Rhodora

JOURNAL OF THE
NEW ENGLAND BOTANICAL CLUB

Vol. 79 July, 1977 No. 819

A REVISION OF THE GENUS GALINSOGA (COMPOSITAE: HELIANTHEAE)

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Most amateur and professional botanists are familiar with the genus *Galinsoga* through acquaintance with *G. parviflora* Cav. and *G. quadriradiata* Ruiz and Pavon (*G. ciliata* (Raf.) S. F. Blake). Both species typically occupy areas disturbed by man (i.e., they are weedy in the sense of Baker, 1966, p. 147) in the New World and Europe, and also have been introduced into Asia, Africa, Australia, and other temperate and subtropical regions of the world. Although the genus has attracted the attention of numerous European botanists (e.g., Müller, 1914; Brenan, 1939; Giacomini, 1947, 1950; Lousley, 1950; Haskell & Marks, 1952, 1954) and several American botanists (e.g., Robinson, 1894, 1899; Turner, 1965, 1966; Shontz & Shontz, 1970; Braden & Cialone, 1971; Ivany & Sweet, 1973) it has never been studied in a comprehensive taxonomic manner.

Thellung (1916) prepared a treatment of only the European species of *Galinsoga,* while St. John and White (1920) provided a synoptic key to the species occurring primarily in the United States. These studies have dealt principally with species of *Galinsoga* from areas in which the species are non-indigenous. The genus apparently is native to Mexico, and in this region the greatest diversity and taxonomic complexity are found.

Recognition of taxonomic limits within *Galinsoga,* particularly at the specific level, has been difficult (DeCandolle, 1836; Robinson, 1894; St. John & White, 1920; Lousley, 1950; Turner & King, 1964). One cause of this difficulty has been that many of the morphological character states used to distinguish the taxa have proven to be variable and intergrading. In most instances, the use by earlier workers of ray corolla color, presence or absence of pappus, and pubescence

of the achenes has proven to be unreliable as a means of distinguishing species. The recognition of new species, varieties, and forms on the basis of these inconstant characters has resulted chiefly from a lack of understanding of populational character variation. The primary objective of this investigation has been to clarify the specific limits in *Galinsoga* by assessing the morphological variation at the intra- and interpopulational levels. Cytological, distributional, and ecological data have been used as well.

Perhaps an even more puzzling problem than the specific relationships in *Galinsoga* has been the confusion regarding generic limits. DeCandolle (1836) questioned the placement of five of the six species he treated as comprising the genus. Bentham and Hooker (1873) commented on the difficulty of distinguishing *Galinsoga* and *Vargasia* DC., and Robinson (1894) noted the difficulties in differentiating *Galinsoga* from several closely allied genera. Blake (1915) established the genus *Stenocarpha* to accommodate a species of *Galinsoga,* and Turner (1966) submerged the genus *Stemmatella* into *Galinsoga.* In addition, the generic delimitation of *Galinsoga* has remained a point of taxonomic confusion even though the genera in the subtribe Galinsoginae most closely related to *Galinsoga* (i.e. *Tridax* L., *Stenocarpha* S. F. Blake, *Sabazia* Cass., *Selloa* HBK., *Tricarpha* Longpre, and *Cymophora* Robins.) have been the subjects of recent taxonomic revisions (Powell, 1965; Turner, 1965; Longpre, 1970; Turner & Powell, 1977). The discussion and resolution of these generic problems associated with *Galinsoga* are reported separately (Canne, in press) and not restated here. The generic circumscription adopted therein, however, is used in this revision.

In the present treatment, *Galinsoga* is recognized to include fourteen species in three sections. From this viewpoint the genus is seen as a Mexican, Central American, and South American taxon of subtropical and temperate regions with the greatest concentration of species in central Mexico. The most significant departure from previous treatments is the enlargement of the generic limits of *Galinsoga* to include *Stenocarpha* and one species each of *Sabazia* and *Tricarpha.* The resultant assemblage of taxa represents a more useful perspective on interspecific relationships as well as providing a better understanding of affinities with other genera in the subtribe Galinsoginae.

TAXONOMIC HISTORY

The first description of *Galinsoga* appeared in the second volume of L. E. Feuillée's *Journal des Observations Physiques, Mathematiques et Botaniques* (1714). Feuillée applied the polynomial "Bidens Mercurialis folio, flore radiato" to the plant he described, and provided an excellent illustration of the taxon later to be known as *Galinsoga parviflora* Cav.

The first valid description of *Galinsoga* appeared in 1794 in Ruiz and Pavon's *Florae Peruvianae et Chilensis Prodromus.* An illustration of various features of the capitulum was provided, but no specific epithet was assigned to the taxon described. The genus was named in honor of Dr. D. Mariano Martínez de Galinsoga, a Spanish physician and director of the Botanical Garden at Madrid. Cavanilles, in his *Icones et Descriptiones Plantarum* of 1795, described the lectotype species, *Galinsoga parviflora,* which he noted was grown in Paris as early as 1785 from seed sent from Peru by Mr. D. Dombey who had traveled with Ruiz and Pavon in Peru and Chile. At the same time, Cavanilles described *G. trilobata,* a species later transferred to *Tridax* by Hemsley (1881).

Ruiz and Pavon published two new names in *Galinsoga, G. quinqueradiata* and *G. quadriradiata,* in the *Systema Vegetabilium Florae Peruvianae et Chilensis* of 1798. Apparently annoyed by Cavanilles' earlier publication of *G. parviflora,* they redescribed his species as their *G. quinqueradiata* and relegated *G. parviflora* Cav. to synonymy.

Roth (1800) published the generic name *Wiborgia,* including one species, *W. acmella,* which he later (1806) realized was synonymous with *Galinsoga parviflora* Cav. The Roth name has since been rejected (*International Code of Botanical Nomenclature,* Appendix III, no. 3661, Stafleu, *et al.,* 1972) in favor of *Wiborgia* Thunberg (1800), a conserved name for a genus in the Leguminosae. In 1808 Poiret formed *Vigolina* as a substitute name for Roth's genus.

Recognizing the generic differences between *Galinsoga parviflora* Cav. and *G. trilobata* Cav., Humboldt, Bonpland and Kunth (1818) included *G. parviflora* in Roth's *Wiborgia* (placing *W. acmella* in synonymy) and described *W. urticaefolia* as new. Meanwhile, they included *G. trilobata* in their genus *Galinsogea* with

the newly described *G. balbisioides*. *Galinsogea* HBK. is now recognized as synonymous with *Tridax* L. (Powell, 1965).

Only three additional *Galinsoga* names appeared following the publication of the two species by Ruiz and Pavon (1798) until Sprengel (1820) named *G. angustifolia* and later in 1826 included four new combinations and four newly described species in the genus. One additional name, *G. resinosa* Hook. & Arn. (1830), appeared before DeCandolle treated the genus in 1836. DeCandolle questioned the placement of five of the six species he included in the genus and referred seven additional species to five other genera. DeCandolle also described as new the genus *Vargasia* and included one species, *V. caracasana*. *Vargasia* DC. is a later homonym of *Vargasia* Bertero ex Spreng. (1825), and *V. caracasana* was transferred to *Galinsoga* by Schultz-Bipontinus (1866).

Rafinesque (1836) described the genus, *Adventina*, in which he included two species. Blake (1922) recognized Rafinesque's taxa, which were described in detail, as synonymous with previously described species of *Galinsoga*.

Six additional names were published in *Galinsoga* in the period between 1836 and the appearance of Bentham and Hooker's *Genera Plantarum* in 1873. In this work, Bentham furnished the first description for the genus *Stemmatella*. The name *Stemmatella congesta* Wedd. had appeared in a list of plants published by Schultz-Bipontinus (1865) and the name remained a *nomen nudum* until Hoffmann (1890) provided a description. Hieronymus (1901) named three other species of *Stemmatella*, one of these being a transfer of *Wiborgia urticaefolia* HBK. This species of *Wiborgia* earlier had been referred to the genus *Jaegeria* by Sprengel (1826), to *Sabazia* by DeCandolle (1836), to *Baziasa* by Steudel (1840), and to *Galinsoga* by Bentham (1852). All species of *Stemmatella*, except *S. lehmannii* Hieron., were referred to *Galinsoga* by Turner (1966).

