt Lavin 2876 (CAS, NY, TEX).

Sundberg & Lavin 2876 is cited under the name *Senecio chihuahuensis* S. Wats. as a voucher for a chromosome count of $2n = ca. 20 II$ by Sundberg, et al. (1986).

Senecio durangensis var. *atrapiculatus* has been called *S. flaccidus* Less. in the past, and *S. durangensis* s. str. has been treated as a variety of *S. flaccidus*

(Barkley 1989). However, the epithet *flaccidus* rests on a type collection that is referable to the taxon long called *S. douglasii* DC. (or *S. douglasii* var. *longilobus* [Benth.] Benson), necessitating nomenclatural adjustments there (Turner & Barkley 1990). Thus, the name *S. durangensis* now becomes the nomenclaturally typical epithet for the species, and in turn, the new epithet, var. *atrapiulatus*, is needed for the former "var. *flaccidus*."

The collection *A. Cronquist 10540* (KSC, MICH, NY) is noteworthy. The date and locality are identical to those of *A. Cronquist 10539*, the type collection of *S. durangensis* var. *atrapiulatus*, but with the following additions: "A single specimen with the leaves of No. 10539, *S. flaccidus* Less., and the pubescence of No. 10541, *S. flaccidus* Less. sens. lat." The latter collection, *A. Cronquist 10541* (CAS, GH, KANU, KSC, MICH, NY, WIS) is clearly referable to *S. stoechadiformis* DC. and was collected at the same locality and at the same time. The single plant of *Cronquist 10540* may be a hybrid or introgressant between *S. durangensis* var. *atrapiulatus* and *S. stoechadiformis* and is indicative of the imprecise distinctions among many of the species of *Senecio*.

The varietal epithet describes the black tips of the involucre bracts.

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AN OVERVIEW OF THE MEXICAN GENUS *DIGITALCALIA*
(ASTERACEAE, SENECTIONEAE)

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ABSTRACT

A taxonomic treatment of *Digitacalia* is rendered. Five species are recognized, two of these newly described, *D. crypta* sp. nov., from Guerrero and adjacent Morelos, and *D. hintoniorum* sp. nov. of southwestern Michoacán. Illustrations of both are provided. A new variety, *D. jatrophioides* (H.B.K.) Pippen var. *pentaloba* var. nov., from Puebla and Oaxaca is also described. A map showing the distribution of the six taxa is provided.

KEY WORDS: *Digitacalia*, Asteraceae, Senecioneae, México.

In connection with a treatment of *Digitacalia* for the Asteraceae of México (Turner & Nesom, in prep.), I have revised the treatment of Pippen (1968). The results and reasons for my treatment are presented herein.

Digitacalia was first proposed by Pippen (1968) and subsequently retained by McVaugh (1984). It is closely related to *Psacalium*, as noted by Pippen, having the white corollas with deeply lobed throats of that genus, but it differs in having robust (1-4 m high), stiffly erect, simple stems with numerous, gradually reduced cauline leaves (vs. well developed basal and lower cauline leaves, those along the middle and upper stem relatively few and much reduced). At maturity, the stems of *Digitacalia* become hollow; those of *Psacalium* are mostly filled with pith and associated tissue at maturity.

Occasional species of the sect. *Palmatinervii* of *Senecio*, approach *Digitacalia* in habit, the most notable being *Senecio ehrenbergianus* Klatt, which has robust simple stems with pinnately lobed leaves which are numerous and rather evenly distributed along the stems. *Senecio ehrenbergianus*, however, has radiate heads with yellow corollas and is presumably properly positioned in sect. *Palmatinervii*.

Pippen (1968) recognized 5 species in *Digitacalia*, including *D. heteroidea* (Klatt) Pippen. Robinson & Brettell (1974) correctly transferred the latter to their proposed genus *Roldana* (= sect. *Palmatinervii* of *Senecio*, sensu Barkley

[1985]). In the treatment that follows, I have combined *D. napeifolia* (DC.) Pippen and *D. tridactylitis* B.L. Robins. & Greenm., thus effectively reducing Pippen's genus to three species, but have raised it again to five species with the description of two new species. In addition, I have recognized two regional varieties within the widespread *D. jatrophoides*. The taxonomy of *Digitacalia* follows.

DIGITACALIA Pippen

Type species, *Digitacalia jatrophoides* (H.B.K.) Pippen.

Stiffly erect perennial herbs to 4 m high, the stems evenly leafy throughout. Leaves alternate, palmately or subpalmately nervate to penninervate. The blades usually 3-9 lobed, often deeply so. Heads eradiate, numerous in terminal divaricate cymose panicles. Involucres turbinate to narrowly campanulate, calyculate with 1-7 much reduced bracts, the inner bracts equal, 5-8, biseriate but often appearing uniseriate. Receptacles plane, epaleate, alveolate. Florets with white or cream colored corollas, the tube about as long as the limb, the latter with lobes much longer than the throat (except rarely in *D. crypta*). Achenes somewhat fusiform to oblong, glabrous, nearly terete in cross section, ribs 8-10, well defined, the pappus of numerous barbellate bristles in 1-3 series. Base chromosome number, $x=30$.

KEY TO SPECIES

1. Heads 5-6 mm high; pappus 2-3 mm long; Chiapas *D. chiapensis*
- 1' Heads 7-9 mm high; pappus 5-7 mm long; not in Chiapas (2)
 2. Blades of midstem leaves deeply divided, the lobes extending to the midrib or nearly so; margins of lobes entire or rarely with only 1-3 broad teeth *D. jatrophoides*
 - 2' Blades of midstem leaves not deeply divided, the lobes not extending to the midrib; margins of lobes dentate to remotely denticulate (3)
3. Involucral bracts 5, semisucculent in texture, oblanceolate, broadest well above the middle; Sierra San Felipe, Oaxaca *D. napeifolia*
- 3' Involucral bracts 6-8, not semisucculent in texture, narrowly ovate to narrowly elliptic, widest at the middle, or nearly so; Michoacán, Morelos, Guerrero (4)

4. Leaves uniformly 3 lobed; pappus bristles white or dirty white, 5-6 mm long; Morelos, Guerrero *D. crypta*
 4' Leaves 3-5 lobed; pappus bristles rusty brown, 7-8 mm long; Michoacán *D. hintoniorum*

Digitocalia chiapensis (Hemsl.) Pippen, Contr. U.S. Natl. Herb. 34:379. 1968. BASIONYM: *Senecio chiapensis* Hemsl., Biol. Centr. Amer. Bot. 2:238. 1881. TYPE: MÉXICO. Chiapas: without specific locality, 1864-70, *Dr. Ghiesbreght 537* (HOLOTYPE: K; Isotypes: GH!, MO!). *Cacalia chiapensis* (Hemsl.) A. Gray, Proc. Amer. Acad. Arts 19:53. 1883. *Odonotrichum chiapensis* (Hemsl.) Rydb., Bull. Torrey Bot. Club 51:418. 1929.

Pippen (1968) provides an excellent description of this species, albeit based upon only two collections, the type and *Nelson 3467* (GH, US). I have seen the following additional collections; taken together these serve as the basis for the map showing its distribution (Figure 1).

MÉXICO. Chiapas: Mpio. Amatenango del Valle, *Ton 1493* (F, CAS, NY); Mpio. Soyalo, *Breedlove 23342* (NY, TEX). Mpio. Venustiano Carranza, *Breedlove 41140* (CAS, TEX); *Laughlin 1932* (CAS, F).

According to label data, the species occurs on mostly dry steep slopes (1700-1800 m) with pine or oak trees and occasional with *Ficus* and *Juniperus*; flowering October-December.

Digitocalia crypta B. Turner, *sp. nov.* Figure 2. TYPE: MÉXICO. Guerrero: Mpio. Chichihualco, km 20 on road from Chilpancingo to Chichihualco, pine-oak zone, 1600 m, 24 Nov 1983, *Fred R. Barrie 722* (HOLOTYPE: TEX!; Isotype: MEXU).

D. napeifoliae (DC.) Pippen similis sed foliis aequabiliter trilobatis, petiolis brevibus (1-4 cm longis) partim alatisque, bracteis involucri plerumque 8 (vs. 5), et antheris flavis (vs. atropurpureis) differt.

Stiffly erect, single stemmed suffruticose herb or shrublet 1-3 m high. Stems puberulent, pithy at first but hollow at maturity. Leaves trilobed, those at midstem 10-25 cm long, 8-15 cm wide; the petioles 1-4 cm long, these gradually tapering into the blades, gradually reduced upwards; blades glabrescent above, moderately puberulent below (glabrescent with age), the margins entire or very remotely denticulate. Heads numerous in terminal obpyramidal or ovoid cymose panicles 15-25 cm across. Involucres 4.5-5.0 mm high, the bracts mostly 8, linear lanceolate, glabrous except for the acute ciliate apices. Florets mostly 10 per head, the corollas glabrous, white, ca. 6 mm long, the

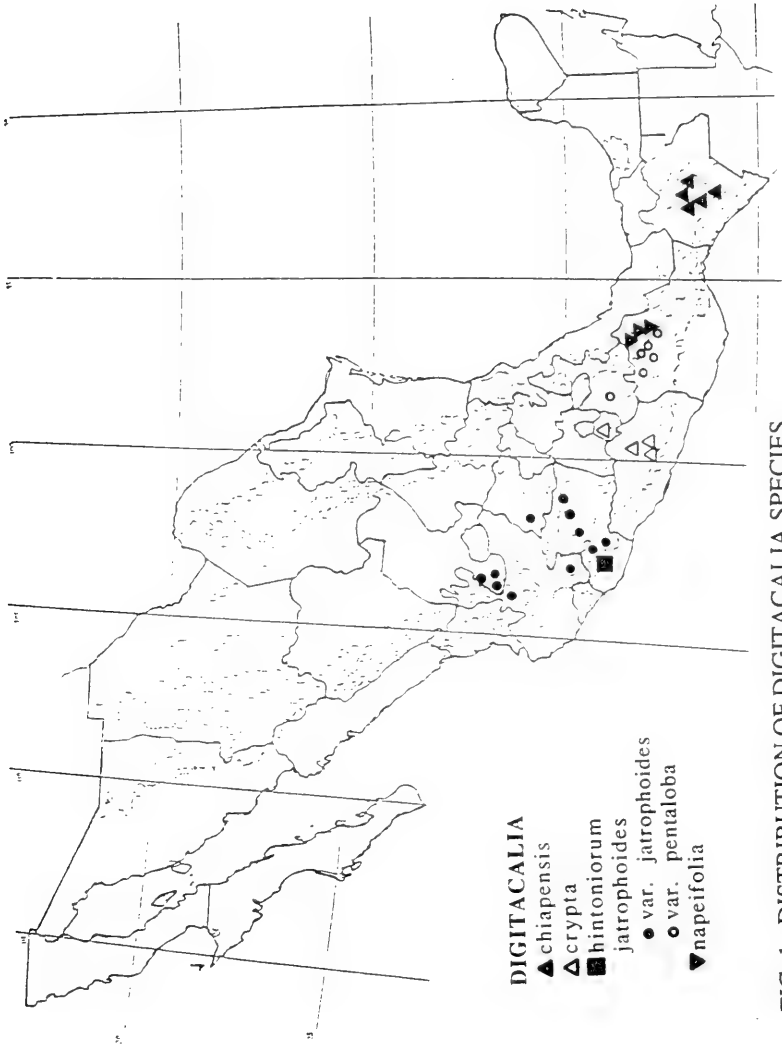


FIG. 1. DISTRIBUTION OF DIGITACALIA SPECIES

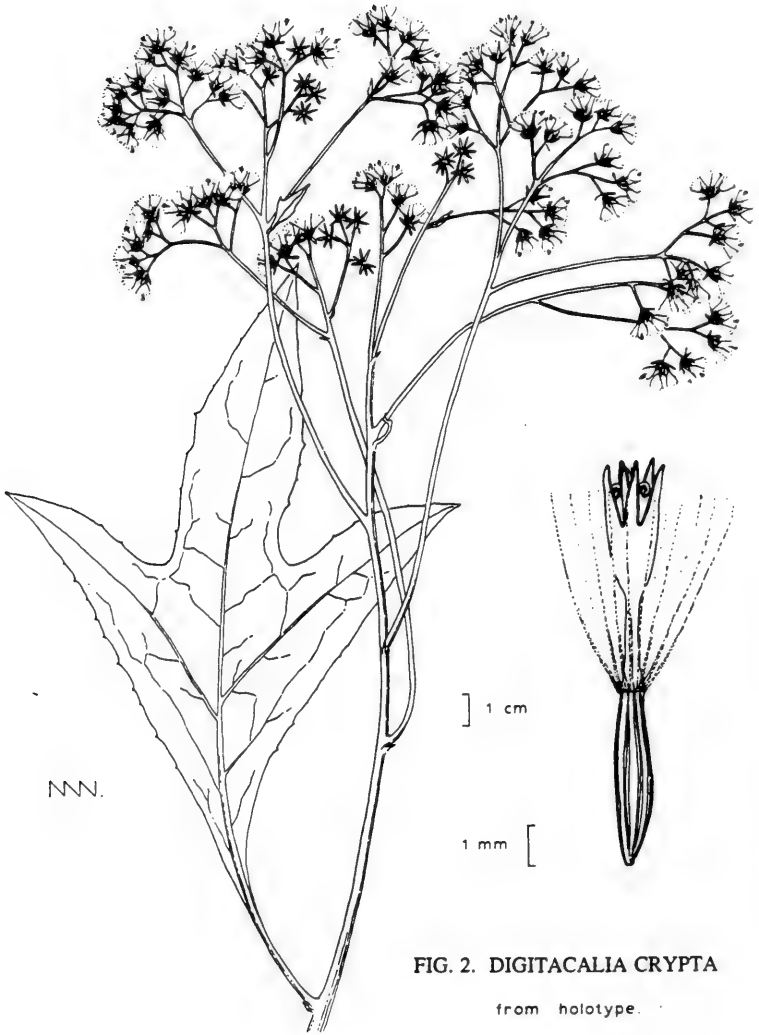


FIG. 2. DIGITACALIA CRYPTA

from holotype.

tube ca. as long as the limb, the lobes narrow, mostly 2-3 mm long. Anthers pale yellow. Achenes fusiform, 3-5 mm long, glabrous, the pappus of numerous sparsely ciliate, pale tawny bristles 5-6 mm long. Chromosome number, $n=30$ pairs (based upon *McVaugh 21903*; cf. Pippen [1968]).

ADDITIONAL SPECIMENS EXAMINED: MÉXICO. Guerrero: Cerro del Alquitrin, ca. Petaquillas, SE of Chilpancingo, ca. 1600 m, 22 Oct 1978, *Schwabe s.n.* (TEX); 3 km S of Huitziltepec, ca. 1400 m, 6 Oct 1981, *Torres R. 970* (TEX). Morelos: barrancas near Cuernavaca, 5400 ft, 10 Nov 1895, *Pringle 6164* (CAS, F, GH, MO); Cuernavaca, 11 Nov 1902, *Pringle 9877* (CAS, F, GH, MO, NMC, NY).

Pippen (1968) included this taxon within his concept of *Digitocalia tri-dactylitis* (= *D. napeifolia* in the present treatment), citing both of the *Pringle* collections from Morelos listed above. In addition, he cited a collection from Guerrero (*McVaugh 21903*) which I would refer to *D. crypta*. The latter taxon was thus effectively hidden within his erroneous concept of *D. napeifolia*, hence the name proposed here.

Digitocalia crypta is readily distinguished from *D. napeifolia*, which is apparently restricted to the Sierra San Felipe, Oaxaca, by its uniformly trilobed leaves, ill defined, shorter petioles, smaller heads with more numerous involucre bracts (8-10 vs. 5), and yellow anthers (vs. purple-black).

***Digitocalia hintoniorum* B. Turner, sp. nov.** Figure 3. TYPE: MÉXICO. Michoacán: Distr. Coalcomán (Mpio. Chinicuila), Villa Victoria, 1500 m, pine forest, 15 Nov 1938, *G.B. Hinton, et al. 12572* (HOLOTYPE: LL!; Isotypes: GH, MICH, NY).

D. napeifoliae (DC.) Pippen similis sed foliis profunde palmatis-partitis paginis infernis glabrescentibus, bracteis involucri minus carnis ad medium latissimisque, et antheris flavis (vs. atropurpureis) differt.

Stiffly erect suffruticose herbs or shrublets 1-3 m high. Stems puberulent to glabrate, hollow at maturity. Leaves up to 25 cm long and 23 cm wide; petioles not winged, up to 10 cm long; blades rounded in outline, about as wide as long, the lobes decidedly serrate, lanceolate, 8-12 cm long, 2-4 cm wide, glabrescent above and below. Heads numerous in terminal cymose panicles, the ultimate peduncles mostly 5-10 mm long. Involucre 4.0-4.5 mm high, the bracts 5, glabrous or nearly so. Florets mostly 5 per head, the corollas white, glabrous, 7-8 mm long, the throat ca. as long as the limb, the lobes 3.0-3.5 mm long. Anthers yellow. Achenes 4-5 mm long, fusiform, glabrous, the pappus of numerous rusty brown ciliate bristles 5-6 mm long.

Pippen (1968) and McVaugh (1984) included this taxon in their concept of *Digitocalia napeifolia*, both citing the above type, and only known collection of

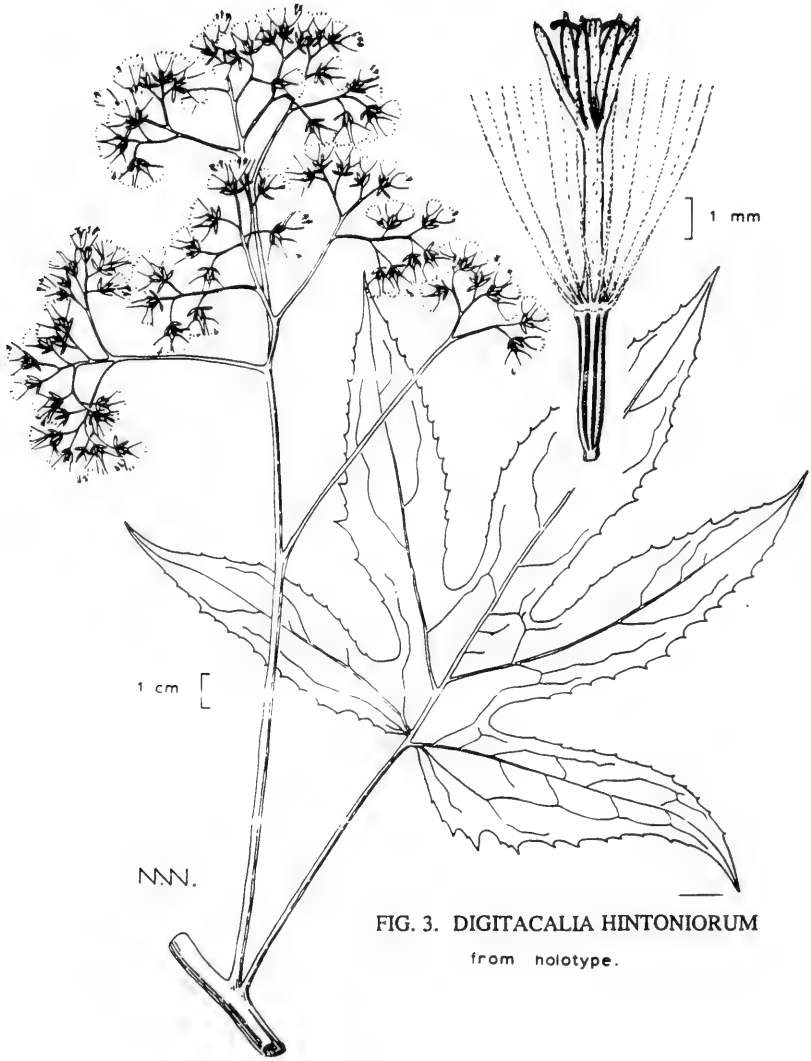


FIG. 3. *DIGITACALIA HINTONIORUM*
from holotype.

D. hintoniorum. The latter is readily distinguished from the former by its more deeply palmately lobed leaves, which are glabrescent beneath at maturity, less carnosely involucre bracts, which are widest at the middle, yellow anthers, and shorter, rusty brown pappus bristles.

Digitacalia jatrophoides (H.B.K.) Pippen, Contr. U.S. Natl. Herb. 34:381. 1968.

Pippen (1968) and McVaugh (1984) have rendered excellent inclusive descriptions of this species, so I will not add yet another. I recognize two regional, seemingly intergrading varieties under this species, as indicated in the following couplet:

Midstem leaves mostly 7 lobed, the rachis (from apex of petiole to base of terminal leaflet) mostly 10-20 mm long; florets 8-10 per head, Zacatecas to Michoacán var. *jatrophoides*

Midstem leaves mostly 5 lobed, the rachis of midstem leaves mostly 1-8 mm long; florets 5-8 per head; Puebla and Oaxaca var. *pentaloba*

Digitacalia jatrophoides (H.B.K.) Pippen, var. *jatrophoides*. BASIONYM: *Cacalia jatrophoides* H.B.K., *Nov. Gen. & Sp.* 4:169. 1820. (Folio ed. 4:132. 1818.) TYPE: MÉXICO. Michoacán: near Lake Cuitzeo. without date, *Humboldt & Bonpland 4298* (HOLOTYPE: P; Photoholotype: MO!). *Senecio jatrophoides* (H.B.K.) Schultz-Bip., *Flora* 28:498. 1845. *Odontotrichum jatrophoides* (H.B.K.) Rydb., *Bull. Torrey Bot. Club* 51:419. 1924.

Cacalia digitata Sessé & Moçino, *Pl. Nov. Hisp.* 132. 1889. TYPE: MÉXICO. Michoacán: near Puruandiro. without date. *Sessé & Moçino 2826* (LECTOTYPE [Pippen 1968]: MA; Photolectotype: F!). Pippen (1968) gave as the type locality, "in Purulandiri Montibus," but McVaugh (1984) cites the locality I have listed here.

ADDITIONAL SPECIMENS EXAMINED. MÉXICO. Guanajuato: *Pringle 4362* (ARIZ, GH, MO, NY). Jalisco: *Viguera, et al. 45* (WIS). Zacatecas: *Breedlove 61625* (CAS, NY).

In addition to the above cited specimens, Pippen (1968) and McVaugh (1984) cite additional specimens from the area concerned which I have not examined, but these have been included in Figure 1.

This is the more widespread, common variety, occurring from southern Zacatecas to Michoacán, as indicated in Figure 1.

Digitacalia jatrophoides (H.B.K.) Pippen, var. **pentaloba** B. Turner, var. nov. TYPE: MÉXICO. Oaxaca: 43 km N of Telixtlahuaca on road to Tehuacán, slope with *Quercus*, *Bursera* and *Dodonaea*, 1680 m, 6 Nov 1983, D.E. Breedlove & F. Almeda 59818 (HOLOTYPE: TEX!; Isotype: CAS).

D. jatrophoides (H.B.K.) Pippen var. *jatrophoides* similis sed foliis aequabiliter atque profunde 5-lobatis ad medium caulium, rhachidi laminae plerumque 1-8 mm longa (vs. 10-20 mm), et capitulis flosculis plerumque 5-8 (vs. 8-10) differt.

ADDITIONAL SPECIMENS EXAMINED. MÉXICO. Oaxaca: 10 km N of Huahuapan de León, 1700 m, 30 Oct 1974, *Breedlove 39205* (CAS); 12 mi S of Nochixtlán, 27 Jun 1947, *Davis s.n.* (TEX); Tonaltepec, 39 km S of Cuicatlán, 2 Aug 1985, *R. Torres C. & M.L. Torres C. 6939* (MEXU, TEX). Puebla: 16 mi W of El Marques, 21 Aug 1980, *Turner 80A-4C* (TEX).

The variety is readily distinguished from the typical variety by the characters given in the key. Nevertheless, occasional plants of var. *pentaloba* have characters which approach those of var. *jatrophoides*. According to label data (*Torres & Torres 6939*), the taxon is a suffruticose herb to 3 m high and is said to be very frequent at the locality cited.

Digitacalia napeifolia (DC.) Pippen, Contr. U.S. Natl. Herb. 34:382. 1968. BASIONYM: *Cacalia napeaeifolia* DC., *Prod.* 6:328. 1838. TYPE: MÉXICO. Oaxaca: summit of Sierra San Felipe, Jul 1834, *G. Andrieux 280* (HOLOTYPE: G-DC, microfiche!; Photoholotype: TEX!). *Senecio napeifolium* (DC.) Schultz-Bip., *Flora* 28:498. 1845. *Odontotrichum napeifolium* (DC.) Rydb., *Bull. Torrey Bot. Club* 51:418. 1924.

Cacalia tridactylitis B.L. Robins. & Greenm., *Amer. J. Sci.* III. 50:159. 1895. TYPE: MÉXICO. Oaxaca: Sierra San Felipe, 6000 ft, 19 Nov 1894, *C.G. Fringle 5841* (HOLOTYPE: GH!). *Odontotrichum tridactylitis* (B.L. Robins. & Greenm.) Rydb., *Bull. Torrey Bot. Club* 51:419. 1924. *Digitacalia tridactylitis* (B.L. Robins. & Greenm.) Pippen, Contr. U.S. Natl. Herb. 34:383. 1968.

Suffruticose herbs or shrublets, 1.0-2.5 m high. Stems glabrous, pithy at first, but hollow at maturity. Leaves 3-7 lobed, often deeply so, those at midstem mostly 5-7 lobed, up to 25 cm long and 25 cm wide, gradually reduced upwards, those below the capitulescence mostly trilobed; petioles to 10 cm long; blades glabrate above, persistently densely puberulent beneath, the margins serrulate to nearly entire. Heads numerous in terminal obpyramidal cymose panicles 20-40 cm across. Involucres 4-5 mm high, the bracts 5, glabrous or with a few ciliate hairs apically; florets mostly 5-6 per head,

the corollas glabrous, cream colored, 8-9 mm long, the tube ca. as long as the limb, the lobes narrow, mostly 3-4 mm long. Anthers blackish purple. Achenes cylindrical, ca. 5 mm long, glabrous, the pappus of numerous ciliate tawny bristles 6-7 mm long.

ADDITIONAL SPECIMENS EXAMINED: MÉXICO. Oaxaca: near summit of highway 175 between Cd. Oaxaca and Tuxtepec, 19 Oct 1986, *Barkley & Villaseñor 3907* (KSC, TEX, WIS); Llano de Las Flores, 2800 m. 5 Aug 1981, *Lorence 3650* (CAS); 50 mi by road from Valle Nacional, 13 mi S of the first high pass, just below the fir zone, 2850 m, 10-12 Oct 1962, *McVaugh 21823* (LL, NY); 2.7 mi S of Llano de Las Flores, near top of pass, 27 Aug 1983, *Turner 15190C* (TEX).

Pippen (1968) recognized *Digitocalia tridactylitis* as a good species, distinguishing this from *D. napeifolia* by its trilobed leaves, "the lobes forming an angle, with the midrib, of less than 45 degrees." Leaf shape and lobing is very variable in the *Digitocalia* complex, as indicated in the above description, which is based solely upon collections from Sierra San Felipe, Oaxaca, the type locality for both taxa. Pippen included within his concept of *D. tridactylitis*, specimens from Guerrero and Morelos which I place elsewhere. McVaugh (1984) followed Pippen's treatment, at least in part, citing material from western Michoacán (*Hinton 12572*) as belonging to *D. napeifolia*. The latter collection typifies *D. hintoniorum* in the present treatment.

ACKNOWLEDGMENTS

I am grateful to Dr. Guy Nesom for the Latin diagnosis and to him and Dr. Ted Barkley for reviewing the manuscript.

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A NEW SPECIES OF TUBEROUS *DROSERA* FROM WESTERN AUSTRALIA

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ABSTRACT

Drosera prostratoscaposa sp. nov. (section *Erythrorhiza*), a species distinctive by virtue of its prostrate many flowered inflorescences, from the southern coast of southwestern Australia, is described as new.

KEY WORDS: *Drosera*, Droseraceae, Australia.

TAXONOMIC TREATMENT

Drosera prostratoscaposa A. Lowrie & S. Carlquist. spec. nov. TYPE: In fine grained black sand on the flats, as well as in a soil mixture of sand, laterite, and a small amount of quartzite rock floaters on the lower scree slopes a short distance away from a small tributary of the Hamersley River, where the tributary crosses Hamersley Drive, ca. 40 km south-east of South Coast Highway. Fitzgerald National Park, Western Australia, Allen Lowrie 96, April 23, 1990. HOLOTYPE: PERTH; Isotypi: CANB, K, RSA.

Tuber amplans. Caulis parte hypogaea 4 cm longus, squamatus. Folia laminata omnia basilaria rosulato-conferta, ad tempore florendi parva, postea adolescentia obovata, demum 4 cm longa, 1.3 cm lata, petiolata. Scapi 1-4, 4-6 cm longi, ramulosi, ca. 5-25 florum, gignens, tempore florendi erecti, tempore fructendi prostrati. Pedicelli ad anthesim erecti, in fructibus cernui. Flores diurnali, jasmino-fragranti. Sepali basi coalita, ovatolanceolati, integra sed apice serrata vel biloboserrata. 4 mm longa. Petala obovata, truncata, alba, 8 mm long, 4 mm lata, apice crenata. Stamina 2.7 mm longa. Ovaria elliptica, ad anthesim 1.5 mm longa, 1.2 mm lata. Styli 3, in segmata multi trans medium subdigitato-incisa partiti, stigma 1-3 lobata. Capsula 2.3 mm longa.

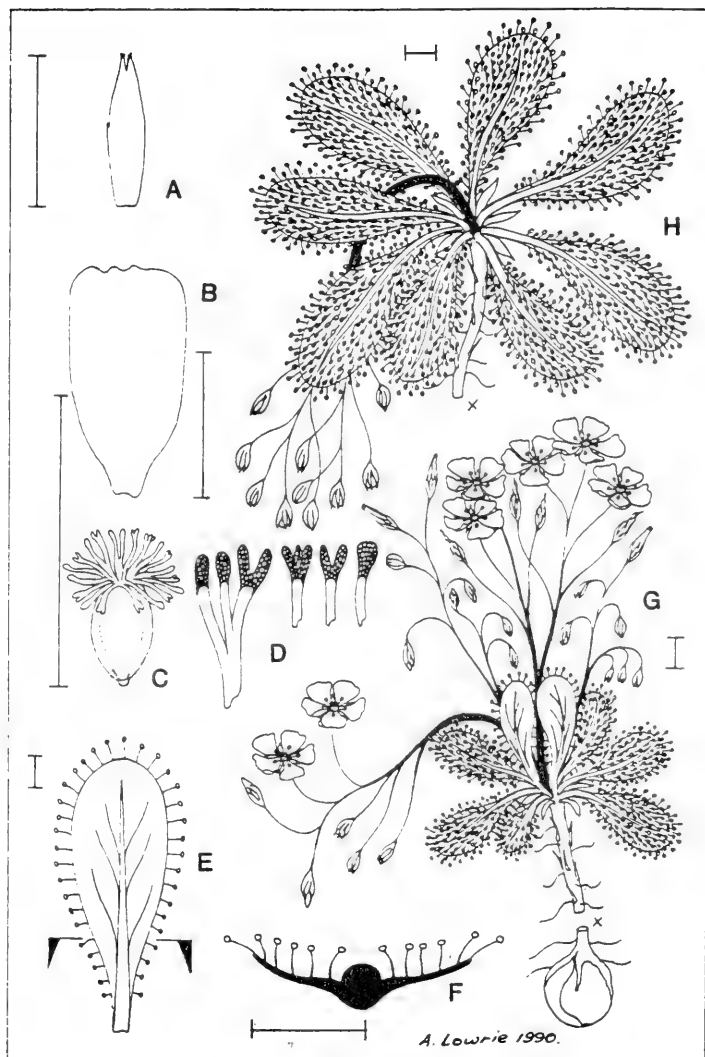


Figure 1. *Drosera prostratoscaposa*. A, sepal; B, petal; C, ovary and styles; D, style portions and stigmas, enlarged; E, leaf; F, leaf section at point indicated; G, plant in flower; H, plant in fruit. Scale bar for all = 5 mm.

Tuber large in size (for the genus). Underground stem 4 cm long, scaly. Foliage leaves all congested into a basal rosette, small at flowering time but maturing thereafter, mostly 4 cm long, 1.3 cm wide, petiolate. Scapes 1 to 4 per rosette, branched, each scape bearing 5-25 flowers erect at flowering time but prostrate when in fruit. Flowers open during the day (closed at night), jasmine-scented. Sepals united at their bases, ovate-lanceolate, entire but serrate or bilobed serrate at their tips, 4 mm long. Petals obovate, truncate, white, 8 mm long, 4 mm wide, tips crenate. Stamens 2.7 mm long. Ovaries elliptic, 1.5 mm long and 1.2 mm in diameter at anthesis. Styles 3, branched subdigitately above the middle into numerous segments, stigmas 1-3 lobed. Capsule 2.3 mm long.

This new species was discovered by Phil Mann in 1989 and shown to Allen Lowrie in the field in 1990. It belongs in *Drosera* subgenus *Ergaleium* section *Erythrorhiza*. The following species are considered the closest relatives of *D. prostratoscaposa*, but differ from it in the features cited.

Drosera macrophylla produces a basal rosette of sessile leaves approximately half the size of the fully mature leaves before the inflorescence is produced. Two or more scapes usually follow, bearing four to six flowers each. Flowers are white and close at night; anthesis lasts several days, so that several flowers per scape are open at once. The scapes and pedicels are erect both at anthesis and in fruit.

Drosera bulbosa produces a rosette of leaves, juvenile at the time of flowering. Leaves are sessile. All scapes are single flowered. Each flower lasts only one day. After anthesis the scapes lie prostrate on the soil, and are thus spatially separated from subsequently produced scapes. Maturation of leaves occurs only when flowering is completed, and thus most of the leaves cover the prostrate inflorescences.

Drosera prostratoscaposa is distinguished from the above species by producing petiolate leaves and branched, many flowered scapes that become prostrate as flowering proceeds; the pedicels themselves are erect at anthesis but prostrate in fruit. Inflorescences are produced when leaves are quite immature. Anthesis lasts for several days (each flower), and the flowers are distinctively jasmine-scented.

Drosera prostratoscaposa is a common species for at least 3 km northwest along the road from the type collection area. Large swarms of plants of this species abound in this area. This species may extend in other parts of Fitzgerald National Park, but lack of roads and rugged terrain in this area have limited exploration. Associated species could not be determined accurately in the collection area because of recent fires.

**TAXONOMY OF *ERIGERON BELLIDIASTRUM* (ASTERACEAE:
ASTEREAE), WITH A NEW VARIETY**

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ABSTRACT

Erigeron bellidiastrum Nutt. var. *arenarius* comb. nov. occurs in trans-Pecos Texas, southeastern New Mexico and northern Chihuahua, México, and differs from both var. *bellidiastrum* and var. *robustus* in its lobed basal and lower cauline leaves. A key, distribution map, and summary of typification for the three varieties of *E. bellidiastrum* are presented.

KEY WORDS: *Erigeron*, Asteraceae, Astereae, United States, México.

Erigeron bellidiastrum Nutt. is a species of sect. *Olygotrichium* Nutt. (Nesom 1989) that occurs in sandy habitats of the western United States. It is recognized by its annual duration, the upcurved hairs of its stem, relatively few ray flowers with broad ligules, simple pappus, and particularly by a feature of its involucre/fruit morphology. Some of the ray flowers are interspersed between involucre bracts, and the mature achenes of these are held in place between the bracts as they reflex. These achenes apparently are not released until the involucre deteriorates. I have not seen this arrangement of ray flowers in any other species of the genus.

Cronquist (1947) correctly noted that the basal leaves of *Erigeron bellidiastrum* vary from entire to pinnately lobed, but he did not include observations on the geographic distribution of these variants. In fact, entire leaved plants occur widely over the range of the species, but plants with lobed or deeply toothed leaves are restricted to the southernmost portion of its range. Johnston (1970) observed that an "unnamed race" of this species occurs in trans-Pecos Texas, "marked by the dense, grayish hispid pubescence and small stature (8-11 cm)." Although Johnston's description of neither the species nor the "unnamed race" included lobed leaves, they are more diagnostic of these atypical plants than features of pubescence or reduced stature. These plants

occur in southeastern New Mexico and northern Chihuahua as well as their primary range in trans-Pecos Texas, and in the following taxonomic synopsis, they are formally recognized as a variety of *E. bellidiastrum*.

Erigeron bellidiastrum Nutt., Trans. Amer. Philos. Soc. 2, 7:307. 1841.
TYPE: UNITED STATES. [Wyoming?]: "On the borders of the Platte, within the Rocky Mountains, [May-Jun 1834], *T. Nuttall s.n.* (GH!). As noted by Cronquist (1947), the NY! specimen labeled "Platte, Fremont" may represent part of Nuttall's original collection.

Erigeron bellidiastrum Nutt. var. *bellidiastrum*.

Erigeron eastwoodiae Woot. & Standl., Contr. U.S. Natl. Herb. 16:183. 1913. TYPE: UNITED STATES. New Mexico: [San Juan Co.], dry hills, N end of the Carrizo Mts., 30 Jul 1911, *P.C. Standley 7433* (HOLOTYPE: US!).

Utah, Colorado, Wyoming, [Montana], South Dakota, Nebraska, Kansas, Oklahoma, Arizona, New Mexico, and Texas; open habitats in deep, loose sand; 1050-1650 m; May-August(-September).

Erigeron bellidiastrum Nutt. var. *robustus* Cronquist, Brittonia 6:256. 1947. TYPE: UNITED STATES. Oklahoma: Greer Co., near Granite, in sandy grassy river valley, 18 Jun 1913, *Stevens 1015.1* (HOLOTYPE: GH!; Isotype: MINN).

Colorado, Nebraska, Kansas, Oklahoma, New Mexico, and Texas; open habitats in deep, loose sand; 550-1100 m; May-July(-September). Cronquist (1947) noted that this is "not a very strong variety," but I agree with him that it can be distinguished, both morphologically and geographically. Leaf shape appears to be a more decisive character than stem width for separating it from var. *bellidiastrum*. Intergrades are common where the two taxa are sympatric. The records mapped for var. *bellidiastrum* that are well inside the range of var. *robustus*, almost certainly represent small sized variants or otherwise depauperate individuals within populations of var. *robustus*.

Erigeron bellidiastrum Nutt. var. *arenarius* (E. Greene) Nesom, *comb. nov.* BASIONYM: *Erigeron arenarius* E. Greene, Bull. Torrey Bot. Club 25:121. 1898. TYPE: UNITED STATES. New Mexico: [Doña Ana Co.], sand hills near Mesilla, 17 Jun 1897, *E.O. Wootton 23* (HOLOTYPE: US!; Isotypes: NMC, RM!).

Basal and lower cauline leaves oblanceolate in outline, deeply toothed to pinnately lobed. Southwestern Texas and adjacent New Mexico and Chihuahua; open habitats in deep, loose sand, sometimes with oaks; 800-1300 m; flowering March-June, otherwise sporadically with rain.

Representative collections examined: MÉXICO. Chihuahua: 10 mi N of Samalayuca on Hwy 45, 20 Mar 1985, *Zika 8665* (TEX).

UNITED STATES. New Mexico: Doña Ana Co., Mesilla valley, 12 Jun 1900, *Barber s.n.* (NMC); Doña Ana Co., 3.7 mi NW of Anapra on Hwy 273, 26 Apr 1983, *Ferguson 243* (TEX); Doña Ana Co., mesa W of Organ Mts. near college, 24 Apr 1900, *Wootton s.n.* (NMC); Doña Ana Co., Mesilla valley, 10 Apr 1907, *Wootton & Standley 3298* (NMC). Texas: Andrews Co., vacant lots around town [of Andrews], 5 May 1959, *Scudday s.n.* (TEX); Crane Co., sandhills ca. 16 mi N of Imperial, 15 Apr 1949, *Warnock 8394* (TEX); El Paso Co., El Paso, 17 Apr 1884, *M.E. Jones 3710* (ARIZ, NY); El Paso Co., E of El Paso along Hwy 62-180, 4.0 mi E of jct with Hwy 659, 23 Oct 1983, *Worthington 11590* (TEX); Hudspeth Co., Indian Hot Springs, 20 Apr 1937, *Whitehouse 8441* (TEX); Jeff Davis Co., [locality unspecified], Apr 1929, *Ingram 2706* (LL); Presidio Co., 11 mi N of Porvenir, 17 Apr 1947, *McVaugh 7998* (TEX); Reeves Co., near Pecos, 5 Jun 1932, *Whitehouse 8460* (TEX); Ward Co., 3 mi ENE of Monahans, 6 May 1947, *McVaugh 8190* (TEX); Ward Co., 4 mi E of Monahans, 20 Jun 1948, *Warnock 7880* (LL); Winkler Co., 3 mi N of Wink on Rte 115, 9 Jul 1965, *Irving 89* (TEX).

Distribution records of var. *arenarius* shown on Figure 1 represent plants with leaves that range from pinnatifid to weakly trilobed. Particularly in Ward and Winkler counties, they have weakly lobed leaves and appear to intergrade with var. *robustus*. I cannot corroborate Johnston's observation that the plants of var. *arenarius* are shorter than others of the species or that they are consistently different in vestiture. The achenes of var. *arenarius* range slightly greater in length (1.1-1.6 mm long) than in the other varieties (1.0-1.4 mm) but there is significant overlap.

Chromosome counts (Solbrig, *et al.* 1964, 1969; Keil & Pinkava 1976; Nesom 1978) from var. *bellidiastrum* and var. *robustus* have all been diploid ($n=9$). Ward (1984) reported a tetraploid ($n=18$) in var. *bellidiastrum* from San Juan Co., New Mexico. No count is available for var. *arenarius*, but I have examined pollen from nine plants of it as well as five of var. *robustus* and found in every case, that the stainability is greater than 95% and the size and shape regular, indicating that the species is probably primarily diploid over its entire range.

KEY TO THE VARIETIES OF *ERIGERON BELLIDIASTRUM*

1. Basal and lower cauline leaves lobed or deeply toothed ... var. *arenarius*
- 1' Basal and lower cauline leaves entire or rarely with a pair of shallow teeth (2)

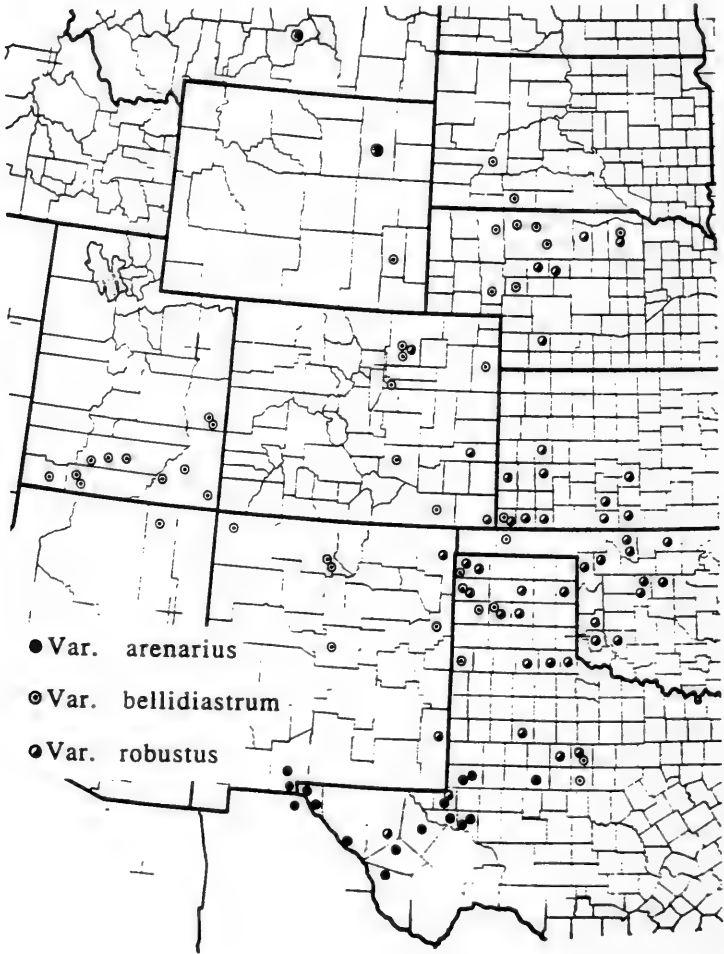


Figure 1. Geographic distribution of the varieties of *Erigeron bellidiastrum*, based on records seen by the author from LL, NY, TEX, and various other herbaria and on specimens cited by Cronquist (1947). The distributions of var. *bellidiastrum* and var. *robustus* are representative as shown but not complete. The two asterisks (Montana, Wyoming) represent range extensions by records on the distribution map published for the Great Plains flora (GPFA 1977) but not seen in the present study.

2. Lower part of stem mostly 1-2(-2.5) mm thick; largest leaves linear to linear oblanceolate, 1.0-1.5(-3.0) cm long, 1.0-2.5(-3.0) mm wide var. *bellidiastrum*
- 2' Lower part of stem mostly (2.0-)2.5-5.0 mm thick; largest leaves oblanceolate, 2-4(-6) cm long, 3-5(-15) mm wide var. *robustus*

ACKNOWLEDGMENTS

I thank Dr. B.L. Turner for his review and comments on the manuscript, Dr. Richard Spellenberg for his observations on the type specimen of *Erigeron arenarius* at NMC, and the staff of NY for a loan of specimens.

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VERNONIA DIAZLUNANA (ASTERACEAE, VERNONIEAE), A NEW SPECIES FROM JALISCO, MÉXICO

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ABSTRACT

A new species, *Vernonia diazlanana spec. nov.*, from southern Jalisco, México, is described and illustrated. It is closely related to *V. tortuosa* (L.) S.F. Blake and *V. koelzii* McVaugh, having vegetative features of the former but involucre features of the latter. It differs from both in its glabrous pungent involucre bracts.