Additional species of *Galinsoga* were described by Grisebach (1879), Hemsley (1879), Rusby (1893), and Hieronymus (1901, 1907). In 1915, S. F. Blake proposed the genus *Stenocarpha* to accommodate *Galinsoga filiformis* Hemsl.

Thellung (1916) discussed at length the two species of *Galinsoga* known to occur in Europe and described several varieties and forms in *G. parviflora* and *G. quadriradiata*. Apparently unaware of Thellung's work, St. John and White (1920) acknowledged none of the names proposed by him when they treated the *Galinsoga*

species occurring in the United States. In their study, St. John and White also described as new *G. bicolorata* from Mexico, *G. purpurea* from Bolivia, and raised to specific rank *G. parviflora* var. *semicalva* A. Gray as *G. semicalva.* Since the treatment of St. John and White, three additional species of *Galinsoga* have been newly described (Cuatrecasas, 1954; Cronquist, 1965; McVaugh, 1972).

DISTRIBUTION AND ORIGIN

Galinsoga parviflora and *G. quadriradiata* are the most wide ranging species of *Galinsoga. Galinsoga parviflora* is weedy in temperate regions of the world and *G. quadriradiata* has a near continuous distribution from southern Canada to Argentina and is known from the Old World as well. The next most widely distributed species is *G. mandonii* which is confined to the Andean regions of Peru, Bolivia, and northern Argentina. Among the remaining species, nine are known only from restricted mountainous areas of western and central Mexico. *Galinsoga caligensis* is known only from the coastal deserts of Peru, and *G. boliviensis* has been reported from the La Paz region of northern Bolivia.

This pattern of distribution strongly suggests that *Galinsoga* originated in the mountainous areas of west-central Mexico. Two of the four species in South America are the weedy *G. parviflora* and *G. quadriradiata.* Their spread into the United States and the Old World within the last 150 years is well documented (see below). Their apparent migration southward is less well known but presumably was aided significantly by the advent of agriculture and road building. One of the other species in South America, *G. boliviensis,* appears to be derived from *G. quadriradiata,* and the extreme desert habitat occupied by *G. caligensis* would indicate that this species is the product of intense selection in a limited habitat. Supporting evidence for a Mexican origin of the genus is the fact that the four genera most closely related to *Galinsoga,* i.e. *Tridax, Cymophora, Sabazia,* and *Selloa,* are also centered in central Mexico (Powell, 1965: Turner & Powell, 1977; Longpre, 1970).

The migration and spread of *Galinsoga quadriradiata* into the United States and Canada during the last century has been traced by Shontz and Shontz (1970) using herbarium material and published reports of sightings. While the data of these authors were

compiled only recently, this type of study has occurred in Europe since the end of the 19th century for both *G. quadriradiata* and *G. parviflora*. Accounts of new sightings appeared regularly from the British Isles in the *Botanical Society and Exchange Club of the British Isles*, from France in *Bulletin de la Société Botanique de France* and *Le Monde des Plantes*, and from Austria and nearby areas in *Osterreichische Botanische Zeitschrift*.

The rapidity with which the two species spread prompted many authors to collect this information into reviews in an attempt to document succinctly the migration of *Galinsoga* through the Old World. The works of Kronfeld (1889) are among the earliest of these compilations. Kronfeld dealt only with *G. parviflora*, the first *Galinsoga* to enter Europe, and he reviewed the nomenclatural history of the species as he knew it, noting that plants had been grown in the Botanic Gardens in Paris and Madrid as early as 1794. Included was a chronological listing of herbarium records and literary references for collections and sightings of *G. parviflora* in areas we know today as Italy, Switzerland, Austria, Hungary, Germany, and England. In 1892, Bargogli elaborated on the spread of *G. parviflora* in Italy, and Buchenau discussed the early history of *G. parviflora* and the nomenclatural confusion which seems to have developed about the species almost as soon as it was recognized on the continent.

Müller (1914) produced a lengthy treatise on *Galinsoga parviflora* including synonymy, common names in use at the time in Germany, morphology, diseases of the species, germination as influenced by achene depth in soil and temperature, and a long discussion of the distribution of the taxon in Europe. The text was accompanied by illustrations of seedlings, mature plants, and parts of the capitulum.

By the turn of the century, *Galinsoga quadriradiata* had entered Europe. Thellung (1916) provided a summary of localities for *G. quadriradiata* and *G. parviflora*, and then subdivided both taxa into numerous varieties and forms. Jovet (1928) and Jovet and Vergnet (1928) reported the introduction of *G. quadriradiata* in France and reviewed the spread of *G. parviflora* in that country.

The following year Majdecka-Zdziarska (1929) contributed a thorough discussion of European and Asian distributions for both Galinsogas as well as synonymy, morphology, gross anatomy, and germination data for *G. quadriradiata* (as *G. hispida* Benth.) and

G. parviflora. Subsequent papers by Jovet and Vergnet (1930), Magnel (1930), Wilczek (1930), Jovet (1931), Homeiu (1934), van Soest (1941), Giacomini (1947), Dizerbo and Nehou (1952), Haskell and Marks (1952, 1954), Lacey (1956), and others continued to follow the spread of *Galinsoga.* The primary emphasis was on European, and to a lesser extent, early Asian sightings.

Little seems to have been written concerning the entrance of *Galinsoga* into Africa, eastern Asia, and the Pacific regions. However, the representative specimens included in the taxonomic section of this paper document the presence of *G. parviflora* and *G. quadriradiata* in the New and Old Worlds. Data from herbarium specimens indicate that *G. parviflora* has become established in India, eastern Asia, the Pacific Islands, Africa, and Australia. *Galinsoga quadriradiata,* on the other hand, has been introduced into India, Nepal, Japan, the Philippines, and parts of Africa, but the smaller number of collections suggests that *G. quadriradiata* is less abundant in these areas than is *G. parviflora.*

The rapid spread of *Galinsoga parviflora* and *G. quadriradiata* is, of course, a reflection of their weediness. Allard (1965, p. 49) cited "*Galinsoga* species" in a list of taxa which ". . . on a world-wide basis [are] the most successful noncultivated colonizers . . ." Biological characteristics which predispose a species toward weediness have been mentioned by Baker (1965, pp. 166, 167). For the most part, both *G. parviflora* and *G. quadriradiata* show these features. They have no special requirements for germination, show rapid seedling development, flower after a short period of vegetative growth, produce flowers and fruits throughout the growing season, are self- and cross-fertile, produce large amounts of fruits in favorable conditions, and produce fruits in a wide range of environmental circumstances (see Ivany & Sweet, 1973, for one of the more recent discussions of many of these characteristics in both species and Shontz & Shontz, 1972, for a discussion of *G. quadriradiata*).

MORPHOLOGY

The determination of the constancy of morphological features forms the basis for assessing their reliability as taxonomic characters. Much of the confusion concerning specific limits in *Galinsoga* has developed because the variability of several morphological

features used as taxonomic characters has not been documented at the populational level or throughout the range of most species. *Galinsoga,* particularly the weedy species, is notable for the number of morphological attributes which vary at the inter- and intra-populational levels. This variability has probably been promoted by the self-compatibility of the plants, which has allowed the establishment of isolated inbreeding populations following achene dispersal. The most outstanding example of variability occurs in the *G. quadriradiata* complex which is treated here as one polymorphic species. Vegetatively the species is very plastic, and features of the capitulum also show a wide array of morphic types. The other weedy species, *G. parviflora* and *G. mandonii,* show to a lesser degree many of the same kinds of morphological variability expressed in *G. quadriradiata.*

In light of the variability of certain morphological features within the genus, the taxonomic value of vegetative and floral characters is discussed at some length below. Vesture terminology follows that of Lawrence (1951), whereas other terminology is used as in Stearn (1966). Measurements were made from dried herbarium specimens except for features of the head. When abundance of material permitted, heads were soaked in detergent solution and measurements made from the expanded structures.

Habit. All species of *Galinsoga* are herbaceous annuals with erect stems. *Galinsoga calingensis,* however, is also commonly decumbent.

Stems. Stems are striated throughout their length and are often reddish in color. Stem pubescence consists of multicellular, appressed to spreading trichomes of varying lengths and densities. Glandular capitate trichomes are interspersed on the uppermost branches in some species. This character is not always stable and, in most cases, cannot be used as a taxonomic feature. Branching is opposite, and most species vary from simple to multibranched.

Roots. All species have a slender taproot with multiple secondary roots. In weedy species the plants are often shallowly rooted and show poor development of the taproot but extensive growth of secondary roots and adventitious roots from the base of the stem.

Capitulescence. In all species the heads are arranged in terminal and axillary cymose clusters. The number and size of heads, and peduncle length are useful for recognition of sections.

Heads. Within certain limits, many features of the heads are useful

as taxonomic characters. Phyllaries — The number of series of phyllaries is stable within each species and is a useful character. The number, relative size, shape and pubescence of the outer and inner phyllaries are also reliable characters. Pales — The pales are dimorphic in most species of *Galinsoga.* The outermost pales are broader and usually longer than the inner. Typically, the outer pales are attached in pairs or in groups of three to a single inner phyllary such that the phyllary and attached pales surround a ray floret. The shape of the inner pales varies within limits in each species and is a useful taxonomic feature. Pale shape is most variable in *G. quadriradiata* and *G. mandonii.* The ease of detachment of the phyllaries and pales is a useful feature, e.g., these structures remain attached to the receptacle long after the achenes have fallen in *G. parviflora* while in other species pales and phyllaries are readily deciduous.

Receptacle. The size and shape of the receptacle is fairly uniform within each species (with the exception of *Galinsoga parviflora, G. quadriradiata,* and *G. mandonii*) and is a useful character.

Florets. The number of ray and disc florets is of restricted value at the specific level, although the number of florets is a useful feature at the sectional level. The shape and relative size of the ray ligule are similarly reliable features at the sectional level. Color of the ray ligule, however, is not a reliable specific indicator as has been suggested by earlier workers (St. John & White, 1920; Thellung, 1916). The relative lengths of the disc corolla throats and tubes are useful taxonomic features.

Achenes. The achenes of most taxa are dimorphic with the ray achenes being slightly larger, more flattened, and usually curved inward at the base. Achenial size relative to the length of the disc corolla is a useful character, When pubescent, the achenes are strigose with 2- or 3-celled, acute trichomes of the Zwillingshaare type (Hess, 1938) or of 2-4 cells and blunt (as in *Galinsoga triradiata*).

Pappus. Herbarium, and especially field studies, have shown the pappose vs. epappose conditions, length of the pappus, and to some degree, the number of pappus scales, to be of limited diagnostic value. With the exception of the little known *Galinsoga formosa,* all pappose species contain epappose members. It would not be surprising to find in the future that the species now known only from epappose specimens (*G. mollis, G. glandulosa, G. durangen-*

sis, and *G. triradiata*) contain pappose representatives as well. Shape of the pappus scales is relatively stable within each species but is variable in *G. quadriradiata* and *G. mandonii*. The ray achenes often lack a pappus even when the disc achenes are pappose, or the ray pappus is shorter and consists of fewer scales than the disc pappus.

Anthers. Total anther length varies little within species but differs among species. In some species the shape of the apical appendage is of diagnostic value.

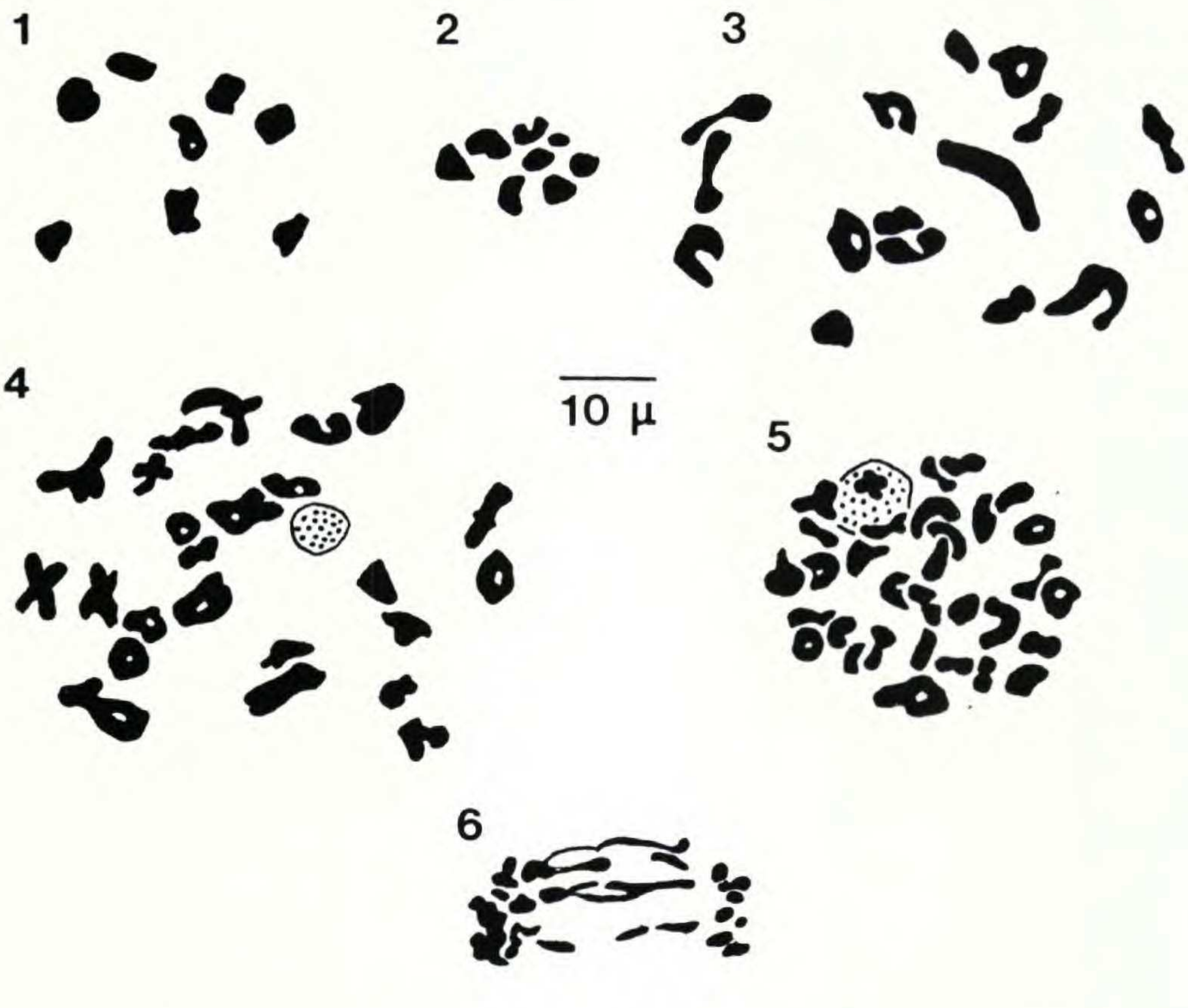
CYTOLOGY

Meiotic chromosome material was collected in the field in Mexico, Guatemala, Peru, and the eastern United States. Buds were killed and fixed in modified Carnoy's solution (4 chloroform : 3 absolute ethanol : 1 acetic acid) and refrigerated until used. Immature florets were stained in acetocarmine solution and slides were prepared using standard squash techniques. Voucher specimens are deposited in The Ohio State University Herbarium (OS).