KEY WORDS: *Vernonia*, Asteraceae, Vernonieae, México.

Preparation of a treatment of *Vernonia* for the Asteraceae of México (Turner & Nesom. in prep.) has revealed the following novelty.

Vernonia diazlanana B. Turner. *spec. nov.* (Figure 1). TYPE: MÉXICO.

Jalisco: Mpio. de Tecalitlán, Río San Pedro, bosque de encino. 1200 m, 20 Nov 1986, *Carlos Luis Diaz Luna 18179* (HOLOTYPE: TEX!).

V. tortuosae (L.) S.F. Blake similis sed bracteis involucri glabris apicibus carinati-apiculatis pungentibusque differt.

Shrub to 1.2 m high. Stems terete, densely short hirsute. Leaves alternate, those at or near midstem 10-14 cm long, 3-5 cm wide; petioles 10-15 mm long; blades elliptical, about equally tapered at both ends, pinnately veined, pubescent above and below, glandular punctate beneath, the margins serrulate to nearly entire. Heads sessile or nearly so, 6-15, arranged in scorpioid cymes, each usually subtended by a leaflike bract. Involucres campanulate, 9-10 mm high, the bracts 5-6 seriate, graduate, chartaceous, glabrous, the apices with somewhat keeled apiculations. Disk florets 30-40 per head, the corollas, when dry, pale purplish, the tube ca. 3 mm long, the limb ca. 4.5 mm long, the lobes linear, ca. 3.5 mm long. Achenes (immature) obpyramidal, ca. 1.5 mm long, densely appressed pubescent, the inner pappus of 40-50 white, readily

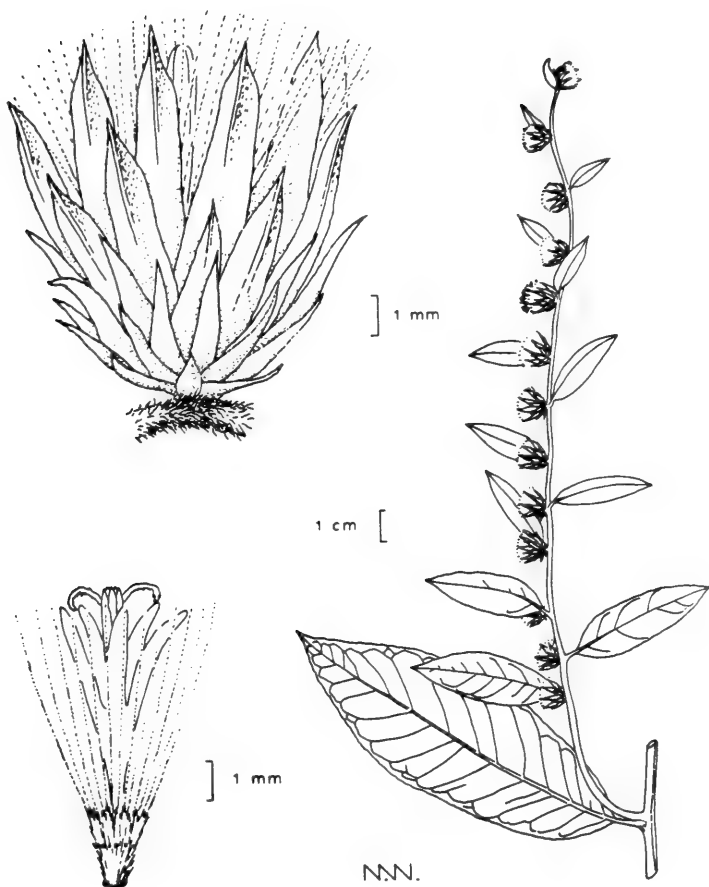


Fig. 1. Vernonia diazlanana, from holotype.

deciduous bristles 6-7 mm long, the outer pappus of 15-20 white lanceolate scales, ca. 1 mm long.

Vernonia diazlanana is closely related to *V. tortuosa* (L.) S.F. Blake of eastern and southern México, but is readily distinguished by its chartaceous involucre bracts, all of which possess somewhat keeled, apiculate, pungent apices; those of *V. tortuosa* are broadly obtuse or rounded and lack an apiculation. It might also be confused with *V. koelzii* McVaugh, which occurs in nearby Colima, but which is readily distinguished by its smaller heads with densely pubescent involucre bracts and broadly ovate leaves. Indeed, *V. diazlanana* appears to stand between *V. tortuosa* and *V. koelzii*, perhaps somewhat closer to the former, although McVaugh (1984) does not account for *V. tortuosa* in his *Flora Novo-Galiciana*.

ACKNOWLEDGMENTS

I am grateful to Dr. Guy Nesom for the Latin diagnosis and to both him and Dr. T. Wendt for reviewing the manuscript. Nancy Webber provided the illustration.

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**A NEW SPECIES OF *NEUROLEANA* (ASTERACEAE, HELIANTHEAE)
FROM SOUTHERN MÉXICO**

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ABSTRACT

A new species, *Neurolaena lamina* *spec. nov.*, from southern México is described and illustrated. It is closely related to *N. lobata* (L.) R. Br., but differs markedly from that species in having thin, subglabrous, nonatomiferous-glandular leaves. It is known by collections from southern Veracruz and adjacent eastern Oaxaca.

KEY WORDS: *Neurolaena*, Asteraceae, Heliantheae, México.

Routine identification of Mexican Asteraceae has revealed a new species of *Neurolaena*. In my revisionary treatment of that genus (Turner 1982), ten species were recognized. Subsequently, an additional species, *N. wendtii* B.L. Turner was added (Turner 1985). The present novelty brings the number of species to twelve.

Neurolaena lamina B.L. Turner, *spec. nov.* (Figure 1). TYPE: MÉXICO. Veracruz: Mpio. Catemaco. en las estribaciones de las montañas de Sta. Marta, ca. 11 km de un camino de terracería que une la población de Tebanca con Bastonal, 800 m, 18 Mar 1988, O. Juárez M. 37 (HOLOTYPE: TEX!; Isotypes: CHAPA, to be distributed).

N. lobatae (L.) R. Br. similis sed foliis multo tenuibus integris eglandulatis tantum hispidis differt.

Suffruticose herbs or shrubs 1-2 m high. Stems terete but somewhat angulate, hispidulous. Leaves 15-26 cm long, 4-7 cm wide, pinnately nerved, very thin, serrulate to entire or nearly so; petioles 1-3 cm long, gradually tapering into the blades; blades ovate-elliptical, sparsely appressed hispid on both surfaces, more so along the major veins, trichomes on the upper surface often with



FIG. 1 NEUROLAEA LAMINA. FROM HOLOTYPE.

broad callous bases. Heads eradiate, 20-numerous, arranged in terminal clusters as in *Neurolaena lobata*. Involucres campanulate, 6-7 mm high, 3-5 mm wide; bracts 5-6 seriate, evenly imbricate, linear spatulate, yellowish, glabrous or nearly so, with broadly rounded scarious apices (except for the outermost bracts, which are much reduced, mostly acute, and sparsely hispid). Florets 16-20, the corollas yellow, 4.5-5.0 mm long, the tube ca. 1.5 mm long, the lobes ca. 0.4 mm long. Achenes ca. 2 mm long, hispidulous, the pappus of 50-60 white ciliate bristles, 4-5 mm long.

Additional specimen examined: MÉXICO. Oaxaca: Mpio. Sta. María Chimalapa, Río Negro, ca. 1 km S Paso Napajo-ua, 13 km S Sta. María (16° 51' N x 94° 40' N), 250 m, selva alta con *Calophyllum*, *Dialium*, *Spondias*, *Brosimum*, etc., suelos café-spardos, pedregosos o profundas con mucha hojarasca, 15 Feb 1985, *H. Hernández G. 858* (CHAPA, TEX).

The species is clearly related to *Neurolaena lobata*, possessing a very similar capitulescence with similar heads. It differs, however, in having very thin, smooth, eglandular, unlobed leaves; the involucral bracts also differ in being essentially glabrous with broad rounded apices.

In leaf shape, venation, and texture, this taxon differs radically from all collections of *Neurolaena lobata* known to me, the taxon with which it is most likely to be confused. *Neurolaena lamina* has leaves very much like *N. intermedia* Rydb., a poorly known species of Guatemala. In my treatment (Turner 1982), the present species will key to the latter, but can be readily distinguished by its larger heads (6-8 mm across vs. 10-12 mm across); otherwise, the two taxa are very similar.

ACKNOWLEDGMENTS

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POLYGONELLA POLYGAMA (VENT.) ENGELM. & A. GRAY,
NEW TO LOUISIANA

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ABSTRACT

Polygonella polygama (Vent.) Engelm. & A. Gray is reported as new to Louisiana.

KEY WORDS: *Polygonella polygama*, Polygonaceae, Louisiana.

Although *Polygonella polygama* has been reported as occurring along the coastal states from Virginia to Texas (Correll & Johnston 1970), it has not been reported from Louisiana (Thomas & Allen 1982; MacRoberts 1989; Paul Lewis, pers. comm.). We discovered *Polygonella polygama* var. *polygama* to be fairly common in xeric, mixed pine-hardwood forest on deep sands in the Winn District of the Kisatchie National Forest in northern Natchitoches Parish (T13N R6W S7). Specimens are deposited at LSUS (*MacRoberts & MacRoberts 920*) and NLU (*Gilmore, Smith, Johnson 3729; Smith & Gilmore 3848, 3849*).

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NEW SPECIES, VARIETIES, AND COMBINATIONS IN *BIDENS* SECTION
GREENMANIA (ASTERACEAE: COREOPSIDEAE)

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ABSTRACT

As a result of systematic studies of *Bidens* section *Greenmania* in México, Central America, and Jamaica, the following new taxa and nomenclatural combinations are proposed: two new species, *Bidens izabalensis* *sp. nov.*, and *Bidens boquetiensis* *sp. nov.*; four new varieties, *Bidens antiguensis* Coulter var. *salvadorensis* var. *nov.*, *Bidens squarrosa* H.B.K. var. *atrostriata* var. *nov.*, *Bidens squarrosa* var. *speciosa* var. *nov.*, and *Bidens squarrosa* var. *hondurensis* var. *nov.*; and three new varietal combinations, *Bidens antiguensis* var. *procumbens* *comb. nov.*, *Bidens squarrosa* var. *tereticaulis* *comb. nov.*, and *Bidens squarrosa* var. *indivisa* *comb. nov.* When appropriate, keys to the taxa are provided.

KEY WORDS: Asteraceae, Coreoideae, *Bidens*, systematics, México, Central America.

A recent systematic study of *Bidens* section *Greenmania* in México, Central America, and Jamaica has resulted in a substantial revision of the section (Roseman 1986). It is now necessary to present the new species and varietal descriptions and new nomenclatural combinations so that they may be used in the treatment of *Bidens* for the Asteraceae of México (Turner & Nesom, in prep). Details of the morphological, phenetic, flavonoid and cytological data that formed the basis of the revision will be published later.

***Bidens antiguensis* Coulter var. *procumbens* (Donn. Smith) Roseman, *comb. nov.* BASIONYM: *Bidens coreopsidis* DC. var. *procumbens* Donn. Smith, Bot. Gaz. (Crawfordsville) 42:299. 1906. TYPE: GUATEMALA. Alta Verapaz: Near Secanquim, 550 m, Jan 1905, *Maxon & Hay 3162* (HOLOTYPE: US!; Isotype: GH!).**

REPRESENTATIVE SPECIMENS: GUATEMALA. Alta Verapaz: *Sternermark 44239*, lowland forest in valley, "pantano," 2.5 mi W of Cubilquitz, 250-300 m, 28 Feb 1942 (F). Petén: *Aguilar 214*, La Liberstad and vicinity, 5 Jan 1935 (AAH, F, MICH, MO); *Contreras 3360*, Lacandon, on El Caribeae trail, ca. 800 m, 8 Feb 1962 (LL); *Contreras 3113*, Polores, in pineland, km 81 of road, 27 Oct 1961 (LL). Zacapa: *Roseman 594*, 9 mi N of Zacapa-Izabal boundary, on road from El Progreso to Puerto Barrios, 100-500 m, 1 Jan 1980 (IA); *Roseman 597*, near Juan de Paz, on road from El Progreso to Puerto Barrios, 3 mi from Zacapa-Izabal boundary, on road from El Progreso to Puerto Barrios, 100-500 m, 1 Jan 1980 (IA).

MÉXICO. Chiapas: *Martínez S. 10440*, en campamento Cofolasa a 24 km al SE de Crucero Corozal, camino a Boca Lacantum, Mpio. Ocozingo, 220 m, 14 Feb 1985 (TEX).

Sherff (1955) listed both *Bidens coreopsidis* DC. var. *procumbens* Donn. Smith and *B. antiguensis* Coulter as synonyms of *B. squarrosa* H.B.K. However, the widespread *B. squarrosa* is almost entirely hexaploid, $n=36$, while both *B. coreopsidis* var. *procumbens* and *B. antiguensis* are tetraploid, $n=24$. In contrast to the hexaploids, populations of *B. antiguensis* have small, mostly smooth awned achenes, shorter leaves with narrower segments, ray florets with fewer striations, and shorter disc florets and anthers.

The var. *procumbens* differs from var. *antiguensis* in having sparsely barbed awns rather than smooth awns, mainly 5 parted rather than 3 parted leaves, with narrower leaflets, and a twining stem with particularly long internodes. Sherff (1955) noted the similarity of *B. c.* var. *procumbens* to *Bidens reptans* (L.) G. Don, a diploid ($n=12$) species, located primarily in Jamaica. *Bidens antiguensis* var. *procumbens* may be readily distinguished from *B. reptans* by its longer leaves (11.0-12.5 cm long vs. 7.5-10.0 cm), narrower rays (2.8-3.5 mm wide vs. 4.0-4.5 mm), shorter achenes (4.8-7.2 mm long vs. 8.4-10.8 mm), and fewer outer involucre bracts (6-8 vs. 7-11).

***Bidens antiguensis* Coulter var. *salvadorensis* Roseman. var. nov. TYPE:** GUATEMALA. Jutiapa: 4.6 mi W of Jutiapa, 700-1000 m, 16 Nov 1979, *Roseman 591* (HOLOTYPE: IA!; Isotypes: to be distributed).

B. antiguensi Coulter multum similis sed differt floribus radii carentibus vel raro 1-4 atque 7.5-11.0 mm longis, involucre bracteis exterioribus plerumque minus quam 0.6 mm latis, et aristis pappi laevibus vel raro 1-4 hamulis retrorsis munitis. Numerus chromosomatum $n=24$.

REPRESENTATIVE SPECIMENS: EL SALVADOR. Ahuachapán: *Stanley 20220*, vicinity of Ahuachapán, 800-1000 m, 9-27 Jan 1922 (GH, NY, US). La Libertad: *Carlson 247*, road between Finca Germania and Finca San Antonio, near Comasagua, ca. 900 m, 23 Jan 1946 (F). Morazan: *Tucker 597*, N

slope of hill north of Montecristo (ca. 15 km NE of San Miguel). 13° 36' N. 88° 04' W, ca. 200 m, 20 Dec 1941 (F, NY, US). San Salvador: *Calderon 169*. San Salvador, 1921 (GH, NY, US). Sonsonate: *Standley 21844*, in hedge, vicinity of Izalco, 19-24 Mar 1922 (GH, US).

GUATEMALA. Esquintla: *Smith 2375*, San Luis, 1000 ft, Apr 1890 (US). Jutiapa: *Roseman 573*, 12.3 mi SE of Zunil on road from Retalhuleu to Quetzaltenango, 500-700 m, 23 Dec 1979 (IA). Retalhuleu: *Standley 88582*, dry thicket, vicinity of Retalhuleu, 240 m, 17 Feb-1 Mar 1941 (F). Santa Rosa: *Heyde & Lux 4193*, Buena Vista, 550 m, Dec 1892 (F, GH, MO, NY, US). Suchitepequez: *Standley 62168*, damp thicket, near Patulul, 330-600 m, 5 Jan 1939 (F, GH, NY).

HONDURAS. Choluteca: *Williams & Molina 10895*, vine in tree in pine forest near San Marcos, 1000 m, 16 Nov 1946 (F, GH, US). Cortez: *Carleton 443*, Cuyamel, 19 Jan 1923 (US). El Paraíso: *Molina 655*, in oak forest below Guayabillas near Quebrada Jagua, 1050 m, 12 Dec 1947 (F, GH, US). Morazan: *Williams & Molina 10826*, barranca near Las Mesas, 900 m, 23 Nov 1926 (F).

NICARAGUA. Estelí: *Stevens & Grijalva 15664*, Loma Ocotezalado (Mesas Moropotente), ca. 11 km NE of Hwy 1 at Estelí, 1260-1300 m, 15 Nov 1979 (TEX). León: *Baker 2121*, Quesalguague, 17 Jan 1903 (TEX). Matagalpa: *Zelaya 1805*. Matagalpa, 6 Jan 1969 (F, GH, MO, NY); *Williams, Molina & Williams 23744*, cloud forest area ca. 5 km N of Matagalpa, Cordillera Central de Nicaragua, 1000 m, 13 Jan 1963 (F, NY, US).

The congested cymose capitulescence and usually discoid heads of var. *salvadorensis* distinguish it from the showier, larger headed var. *antiguensis*. Var. *salvadorensis* occurs along the Pacific slopes in Guatemala and further SE in Central America, whereas var. *antiguensis* occurs in the highlands of Guatemala and Chiapas. Var. *procumbens* is restricted to lower elevations with drainages to the Gulf of Mexico or the Gulf of Honduras. The varieties of *Bidens antiguensis* may be identified by the characters given in the following key.

KEY TO VARIETIES OF *BIDENS ANTIGUENSIS*

1. Leaves mainly 3 parted. blade segments 2.2-3.5 cm wide; achene awns smooth 2
- 1' Leaves mainly 5-7 parted. blade segments 1.5-2.1 cm wide; achene awns with 1-6 retrorse barbs and 0-2 antrorse barbs var. *procumbens*
2. Heads 6-9 mm wide, eradiate or with 1-4 rays, these 7.5-11.0 mm long; outer involucre bracts 3.5-4.5 mm long and 0.4-0.6 mm wide;

SW Guatemala, El Salvador, Honduras, and

Nicaragua var. *salvadorensis*

2' Heads 20-30 mm wide, radiate with 4-5 rays, these 10.3-15.0 mm long; outer involucre bracts 3-4 mm long and 0.5-1.3 mm wide; central Guatemala var. *antiguensis*

Bidens squarrosa H.B.K. var. *atrostriata* Roseman, var. nov. TYPE: MÉXICO. Oaxaca: Monte Alban, hillside behind grand court, 1500-2000 m, 11 Nov 1979, *Roseman 518* (HOLOTYPE: IA!; Isotypes: to be distributed).

B. squarrosae H.B.K. var. *squarrosae* similis sed differt capitulis majoribus (2.3-2.6 cm vs. 2.0-2.3 cm latis), floribus radii longioribus (14-16 mm vs. 12-13 mm longis), et ligulis sulphureis sed pallidis vs. fuscatis.

Leaves 3 parted, (5.8)6.2-14.0(17.8) cm long, (3.9)4.2-10.6(14.0) cm wide, glabrous to densely tomentose, leaflets ovate lanceolate to lanceolate, acuminate; peduncles (1.2)1.4-4.1(4.6) cm long; capitula (2.0)2.3-3.6(4.1) cm wide; outer involucre bracts 5-9(12), these 4.1-6.3(8.0) mm long, 0.6-1.2(1.8) mm wide, densely tomentose on both surfaces; inner involucre bracts 4.1-6.3(8.0) mm long, 1.0-1.4(1.6) mm wide, usually dark brown striped, moderately to densely tomentose; ray florets 5-7(8); ligules 1.2-1.8(2.1) cm long, (3.5)4.0-6.0(7.5) mm wide, pale lemon yellow with dark striations (when dried); disc florets 5.3-6.9(8.2) mm long; anther tubes golden brown, 3.2-4.0 mm long; chromosome number $n=36$ or (rarely) $n=24$.

REPRESENTATIVE SPECIMENS: MÉXICO. Chiapas: *Breedlove & Thorne 30442*, Steep ravine adjacent to Mexican Hwy 190, 20 km W of Cozoacoatlá. 1000 m, 22 Dec 1972 (LL). Guerrero: *Martínez S., et al. 4979*, 2 km al SW de Cruz de Ocote, Camino Filo de Caballo-Puerto de Gallo, 1900 m, 18 Oct 1983 (TEX). Jalisco: *McVaugh 15980*, volcanic slopes 14-15 mi by rd. N of Autlán de Navarro, 3800-4100 ft. 27 Oct 1970 (LL). Michoacán: *Cronquist 9732*, 12 mi S of Ario de Rosales, 4500 ft, 25 Oct 1962 (GH, MICH, MO, US); *King & Soderstrom 4880*, ca. 22 kms S of Uruapan, 3300-3700 ft, 16-22 Oct 1961 (MICH, NY, US); *Roseman 514*, ca. 20 mi S of Arteaga. 1000-1500 m, 7 Nov 1979 (IA). Oaxaca: *Melchert 71-163*, ca. 40 mi S of Totolapán, just SE of Lajarcia, on Hwy 190, ca. 800 m, 18 Oct 1971 (IA); *Roseman 519*, 46-47 mi SE of Oaxaca, just N of Totolapán, 800-1600 m, 11 Nov 1979 (IA); *Cronquist 9685*, savanna-land hillsides just below the pine zone, along the Pan-American highway, 42 mi NW of Tehuantepec, ca. 2300 ft, 17 Oct 1962 (GH, MICH, MO, MSC, NY, US).

The most striking feature of var. *atrostriata* is the pale sulfur yellow color of its ligules, contrasting with the darker sulfur yellow of other *Bidens squarrosa* varieties. When dried, the ligules of var. *atrostriata* become pale with very

dark striations, the inner involucre bracts have dark brown to black striations, and the anthers are golden to light brown. Var. *atrostriata* can also be distinguished from varieties *tereticaulis*, *hondurensis*, and *squarrosa* by its much larger capitula (29.5 ± 1.4 mm wide) and longer rays (14.9 ± 0.7 mm long). Var. *speciosa* has even larger heads; however, var. *atrostriata* has more numerous ray florets (6.3 ± 0.3) and longer anther tubes (3.6 ± 0.1 mm).

***Bidens squarrosa* H.B.K. var. *speciosa* Roseman var. nov.** TYPE: GUATEMALA. Quetzaltenango: 1 mi from Zunil on road to Fuentes Georgina, ca. 2500 m, 24 Dec 1979, *Roseman 583* (HOLOTYPE: IA!; Isotypes: to be distributed).

B. squarrosae H.B.K. var. *atrostriatae* Roseman similis sed floribus radii longioribus (17-18 mm vs. 14-16 mm longis) ligulis atrosulphureis et involucri ciliis longis ad margines atque bases bractearum strigosarum externarum.