Chromosome numbers are known for *Galinsoga parviflora* (Figure 1), *G. subdiscoidea* (Figure 2), and *G. quadriradiata* (Figures 3–6) of sect. *Galinsoga*, for *G. filiformis* of sect. *Stenocarpha*, and for *G. elata* and *G. durangensis* of sect. *Elata* (Table 1). The six remaining species of sect. *Galinsoga* and the additional two species of sect. *Elata* are unknown cytologically. Although counts are available for only 43% of the species, all sections have representatives at $n = 8$, and it appears that the base number is $x = 8$.

The count for *Galinsoga subdiscoidea*, $n = 8$, is reported here for the first time. One aneuploid number at $n = 9$ was published for *G. filiformis* by Solbrig, Kyhos, Powell, and Raven (1972) while other authors (Turner, 1965; Turner & Flyr, 1966) list $n = 8$ for this species.

The two widespread weedy species, *Galinsoga parviflora* and *G. quadriradiata*, are the best known cytologically (Table 1). The former taxon has been counted numerous times and apparently is uniformly diploid. The anomalous $n = 18$ count reported by Nawaschin (1926) for *G. parviflora* would seem to be based on a misidentified specimen. Vouchers of *G. parviflora* which I have examined and which were reported in the literature as $n = 16$ have consistently been misidentified specimens of *G. quadriradiata*. An



Figures 1–6. **Camera lucida drawings of meiotic chromosomes of Galinsoga.** 1, *G. parviflora, Canne & Hruschak 91*, $n = 8$. 2, *G. subdiscoidea, Keil & Canne 8917*, $n = 8$. Figures 3–6, *G. quadriradiata:* 3, *Canne 192*, $n = 16$; 4, *Canne 200*, $n = 24$; 5, *Canne 201*, $n = 32$; 6, *Canne 48*, other cells (not shown) same plant $n =$ ca 16. Diakinesis, Figures 1, 3–5; metaphase I, Figure 2; anaphase I with bridges and fragments, Figure 6.

additional problem is that these two species sometimes occur in mixed collections.

Most populations of *Galinsoga quadriradiata* are tetraploid ($n = 16$), though collections from Peru are $n = 24$, and one population was counted as $n = 32$. Many of the tetraploid populations from Mexico and Guatemala show considerable phenotypic variability. Data suggest that these populations differ cytologically as well, for when hybrids are formed meiotic cells frequently contain multivalents and anaphase bridges and fragments (Figure 6). Morphological and chromosomal variation in *G. quadriradiata* is discussed further in the taxonomic section under *G. quadriradiata*.

Table 1. **Chromosome counts in Galinsoga**

Taxon	Chromosome number (*n*)	Reference
G. durangensis (Longpre) Canne		
(as *Tricarpha durangensis*)	8	Keil & Stuessy (1975)
(as *Galinsoga parviflora* and *Sabazia durangensis*)	8	Powell & Sikes (1970) and Urbatsch & Turner (1975), same collection.[1]
(as *Sabazia microglossa* DC.)	8	Turner & Flyr (1966)
G. elata Canne	8	Turner (pers. comm.)
G. filiformis Hemsl.		
(as *Stenocarpha filiformis*)	9	Solbrig, Kyhos, Powell, & Raven (1972)
(as *Stenocarpha filiformis*)	8	Turner & Flyr (1966) and Turner (1965), same collection.[1]
G. quadriradiata Ruiz & Pavon	16	Canne (present paper), 229 plants from 181 populations.[2]
	24	Canne (present paper), 24 plants from 16 populations.[3]
	32	Canne (present paper), 2 plants from 1 population.[4]
(as *G. ciliata*)	ca 16(15)	DeLisle (1965)
(as *G. ciliata*)	16	Haskell & Marks (1952, 1954);[1] Longpre (1970); Solbrig, Kyhos, Powell, & Raven (1972)
(as *G. urticaefolia*)	ca 16	Powell and King (1969)
	16	Skalińska, et al. (1964)[1]
(as *G. parviflora*)	16	Turner & Flyr (1966)
(as *G. urticaefolia* & *G. parviflora*)	16	Turner & King (1964), four collections
(as *G. parviflora*)	ca 16,16	Turner, Powell, & King (1962), six collections
(as *G. ciliata*)	16	van Loon (1974)[1]

G. subdiscoidea Cronq.	8	Canne (present paper), three plants from three populations[2]
G. subdiscoidea × **G. quadriradiata**(?)	24	Canne (present paper), two plants from one population[2]
G. parviflora Cav.	8	Canne (present paper), 59 plants from 50 populations[2]
	8	Chatterjee & Scharma (1968);[1] Covas & Schnack (1946);[1] Diers (1961); Fernandes & Queiros (1971)[1]
(as *G. ciliata*)	8	Gadella (1972);[1] Gadella & Kliphuis (1967);[1] Haskell & Marks (1952, 1954);[1] Koul (1964);[1] Majovský (1970);[1] Mehra, Gill, Mehra, & Sidhu (1965), two collections[1]
G. parviflora	18	Nawaschin (1926)[1]
	8	Pólya (1950)[1]
	ca 8	Powell & King (1969), two collections
	8	Skalińska et al. (1964);[1] Solbrig, Kyhos, Powell, & Raven (1972); Strother (1976);[1] Subramanyam & Kamble (1967);[1] Torres & Liogier (1970); Turner & Lewis (1965); Turner, Powell, & King (1962), two collections

[1]Voucher specimens not examined.
[2]Vouchers for these counts indicated by * in representative specimens.
[3]Vouchers for these counts indicated by † in representative specimens.
[4]Voucher for this count indicated by § in representative specimens.

Based on karyotype analysis, Haskell and Marks (1952) concluded that *Galinsoga quadriradiata* was not a tetraploid derivative of the diploid *G. parviflora* (see also the discussion in the taxonomic section under *G. parviflora*).

PHYLOGENY

The phylogenetic relationships discussed here are based upon morphological, distributional and chromosomal information. Although the scheme proposed in Figure 7 is speculative at best, it is also plausible and thus illustrates a possible phylogeny for the genus. The difficulties inherent in constructing phylogenies are well known (Stebbins, 1974). Additional uncertainties are encountered with *Galinsoga* because several species are known only from a few collections, and some species only from the type collections. In these latter cases particularly, chromosome numbers are unknown and morphological variability is not well documented.

These deficiencies notwithstanding, enough information is available to make the following comments. Because the center of diversity for *Galinsoga* is in Mexico, and the most closely related genera (*Sabazia, Tridax,* and *Selloa*) are also centered in central Mexico (Longpre, 1970; Powell, 1965), it is assumed that *Galinsoga* underwent initial diversification there. Three major lines of divergence appear to have occurred and have led to the presently recognized sections of the genus.

The determination of which of these sections is most similar to the ancestral *Galinsoga* is based partially on the premise that the more primitive section would display its greatest diversity and distribution in central Mexico where the genus is thought to have originated. Second, the taxa in the primitive section could be expected to occupy fairly stable habitats (Stebbins, 1974), in this case mesic sites in or near the pine forest zone in central Mexico. Third, the primitive section would be composed of taxa most similar to species of the genus most closely related to *Galinsoga,* the genus *Sabazia,* because they would presumably share common ancestral features.