Leaves usually 5 parted, (7.6)10.0-15.2(17.2) cm long, (4.8)6.4-12.6(14.2) cm wide, leaf segments (1.9)2.3-3.9(4.7) cm wide; peduncles 2.6-4.3 cm long; capitula 2.6-3.8(4.2) cm wide; outer involucre bracts (5)6-8(9), these 3.8-6.2(8.0) mm long, 0.8-1.4(1.8) mm wide, long strigose on both surfaces. long ciliate margins; inner involucre bracts 5.7-7.1(7.5) mm long, 1.3-1.9 mm wide, usually containing purple anthocyanins. yellow tomentose apically: ligules (1.3)1.5-2.0(2.4) cm long, 4.4-5.8(6.2) mm wide; disc florets 5.4-7.0(7.5) mm long; anther tubes 2.7-3.7 mm long; chromosome number, $n=36$.

REPRESENTATIVE SPECIMENS: GUATEMALA. Chimaltenango: *Skutch 763*, near Tecpam, 7200 ft, 16 Dec 1933 (AAH, MICH, US). Huehuetenango: *Steyermark 48839*, vicinity of Moxbal, ca. 17 mi N of Barillas, Sierra de los Cuchumatanes, 1500 m, 15-16 Jul 1942 (F, US). Quetzaltenango: *Roseman 574*, just past village of Santa María de Jesús on road to Quetzaltenango, 2000-2500 m, 23 Dec 1979 (IA). Quiché: *Skutch 1816*, "Zona Reyna." 2600 ft. 2 Dec 1934 (AAH). Sacatepequez: *Kellerman* (US 2442545), Antigua, Volcán de Agua, 15 Feb 1905 (US). Solola: *Kellerman 7474*, San Lucas Toliman, Atitlan, 7000 ft, 23 Jan 1907 (US). Zacapa: *Steyermark 42580*, slopes of Monte Virgen, 2200-2400 m, 12-13 Jan 1942 (F, NY).

MÉXICO. San Luis Potosí: *Pringle 3373*, Tamosopo Canyon, 28 Nov 1890 (F, GH, MO, MSC, NY, RSA, US). Tamaulipas: *Viereck 944*, San Lucas, 800 m, (without date) (US). Veracruz: *Roseman 631*, Cascades de Naolinca, 1000-1500 m, 23 Jan 1980 (IA); *Roseman 629*, 10 mi S of Huatusco, 1500-2000 m, 21 Jan 1980 (IA).

Var. *speciosa* occurs primarily in the mountains of Guatemala, and also on volcanic peaks of central and southern México. It has the longest peduncles (37.0 ± 2.3 mm), widest capitula (33.9 ± 1.0 mm) and longest ray florets

(17.7±0.5 mm) of any variety within *Bidens squarrosa*. It has large, often 5 partite leaves, with deep, forward pointing serrations and long ciliate margins. Both inner and outer involucre bracts are strigose, and the outer bracts have long ciliate margins and bases.

***Bidens squarrosa* H.B.K. var. *tereticaulis* (DC.) Roseman, *comb. nov.*
 BASIONYM: *Bidens tereticaulis* DC., *Prodr.* 5:598. 1836. LECTO-
 TYPE (here designated): MÉXICO. Veracruz: in silvis, Tantoyuca,
 Dec 1830, *Berlandier 2150* (G-DC; Isolectotypes: F!, GH!, MO!).**

REPRESENTATIVE SPECIMENS: BELIZE: *Proctor 29365*, wooded lime-
 stone hillside, Los Altos Hill, Augustine, 1500-1600 ft, 3 Dec 1968 (LL); *Lundell*
136, Honey Camp, Orange Walk, Sep-Dec 1928 (F, GH, US).

MÉXICO. Campeche: *Lundell 1032*, Tuxpena, Dec 8, 1931 (F, MICH,
 MO, NY, US). Chiapas: *Breedlove 7687*, slopes along the Tana Te' river
 near Sahal K'esh, paraje of Mahben Chauk, 2900 ft, 27 Nov 1964; *Breedlove*
41895, 15 km E of La Trinitaria on rd. to Monte Bello, 1600 m, 28 Nov
 1976 (LL); *Breedlove 41480*, rd. from Tuxtla Gutiérrez to Chicoasen Dam, 850
 m, 17 Nov 1976 (TEX); *Roseman 523*, single vine 25 ft high in a tree, ca.
 30 mi SE of San Cristóbal de las Casas, 1600-2400 m, 13 Nov 1979 (TEX).
 Hidalgo: *Roseman 634*, ca. 12 mi S of Huehuetla, 28 Jan 1980 (IA). Oaxaca:
Roseman 619, sprawling over wet ground, ca. 8 mi N of Chiltepec, 200-400
 m, 17 Jan 1980 (IA). Puebla: *Goldman 30*, near Metaltoyuca, 800 ft, 27
 Jan 1898 (GH, MICH, US). San Luis Potosí: *Frye & Frye 2958*, S of Valles,
 near Río Tampaon, 31 Dec 1940 (F, GH); *Roseman 639*, growing along cliffs
 3-4 mi N of Tamazunchale. 400-800 m, 30 Jan 1980 (IA). Tabasco: *Rovirosa*
688, in thickets between San Juan Bautista and Atasta, 8 Jan 1890 (NY, US).
 Tamaulipas: *Palmer 122*, vicinity of Tampico, ca. 15 m, 1-31 Jan 1910 (F, GH,
 MO, NY, US). Veracruz: *Smith 587*, Coatzacoalcos, Isthmus of Tehuantepec,
 5 Feb 1895 (GH, MICH, MO, NY, US); *Roseman 637*, near Tampico, 0-100
 m, 29 Jan 1980 (IA). Yucatán: *Roseman 612*, ruins at Uxmal, 0-100 m, 14
 Jan 1980 (IA); *Greenman 468*, Izamal, 22 Feb 1906 (F).

Var. *tereticaulis* occurs along the Gulf slopes in E México. in the Yucatán
 Peninsula, and also in Chiapas. Several distinctive flavonoid populational
 groupings have been found within var. *tereticaulis* (Roseman 1986). It can
 be distinguished from other varieties of *Bidens squarrosa* by means of the
 characters listed in the following key.

KEY TO VARIETIES OF *BIDENS SQUARROSA*

1. Heads usually larger than 25 mm, ray number usually 5 or more, ray
 length greater than 14 mm, ray width greater than 4.5 mm, disc floret
 length greater than 5.5 mm2

- 1' Heads usually smaller than 25 mm, ray number zero to 4 (or rarely 5), ray length less than 14 mm, ray width less than 4.5 mm, disc floret length less than 5.5 mm 3
2. Peduncles longer than 32 mm, achenes shorter than 10.5 mm, awns usually with less than 5 retrorse barbs, rays and inner involucre bracts with brown or golden striations (when dried), anthers dark brown or purplish var. *speciosa*
- 2' Peduncles shorter than 32 mm, achenes longer than 10.5 mm, awns usually with more than 5 retrorse barbs; rays and especially inner involucre bracts with dark brown to blackish striations (when dried), anthers golden to light brown var. *atrostriata*
3. Achenes usually longer than 9.5 mm, awns usually shorter than 3.4 mm; plants of México and Belize var. *tereticaulis*
- 3' Achenes usually shorter than 9.5 mm, awns usually longer than 3.4 mm; plants of Central and South America 4
4. Heads usually 17-20 mm across, the ligules mostly shorter than 11 mm, striations of ligule usually 10 or more, leaves mostly simple, these glabrous to sparsely hispidulous (never tomentose), plants of Nicaragua var. *indivisa*
- 4' Heads usually 20-26 mm across, the ligules mostly longer than 11 mm; striations of ligule usually 8-9, leaves simple or 3-5 parted, variously glabrous to tomentose; plants of Honduras, El Salvador, Costa Rica, Panamá, and South America 5
5. Leaves simple and tomentose, outer involucre bracts usually shorter than 4 mm, inner involucre bracts usually shorter than 5.5 mm; plants of Honduras, El Salvador, and northern Costa Rica var. *hondurensis*
- 5' Leaves usually 3 parted, sometimes simple or 5 parted, glabrous to moderately pubescent, outer involucre bracts usually longer than 4 mm, inner involucre bracts usually longer than 5.5 mm; plants of Costa Rica, Panamá, and South America var. *squarrosa*

***Bidens squarrosa* H.B.K. var. *hondurensis* Roseman, var. nov.** TYPE: HONDURAS. Morazan: over shrubs in bog, San Juan del Rancho, slopes of Mt. Uyuca, 1500 m, 12 Dec 1975, *L.O. Williams & Antonio Molina R. M-10* (HOLOTYPE: IA!; Isotype: EAP). The types cited here are part of a group of specimens sent by L.O. Williams to T. Melchert for cytological and flavonoid studies.

B. squarrosae H.B.K. var. *squarrosae* similis sed differt foliis parvis simplicibus dense tomentosisque, pedunculis brevioribus (23-27 mm vs. 30-33 mm longis), et involucri bracteis interioribus brevioribus (4.8-5.2 mm vs. 5.6-5.8 mm longis).

Leaves simple, (3.5)7.3-11.3(13.7) cm long, 2.2-3.0 cm wide, moderately to densely tomentose; peduncles 1.8-3.1 cm long, capitula (0.9)1.7-3.1(3.4) cm wide; outer involucre bracts 2.6-4.8 mm long; inner involucre bracts (3.0)4.2-5.6(6.0) mm long; chromosome number $n=36$.

REPRESENTATIVE SPECIMENS: COSTA RICA. Puntarenas: *Roseman 570*, ca. 6 mi S of Santa Elena, 21 Dec 1979 (IA).

HONDURAS. Comayagua: *Standley 56430*, vicinity of Siguatepeque, 1080-1400 m, 14-27 Feb 1928 (F, US). Copán: *Pittier 1838*, in hedges around Copán, 600 m, 9 Jan 1907 (F, US). El Paraíso: *Williams & Molina M-11*, Ojo de Agua, Choluteca river valley, 650 m, 11 Jan 1976 (EAP, IA). La Paz: *Williams & Molina M-3*, Hoya Grande, above Escuela Agrícola Panamericana, 1200 m, 18 Dec 1975 (EAP, IA). Olancho: *Standley 18288*, trail from Catacamas, 500-900 m, 19 Mar 1949 (F).

This variety is widespread in Honduras, and is found also near the crater of Volcán San Salvador in El Salvador, and at scattered localities south into northwestern Costa Rica. The plants are commonly simple leaved and densely tomentose throughout, with small capitula (23.9 ± 1.5 mm across), short peduncles (24.5 ± 1.6 mm), and particularly short inner involucre bracts (5.0 ± 0.2 mm long). Although the small heads are quite similar to those of var. *tereticaulis*, the small, tomentose, simple leaves of var. *hondurensis* are in marked contrast to the large 3-5 partite, usually glabrous or slightly pubescent leaves of var. *tereticaulis*. The short peduncles of var. *hondurensis* distinguish it from var. *squarrosa*.

Bidens squarrosa H.B.K. var. *indivisa* (B.L. Robins.) Roseman, *comb. nov.* BASIONYM: *Bidens tereticaulis* DC. var. *indivisa* B.L. Robins.. Proc. Bost. Soc. Nat. Hist. 31:270. 1904. TYPE: NICARAGUA. Masaya: Masaya, 27 Jan 1903, *Baker 2214* (HOLOTYPE: GH!; Iso-types: GH!, MICH!, MO!, NY!, POM!, US!).

REPRESENTATIVE SPECIMENS: HONDURAS. Yoro: *Standley 55075*, near Progreso, 30 m, 24 Jan 1928 (F, US).

NICARAGUA. Managua: *Standley 8229*, vicinity of Casa Colorado near El Crucero, summit of Sierra de Managua, 800-900 m. 14-15 May 1947 (F); *Grant 1003*. Sierras de Managua. 400 m, 18 Dec 1940-9 Feb 1941 (AAH, F).

This variety is primarily found within the Sierras de Managua, a low elevation, small volcanic mountain range near the Pacific Ocean. Although it seems most closely associated morphologically and geographically with var.

hondurensis, it differs in having glabrous to slightly hispidulous leaves, which are much longer and broader than those of var. *hondurensis*, and smaller capitula, with fewer, shorter ray florets. Unfortunately, no flavonoid data or chromosome counts are available from this variety.

Bidens izabalensis Roseman, *sp. nov.* TYPE: GUATEMALA. Izabal: abundant, climbing along roadside over shrubs and grass, 1 mi SW of road to Mariscos from main highway to Puerto Barrios, 1 Jan 1980, *Roseman 598* (HOLOTYPE: IA!; Isotypes: to be distributed).

B. squarrosae H.B.K. var. *speciosae* Roseman similis sed differt foliis plerumque simplicibus (vs. 3-5 partitis), ciliis longis ad basim involucri, et pedunculis longioribus (41-48 mm vs. 35-39 mm). Differt a *B. squarrosae* vars. *indivisae* (B.L. Robins.) Roseman et *hondurensi* Roseman foliis crassis coriaceisque et capitulis majoribus (plus quam 33 mm vs. minus quam 26 mm latis).

Stems scandent, robust, often rooting at the nodes, glabrous or densely tomentose; leaves coriaceous, usually simple, sometimes 3 parted, (9.6)11.3-15.7(18.3) cm long, 3.0-11.8 cm wide, petioles (1.2)1.9-4.5(6.2) cm long, leaves or leaflets ovate lanceolate to triangular, acuminate, margins sharply serrate, usually glabrous but rarely densely puberulent on both surfaces; heads few, in large, open cymose inflorescences, peduncles 3.1-5.8(7.0) cm long, capitula (2.5)2.7-3.4(3.5) cm wide; involucre basally strigose or rarely tomentose. outer involucral bracts (4)6-8(10), (3.0)4.0-6.8(9.0) mm long, 1.0-1.6(2.0) mm wide, linear to linear spatulate, acute, ciliate, glabrous (tomentose); inner involucral bracts 8-12, (5.0)5.6-7.8(8.5) mm long, (1.2)1.5-1.9(2.0) mm wide, glabrous to sparsely strigose on outer surface, yellow tomentose apically; ray florets 3-7(9), ligule narrowly elliptic, acuminate to slightly mucronate, (12.5)13.7-19.1(22.0) mm long, 3.7-5.5(6.0) mm wide, 7-9 striate; disc florets (18)26-38, 5-6 mm long; anther tubes 2.8-3.5 mm long, dark brown; achenes 7.0-9.5(10.0) long, awns 2, straight, (2)3(4) mm long, 2-6 retrorse and 0-1 antrorse barbs; chromosome number $n=36$.

REPRESENTATIVE SPECIMENS: BELIZE: *Funk 2601*, Cayo, 26.6 mi W of Belize on Hwy to Roaring Creek, 1 Dec 1977 (TEX); *Crane 162*, Corozal district, Cerros Maya Ruins, Lowry's Bight, coastal area, 18 Mar 1981 (LL); *Gentle 949*, Maskall, 9 Dec 1933 (F, MICH, NY).

GUATEMALA. Alta Verapaz: *Tuerckheim 1475*, Cobán, 1350 m, Nov 1906 (F, MICH, MO); *Johnson 921*, Samac, "Tsulah-karn," 4500 ft, 20 Nov 1920 (US). Baja Verapaz: *Hawkes, Hjerting & Lester 1930*, summit of road, damp forest, clearings, 16 mi from Salamá on road to Cobán, Patal, 1700 m, 11 Nov 1958 (F). Izabal: *Roseman 598*, 1 mi SW turn off to Mariscos from Hwy to Puerto Barrios, 1 Jan 1980 (IA); *Steyermark 38518*, jungle thickets, between Milla 49.5 and ridge 6 mi from Izabal, Montaña del Mico, alt. 65-600

m, 1 Apr 1940 (F). Petén: *Aquilar 231*. La Libertad and vicinity, 29 Nov 1934 (AAH. MICH. MO, NY, US); *Contreras 3646*, Vaxactun, Bajo El Brinco. in tinal on Dos Lagunas Rd.. ca. 4 mi N, 23 Dec 1963 (LL). Zacapa: *Roseman 595*, scrambling over muddy bank. rooting at the nodes. near Juan de Paz. 4 mi from Zacapa-Izabal boundary line, 1 Jan 1980 (IA).

MÉXICO. Chiapas: *Breedlove & Davidse 55236*, 70 km SW of Palenque on rd to Ocosingo along the Jol Uk'um, 550 m, 9 Nov 1981 (TEX).

This species differs from *Bidens squarrosa* varieties *indivisa* and *hondurensis*, which also have simple leaves, by the thick, coriaceous leaf texture and larger heads (greater than 33 mm across vs. less than 26 mm).

Bidens izabalensis occurs mainly in the Atlantic drainage slopes of Guatemala. Most plants are robust vines, with especially long internodes, thick stems, and thick, coriaceous, primarily simple leaves. Specific morphological features which characterize *B. izabalensis* and help to distinguish it from the ubiquitous *B. squarrosa* and *B. antiguensis* populations are: 1) heads 30.6 ± 0.9 mm wide at anthesis, 2) peduncles 44.5 ± 3.4 mm long, 3) base of the involucre with long cilia, 4) outer involucral bracts 5.5 ± 0.4 mm long and 1.3 ± 0.1 mm wide.

Bidens boquetiensis Roseman, *sp. nov.* TYPE: PANAMÁ. Boquete: climbing 20 ft. into trees near coffee finca. 23 mi from church in Boquete, on road to Altos de Boquete, 6 Dec 1979, *Roseman 556* (HOLOTYPE: IA!; Isotypes: to be distributed).

B. holwayi Sherff & S.F. Blake similis sed differt involucri bracteis exterioribus longioribus (8.9-9.9 mm vs. 7.1-7.5 mm longis) et floribus disci longioribus (7.8-8.2 mm vs. 6.3-6.5 mm longis). Differt a *B. squarrosae* H.B.K. var. *squarrosae* floribus radii longioribus (2.1-2.7 cm vs. 9.4-14.7 cm longis) et pedunculis longioribus (5.0-7.8 cm vs. 2.3-4.0 cm longis).

Stems scandent, robust, glabrous to moderately tomentose; leaves simple or 3 to 5 parted, 11.9-14.9(19.2) cm long, 4.8-10.6(16.4) cm wide. leaf segments 1.8-4.3(4.8) cm wide, petioles 1.9-3.7(4.3) cm long, leaflets lanceolate or ovate lanceolate, acuminate, margins sharply serrate, glabrous to hispidulous on upper surface, hispidulous to densely tomentose on lower surface; heads few, in terminal and lateral open cymose inflorescences, peduncles (3.0)5.0-7.8(9.3) cm long, capitula (3.5)4.2-5.2(6.0) cm wide; involucre basally strigose to densely long tomentose; outer involucral bracts 8-10(12), these (5.0)5.9-8.7(9.0) mm long, (0.8)1.0-1.6(2.2) mm wide, linear spatulate, acute, with swollen bases, ciliate, glabrous to densely pubescent on both surfaces; inner involucral bracts (6)7-11(13), these 6.5-8.1(9.0) mm long, 1.4-2.2(3.0) mm wide, with swollen bases, densely yellow tomentose apically, glabrous to moderately hispidulous;

ray florets 5-7, ligules narrowly elliptic, acute to acuminate, slightly mucronate to denticulate, 2.1-2.7 cm long, 6.1-9.0 cm wide, 9-13 striate, sometimes with interrupted or branched striations; disc florets 12-28, the corollas 5.8-7.0 mm long; anther tubes 3.5-4.5 mm long, black; achenes linear, dark brown to black, glabrous, ciliate on margins and summit, 9.5-13.6(16.0) mm long, the awns 2, reflexed, 4.3-5.7(6.0) mm long, with 3-6(8) retrorse and 0-1 antrorse barbs per angle of awn; chromosome number, $n=48$ or, very rarely, $n=72$ or $n=36$.

REPRESENTATIVE SPECIMENS: COSTA RICA. Alajuela: *Standley & Torres R. 47910*, Viento Fresco, 1600-1900 m, 13 Feb 1926 (US). Cartago: *Holway 453*, Volcán de Irazú, 1500 m, 21 Jan 1916 (GH); *King 5398*, 16 kms S of Cartago, 24 Aug 1962 (TEX). Heredia: *Jiminez 2510*, San Rafael de Heredia, 1570 m, 12 Nov 1964 (F); *Roseman 563*, Vara Blanca, 16 Dec 1979 (IA). Puntarenas: *Pounds 98*, Monteverde Cloud Forest Reserve, 1500-1600 m, 14 Oct 1983 (TEX); *Roseman 567*, 1.5 mi N of cheese factory, Monteverde, 1450 m, 20 Dec 1979 (IA).

PANAMÁ. Chiriquí: *Allen 1342*, vicinity of "New Switzerland," central valley of Río Chiriquí Viejo, 1800-2000 m, 6-14 Jan 1939 (F, GH, MO NY, US); *Davidson 151*, Bajo Chorro. Boquete. 6000 ft, 18 Jan 1938 (F, GH, MO US); *Davidson 1004*, Volcán de Chiriquí, Boquete district, 9500 ft, 16 Jul 1938 (F); *Roseman 555*, 3.3 mi N of Boquete near bridge, 3300-4200 ft, 5 Dec 1979 (IA); *Roseman 559*, ca. 5 mi NW of Volcán, on road to Río Serreno, 8 Dec 1979 (IA).

Populations of *Bidens boquetiensis* are found in the cloud forest of many high elevation sites in Costa Rica and Panamá. These primarily octoploid populations are vigorous and robust, climbing as high as 20-30 m into forest trees and then hanging downwards. They have extremely large, showy heads and large simple or 3-5 parted leaves. They may be distinguished from the hexaploid *B. squarrosa* var. *squarrosa* populations of the same geographic areas by their much larger heads (4.2-5.2 cm across vs. 1.2-2.8 cm), longer peduncles (5.0-7.8 cm vs. 2.3-4.0 cm), and longer rays (21-27 mm vs. 9.9-14.7 mm). The only other closely related taxon with extremely large heads is *B. holwayi* Sherff & S.F. Blake of Guatemala and México. *Bidens holwayi* is also an octoploid taxon ($n=48$), but has a quite different flavonoid chemistry. It can be distinguished morphologically from *B. boquetiensis* by its longer outer involucre bracts (9.4 ± 0.5 vs. 7.3 ± 0.2), longer inner involucre bracts (9.8 ± 0.4 vs. 7.3 ± 0.1), and longer disc corollas (8.0 ± 0.2 mm vs. 6.4 ± 0.1).

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NEW NAMES AND COMBINATIONS IN *COSMOS*
(ASTERACEAE, COREOPSIDEAE)

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ABSTRACT

A newly discovered white to pale pink rayed *Cosmos* "intercedens-like" tetraploid from Jalisco, México is described as a variety of the yellow rayed *Cosmos landii* Sherff (*C. landii* var. *achalconensis* var. *nov.*). A large headed, previously named, tetraploid race of *C. diversifolius* Otto, found to the south of México City is reduced to varietal rank as *C. diversifolius* var. *dahlioides* *comb. nov.* *Cosmos stellatus* Sherff is treated as a geographically isolated variety of *C. sessilis* Sherff (*C. sessilis* var. *stellatus* *comb. nov.*; and the Jalisco endemic, *C. diversifolius* var. *deficiens* Sherff is elevated to species status (*C. deficiens* *comb. nov.* Illustrations and discussions relating to these proposals are presented.