Galinsoga sect. *Elata* best meets these criteria. On morphological grounds, *G. formosa* is clearly the species most closely resembling *Sabazia,* followed by *G. elata, G. durangensis,* and *G. mollis.* Sect. *Stenocarpha* is represented by *G. filiformis,* a species of un-

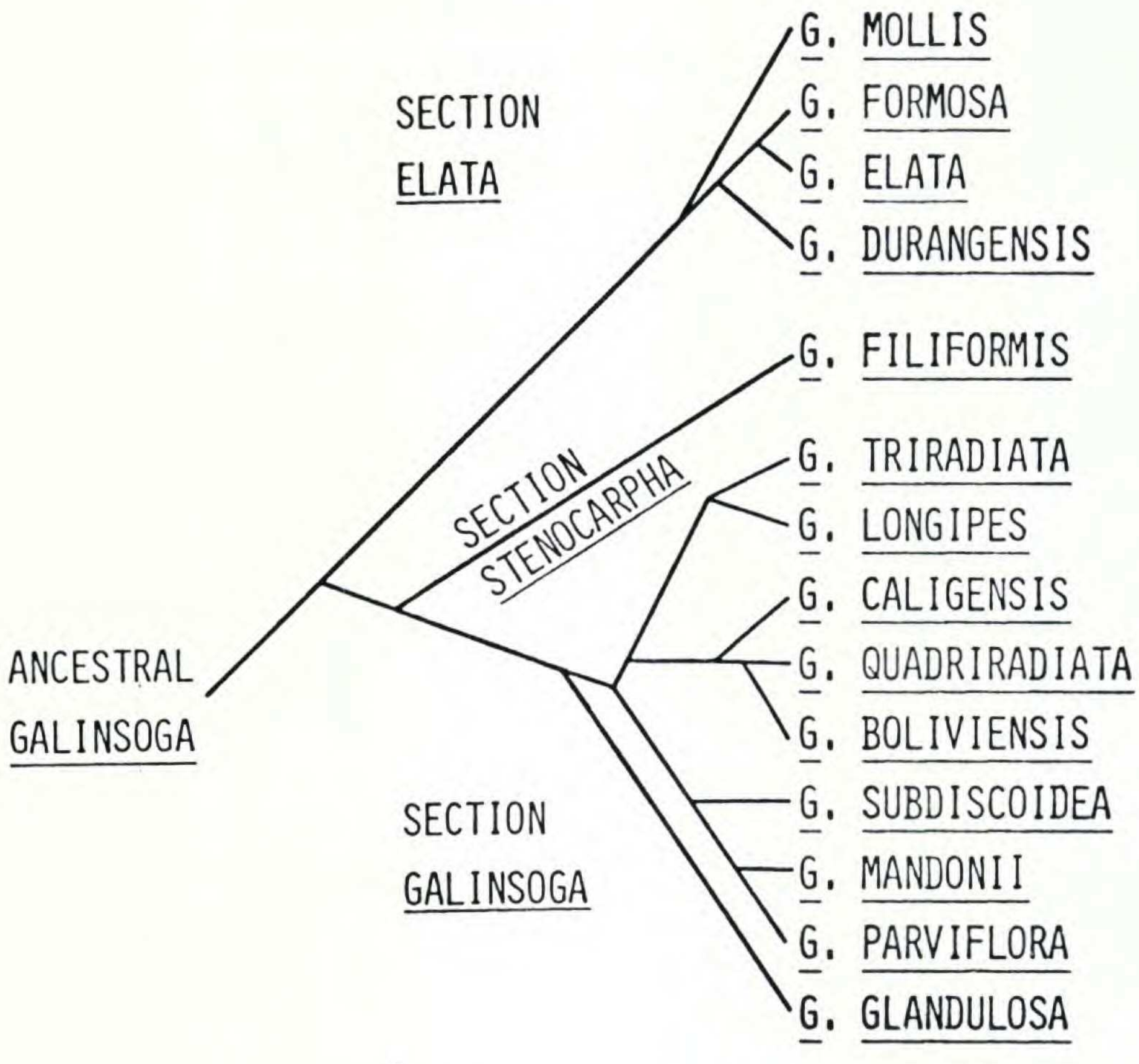


Figure 7. **Proposed phylogeny for Galinsoga.** Amount of branching indicates relative degree of departure from the ancestral *Galinsoga*.

certain affinities which falls morphologically between sect. *Elata* and sect. *Galinsoga*.

Sect. *Galinsoga* is the largest section and contains the most widely distributed species. Three lines of divergence have occurred within the section. *Galinsoga glandulosa* is included in sect. *Galinsoga* because of its habit, leaf features, and capitula characteristics, but it is unique within the section because of a few *Tridax*-like characters. Presumably, these latter characteristics were retained during evolution from that part of the ancestral Galinsoginae complex from which *Tridax* and *Galinsoga* arose.

The line which gave rise to the weedy *Galinsoga quadriradiata* diversified in Mexico, and apparently later in South America. Perhaps *G. triradiata* and *G. longipes* of Mexico came off this line

earlier than the others because these species are more similar to the species in sect. *Elata* than are others in the section. Migration into Central America and South America was followed by the differentiation of *G. caligensis* in the coastal deserts of Peru, and apparently sometime later, by the formation of *G. boliviensis*. This latter species is morphologically more similar to *G. quadriradiata* than is *G. caligensis*, but also, it is not subjected to the extreme environmental conditions and selection pressures of the desert species.

Galinsoga quadriradiata itself is the most variable species in the genus. It is also the only known polyploid member (except for one $n = 9$ count for *G. filiformis*, also known at $n = 8$). Because the chromosome numbers of the other members of the *G. quadriradiata* line are unknown, it is not possible to determine if polyploidy occurred early in the diversification of the line, for example, before it entered South America, or if *G. quadriradiata* is the only taxon in the line to have experienced chromosomal increase.

The remaining three species in sect. *Galinsoga* all have very small ray corollas and may even lack ligules. This *G. parviflora* line apparently originated in Mexico where *G. subdiscoidea* and *G. parviflora* appear to be native. *Galinsoga mandonii*, however, is known only from the Andes of western South America and presumably originated there following the introduction of the *G. parviflora* line into the continent. *Galinsoga parviflora* also occurs in South America but as a weed in cities and agricultural areas, and so it seems to be introduced there.

TAXONOMIC CONCEPTS

The primary criterion employed during this study for delimitation of taxa at all levels was morphological continuity within, and discontinuity among, the taxa. Chromosomal and eco-geographical data were used as well. Because most species of *Galinsoga* are morphologically variable at the inter- and intrapopulational levels, the diagnostic characters chosen here are those features found to be least variable, and these are used in combination to distinguish species. With one notable exception involving *G. subdiscoidea*, little morphological and chromosomal evidence of gene flow exists among species. Presumably the morphological units delineated here are maintained as distinct due to reproductive barriers among them.

TAXONOMY

Galinsoga Ruiz & Pavon, Prod. 110. *t. 24.* 1794. LECTOTYPE SPECIES: *Galinsoga parviflora* Cav.

Wiborgia Roth, Catal. Bot. **2:** 112. 1800. *nom. rejic.* non *Viborgia* Moench. 1794. nec *Wiborgia* Thunberg. 1800. *nom. conserv.* TYPE SPECIES: *Wiborgia acmella* Roth = *Galinsoga parviflora* Cav.

Galinsogea [attributed to Ruiz & Pavon] Willd. Sp. Pl. **3:** 2228. 1803. *Orth. mut.*

Gallinsoga [attributed to Cav.] Jaume St. Hil. Expos. **1:** 417. 1805. *Orth. mut.*

Galinsoja [attributed to Cav.] Roth, Catal. Bot. **3:** 78. 1806. *Orth. mut.*

Vigolina Poiret in Lamarck, Encycl. Meth. **8:** 613. 1808. Substitute name for *Wiborgia* Roth. *nom. rejic.*

Galinsogaea [attributed to Ruiz & Pavon] Zucc. Flora **4:** 612. 1821. *Orth. mut.*

Galinsogea [attributed to Ruiz & Pavon] Spreng. Syst. Veg. **3:** 579. 1826. *Orth. mut.*

Galinzoga [attributed to Cav.] Dumort. Fl. Belg. 72. 1827. *Orth mut.*

Vargasia DC. Prodr. **5:** 676. 1836. non Bertero ex Spreng. 1825. *nom. illegit.* TYPE SPECIES: *Vargasia caracasana* DC. = *Galinsoga quadriradiata* Ruiz & Pavon.

Adventina Raf. New Fl. N. Amer. **1:** 67. 1836. LECTOTYPE SPECIES (here designated): *Adventina parviflora* Raf. = *Galinsoga parviflora* Cav.

Stemmatella Wedd. ex Benth. in Benth. & Hooker, Gen. Pl. **2:** 193, 359, 360. 1873. TYPE SPECIES: *Stemmatella congesta* Wedd. ex O. Hoffm. = *Galinsoga mandonii* Sch.-Bip.

Galinsogaea [attributed to Cav.] Himpel, Fl. Elsass-Lothr. 187. 1891. *Orth. mut.*

Stenocarpha S. F. Blake, Bull. Misc. Inform. 1915. 348. 1915. TYPE SPECIES: *Stenocarpha filiformis* (Hemsl.) S. F. Blake = *Galinsoga filiformis* Hemsl.

Annual herbs. Stems erect or decumbent, striate, green to red, sparsely to densely pilose with multicellular trichomes. Leaves opposite, sessile or petiolate, the petioles narrowly connate around the stem; blades elliptic to broadly ovate, nearly glabrous to densely pilose on both surfaces, with 3 principal veins, at the apex acute to acuminate, at the base rounded, cuneate or attenuate. Peduncles slender, pilose. Heads in loose to congested cymose clusters. Involucre 1–3 seriate, hemispherical to narrowly campanulate; outer phyllaries 1–4, herbaceous, triangular to elliptic, flattened or convex, glabrous or sparsely short pilose, at the apex acute to obtuse, with the margins entire or minutely laciniate and sometimes scarious; inner phyllaries herbaceous or scarious, narrowly to broadly ovate or lanceolate-ovate, glabrous or sparsely pilose, at the apex acute or obtuse, with the margins entire, ciliate or minutely lacini-

ate. Receptacle broadly to narrowly conical. Pales usually dimorphic, scarious, with conspicuous veins; outer pales lanceolate, elliptic or broadly ovate, entire to trifid, convex, at the apex acute to obtuse, sometimes purple or red, with the margins minutely laciniate above the middle; often joined in groups of 2–3 at the base to a single phyllary and these together enclosing a ray floret; inner pales linear to narrowly ovate, convex to conduplicate, entire to deeply trifid, at the apex acute or obtuse, rarely weakly cuspidate. Ray florets 3–15, usually 5–8, rarely lacking, fertile, with corollas white to purple; ligules ovate, obovate to oblong, usually trilobed, rarely bilabiate; tubes pilose; style bifid; achenes black, obconical or obpyramidal, usually somewhat flattened and curved inward at the base, glabrous or strigose, pappose or epappose. Disc florets 5–150, fertile, corollas yellow, greenish-yellow or rarely purple; throats cylindrical, rarely campanulate, pilose or rarely glabrous; lobes 5, acute, papillose, erect or recurved; tubes minutely pilose; anthers yellow or brown, with ovate to oblong apical appendages, at the base sagittate; style branches recurved, somewhat flattened, at the apex acute; achenes black, obconical to obpyramidal, subterete, glabrous or strigose, epappose or with a pappus of lanceolate, laciniate or fimbriate, obtuse to aristate scales, or rarely of setose bristles. Chromosome numbers, $x = 8$ ($n = 8, 16, 24, 32$).

KEY TO SPECIES

A. Ray florets 8–15; ligules 3–12 mm long; disc corollas with throats 1.5–2.5 mm long. ..... B.
  B. Leaves cauline and basal; inner pales linear, entire, 0.2–0.4 mm wide; achenes 0.5–0.8 mm long. ..... 5. *G. filiformis.*
  B. Leaves cauline; inner pales lanceolate and trifid or linear-oblong and entire, or with 1–2 short, lateral lobes, 0.4–3.5 mm wide; achenes 1–1.5 mm long. ..... C.
    C. Plants 100–150 cm tall; leaves entire or with margins remotely denticulate; inner pales linear and entire or with 1–2 short, lateral lobes. ..... 4. *G. mollis.*
    C. Plants to 75 (–100) cm tall; leaf margins serrate; inner pales deeply trifid. ..... D.
      D. Phyllaries and outermost pales attached at the base and enclosing the ray florets; ligules conspicuously trifid; pappus of fimbriate scales or lacking. ..... 2. *G. elata.*
      D. Phyllaries and outermost pales separate, not enclosing the ray florets; ligules shallowly tridentate; pappus of caducous seta or lacking. .... E.
        E. Ligules 1–1.2 cm long; disc corollas with throats 1.5–1.8 mm long; pappus of caducous seta. ..... 1. *G. formosa.*

E. Ligules 0.3–0.7 cm long; disc corollas with throats 1.7–2.5 mm long; pappus lacking. ..... 3. *G. durangensis.*

A. Ray florets 0–5; ligules absent or to 6 mm long; disc corollas with throats 0.7–1.6 mm long. ..... F.

F. Involucre uniseriate; pales with conspicuously ciliate margins; anther appendages with 1 or 2 multicellular glands. ..... 14. *G. glandulosa.*

F. Involucre biseriate; pales with minutely laciniate margins; anther appendages without glands. ..... G.

G. Heads usually 4–15 mm wide; ligules 2–7 mm wide, 3 lobed, the lobes conspicuous and about equal. ..... H.

H. Ligules usually 3–6 mm long; ray achenes 1–1.4 mm long. ..... I.

I. Ray florets 5; ligules 2–3.5 mm wide; inner pales lanceolate, entire or with 1–2 short, lateral lobes; achenes strigose with acute trichomes or glabrous. ..... 6. *G. longipes.*

I. Ray florets 3 (–5); ligules 4–7 mm wide; inner pales linear-obovate, entire; achenes with blunt trichomes or glabrous. ..... 7. *G. triradiata.*

H. Ligules 0.9–3.8 mm long; ray achenes 1.3–2.3 mm long. ..... J.

J. Plants usually 20–62 cm tall; leaf margins serrate; outermost pales 2–3 mm long. ..... 9. *G. quadriradiata.*

J. Plants usually 3–15 cm tall; leaf margins entire or sometimes serrulate; outermost pales 3–4 mm long. ..... K.

K. Heads 8–10 mm wide; ligules 2–3.8 mm long; outer row of disc florets pistillate; ray achenes 1.4–1.7 mm long. ..... 8. *G. caligensis.*

K. Heads 4–7 mm wide; ligules 1.4–2.3 mm long; all disc florets perfect; ray achenes 2–2.3 mm long. ..... 10. *G. boliviensis.*

G. Heads usually 1.5–5 mm wide; ligules absent or 0.2–2 mm wide, 1–3 lobed, the lobes short and unequal. ..... L.

L. Leaves elliptic to oblanceolate; inner pales entire or with 1–2 short, lateral lobes; disc corollas greenish-yellow with cupulate throats; pappus of spathulate yellow scales. ..... 11. *G. subdiscoidea.*

L. Leaves ovate to lanceolate; inner pales trifid; disc corollas deep yellow to reddish-purple with cylindrical throats; pappus of lanceolate, obtuse to aristate, white or gray scales or absent. ..... M.

M. Heads usually sessile; phyllaries reddish-purple; ray corollas white to reddish-purple; phyllaries and pales deciduous. . 12. *G. mandonii.*

M. Heads on peduncles 0.1–4 cm long; phyllaries green; ray corollas dull white or rarely pink; phyllaries and pales persistent. ..... 13. *G. parviflora.*

I. **Galinsoga** section **Elata** Canne, sect. nov.

Plantae 0.25–1.5 m altae; folia caulina; pedunculi (0.5–) 1.5–8.2 cm longi, graciles; capitula in cymis laxis; paleae interiores lanceolatae et trifidae vel anguste obovatae et integrae-aliquanto trifidae, 0.4–1.5 (–3.5) mm latae; flosculi radii 8–13 (–15), ligulis (3–) 4–12

mm longis, obovatis-oblongis; flosculi disci (30–) 50–150, faucibus corollarum 1.5–2.5 mm longis. TYPE SPECIES: *Galinsoga elata* Canne.

1. **Galinsoga formosa** Canne, nom. nov.