KEY WORDS: Asteraceae, Coreopsideae, *Cosmos*, México.

The main purpose of this publication is to put forward several new *Cosmos* names and combinations so that they can be included in the author's treatment of the genus in the soon to be published Asteraceae of México (Turner & Nesom, in prep). More detailed data will be published elsewhere.

Cosmos diversifolius Otto var. *dahlioides* (S. Wats.) Melchert, *comb. nov.* BASIONYM: *Bidens dahlioides* S. Wats., Proc. Amer. Acad. Arts 26:142. 1891. MÉXICO. México: hills Flor de María, 3 Sep 1890, Pringle 3168 (HOLOTYPE: GH!; Isotype: F!).

ADDITIONAL SPECIMENS EXAMINED: MÉXICO. D.F.: ca. 6.5 mi N of Tres Cumbres along toll road from Cuernavaca to México City (Route 95D), plants growing in deep rich soil of grain fields on gradual slope of volcanic mountain, 15 Aug 1965, Melchert & Sorensen 6113 (IA, TEX); old highway 95, 5.5 mi S of jct with road to Ajusco (at km 65), plants in grassy area along

roadside, area of pine and fir, 18 Sep 1967, Melchert, Crawford, & Averett 67-123 (IA).

Though widespread in southern and eastern México, *Cosmos diversifolius* Otto is particularly common in the states of Oaxaca, Chiapas, Hidalgo, and San Luis Potosí. As suggested by its name, it includes a wide variety of vegetative forms (plants strictly *scapose* with once pinnatifid leaves, *subscapose* with a mix of simple and once pinnatifid leaves, or with well spaced, sometimes coarsely dentate, *cauline* leaves). A wide array of vegetative forms found in Oaxaca were all shown to be diploid ($n=12$ [Melchert 1968]), but more recent counts of the species from several Hidalgo and San Luis Potosí populations were uniformly tetraploid ($n=24$ [Melchert, unpubl.]). As of yet, no morphological features have been discerned which distinguish between the diploid and tetraploid races.

The name proposed by Watson in his original description calls attention to the very large attractive heads which superficially resemble those of *Dahlia*. The small cluster of populations concerned are tetraploid ($n=24$) and known only from the area of Tres Cumbres, México, D.F. Though clearly part of the *Cosmos diversifolius* species assemblage, they are distinguished at a glance from other diploid or tetraploid populations of var. *diversifolius* by their exaggerated floral features: heads mostly 7.0-9.2 cm across the expanded rays, not mostly 5-6 cm across as in var. *diversifolius*; ligules 4 cm long, 2 cm wide; outer involucre bracts markedly foliose, often 10-12 mm long, (4.5)5.0-7.0 mm wide, usually much overlapping laterally, not mostly 3.0-4.0(4.5) mm wide as in var. *diversifolius* (Figures 1, 2, 3). Additionally, var. *dahlroides* is typically *scapose* with glabrous leaves that are either broadly spatulate or once pinnate with 3-5 entire, lance ovate segments, i.e., they are vegetatively much more uniform than var. *diversifolius* plants.

Whether var. *dahlroides* is strictly a local evolutionary product, or related phylogenetically to similar appearing, large headed *Cosmos diversifolius* plants from Guatemala and South America remains an open question.

Cosmos deficiens (Sherff) Melchert, *comb. nov.* BASIONYM: *Cosmos diversifolius* Otto var. *deficiens* Sherff, Brittonia 16:65. 1964. MÉXICO. Jalisco: pine oak forest W of summits, alt. 1900-2000 m, Sierra de la Campana, along road to Mascota, 7-8 mi NW of Los Volcanes, 23-25 Oct 1952, McVaugh 13747 (HOLOTYPE: MICH!).

ADDITIONAL SPECIMENS EXAMINED (all topotypes): MÉXICO. Jalisco: road from Los Volcanes to Mascota, 9 mi NW of Los Volcanes, 18 Sep 1968, Carman & Giannasi 68-114 (IA, TEX); ca. 9 mi W of Los Volcanes, along dirt road to Puerto Vallarta, 14 Sep 1966, Melchert, Sorensen & Crawford 6389 (IA, TEX).

Sherff (1964) positioned this relatively delicate, isolated, Jalisco endemic in *Cosmos diversifolius* largely on the basis of its *scapose* habit. Field and



Figure 1. Heads of *Cosmos diversifolius* (upper view): var. *dahlioides* (left); var. *diversifolius* (right). Sizes of structures given in text.



Figure 2. Heads of *Cosmos diversifolius* (underview): *var. diversifolius* (left); *var. dahlioides* (right). Sizes of structures given in text.



Figure 3. Unopened buds of *Cosmos diversifolius*: var. *dahlioides* (left); var. *diversifolius* (right). Sizes of structures given in text.

greenhouse studies, however, have shown *C. deficiens* to be one of the most distinctive elements of the tuber bearing *Cosmos* species. Though generally similar in habit to certain scapose forms of *C. diversifolius* (particularly the diminutive var. *pumilus* Sherff), these two species differ markedly in leaf shape and dissection patterns, size and shape of outer involucre bracts, fruit size, and distribution.

Leaf dissection: as indicated by its epithet, the leaves of *Cosmos diversifolius* are highly variable in form, varying more or less continuously from undivided with subspatulate or lance ovate blades to very deeply pinnate. When pinnate in form, their mostly entire segments, though well separated, are connected by a broadly winged rachis (at least above, the segments varying in shape from lanceolate to oblong, lance obovate or even subspatulate). In sharp contrast, *C. deficiens* has distinctive pinnate-pinnatifid or (less frequently) bipinnate leaves with (3)5(7) primary segments that are well separated on a very narrow (unwinged) rachis (Figures 4 & 5). As shown, the primary segments each typically bear ca. 5 very large forward pointing teeth (the lowermost may be bipinnately dissected); the very narrow, unwinged (rachislike) petiole is roughly half the length of the entire leaf; and, regardless of leaf size, the highly dissected blade is clearly narrowly triangular in overall outline. This leaf type is unique among species of *Cosmos*.

Outer involucre bracts: regardless of their habit and/or leaf shape (plants scapose to leafy stemmed, the leaves pinnate or undivided), *Cosmos diversifolius* is easily recognized by its long peduncled, usually solitary heads, which are subtended by distinctive thick, subfoliose outer involucre bracts which are (6)7-12 mm long, 3-5(7) mm wide, and marked with 6-16 prominent (sometimes interrupted) black veins (Figure 3). Indeed, due to their foliose nature, they often overlap laterally, particularly in bud (the enclosed unopened capitulum sometimes being nearly hidden). *Cosmos deficiens*, on the other hand, has relatively inconspicuous, well separated, narrowly linear outer involucre bracts, these only ca. 5 mm long and 1 mm wide.

Achenes: though similar in shape to *Cosmos diversifolius* (both taxa have linear fusiform bodies without tapered apical beaks - a shape common among tuberous *Cosmos*), those of *C. deficiens* are much smaller, i.e., 6.0-10.5 mm long and either exaristate or with 2 very short, easily broken, cusplike awns (vs. achenes 10-18 mm long with 2 or 3 stout, unequal awns 2.0-3.5 mm).

Distribution: *Cosmos diversifolius* is relatively widespread, occurring from Chiapas northwestward into México State and San Luis Potosí, whereas *C. deficiens* is restricted to a very small area in southwestern Jalisco (between Los Volcanes and Mascota).

The phyletic affinities of *Cosmos deficiens* appear to be with *C. schaffneri* Sherff, a much larger but subscapose species from southwestern México State, the leaves of which show basically the same dissection pattern seen in *C. deficiens*.



Figure 4. *Cosmos deficiens*, some basal leaves removed for clarity.



Figure 5. Individual leaves of *Cosmos deficiens*.

***Cosmos landii* Sherff var. *achalconensis* Melchert, var. nov.** TYPE: MÉXICO. Jalisco: route 15, ca. 5 mi W of Guadalajara city limits; region of low, open, wooded foothills with broad leaved oak and scattered pine; plants among boulders in gullies and on slopes, fairly abundant, but most not yet flowering; rays 5, white with a pink tinge; 7 Sep 1966, T. Melchert, P. Sorensen & D. Crawford 6340 (HOLOTYPE: TEX!; Isotypes: IA!, MEXU!).

C. landii Sherff var. *landii* similis sed floribus radii ligulis albis (vs. lutescentibus) ac 17-19 mm longis 14-15 mm latisque et caulibus mediis infernisque glabris vel sparsim hispidulis trichomatibus minutis (vs. omnino minute atque dense hispidulis) differt.

ADDITIONAL SPECIMENS EXAMINED: MÉXICO. Jalisco: route 15, ca. 14 mi W of Guadalajara, between kms 700-701, pink rayed perennials growing along highway, 12 Aug 1968, Carman 68-63 (IA); route 15, ca. 5 mi W of Guadalajara (between kms 692 and 693), plants in dry, grass covered areas along road, rays light lavender, 20 Sep 1968, Carman & Giannasi 68-121 (IA).

Cosmos landii Sherff (a rhizomatous species of section *Mesinenia*) is the only perennial *Cosmos* species with yellow rays, the pale lemon yellow ligules resulting from the presence of a set of chalcones found in the yellow disc florets of these and all other *Cosmos* species (butein and isoliquiritigenin glycosides, [Melchert, unpubl.]). Typical (i.e., yellow rayed) *C. landii* is known only from barrancas to the immediate N of Guadalajara. The new varietal epithet calls attention to the white to pink rayed phase of this taxon occurring in open, broad leaved oak woodlands ca. 5-15 mi W of Guadalajara (all collections along route 15). Viewed phylogenetically, var. *achalconensis* ($n=22$) is essentially a rather lanky, large headed, tetraploid derivative of *C. intercedens*, a white to pink rayed diploid ($n=11$) from southwestern Jalisco and adjacent Nayarit (the Los Volcanes and Barranca del Oro areas, respectively); while var. *landii*, in turn, is probably a yellow rayed (i.e., chalcone bearing) derivative of var. *achalconensis*. Since the varieties *landii* and *achalconensis* proved to be completely interfertile (Melchert, unpubl.), I have included both in the single tetraploid species, *C. landii*.

***Cosmos sessilis* Sherff var. *stellatus* (Sherff) Melchert, comb. nov.** BASIONYM: *Cosmos stellatus* Sherff, Brittonia 16:70-71. 1964. MÉXICO. Michoacán: abundant on high ridges, flowers dark purplish red, in pine forest on precipitous slopes, alt. 2000-2100 m, cloud forest area locally called "Cerritos de Agua," ca. 3 mi below the lumber camp at Dos Aguas, nearly W of Aguililla, ca. 18° 45' N 102° 56' W, 15 Sep 1958, McVaugh 17878 (HOLOTYPE: MICH!; Isotypes: F-photograph no. 51426!).

ADDITIONAL SPECIMENS EXAMINED (other than the type): MÉXICO. Michoacán: road from Apatzingan to Dos Aguas, ca. 2 mi E of Dos Aguas, 22 Sep 1968, *Carman & Giannasi 68-123* (IA, TEX).

Cosmos sessilis Sherff and *C. stellatus* Sherff were both described (Sherff 1964) from a single collection each. Commenting on *C. sessilis*, Sherff stated that this species appears closest to *C. stellatus*, but is readily distinguished by its "larger, greener leaves, these in pairs not at all suggesting stars: its heads discoid, not beautifully radiate with dark-purplish-red rays; and its ovaries exaristate, not biaristate with retrorsely barbellate aristae." Subsequent studies of *C. sessilis* at the type locality (Melchert 1967) revealed the discoid nature of the type specimen to be an artifact of its collection late in the flowering season. At early anthesis, *C. sessilis* invariably has 8, black sanguineous rays per head that are virtually identical to those of *C. stellatus* (no exceptions); these, however, are rather delicate and soon falling (plants in later stages of anthesis either had fewer rays or were entirely discoid). Likewise, at early anthesis, each of the disc floret ovaries were found to bear 2 short (ca. 2 mm long), smooth or retrorsely barbed awns that usually dehisce during fruit development (mature achenes, which were unknown to Sherff, are either exaristate or bear 2 minute teeth at their apices). Moreover, a recent chromosome count obtained from topotypic material of *C. stellatus* (*Carman & Giannasi 68-123*, $n=12$ [Melchert, unpubl.]) shows this species to have the same number reported for *C. sessilis* ($n=12$ [Melchert 1967]). In short, these taxa are exceedingly similar. The only consistent difference between them when grown in the University of Iowa greenhouses was found to be a relatively minor one in the dissection pattern of their sessile leaves, the ultimate segments of var. *sessilis* being (2.5)3.0-6.0 mm wide, the larger segments linear oblong and notably expanded terminally (vs. mostly narrowly linear and 1.0-3.0(4.0) mm wide in var. *stellatus*; cf. Figures 2 & 4, [Melchert 1967]).

Given all their similarities, it seems likely that *Cosmos stellatus* and *C. sessilis* may ultimately prove to be but forms of a single variable species. Nonetheless, since the populations concerned are well isolated geographically (*C. stellatus* near Dos Aguas in SW Michoacán and *C. sessilis* near Los Volcanes in SW Jalisco), and each has slightly different leaf morphologies, for now I prefer to recognize them at the varietal level.

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COSMOS CAUDATUS (ASTERACEAE: COREOPSIDEAE) IN
MÉXICO: A CYTOTAXONOMIC REAPPRAISAL

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ABSTRACT

Data from cytotaxonomic, comparative flavonoid and greenhouse progeny studies (morphology and reproductive biology) are combined to show that the Mexican populations of the pantropical annual, *Cosmos caudatus* H.B.K., includes two very distinct species: a relatively small headed, self compatible tetraploid *C. caudatus* sensu Sherff) which in México frequents the Gulf Coastal Plain from southern Tamaulipas, southward to Chiapas and the Yucatán Peninsula; and a self incompatible diploid, the heretofore undescribed *C. pacificus* sp. nov., large headed "forms" of which are found along the Pacific slopes of the Transvolcanic Belt in southwestern México State, Michoacán and Jalisco. Additionally, a "small headed" diploid from Chiapas (one known population) that is superficially very similar to nearby *C. caudatus* populations, is shown to be a geographically isolated member of the *C. pacificus* complex. The small headed Chiapas diploid is formally described as *C. pacificus* var. *chiapensis* var. nov.

KEY WORDS: Asteraceae, Coreopsideae. *Cosmos*, México.

Cosmos caudatus H.B.K. is by far the most frequently collected and widespread of all *Cosmos* species. In the western hemisphere, this pantropical annual is especially abundant in Central America and the West Indies, reaching southward to Ecuador, Bolivia, Paraguay, and southernmost Brazil; and northward along the Gulf Coastal Plain into southern Tamaulipas, México. Numerous collections are also available from southeast Asia (Philippine Islands, Java, Sumatra, China, India, etc.) where it commonly escapes cultivation.

Throughout its range, *Cosmos caudatus* demonstrates remarkable environmentally induced vegetative plasticity. In lush moist environments it is not uncommon for individual plants to reach 2-3 meters in height and have widely branching, open inflorescences (Figure 1), whereas plants from inhospitable

sites may be accommodated on a single herbarium sheet. Despite such plasticity, *C. caudatus* is rarely misidentified. Its only close relative, the well known, widely cultivated, *C. sulphureus* Cav. (also a pantropical annual weed) has showy heads with distinctive, bright orange ligules, not small heads with short white to pale lavender rays as found in *C. caudatus* (Figures 2A & 3C).

As part of his extensive herbarium studies of the subtribe Coreopsidinae, Sherff (1932, 1955) examined *Cosmos caudatus* specimens on a worldwide basis. From among this assemblage he recognized not a single intraspecific category. In his very last paper on the Coreopsidinae, however, Sherff (1964) called attention to an annual *Cosmos* collected near Nuevo Italia, Michoacán, México (McVaugh 18019 [MICH]) that was "very similar to *C. caudatus*, but conspicuously different as to its achenes, these exaristate even when very young." He noted especially that it was the very first *C. caudatus* specimen that he had ever observed with awnless achenes. In keeping with his treatments of similar forms in other *Cosmos* annuals, the McVaugh collection was described as *C. caudatus* var. *exaristatus* Sherff. No mention, whatsoever, was made of the floral or vegetative portions of this new variety.

My own field investigations of Mexican Coreopsidinae have revealed numerous *Cosmos* and *Bidens* species which include forms with both aristate and exaristate achenes, even within single populations. Indeed, in such populations, it is not uncommon to find awned and awnless achenes within single heads. My initial presumption, therefore, was that *C. caudatus* var. *exaristatus* Sherff was just another taxonomically trivial, awnless segregate. Subsequently, however, this view was challenged by the discovery, near the type locality of *C. caudatus* var. *exaristatus*, of a remarkable annual *Cosmos* which combined exceedingly large, showy, lavender rayed heads (similar to those of the widely cultivated annual, *C. bipinnatus* Cav.), with large 2-3 pinnatisect leaves similar to those of *C. caudatus* and *C. sulphureus* (i.e., their ultimate segments broadly lanceolate, not linear filiform as in *C. bipinnatus*). Most interestingly, the chromosome number of this collection (Carman & Gianassi 68-124 [IA]) proved to be $n=12$, not $n=24$ as was previously reported for *C. caudatus* (Melchert 1968). A herbarium search stimulated by these observations revealed that morphologically similar plants had been collected previously in México State and Colima, and that the type photograph of var. *exaristatus*, though not mentioned in Sherff's description, shows the same large rayed heads seen on the Carman-Giannasi diploid.

Viewed in totality, these observations suggested that *Cosmos caudatus* sensu Sherff (1955) might well include two distinct species, a large headed diploid of central México (Sherff's "var." *exaristatus*) and a small headed tetraploid (the pantropical var. *caudatus*). To test this hypothesis, populations were sampled across the range of *C. caudatus* as it occurs in México. At each collection site (Table 1) floral buds were fixed for chromosome studies; bulk floral and vegetative tissues were obtained for comparative flavonoid

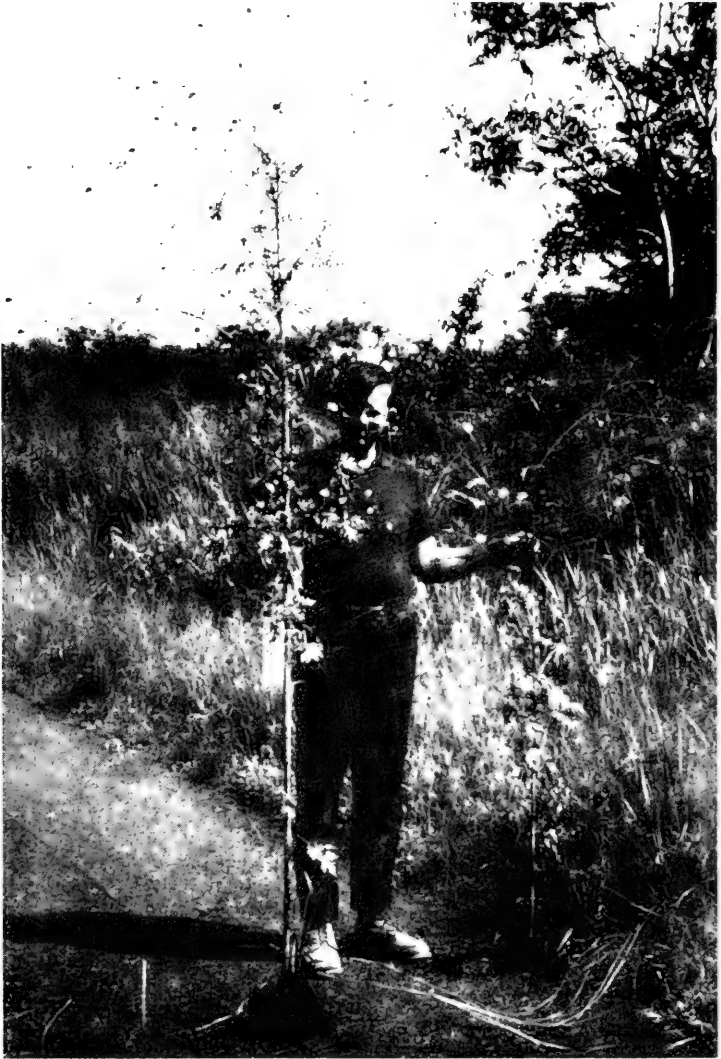


Figure 1. Habit of *Cosmos caudatus*, Gulf Coastal Plain in Veracruz.



Figure 2. Leaf silhouettes and heads of *Cosmos caudatus* and *C. pacificus* (photoreduction of field pressed specimens): A = *C. pacificus* var. *pacificus*, $n=12$; B = *C. caudatus*, $n=24$. Refer to text for sizes of structures.

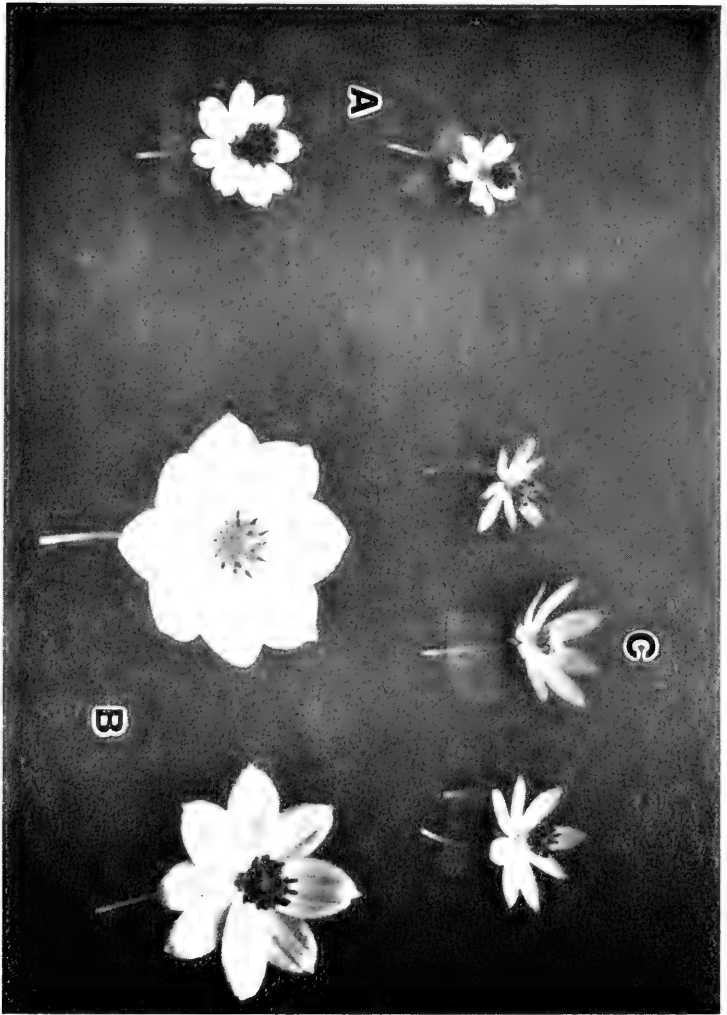


Figure 3. Heads of greenhouse progeny of *Cosmos caudatus* and *C. pacificus*: A = *C. caudatus*, $n=24$; B = *C. pacificus* var. *pacificus*, $n=12$; and C = *C. pacificus* var. *chiapensis*, $n=12$. Refer to text for sizes of structures.

investigations; achenes were collected for establishment of greenhouse populations; and floral heads were preserved (for later measurement) in a premixed solution of ethanol, water and glycerin.