Sabazia trifida Fay, Brittonia **25:** 197. *t. 4.* 1973. TYPE: **Mexico:** Oaxaca, Sierra Madre del Sur, ca 125 km S of Oaxaca, on rd to Puerto Angel, 8 Nov 1970, *A. Cronquist & J. Fay 10889* (Holotype, NY!; isotypes, CAS, DUKE, ENCB, F, GH, KANU, MEXU, MICH! MSC, S, TEX, US, UTC). The specific epithet "trifida" is not used here because of the earlier publication by Persoon (1807) of *Galinsoga trifida*.

Annual herbs, to ca 1 m tall. Stems sparsely to moderately pilose with spreading to retrorse, multicellular trichomes to 1.5 mm long. Leaves with petioles 1–25 mm long; blades lanceolate-rhomboid to lanceolate-ovate, 2–6(–11) cm long, 0.5–3(–5.5) cm wide, with both surfaces hirsute, at the apex acute to acuminate, at the base cuneate to rounded, margins serrate, ciliate. Peduncles to 5 cm long, pilose. Heads to 0.8 cm tall, to 2.2 cm wide. Involucre 3-seriate, hemispherical; outer phyllaries lanceolate-ovate to rhomboid, 3.2–6.1 mm long, 1–2 mm wide, pilose, at the apex acute, with the margins ciliate; inner phyllaries elliptic to lanceolate, herbaceous to scarious, to 5 mm long, to 3 mm wide, sparsely pilose, at the apex acute to obtuse, with the margins ciliate. Receptacle conical. Pales 3–5 mm long, deeply bifid or trifid. Ray florets (8–)10–15, with corollas white, often purple below; ligules oblong, 1–1.2 cm long, to ca 0.3 cm wide; tubes ca 2.5 mm long; achenes narrowly obconical, 1.2 mm long, 0.5 mm diam, glabrous; pappus of 3–5 caducous seta, 1–2 mm long. Disc florets ca 100, with throats 1.5–1.8 mm long, 0.7 mm diam, minutely pilose near the base, with the lobes 0.3–0.4 mm long; tubes 1–1.2 mm long; anthers ca 1 mm long, with the appendage ovate and bearing 2 multicellular glands; achenes like those of the ray florets. Chromosome number unknown.

DISTRIBUTION. Known only from the type collection from steep, gravelly banks in the pine-oak-alder zone of the Sierra Madre del Sur, Oaxaca, Mexico, ca 2400 m. Figure 8.

Fay (1973), who originally described this taxon as *Sabazia trifida*, commented that it was included in *Sabazia* as "a somewhat anomalous species" because it combined deeply trifid pales, shallowly lobed ligules, and a setiform pappus. The first two of these char-

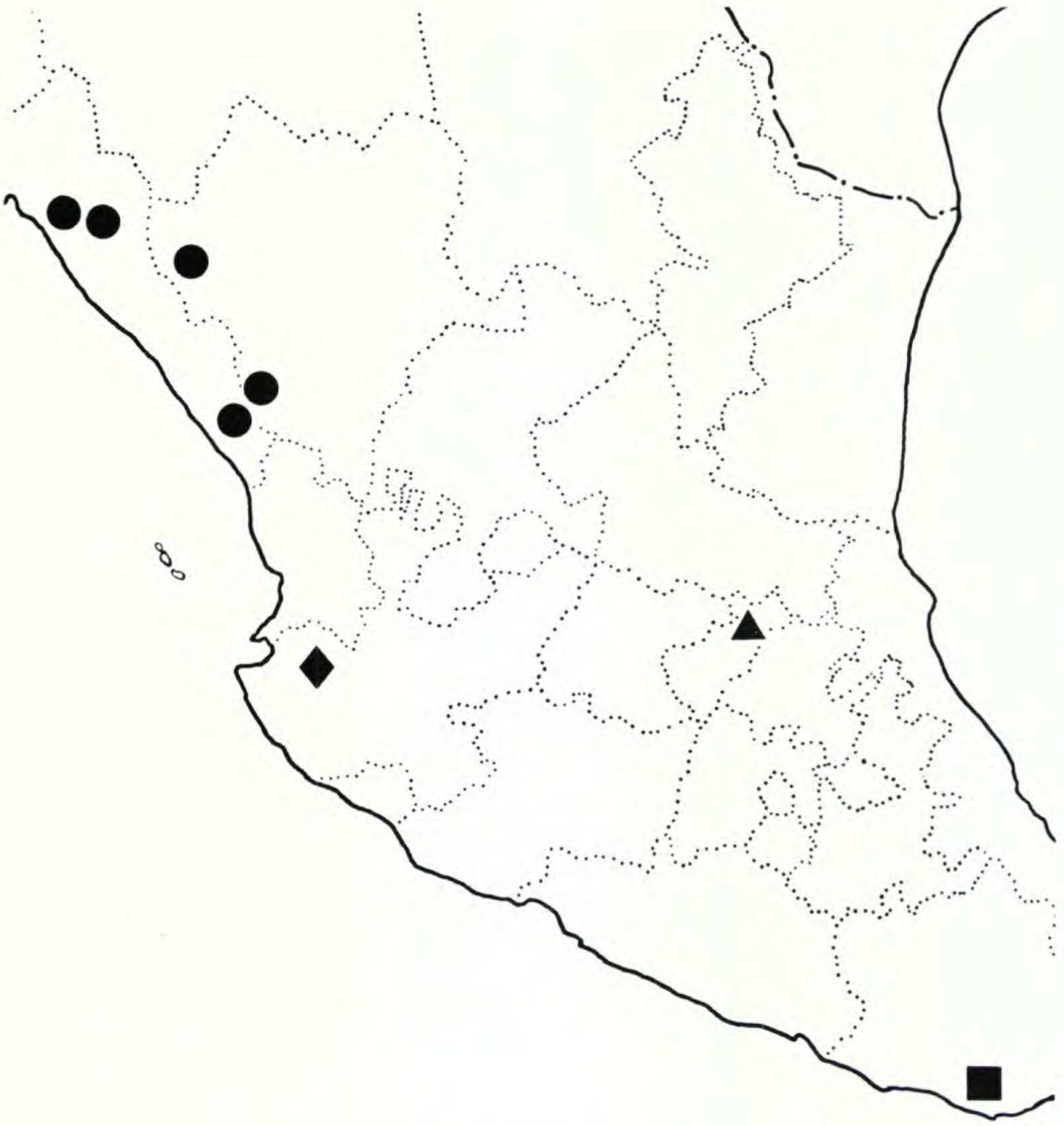


Figure 8. **Mexican distributions of Galinsoga.** Map of Mexico indicating the distributions of *Galinsoga durangensis* (dots), *G. elata* (triangle), *G. formosa* (square), and *G. mollis* (diamond).

acters were used to distinguish the genus *Tricarpha* (Longpre, 1970) and the third feature was unknown in *Sabazia,* but it occurred in the related genus *Selloa.* Shallowly lobed ligules and trifid pales are common in *Galinsoga,* but *G. formosa* is the only species to possess a setiform pappus.

This species is transferred to *Galinsoga* because it is an annual with a slender taproot typical of *Galinsoga,* whereas *Sabazia* is primarily a genus of perennials arising from caudices. In features of leaves, stems, and capitulescence the taxon is very similar to the

other species of *Galinsoga* sect. *Elata,* especially *G. elata* (under which see discussion). Finally, the achenes, pales, anthers, and lobing of the ray ligule resemble those found in various species of *Galinsoga* from all three sections. The specific epithet, *formosa,* was chosen because of the attractiveness of this species.

2. **Galinsoga elata** Canne, sp. nov. Figure 9.