Methods

Chromosome Studies

Freshly collected buds were killed and fixed in modified Carnoy's solution (4 chloroform: 3 absolute ethanol: 1 glacial acetic acid [v/v]). Young anthers were subsequently removed and squashed in aceto-hematoxylin. Cytoplasmic clearing (and short term preservation) was accomplished by mixing a small drop of Hoyer's mounting medium into the stain before the cover slip was applied. The meiotic chromosome counts obtained and the pairing relationships observed are presented in Table 1 with a list of their voucher specimens (IA). In Table 1, a letter amended to the collection number indicates that the count was made from buds collected from a single individual; counts obtained as populational samples (buds taken from several plants of a single population) are indicated by the collection number only.

Flavonoid Studies

Methanolic extracts were prepared separately for the leaves, rays, and disc floret corollas (including stamens), from individuals of each population listed in Table 1. Using Whatman 3MM chromatographic paper (46 x 57 cm) a two dimensional flavonoid profile of each extract was then developed in TBA (3 tertiary butanol: 1 glacial HOAc: 1 H₂O [v/v]) and 15% HOAc [v/v], long and short runs respectively. All major flavonoids (chalcones, flavones, and flavonols) were isolated from duplicate chromatograms and then characterized via the now standard spectral chemical tests (MeOH, AlCl₃, NaOMe, Ba acetate/borate) described by Mabry, *et al.* (1970). Spectral data available upon request from the author.

Greenhouse Progeny Studies

Greenhouse populations of all *Cosmos caudatus* populations listed in Table 1 were established from seed in the University of Iowa, Botany Department greenhouses and maintained with a vigorous programmed watering schedule on plants of the same age grown under very similar conditions. In addition to allowing direct morphological comparison of living plants, these greenhouse populations were utilized in studies aimed at determining the reproductive

TABLE 1. Meiotic chromosome counts and localities of *Cosmos* species

Species	Chrom. no.	Locality
<i>Cosmos caudatus</i> H.B.K.	$n = 24$ II	Chiapas: 18 mi E of Cintalapa, route 190, 24 Sep 1966, MSC 6467.
	$n = 24$ II	Vera Cruz: 7 mi E of El Mirador, ca 32 mi ne of Coscomatepec, route 125, 15 Oct 71, MBH 71-126.
	$n = 24$ II	Vera Cruz: Along local road from Ciudad Catemaco to Lago Catemaco (near Plaze Azul Motel), 16 Oct 1971, MBH 71-132.
	$n = 24$ II	Panama: near village of Santa Fe, ca 60 km n of Santiago, 25 Nov. 1979, Roseman 538.
<i>Cosmos pacificus</i> var <i>pacificus</i> Melchert (= <i>C. caudatus</i> var <i>exaristatus</i> Sherff)	$n = 12$ II	Mexico: 1/2 mi sw of bridge at power plant at Santa Barbara on road from Valle de Bravo, 24 Oct 1971, MBH 71-236.
	$n = 12$ II	Michoacan, ca 28 m s of Uruapan, route 37, 23 Sep 1968, C & G 68-124.
	$n = 12$ II	Michoacan: 16.5 mi s of Uruapan, route 37, 25 Oct 1971, MBH 71-248.
	$n = 12$ II	Michoacan: 16 mi s of Uruapan, route 37, 25 Oct 1971, MBH 71-251a.
	$n = 12$ II	Michoacan: 16 mi s of Uruapan, route 37, 25 Oct 1971, MBH 71-251b.
	$n = 12$ II	Colima: 11.5 mi w of Jalisco border, route 110, 26 Oct 1971, MBH 71-259.
<i>Cosmos pacificus</i> var <i>chiapensis</i> Melchert	$n = 12$ II	Chiapas: 50 mi e of border with Oaxaca, route 190, 17 Oct 1971, MBH 71-161.

MSC = Melchert, Sorensen and Crawford, 1967

MBH = Melchert, Ballard and Hart, 1971

C & G = Carmen and Gianassi, 1968

"strategies" of the plants concerned. Specifically, just prior to anthesis, unopened buds were enclosed in a single layer of cheesecloth. Development (or lack thereof) of achenes in these "bagged heads" was then compared to development of achenes in nonbagged, open pollinated heads. Additionally, individual plants of selected populations were grown in isolated greenhouse compartments, a procedure which precluded cross pollination without having to bag the heads.

Results and Discussion

As shown in Figure 5, the overall ranges of the diploids and tetraploids proved to be quite different. Contrary to our initial expectations, however, the populations sampled in this study fell into three *morphological/geographical/chromosomal* subgroupings as follows:

(1) A series of *large headed diploids* ($n=12$ II), (Figures 3B & 4A), rays lavender and white respectively) found along the subtropical southern flank of the Transvolcanic Belt from southwestern México State westward into southeastern Jalisco (circles, Figure 5). When fully expanded, the capitula of these diploids are commonly 5-8 cm across the rays, their showy, obovate ligules commonly measuring 20-38 mm long by 11-25 mm wide.

(2) A *small headed diploid* ($n=12$ II) Figures 3C & 4B, known from a single collection in Chiapas (Figure 5, note arrow). The heads of these plants (and their greenhouse progeny) were found to be only 2.5-3.8 cm in diameter, i.e., roughly $1/2$ the size of the large headed var. *exaristatus*, their narrowly oblanceolate ligules measuring only 11-19 mm long by 7-12 mm wide.

(3) A *small headed tetraploid* ($n=24$ II) Figures 3A & 4C, occurring primarily along the Gulf slopes of México from Tamaulipas southward through Veracruz into Chiapas, the Yucatán Peninsula and beyond (Figure 5).

In the field, even before the chromosome numbers of these plants were determined, it was immediately obvious that the plants occurring along the Transvolcanic Belt were part of a totally distinct morphological entity, not just a simple assemblage of exaristate forms. In addition to having some of the showiest heads in *Cosmos*, the ultimate segments of their 2-3 pinnatisect leaves were obviously larger and more confluent than those of *C. caudatus* (or any other *Cosmos* annual [Figure 2A]).

In contrast, the small headed diploid from Chiapas was collected simply as "one additional sample" of *Cosmos caudatus*, i.e., was not recognized as distinct *in the field* (this erroneous initial identification being influenced, no doubt, by the fact that the plants found at this dry roadside site were rather depauperate and occurred within the general range of *C. caudatus*, only miles from a previously known tetraploid site [Melchert 1968]). However, once attention was focused on this population (because it was unexpectedly diploid) it quickly became evident that its true relationship was clearly with the large

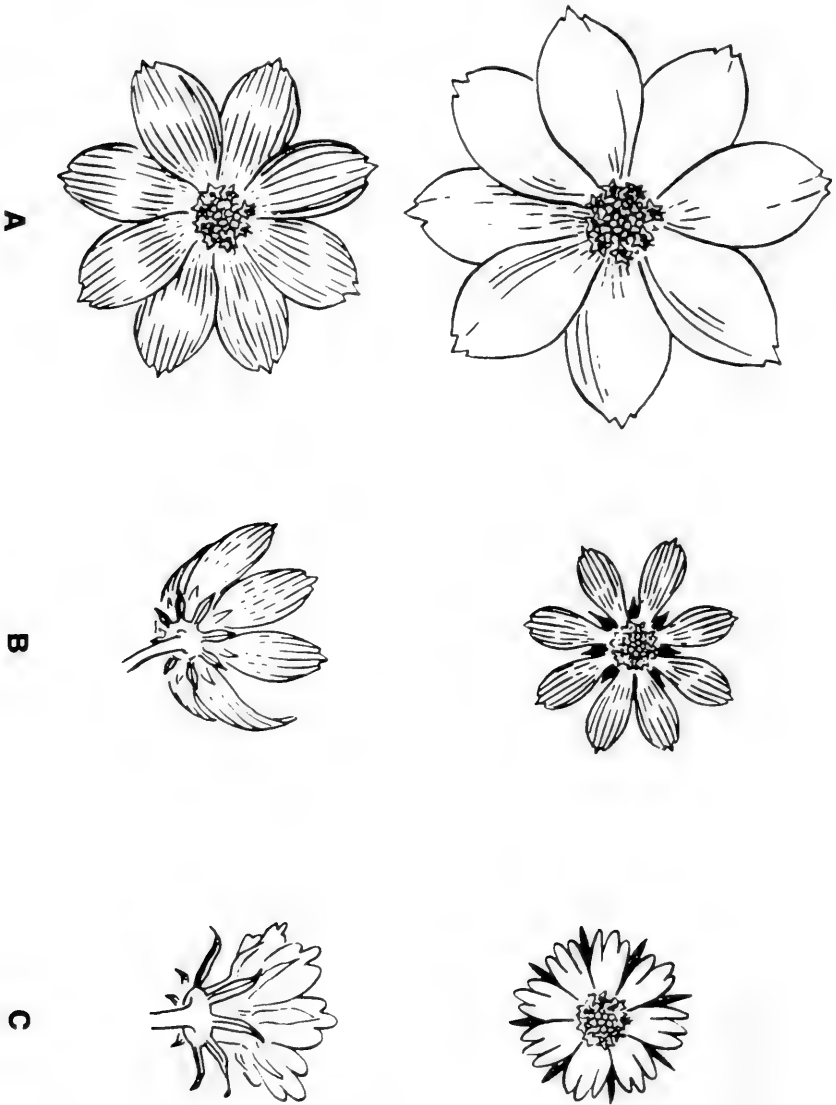


Figure 1. Heads of greenhouse progeny of *Cosmos caudatus* and *C. pacificus* drawn to relative scale: A = *C. pacificus* var. *pacificus* (white and lavender forms); B = *C. pacificus* var. *chiapensis*; and C = *C. caudatus*. Refer to text for sizes of structures.

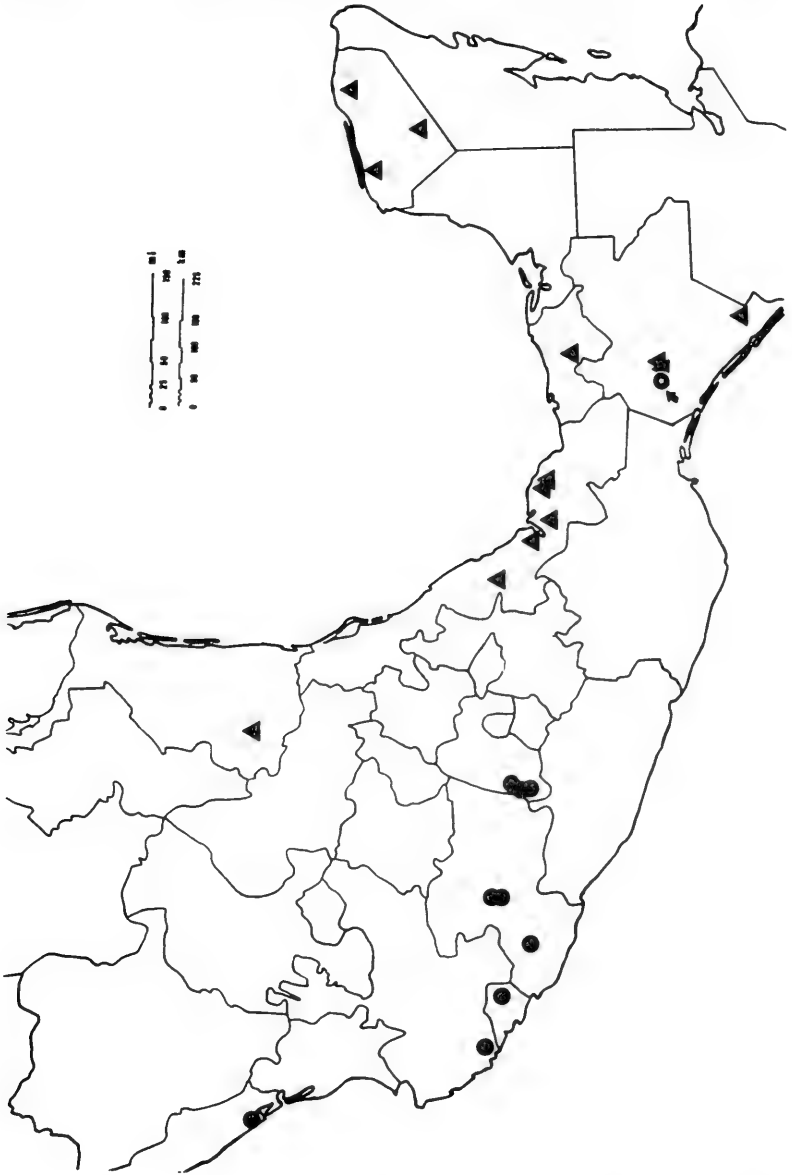


Figure 5. Distribution of *Cosmos caudatus* (triangles), *C. pacificus* var. *pacificus* (circles) and *C. pacificus* var. *chiapensis* (starred circle, note arrow).

headed "var. *exaristatus*" populations of the Transvolcanic Belt, not with *C. caudatus*. Features which both demonstrate this alliance and which can be employed as "key" characters to distinguish the diploids (regardless of head size) from the tetraploids follow:

(1) *Vestiture* - Regardless of head size, the leaves and main stems of the diploids are *exceedingly soft velvety to the touch*, a somewhat surprising feature since they appear smooth and glabrous to the naked eye. The hairs responsible for this velvety texture, though normally quite dense, are so minute that unless the leaf surface is properly side shadowed, they can be overlooked, even when viewed under a dissecting scope. No other vestiture of this type is known in *Cosmos*. It must be emphasized that this diagnostic vestiture is essentially obliterated by pressing; indeed, it would not have been discovered had it not been for the study of living greenhouse plants. As viewed on herbarium specimens, these tiny hairs appear somewhat appressed and may be shorter than the setae found along the leaf margin. A better (i.e., more easily seen) pubescence feature for identifying herbarium specimens of the diploid is the presence of moderate to dense hairs on both surfaces of the outer phyllaries and the adjacent uppermost portion of the peduncle.

The tetraploids (var. *caudatus*) are essentially glabrous throughout. At most, a very few hairs of moderate length will occasionally be found on the lower leaf surface and/or on the abaxial surface of the outer phyllaries. The leaves of living tetraploids were never found to be soft velvety.

(2) *Head configuration* - The spatial and relative size relationships between the rays and outer phyllaries, rather than absolute size, are of primary interest here. Regardless of head size, the outer phyllaries of the diploids are much shorter than, and more or less appressed to, the rays which they subtend; the rays themselves widely spreading below, but arching forward above to form a cuplike "corolla" (Figure 4B [Chiapas diploid]). In the tetraploids, the short rays are held in a semi limb/claw arrangement above and apart from the divergent outer phyllaries (Figure 4C [lower]). Because of this arrangement, the outer phyllaries *on living heads* often equal (or at least appear to equal) the rays, particularly laterally (Figure 4C [upper]).

(3) *Reproductive Biology* - In the greenhouse, all *Cosmos* annuals typically produce flowering heads over a period of several months. As the plants age, the heads become progressively smaller, but are otherwise normal. During the fall, when pollinators are still available in our greenhouses, the small headed Chiapas diploids typically set a full head of achenes. When "bagged" with a single layer of cheesecloth, seed set was reduced to a maximum of one or a few achenes per head. In the winter, when pollinators were no longer available, unbagged heads of *the same plants* never set achenes. The same pattern was noted for all the large rayed diploids from south central México.

In sharp contrast, the tetraploids invariably set a full head of achenes, winter as well as summer, bagged or unbagged. In short, the tetraploids are at

least facultatively self fertile, whereas the diploids, like most species of *Cosmos*, (*C. parviflorus* [Jacq.] H.B.K. excepted) are seemingly obligate outcrossers.

(4) *Pappus ontogeny* - All of the diploid populations were marked by the presence of exaristate achenes. However, contrary to Sherff's description of var. *exaristatus* as "exaristate from the very first," the disc florets of all diploids studied were typically biaristate at anthesis. During fruit maturation, the awns became thin and variously divergent or reflexed. At this stage they were readily dislodged (some perhaps naturally dehiscent), a developmental phenomenon which results in most mature fruiting capitula typically including a mixture of bi-, mono-, and exaristate achenes. Totally exaristate achenes, although present in certain populations, are the exception.

Ontogenetic awn loss has never been noted among the tetraploids (var. *caudatus*). Indeed, only one of the ca. 500 herbarium collections I have studied was exaristate, this completely so from the very first. Otherwise, the total complement of achenes in each mature fruiting head of var. *caudatus* typically has (1)2-5 stout awns.

(5) *Flavonoid Chemistry* - Like most other *Cosmos* species (Melchert, unpublished), the leaves of all diploid populations contained a like complement of 5 or 6 flavonols, all of which proved to be rather ordinary 3-O-glycosides of *quercetin* and *kaempferol*. The Mexican tetraploids contained these same flavonols, as their major leaf constituents. However, each added one or more flavone-C-glycosides (vitexin and/or isovitexin) that were not seen in the diploid profiles.

In sharp contrast to the leaves, the rays of both the diploids and tetraploids were dominated, visually by a like set of flavones, 7-O-glycosides of *luteolin* and *apigenin* being the principal components in both. Profiles of all the diploids, however, contained aglycones of these compounds (as minor spots), the tetraploids did not. Additionally, rays of the diploids all contained several *purple* anthocyanins in addition to a set of *pink* anthocyanin spots; the tetraploid profiles showed the same set of pink spots, but lacked the purple ones entirely (none of the anthocyanins was identified spectrally).

Conclusions

When the above data are considered in their totality (Table 2), two conclusions are inescapable. First, the *small headed diploid* population from Chiapas is very clearly part of the *large headed* "exaristatus" assemblage found along the Transvolcanic Belt. Second, the "exaristatus" assemblage is, by reproductive criteria (chromosome number and reproductive biology), as well as phenotypic criteria (morphology and flavonoid chemistry), a distinct species, not just a variety of *Cosmos caudatus*. Accordingly, a complete description of the diploid is rendered here.

TABLE II. Data summary contrasting *Cosmos caudatus* and *C. pacificus*.

Data Summary	<i>Cosmos caudatus</i>	<i>Cosmos pacificus</i> var. <i>chiapensis</i>	<i>Cosmos pacificus</i> var. <i>pacificus</i>
Meiotic chromosome complement	$\bar{n} = 24$ II	$\bar{n} = 12$ II	$n = 12$ II
Reproductive Biology self-compatible	+		
Leaf flavanoids			
<u>Flavonols</u>			
Quercetin-3-0-glyc	+	+	+
Kaemferol-3-0-glyc	+	+	+
<u>Flavones</u>			
vitexin and/or isovitexin		+	+
Ligule flavanoids			
Flavone + Flavonol <u>glycosides</u>	+	+	+
Flavone + Flavonol <u>aglycones</u>		+	+
Anthocyanins			
pink spots	+	+	+
purple spots		+	+
Pubescence patterns			
Leaves velvety to touch		+	+
Outer involucral bracts pubescent on both surfaces		+	+
Head size			
Diameter across expanded ligules	19-27(3.5) cm	(2.5) 3.0-3.8 cm	(4.0) 5-8 cm
ligule			
length	9-17 (18) mm	11-19 mm	(20-) 25-38 mm
width	5.0-8.0 (8.5) mm	7-12 mm	(9) 11-25 mm

Table 2

Elevation of the varietal name *exaristatus* to specific status, a recommended procedure, is rejected here because the name *exaristatus* is descriptively inaccurate and hence potentially confusing (particularly so because true exaristate forms are found in several related *Cosmos* species).

Cosmos pacificus Melchert, *sp. nov.* Based on *Cosmos caudatus* H.B.K. var. *exaristatus* Sherff, *Brittonia* 16:66. 1964. TYPE: MÉXICO. Michoacán: Summit of Cañon El Marques, 5 mi n of Nueva Italia; abundant on banks and disturbed ground; ungrazed hillsides in *Bouteloua* grassland, 450-500 m, 19 Sep 1958, *McVaugh 18019* (HOLOTYPE: MICH!; Isotype: F [photograph no. 51415!]).

Tall annuals, single stemmed below, freely branching in the inflorescence, 0.5-2.0 m high; the leaves and stems of *living plants* with a soft velvety texture. Stems multiridged and multisulcate, moderately or, more often, densely short pubescent, basically terete, but with age (and pressing) becoming somewhat tetragonal, reddish purple anthocyanins may develop along the ridges or throughout. Leaves 2-3(4) pinnate-pinnatisect, long petiolate, broadly triangular, 10-32 cm long (including the 4-12 cm long, pubescent petiole), largest leaves to 20 cm wide; leaf segments broadly lance oblong to ovate oblong, (3)6-10(13) mm wide, 14-18 mm wide when segments confluent, abruptly rounded to sharp, indurated tips, both surfaces with *very minute*, often somewhat appressed, hairs that are notably shorter than the marginal hairs (though relatively dense these seen only under high magnification); the proximal (i.e., trailing) edge of the lower secondary leaflets or upper primary leaflets frequently, but not necessarily, less dissected than the distal side (this viewed as an entire, winglike margin along the lower side of the secondary or tertiary rachis). Heads radiate, showy, mostly 5.0-8.0 cm across the expanded ligules, aggregated in clusters of 3-6 on elongate naked peduncles, these 6-22 cm long, with scattered multicellular hairs. Ray florets mostly 8, neutral, the ligules white with faint pink anthocyanins along the lower portion of the major veins to very deeply purplish lavender throughout; broadly obovate, 18-38 mm long, 11-25 mm wide, the apex abruptly rounded, usually coarsely tridentate. Involucre dimorphic, the outer bracts green, broadly linear to lance linear, 5-8(10) mm long, 1.5-2.0(2.5) mm wide, 1/2 to 2/3 the length of the inner bracts, much shorter than the rays, short pubescent on both surfaces (the receptacle base and upper portion of the peduncle also pubescent); inner bracts white to yellow, the margins hyaline, reddish anthocyanins may be present at the tip, along the margins, or over the entire surface, (8)10-13 mm long, (2.5)3.0-4.0 mm wide, acute. Disc florets 23-50, the corollas yellow above, whitish below, 4.5-9.5 mm long; filaments of stamens with pilose hairs; anthers (1.8)3.1-5.0 mm long, the terminal appendages (0.6)1.0-1.2 mm long. Pales similar in texture to inner involucre, becoming elongate and narrowed toward center of the

head. Mature fruiting capitula with elongate achene beaks protruding 5-15 mm above the pales; achenes black, (10)13-27 mm long (beaks included), the lower fertile portion fusiform tetragonal, each of the 4 faces with a median longitudinal sulcus (in mature fully expanded achenes, a slender nerve often seen extending the length of this sulcus); the shorter peripheral achenes somewhat incurved, with angled corners, short beaked; beaks antrorsely scabrous, tipped with 1 or 2 divergent to reflexed awns or exaristate (ovaries of disc florets typically biaristate, one or both awns lost during fruit development). Awns thin, easily broken, retrorsely barbed, 2-6 mm long. Chromosome number, $n=12$ II.

ADDITIONAL SPECIMENS EXAMINED (see also Table 1). MÉXICO. Colima: 8 mi SE of Colima, 450 m, 29 Oct 1962, *McVaugh 21979* (MICH, NY). México: Puerto Salitre, District Temescaltepec, 1300 m, 20 Sep 1932, *Hinton 1786* (GH, NY); Acatitlán, District Temescaltepec, 12 Oct 1934, *Hinton, et al. 6745* (F, GH, US); Sta. Barbara, Sto. Tomás de las Platonos, 1100 m, 11 Oct 1953, *Matuda, et al. 30380* (NY, US); Otzoloapan, District Valle de Bravo, 1250 m, 5 Sep 1954, *Matuda, et al. 31451* (US); Pungaranch, District Temescaltepec, 22 Sep 1933, *G.B. Hinton 4790* (F, GH, MO, NY, US). Michoacán: Aguila, District Coalcomán, 20 m, 21 Nov 1938, *Hinton 12632* (GH, NY); 3 km al 5 de Paricuar, sobre la carretera a Tazantla, 1200 m, 21 Oct 1970, *Rzedowski 27983* (IA). Sinaloa: Mazatlán, 1925, *J.G. Ortega 5966* (US).

It is important to note that ray color in *Cosmos pacificus* varies considerably both within and between populations. While the vast majority of plants in the Colima population (71-259) had white or extremely pale pink rays, just the opposite was true in the populations from the state of México (71-236), most individuals of which had deep purple-lavender rays. Flavonoid studies have shown these color differences to be largely superficial. Regardless of color, their 2-10 chromatographic profiles are dominated by identical sets of luteolin and apigenin based glycosides, the overt color differences relating directly to quantitative differences in anthocyanin concentration (Melchert, unpublished).

Cosmos pacificus T. Melchert var. *chiapensis* T. Melchert. var. nov. TYPE: MEXICO. Chiapas: Route 190, 50 mi E of the border with Oaxaca, "semitemperate" vegetation on low mountain slopes, 17 Oct 1971, *Melchert, Ballard, Hart 71-161* (HOLOTYPE: TEX!; Isotypes: IA!, MEXU!).

C. pacificus T. Melchert var. *pacificus* T. Melchert multo similis sed differt capitulis ut maximum dimidio angustioribus (3.0-3.5 mm vs. plerumque 5.0-8.0 mm latis), ligulis (10-)14-21 mm longis, et numero chromosomatibus $n=12$ II ut var. *pacificus* (vs. $n=24$ II ut *C. caudatus* H.B.K.).

Much resembling var. *pacificus*, but heads at most 1/2 the size of that variety; only 3.0-3.5 cm across (not mostly 5.0-8.0 cm as in var. *pacificus*);

ligules (10)14-21 mm long, 3.0-8.5 mm wide; chromosome number, $n=12$ II as in var. *pacificus*, not $n=24$ II as in *C. caudatus*.

This small headed phase of *Cosmos pacificus* occurs some 500 miles to the southeast of the nearest known var. *pacificus* population, occurring within the "general range" of *C. caudatus*. Indeed, because of their small heads, herbarium specimens of var. *chiapensis* look superficially more like *C. caudatus* than var. *pacificus*. As noted in the text, however, they are distinguished by the size (Figure 2) and texture of their leaf segments (those of var. *chiapensis* being soft and velvety to the touch when living, not essentially glabrous) and by the configuration of their heads (cf. Figures 4B & 4C). Given the overall distribution of *C. pacificus* (Figure 5), additional populations of var. *chiapensis* might be anticipated in the Sierra Madre del Sur of Oaxaca and Guerrero.

ACKNOWLEDGMENTS

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NEW TAXA AND NEW COMBINATIONS IN *THELESPERMA*
(ASTERACEAE: COREOPSIDEAE) FROM MÉXICO

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ABSTRACT

Bidens muelleri Sherff and *Bidens muelleri* var. *graminiformis* Sherff are transferred to *Thelesperma*, the latter as a distinct species, *T. graminiformis* comb. nov. A hexaploid phase of *T. simplicifolium* A. Gray from Nuevo León and southernmost Coahuila is described as *T. simplicifolium* var. *macrocarpum* var. nov.; and *T. ramosius* S.F. Blake is transferred to the *T. megapotamicum* (Spreng.) O. Ktze. species complex as *T. megapotamicum* var. *ramosius* comb. nov.

KEY WORDS: Asteraceae, Coreopsideae, *Thelesperma*, *Bidens*, México.

The main purpose of this publication is to legalize several new names in *Thelesperma* so they may be used in the author's treatment of this genus in the soon to be published Asteraceae of México (Turner & Nesom, in prep). More detailed morphological, chromosomal, flavonoid, and distributional data will be published elsewhere.

Bidens muelleri Sherff includes two geographically / morphologically diverse elements, var. *muelleri* - a very easily recognized dwarf, yellow rayed, caespitose perennial (Figure 1) that is endemic to the rock strewn, windswept alpine meadow atop Cerro Potosí, a 3650 meter promontory above Galeana, Nuevo León, México; and var. *graminiformis* Sherff - a taller, more robust taxon with longer leaves, longer narrower leaf segments, and longer stouter lateral branches and peduncles (Figure 2) found in open meadows (3 sites, 2800-3030 m) on the forested flanks of Peña Nevada, a mountain complex on the Nuevo León - Tamaulipas border. The sites of these two taxa are separated by approximately 115 kilometers.

In the very brief comments which accompanied the original description of this species, Sherff (1937) noted that the dried capitula of *Bidens muelleri* "offer an illusory resemblance to South American species of *Coreopsis*," but then

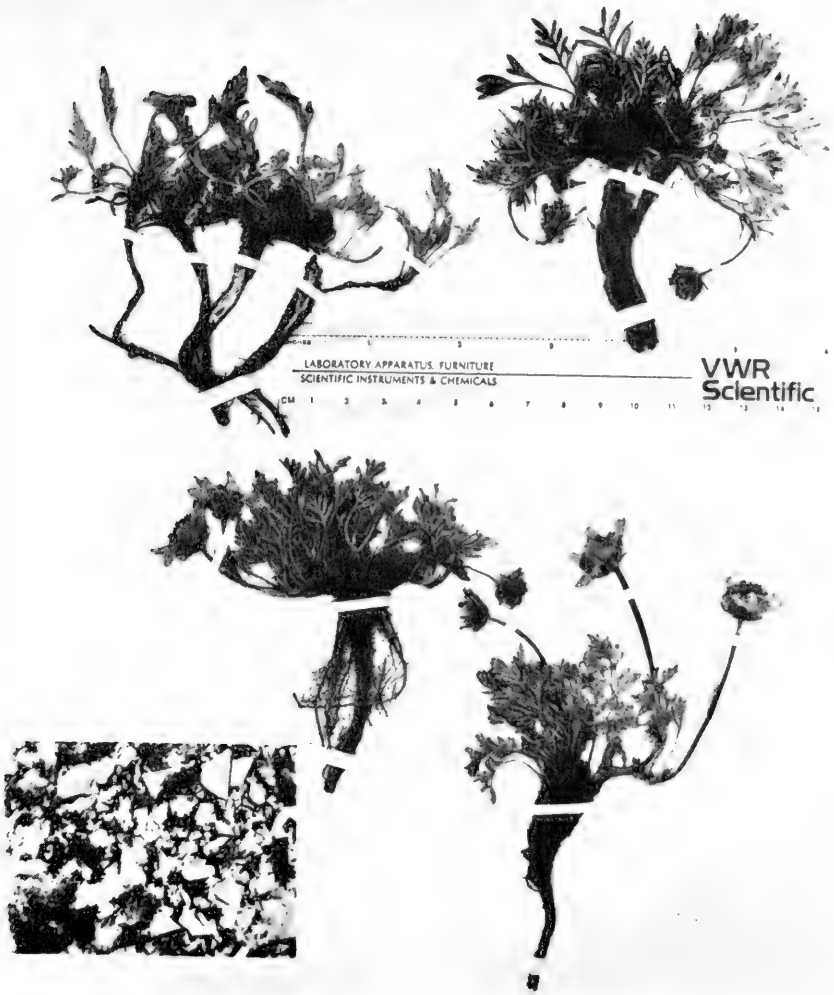


Figure 1. Herbarium specimen of *Thelesperma muelleri*, R.A. Schneider, et al. 940 (F).



Figure 2. Herbarium specimen of *Thelesperma graminiformis*, Stanford, Lauber, & Taylor 2510 (US).

suggested that its closest affinities were probably with *Bidens anthemoides* (DC.) Sherff, *B. andicola* H.B.K., and *B. triplinervia* H.B.K. var. *macranthra* (Wedd.) Sherff. While no specific reasons were given for this assessment, like *B. muelleri*, these particular species of *Bidens* (though much larger) are all prostrate to decumbent perennials with several stems radiating from a central rootstock, highly pinnatisect leaves, and showy yellow rayed heads that are borne on upturned naked peduncles. In short, *B. muelleri* was positioned in *Bidens* largely on the basis of the "apparent" gross morphological similarity, not because of any specific technical features.

Having studied *Thelesperma* (Melchert 1963, 1966) my initial reaction upon viewing the type of var. *graminiformis* was that, except for its nonconnate inner involucre bracts, it looked overall much more like a diminutive *Thelesperma subnudum* A. Gray than any Mexican *Bidens*. More importantly, subsequent examination of a series of *graminiformis* isotypes not available to Sherff, revealed *B. muelleri* to have short, rather squat, incurved, dorsally rounded, somewhat verrucose wrinkled achenes (Figure 3) that are strikingly similar to those of *Thelesperma subaequale* S.F. Blake (a taller, rather slender, *T. simplicifolium* A. Gray-like species found in the mountains of nearby central and western Coahuila); not linear tetragonal achenes with 3 longitudinal ribs per face (2 corner and 1 medial, each), as in the above noted *Bidens* species to which *B. muelleri* was supposedly related. While it is true that a few Mexican species of *Bidens* have small clavate achenes (e.g., *B. mollifolia* Sherff and *B. clavatus* Ballard), close examination of these highly modified achenes always reveals vestiges of the above noted longitudinal ribs, particularly so on their inner surfaces. No such ribs occur on the somewhat concave inner surfaces of *graminiformis* achenes (nor on any other *Thelesperma*).

Additional evidence supporting the transfer of *Bidens muelleri* to *Thelesperma* (S.E.M. of achenes, disc floret morphology, flavonoid chemistry, and inner involucre bract connation pattern) will be presented elsewhere in a paper redefining *Thelesperma*. In Sherff's defense, however, it must be noted that *Thelesperma* was one of the few genera of the Coreopsidinae that he did not monograph or revise personally, the treatment of this genus for the North American Flora being provided by Alexander (1955) who, in turn, had no reason to examine "*Bidens*" *muelleri*.

***Thelesperma graminiformis* (Sherff) Melchert, comb. nov.** BASIONYM: *Bidens muelleri* Sherff var. *graminiformis* Sherff, Brittonia 14:173. 1962. MÉXICO. Tamaulipas: en route to Peña Nevada out of Hermosa, 16 Jul 1949, Stanford, Lauber & Taylor 2510 (HOLOTYPE: US!; Isotypes: MICH!, TEX! [isotypes not seen by Sherff]).

ADDITIONAL SPECIMENS EXAMINED: MÉXICO. Nuevo León: Mpio. Zaragoza, ridge top and rocky meadow on N side of northernmost peak of Peña

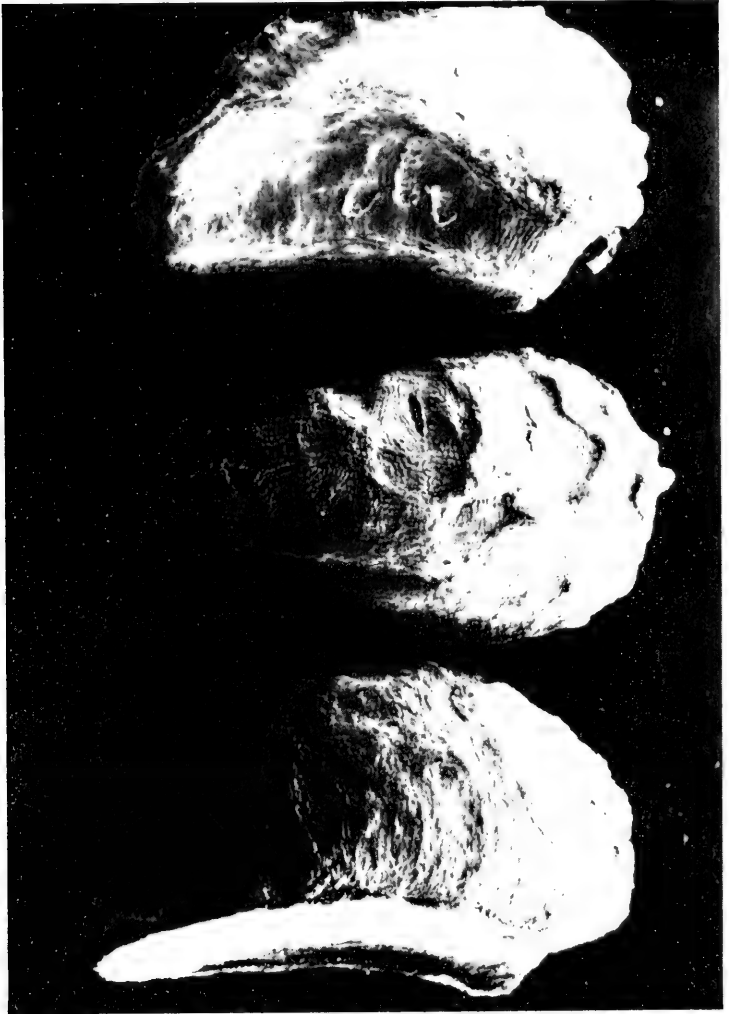


Figure 3. Achenes of *Thelesperma graminiformis*, Stanford, Lauber, & Taylor 2510 (MICH).

Nevada complex, up and S on foot trail from Puerto Pinos (at jct to Joya de San Diego on road from San Antonio de Peña Nevada to Zaragoza, 24° 47' N, 99° 53' W), common in local area of open meadow, 3130 m, 25 Aug 1989, *Guy Nesom, et al.* 7139 (TEX); District Dr. Arroyo, Puerto San Onfre, glade in pine forest, 2860 m, 30 May 1978, *G.B. Hinton* 17346 (TEX).

The above noted specimens from Nuevo León, both of which were collected subsequent to Sherff's description of var. *graminiformis*, are morphologically very similar to the type. Though unquestionably very closely related to *T. muelleri*, the fact that var. *graminiformis* is isolated on Peña Nevada, ca. 115 km southeast of Cerro Potosí (the only site for *T. muelleri*), and is easily distinguished morphologically, argues for its recognition at the species level.

In contrast to *Bidens muelleri*, the type of var. *graminiformis* contains relatively mature achenes. Although Sherff described the achenes in considerable detail, he inexplicably did so without any phylogenetic comment whatsoever (again, as already noted, he was unfamiliar with *Thelesperma*).

Thelesperma muelleri (Sherff) Melchert, *comb. nov.* BASIONYM: *Bidens muelleri* Sherff, Field Mus. Publ. Bot. 16:645. 1937. MÉXICO. Nuevo León: abundant in meadow above timberline, peak of Cerro Potosí, Galeana, 21 Jul 1935, *C.H. Mueller* 2267 (HOLOTYPE: F!; Isotypes: GH!, MICH! [isotypes not seen by Sherff]).

SPECIMENS EXAMINED (all topotypes): MÉXICO. Nuevo León: Cerro Potosí: 26 Jul 1934, *C.H. & M.T. Mueller* 1253 (F, GH, MICH); 20 Jul 1938, *Schneider (and students)* 940 (GH, MICH, MO, NY); 1 Jul 1959, *Beaman* 2650 (GH, MSC, US); 26 Jun 1960, *Beaman* 3345 (GH, MSC); 20 Jun 1972, *Chiang, Wendt, & Johnston* 8053 (TEX).

Despite the fact that the population of *Thelesperma muelleri* atop Cerro Potosí has been sampled frequently in recent years (perhaps too often) mature achenes are still unavailable. Submature achenes found on *Schneider, et al.* 940 (NY) are similar in size and form to those of *T. graminiformis* (at a similar stage of development). Viewed in an evolutionary sense, it probably represents a dwarf form of *T. graminiformis*. The chromosome number of *T. muelleri* is $n=11$ (*Beaman, et al.* 1962); that of *T. graminiformis* is unknown.

Thelesperma megapotamicum (Spreng.) O. Ktze. var. *ramosius* (S.F. Blake) Melchert, *comb. nov.* BASIONYM: *Thelesperma ramosius* S.F. Blake, Proc. Biol. Soc. Washington 54:20. 1941. MÉXICO. Coahuila: 1 mi S Hermanas, 22-24 Aug 1938, *I.M. Johnston* 7059 HOLOTYPE: GH!; Isotype: US!).

Thelesperma megapotamicum, an easily recognized, discoid, perennial *Thelesperma* with a disjunct distribution in North and South America (Melchert 1963), includes diploid ($n=11$) and tetraploid ($n=22$) populations. For the

most part, the chromosomal races segregate geographically: diploids occurring on the grasslands of Wyoming and Nebraska, southward through the panhandle of Texas (and disjunctly in Argentina and Uruguay); and tetraploids in the more arid regions of southern Texas and northern México (Coahuila, Chihuahua, and Durango). Both chromosome races occur in the trans-Pecos area of Texas (seemingly in random fashion). Although the plants from México and SW Texas tend to be bushier (have more stems from the base) than their counterparts from more mesic portions of the United States, there is as yet no sure way to distinguish the diploids and tetraploids morphologically.

The new combination, *Thelesperma megapotamicum* var. *ramosius* is used here to highlight a geographically restricted series of generally depauperate, small headed, diploid ($n=11$), *T. megapotamicum*-like plants that occur on gypsum soils immediately south of Hermanas, Coahuila, México. In brief, these plants are in all respects similar to *T. megapotamicum* except that they have: (1) unusually slender stems that diverge somewhat at the base before turning upward; (2) notably smaller heads (these only 8-9 mm wide at full anthesis); (3) shorter inner involucral bracts (these ca. 5.0 mm long); and (4) very slender peduncles (these mostly 0.5 mm wide at midpeduncle).

ADDITIONAL SPECIMENS EXAMINED (all topotypes): MÉXICO. Coahuila: 1 mi S of Estación Hermanas, perennial in gypsum, common along roadside, and beneath shrubs, 3 Apr 1970, *Turner 6005* (TEX); same general location, 11 Apr 1970, *Turner 6038* (TEX); 20 May 1972, *Powell & Turner 2259* (TEX); *Powell & Turner 2264* (TEX).

Turner (pers. comm.) has examined this taxon in the field on several occasions. In his opinion, *Thelesperma ramosius* is probably nothing more than a localized gypseous ecotype of *T. megapotamicum*. However, since the chromosome number of *ramosius* is $n=11$, not $n=22$ as in all other Mexican populations of *T. megapotamicum* examined to date, it is provisionally retained here as a separate varietal taxon. More extended chromosomal sampling and experimental study is clearly in order.

Thelesperma simplicifolium A. Gray var. *macrocarpum* Melchert, var. nov. TYPE: MÉXICO. Nuevo León: Route 60, immediately W of the junction with the road to Galeana, plants rather frequent in rocky terrain along roadside (wooded, high mountain plateau), 9 Sep 1967, *Melchert, Crawford, & Averett 67-3* (HOLOTYPE: TEX!; Isotypes: IA!, MEXU!).

T. simplicifoliae A. Gray typicae similis sed acheniis majoribus (4.5-5.5 mm longis vs. 3.0-4.5 mm) clavatis vel ovalibus (vs. subteretibus vel subclavatis), et numero chromosomatum parium $n=30$ (vs. parium 10, 11, 12, vel 20).

ADDITIONAL SPECIMENS EXAMINED: MÉXICO. Coahuila: Route 54, km 318-319, SW of Saltillo along roadside by railroad tracks, 7 Oct 1971,

Melchert, Ballard, & Hart 71-27 (IA); Route 57, ca. 17 mi SE of Saltillo, 0.6 mi off highway on road to Los Liros, with *T. megapotamicum*, thin gypsum soil along roadside, 7 Oct 1971, Melchert, Ballard, & Hart 71-33 (IA, TEX). Nuevo León: Route 60, 2.5 mi E of the junction with road to Galeana, plants few along roadside in rocky gravel (wooded mountain plateau), 9 Sep 1967, Melchert, Crawford, & Averett 67-1A (IA, TEX); Galeana-Dr. Arroyo Highway, 29-30.2 mi S of junction with route 60, rather common in gravel and clay along top of roadside ledge, 10 Sep 1967, Melchert, Crawford, & Averett 67-10 (IA); 27 mi N of Dr. Arroyo on road to Galeana, plants only along steep, dry, clay roadside in area of desert scrub with *Juniperus* and *Yucca*, 10 Sep 1967, Melchert, Crawford, & Averett 67-12 (IA).

Thelesperma simplicifolium is a morphologically homogeneous, but chromosomally diverse, species (really a polyploid complex, [Melchert 1966]) from central and western Texas, Coahuila, and Nuevo León. The name var. *macrocarpum* is proposed here to highlight a newly discovered hexaploid race ($n=30$ pairs, Melchert, unpubl.) of this species which appears to have a rather limited distribution in southernmost Coahuila and adjacent Nuevo León. This hexaploid race proved to have the most robust *achenes* in the species, indeed in all of *Thelesperma* (Figure 4), several in each fruiting capitulum measuring 4.0-5.2 mm long by 2.0-3.0 mm wide (vs. 3.2-4.0[4.5] mm long and 1.0-1.7 mm wide in var. *simplicifolium* [Figure 5]). Additionally, they tend to be bushier, have slightly larger flowering heads (to 3.5 cm across the expanded ligules) and slightly larger disc floret corollas (to 5.5 mm long).

Since hexaploids are unknown elsewhere in the species (chromosome counts of $n=10$, 11, and 22 have been established for numerous Texas populations [Melchert 1966], and single counts of $n=12$ and 20 from NW México [J. Graham & M.C. Johnston 4216], and NE Coahuila, [Henrickson & Lee 16126], respectively [both TEX]) it is likely that var. *macrocarpum* will ultimately prove to be a distinct, albeit cryptic, species. However, given the high degree of infraspecific polyploidy found in most of the perennial species of *Thelesperma* (Melchert 1963), until additional populations of *T. simplicifolium* from central and northern Coahuila are sampled thoroughly, it seems prudent to retain the hexaploids within the species, hence its recognition as a variety at the present time.

ACKNOWLEDGMENTS

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Figure 4. Achenes of *Thelesperma simplicifolium* var. *simplicifolium*, 12X.



Figure 5. Achenes of *Thelesperma simplicifolium* var. *macrocarpum*, 12X.

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TAXONOMY OF THE *ERIGERON PRINGLEI* GROUP (ASTERACEAE:
ASTEREAE)

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ABSTRACT

Three previously undescribed species of *Erigeron* endemic to Arizona are recognized, *E. heliographis* *sp. nov.* of the Pinaleno Mountains in Graham County, *E. anchana* *sp. nov.* primarily of the Sierra Ancha in Gila County, and *E. saxatilis* *sp. nov.* of south central Coconino County. All three appear to be closely related to *E. pringlei* A. Gray, but in contrast to the pinnatifid basal leaves of *E. pringlei*, each of the new species has entire basal leaves. A map and key to these four species, and a formal description for each of them are presented.

KEY WORDS: *Erigeron*, Astereae, Asteraceae, Arizona

During the 40 years, since the publication of Cronquist's study of North American *Erigeron* (1947), a number of specimens have accumulated that have been identified as *E. pringlei* A. Gray. Among these plants, the leaves vary from pinnatifid to entire and from linear or linear oblanceolate (0.5 to 2.0 mm wide) to obovate spatulate (4 to 10 mm wide). Cronquist's observation (1947, p. 210), however, that *E. pringlei* is "thoroughly distinct from all others, and need never be confused with anything else" remains generally valid with regard to this group of closely related populations, which are similar among themselves in their rocky habitats, rhizomelike caudex branches roughened by persistent leaf bases, stems and leaves that are eglandular and sparsely short strigose (with hairs 0.1-0.3 mm long) to nearly glabrous, erect buds, relatively small heads on leafy stems, phyllaries that are strongly graduated and glabrous to glabrate, and ray flowers with white, reflexing ligules. All plants of the *E. pringlei* group are restricted to Arizona, where they grow in rock crevices or ledges on boulders and vertical rock faces.

Among these populations, however, three distinct entities can be identified apart from *Erigeron pringlei*, and I recognize four species within the group. The three new ones are distinct from *E. pringlei* particularly in their entire

leaves and lack of a prominent outer pappus. Each is morphologically as well as geographically (Map 1) distinct, although two instances of possible intergradation are noted below. The four species of the *E. pringlei* group might be treated as geographic entities within a single species, where they would be given formal status as varieties. The differences among them, however, are consistent with the degree of difference found among other groups of similar, closely related species of North American *Erigeron* traditionally recognized as distinct.

KEY TO THE SPECIES OF THE *ERIGERON PRINGLEI* GROUP

1. Leaves pinnatifid with 2-3(-5) pairs of lobes; pappus of 11-16 thick bristles 1.8-2.0 mm long, with a prominent outer series of squamellae or thick setae *E. pringlei*
- 1' Leaves entire or rarely with a pair of lobes; pappus of 9-26 bristles 2.2-3.1 mm long, with a barely developed outer series of slender setae (2)
 2. Leaves linear, 0.5-0.9 mm wide; pappus bristles 16-21, 2.9-3.1 mm long *E. heliographis*
 - 2' Leaves oblanceolate to spatulate; pappus bristles 9-26, 2.2-2.7 mm long (3)
3. Stems mostly 3-5 cm long; basal leaves linear oblanceolate to slightly spatulate, 1-3 cm long, 0.5-2.0(-3.0) mm wide at the widest point, the petiole, when distinct, about as long as the blade; midvein of phyllaries greenish yellow, not at all swollen; ray flowers 20-29, the ligules 1.0-1.5 mm wide; disc corollas without prominent orange resinous veins; pappus of 9-13(-15) fragile bristles *E. saxatilis*
- 3' Stems mostly 7-22 cm long; basal leaves spatulate, (3-)4-9 cm long, the blade 4-8 mm wide, the petiole about twice as long as the blade; midvein of phyllaries orange resinous, slightly but distinctly swollen; ray flowers 24-36, the ligules 0.6-1.0 mm wide; disc corollas with prominent orange resinous veins; pappus of 19-26 thick bristles *E. anchana*

Erigeron pringlei A. Gray, Proc. Amer. Acad. Arts 17:210. 1882. TYPE: UNITED STATES. Arizona: Santa Cruz Co., Mt. Wrightson, clefts of ledges and cliffs, 8500-9400 ft, 6 Jun 1881, C.G. Pringle s.n. (HOLOTYPE: GH!; Isotypes: NY!, US!).

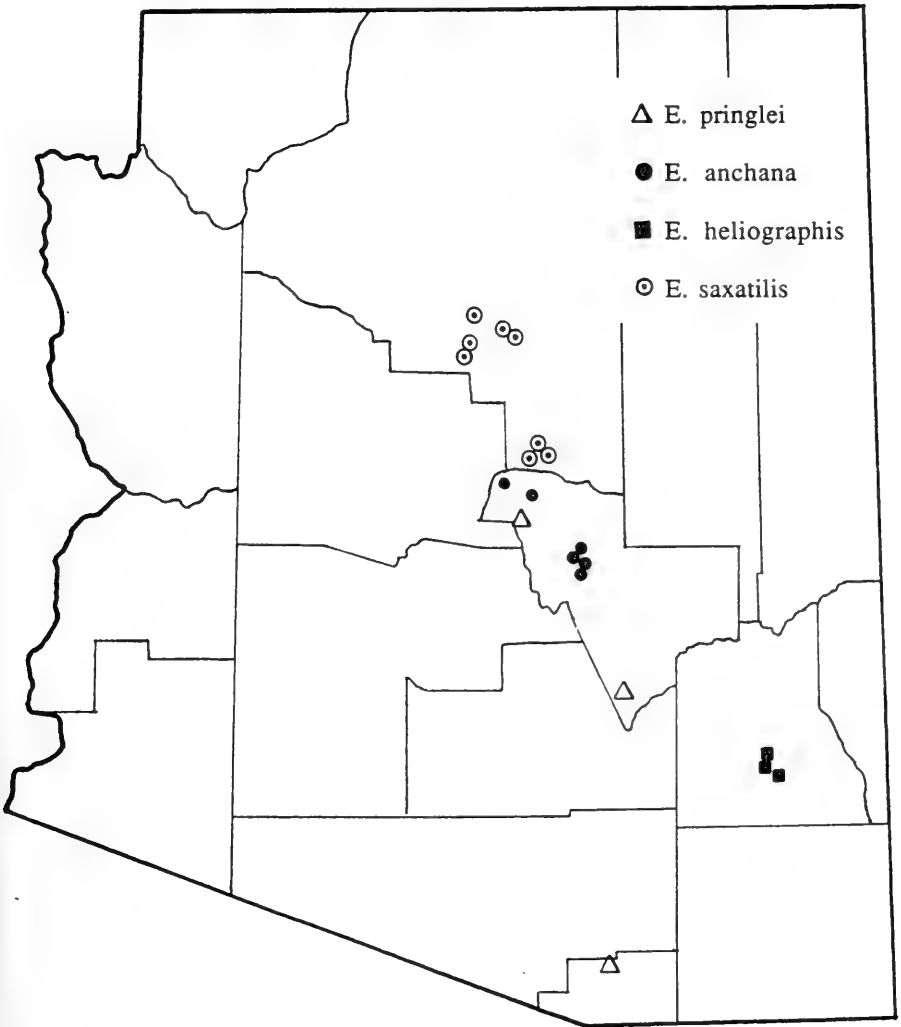


Figure 1. Geographic distribution of *Erigeron pringlei*, *E. anchana*, *E. heliographis*, and *E. saxatilis*.

Perennials from a thick taproot bearing several, thick caudex branches 1-2(-7) cm long and roughened with old petiole bases, these short and crowded to longer and rhizomelike. Stems 4-16 cm long, erect to arching, unbranched or less commonly with 1-2 short branches, sparsely to moderately short strigose. Basal leaves spatulate and long petiolate, (1-)2-6 cm long, the blades apically 3 lobed to pinnatifid, obovate in outline, 4-10 mm wide, usually with 2-3(-5) pairs of lobes, the cauline gradually reduced upwards, entire, narrowly oblanceolate. Heads 5-6 mm wide, on leafy stems; phyllaries often purplish, glabrous to very sparsely strigose, in 3-4 strongly graduated series, the innermost (3.0-)3.5-4.5 mm long. Ray flowers 20-35 with corollas 6-8 mm long, ligules white to pinkish, sometimes with a midstripe beneath, reflexing. Disc corollas 2.5-3.5 mm long, narrowly funnelform, not strongly inflated or indurated. Pappus of 11-16 bristles ca. 2 mm long, with a short but prominent series of outer setae or lanceolate squamellae 0.2-0.3 mm long. Flowering May-August(-September), 6200-9250 ft.

Additional collections examined: UNITED STATES: Arizona. Gila Co.: Mescal Mts., north face below El Capitan and Pioneer peaks, ledges and rock face in shade with *Heuchera*, ferns and mosses, 6200 ft, 10 Jul 1978, *Bingham 2775* (ASU); Mazatzal Mts., Barnhardt Pass, 1500-1710 m, 7 Sep 1935, *Collom s.n.* (ARIZ). Santa Cruz Co., Santa Rita Mts.: Mt. Wrightson, Madera Canyon, cracks of N facing cliff, 9250 ft, 18 May 1986, *Bertelsen s.n.* (ARIZ); Mt. Wrightson, cliff faces below peaks, 9000 ft, E exposure, 3 Jun 1987, *Bertelsen s.n.* (ARIZ); cliffs, 25 Jul 1884, *Pringle s.n.* (NY).

The plants of the Santa Rita Mountains are somewhat smaller (stems 4-7 cm long, caudex branches 1-2 cm long) than those from the two more northern localities. There appear to be no other morphological features, however, that would clearly distinguish them, although these disjunct populations probably have been isolated for long periods of time and some accumulated differences might be expected. The long branches are more similar to those of *Erigeron anchana*, described below, than to typical *E. pringlei*. Field study and collections from additional sites will be essential to a more critical interpretation of variation among these plants. See further comments following *E. anchana*.

***Erigeron heliographis* Nesom, sp. nov.** TYPE: UNITED STATES. Arizona: Graham Co., Pinaleno Mts., 1 1/8 mi above Shannon Campground on trail to Heliograph Peak lookout, crevices of exposed bedrock, 10 Jun 1984, *T. & R. Van Devender 84-292* (HOLOTYPE: ARIZ!; Isotype: TEX!).

Differt a *Erigeron pringlei* A. Gray foliis linearibus integrisque et pappi setis numerosioribus atque serie externa vix evoluta. A *E. sazatali* Nesom similis sed foliis linearibus et setis pappi numerosioribus differt.

Perennials from a thick taproot bearing several crowded, thick caudex branches 1-3 cm long and roughened with old petiole bases. Stems sparsely to moderately short strigose, 1.5-4.5 cm long, erect to ascending, unbranched or rarely with 1-2 branches. Basal leaves tufted, erect, linear or very slightly broadened upward, 1-2(-4) cm long, 0.5-0.9 mm wide, entire, sparsely short strigose to nearly glabrous; cauline like the basal, slightly reduced upwards or reduced to linear bracts below the heads. Heads on bracteate peduncles 5-10 mm long, 5-6 mm wide (pressed); phyllaries elliptic-oblancoate, glabrous or very sparsely strigose, usually purplish, with slightly lacerate ciliate margins, strongly graduated in 3-4 series, the innermost 3-4 mm long. Ray flowers 20-23 in a single series, the corollas 5-8 mm long, white, drying white to lavender, the ligules 1.2-1.8 mm wide, reflexing with maturity. Disc corollas 3.0-3.5 mm long, narrowly funnellform. Achenes sparsely strigose, ca. 1.2 mm long; pappus of 16-21 persistent bristles, the longest ca. 3 mm long, with a few, outer setae or squamellae 0.2-0.3 mm long. Flowering May-July, 8250-9500 ft.

Additional collections examined: UNITED STATES. Arizona. Graham Co., Pinaleno Mts.: Mt. Graham, mixed conifer forest, 9000 ft, 16 Jun 1983, *Johnson 1146* (ASU); Fort Grant Lookout, dry, W facing mountain side, 9356 ft, 25 Jun 1966, *Moore, Pinkava, & Lehto 6543* (ASU, NCU); NE side of Heliograph Peak, ca. 1.2 mi above Shannon Natl. Forest Campground on trail to peak, 9400 ft, 15 Jul 1989, *Nesom 7070* (ARIZ, NY, TEX); lookout near Post Creek, Swift Trail, rocky S slope, 9400 ft, 4 Sep 1944 (past fir and frt), *Pultz, et al. 1158* (ARIZ); Heliograph Peak on trail from Shannon to the summit at fork with Arcadia trail, 22 Aug 1987, *Reichhardt 87-94* (ASU); Marijilda Canyon, ca. 0.5 mi NE of Shannon Camp, crack of E facing cliff face, 8250 ft, 4 Jul 1980, *Yatskievych 80-241* (ARIZ).

Erigeron heliographis differs from *E. pringlei* in leaf shape, linear, entire in the former, but deeply oblanceolate, pinnatifid in the latter. These shapes appear to be consistent within both species, and examination of several hundred scattered individuals (all that could be found) at the type locality of *E. heliographis*, has further confirmed this morphological constancy.

***Erigeron anchana* Nesom, sp. nov.** TYPE: UNITED STATES. Arizona: Gila Co., Sierra Ancha, Devil's Chasm, scattered on granite cliff face near canyon bottom, 3600 ft, 7 Aug 1981, *G. Yatskievych 81-305* (HOLOTYPE: ARIZ!; Isotype: TEX!).

Differt a *Erigeron pringlei* A. Gray caulibus longioribus, foliis longioribus integrisque, et pappi setis numerosioribus atque serie externa vix evoluta.

Perennials from a thick taproot bearing several, crowded, thick caudex branches 2-3 cm long and roughened with old petiole bases, the stems and leaves nearly glabrous to sparsely pubescent with ascending-appressed hairs

0.1-0.3 mm long. Stems 7-22 cm long, ascending to somewhat pendant, usually with a few branches above the middle. Basal leaves (3-)4-9 cm long, the blades obovate, entire, 2-3 cm long, 4-8 mm wide, gradually attenuate to a linear petiole 2-5 cm long, usually about twice the length of the blade, the cauline only slightly reduced upwards, oblanceolate epetiolate at midstem, the upper becoming linear, 1 cm long. Heads 5-10 mm long, 5-7 mm wide (pressed), on bracteate peduncles; phyllaries elliptic-oblanceolate, glabrous or very sparsely strigose, usually purplish, with slightly lacerate ciliate margins, strongly graduated in 3-4 series, the innermost 3.0-3.5 mm long. Ray flowers 24-36 in a single series, the corollas 6-8 mm long, white, drying white to lavender, the ligules 0.6-1.0 mm wide, reflexing with maturity. Disc corollas narrowly funnellform, 2.0-2.8 mm long. Achenes 1.2-1.4 mm long, sparsely strigose; pappus of 19-26 persistent bristles, the longest 2.3-2.6 mm long, with a few, outer setae or squamellae 0.2-0.3 mm long. Chromosome number, $n=9$ pairs. Flowering (May-)June-November, 3600-7000 ft.

Additional collections examined: UNITED STATES. Arizona. Gila Co., Sierra Ancha: cliffs opposite Workman Falls, 24 May 1981, *Bowers & McLaughlin 2149* (ARIZ); rim of Puebla Canyon, 13 May 1931, *Harrison 7884* (ARIZ); Workman Creek Falls, cliff pockets, 6600 ft, 12 Aug 1958, *Johnston s.n.* (ASU); Tonto Forest Road 405 at Tonto Creek, 4.4 mi S of Rte. 160, 7 Jun 1973, *Lehr & Weber 990* (ASU); road to Aztec Peak, between hwy to Young and Workman Creek Falls, W facing slope along Workman Creek in ponderosa pine-gambel oak forest, 30 Jun 1978, *Lehto 23158* (ASU, NY); road to Aztec Peak, just below Workman Creek Falls. roadside at cliff base, 3 Nov 1979, *Lehto 24123* (ASU); "natural corral," 4500 ft, [no date], *Little 4204* (ASU); Parker Creek Canyon, 4000-6000 ft. 22 Jul 1968, *Pase & Keil 3401* (ASU); cliff face by Workman Creek road above the falls, 7000 ft, 3 Aug 1958, *Wagner 306* (DUKE); NW wall of Devil's Chasm ca. 0.25 km above spring, 4400 ft, 29 Aug 1982, *Windham & Windham 82-2* (ASC) (voucher for chromosome count of $n=9$ [Schaack 1983]; Tonto Natural Bridge, [ca. 4 mi S of Pine], limestone boulders along Pine Creek at base of bridge, 4535 ft. 22 May 1986, *Benham 831* (ASC); Tonto Natural Bridge, 21 Aug 1937, *Darrow s.n.* (NY); Tonto Natural Bridge, 19 May 1935, *Nelson 2026* (NY).

Erigeron anchana apparently is endemic to northern Gila County, where it is abundant and centered in the Sierra Ancha. Its long branches are sprawling or arching to somewhat pendant as they usually emerge from nearly vertical habitats. The entire, spatulate, long petiolate leaves, the orange resinous veins of the phyllaries and disc corollas, and the numerous pappus bristles of this taxon are distinctive. The plants of *Benham 831* and *Nelson 2026* are clearly referable to *E. anchana* on the basis of their long stems, long petiolate leaves, and numerous (21-22) pappus bristles. Some of the leaves, however, have a pair of deep lobes or teeth, and outer squamellae are present in the pappus, both features more similar to those characteristic of *E. pringlei*. *Erigeron anchana*

and *E. pringlei* are similar in their long petiolate, spatulate (in outline) leaves, but the exact pattern of relationship between them or any of the species of the *E. pringlei* group is not clear.

Erigeron saxatilis Nesom, *sp. nov.* TYPE: UNITED STATES. Arizona: Coconino Co., Oak Creek Canyon, [SW] of Flagstaff, caespitose in fissures of sandstone cliffs, rare, 5500 ft, 24 May 1940, *H.D. Ripley & R.C. Barneby 3109* (HOLOTYPE: NY!; Isotype: NY!).

Erigeron heliographi Nesom similis sed foliis anguste oblanceolatis, corollis disci brevioribus, et setis pappi paucioribus differt.

Perennials from a thick taproot bearing several crowded, thick caudex branches 1-3 cm long and roughened with old petiole bases, with sparsely short strigose to nearly glabrous stems and leaves. Stems 3-5 cm long, erect to ascending, unbranched. Basal leaves tufted, erect, narrowly linear-ob lanceolate, 1-3 cm long, 0.5-2.0(-3.0) mm wide, entire; cauline like the basal, slightly reduced upwards or reduced to linear bracts below the heads. Heads 6-7 mm wide (pressed), on bracteate peduncles 8-15 mm long; phyllaries elliptic-ob lanceolate, glabrous or very sparsely strigose, usually purplish, with slightly lacerate ciliate margins, strongly graduated in 3-4 series, the innermost 2.5-3.5 mm long. Ray flowers 20-29 in a single series, the corollas 5.5-7.0 mm long, white, drying white to very slightly lavender, the ligules 1.0-1.5 mm wide, reflexing with maturity. Disc corollas 2.1-3.0 mm long, narrowly funnelform, not strongly inflated or indurated. Achenes sparsely strigose, 1.3-1.6 mm long; pappus of 9-13(-15) persistent bristles, the longest 2.5-2.6 mm long, with a few, inconspicuous outer setae 0.1-0.2 mm long. Flowering April-July(-September), 4400-8350 ft.

Additional collections examined: UNITED STATES. Arizona. Coconino Co.: West Fork Oak Creek Canyon, ca. 3 mi upstream from the jct of West Fork and Oak Creek, 11 mi N of Sedona, 4400 ft, 28 May 1986, *Benham 838* (ASC); E side of East Clear Creek at the jct of USFS Roads 95 and 96, ca. 23 air mi NE of Payson, 6540 ft, 12 Sep 1987, *Benham 1058* (ASC); Red Hill, 15 mi NE of Blue Ridge, 5800 ft, 10 Jun 1987, *Boucher 636* (ASC); entrance to Walnut Canyon, ca. 7000 ft, 5 Jun 1987, *Boucher 646* (ASC); Mogollon Rim, Barbershop Canyon, 6800 ft, 25 Jun 1987, *Boucher 654* (ASC); Walnut Canyon, 6400 ft, 8 Jun 1982, *Goodwin 1315* (ASC); 0.5 mi S 50° W of Little Elden Spring on the NE ridge, 8350 ft, 29 Jul 1985 [almost completely past fir], *Morefield 2964* (ASC, NY).

The geographic range of *Erigeron saxatilis* apparently is contiguous with that of *E. anchana*, but the former is restricted to the plateau demarcated by the Mogollon Rim. All collections of *E. anchana* have been made south of the rim, and except for one collection, the two taxa appear to be completely distinct in morphology. The plants of *Benham 1058*, from near the Mogollon

Rim, have long stems (to 15 cm) and relatively large basal leaves (1-5 mm wide, to 5 cm long) and in these respects approach *E. anchana* in habit, but in all other features, they are inseparable from *E. saxatilis*. In addition to the differences noted in the key couplet above, *E. saxatilis* tends to flower earlier than *E. anchana*.

Erigeron saxatilis differs from *E. heliographis* in its apically broadened leaf blades, shorter disc corollas, and fewer and shorter pappus bristles.

RELATIONSHIPS

Erigeron pringlei was placed in sect. *Scopulincola* (Nesom 1989) along with three other species, *E. leiomerus* A. Gray, *E. kachinensis* Welsh & Moore, and *E. scopulinus* Nesom & Roth. The new species described here also belong in this section. Phylogenetic relationships within sect. *Scopulincola* are obscure, but the entire, spatulate to oblanceolate leaves of *E. anchana* and *E. saxatilis* are the most similar to species of the section outside of the *E. pringlei* group, and on that basis they might be hypothesized to be the most primitive in the group. *Erigeron heliographis* and *E. saxatilis* are the only species of the section with such narrow leaves, and *E. pringlei* is the only species with lobed leaves.

Within sect. *Scopulincola*, *Erigeron scopulinus* may be more closely related to the *E. pringlei* group than *E. leiomerus* or *E. kachinensis*, a hypothesis based on its more similar geographic distribution in the Chiricahua Mountains of southeastern Arizona and in adjacent New Mexico (Nesom & Roth 1981). It differs from the *E. pringlei* group in its solitary heads on essentially scapose stems and its matted rhizomatous habit, the latter feature shared with *E. leiomerus* and *E. kachinensis*.

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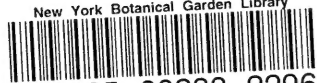
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