Herbae annuae, usque ad 75 cm altae. Caules internodiis usque 10.5 cm longis, virides-rubri vel rubri, sparse vel modice pilosi. Folia petiolis 2–15 mm longis; laminae elongatae ovatae vel lanceolatae, 2–7 cm longae, 0.6–3 cm latae, sparse vel modice pilosae utrinque, apice acuto-acuminato, basi rotundata usque cuneata; margines serrulati-serrati. Pedunculi 0.9–8.2 cm longi. Capitula 5–8 mm alta, 9–20 mm lata. Involucrum biseriatum, hemisphaericum; phyllaria exteriora covexa, elliptica-lanceolata, 2.2–4 mm longa, 1–2 mm lata, pilosa, trichomatibus glandulosis et eglandulosis, apice acuto vel obtuso, marginibus anguste scariosis, integris vel minute laciniatis; phyllaria interiora parabolica vel lanceolata-ovata, usque ad 5 mm longa et 2.5 mm lata, glabra vel pilosa, apice obtuso, marginibus scariosis, purpureis-laciniatis. Receptaculum 3–3.8 mm altum, 2.2–2.3 mm diametro. Paleae extimae ellipticae-lanceolatae, 3–3.5 mm longae, 1.2–1.5 mm latae, integrae vel bilobatae, junctae ad basim binatim et terni ad phyllarium contiguum; paleae interiores lanceolatae, 2.1–3 mm longae, 0.7–1.5 mm latae, profunde trifidae. Flosculi radii 8, corollis albis vel purpureis; ligulae quadratae vel obovatae, 4.5–6 mm longae, 3.5–4.5 mm latae, brevipilosae in venis dorsalibus, lobis obtusis, 1–2 mm longis; tubi 1–1.5 mm longi; achenia obconica, aliquantum complanata, 1.5 mm longa, strigosa vel glabra; pappi absentes vel squamellae ca 7, adaxiales, obtusae, fimbriatae, ca 0.5 mm longae. Flosculi disci 75–120, corollis luteis; fauces 1.5–1.6 mm longae, 0.8–1 mm diametro, lobis 0.3–0.5 mm longis; tubi 0.5–0.8 mm longi; antherae brunneolae, 0.9–1 mm longae, appendice anguste ovata; achenia obconica, aliquantum angulata, 1.1–1.5 mm longa, 0.3–0.5 mm diametro, strigosa vel glabra; pappi absentes vel squamellae 15–20, obtusae, fimbriatae, 0.6–1.2 mm longae. Chromosomatum numerus: $n = 8$.

TYPE: **Mexico:** Querétaro, ca 1.5 mi E of Pinal de Amoles, rd between Vizarrón and Jalpan, 21° 10′N, 99° 38′W, 7200 ft, 8 Nov

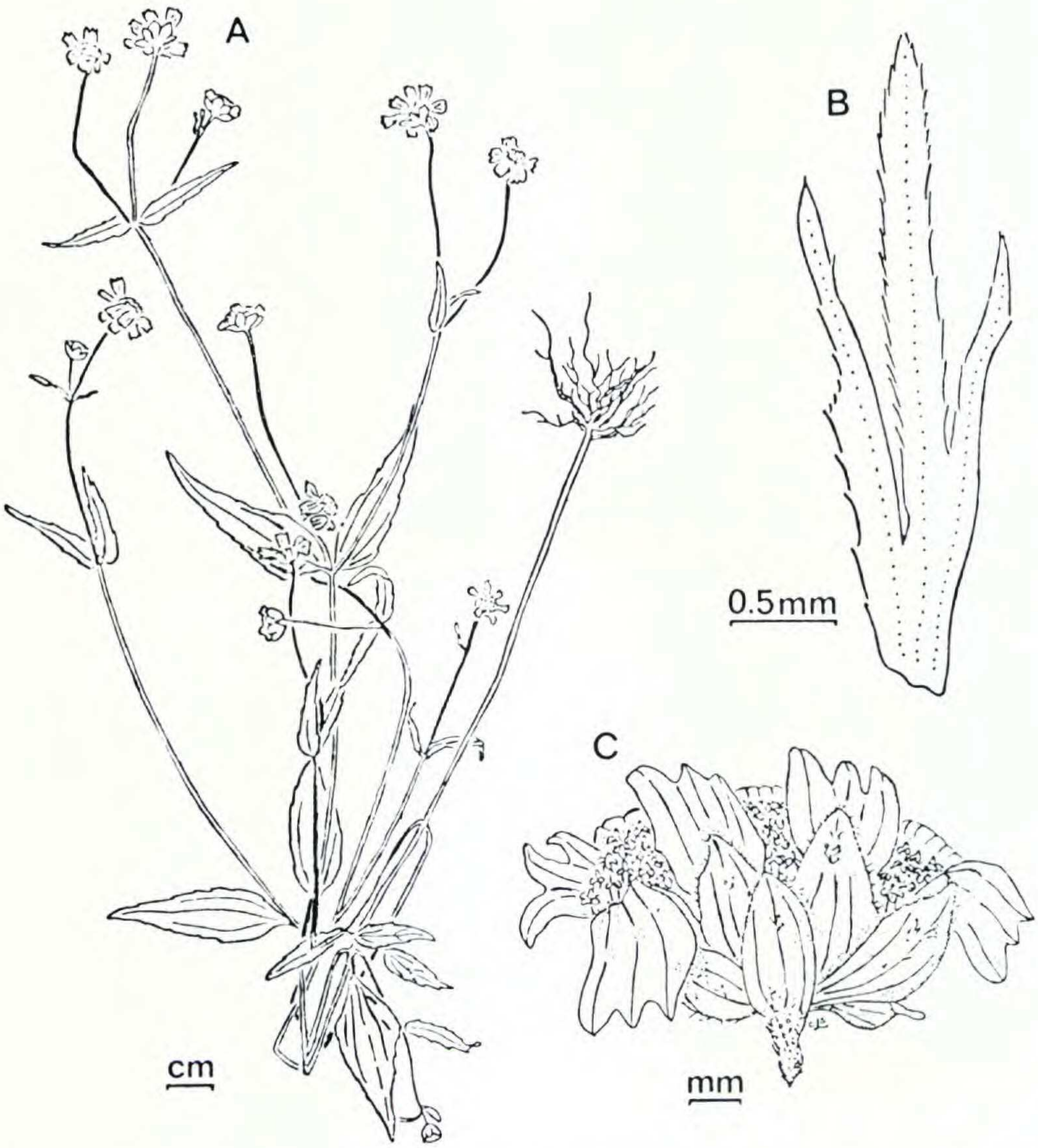


Figure 9. **Galinsoga elata.** A, habit; B, inner pale; C, head. All *Webster & Breckon 16302*; A (OS), B and C (MICH).

1970, *G. L. Webster & G. J. Breckon 16302* (Holotype, DAV!; isotypes, MICH! OS!).

DISTRIBUTION. *Galinsoga elata* is known only from the type locality, where the species is common on gray metamorphic rock in wet steep places along the highway.

In terms of overall morphology, *Galinsoga elata* appears close to *G. formosa.* Although the leaf surfaces of *G. formosa* are more densely pilose than in *G. elata,* leaf shape is similar. The peduncles, capitulescence, and inner pales are similar, and both species have

large heads containing numerous disc florets. The species differ most dramatically in that *G. elata* has a pappus of short scales and aglandular anther appendages, whereas *G. formosa* has a setose pappus and anther appendages with 2 multicellular glands. The species is named for its attractive tall stature.

SPECIMENS EXAMINED. **Mexico.** QUERETARO: 1.5 mi E of Pinal de Amoles, *Turner 76–9* (OAC, OS).

3. **Galinsoga durangensis** (Longpre) Canne, comb. nov.

Tricarpha durangensis Longpre, Publ. Mus. Michigan State Univ., Biol. Ser. **4**(8): 378. 1970. TYPE: **Mexico:** Durango, Mexico hwy 40, 7.5 mi ENE Revolcaderos, 7200 ft, 7 Nov 1964, *D. Flyr 292* (Holotype, MSC!; photograph of holotype, MSC!; isotype, TEX).

Sabazia durangensis (Longpre) Urbatsch & Turner, Brittonia **27**: 351. 1975.

Annual herbs to 66 cm tall. Stems with internodes to 17 cm long. Leaves with petioles 0.2–1.6 cm long; blades ovate to narrowly lanceolate, 1.2–8 cm long, 0.5–3.7 cm wide, at the apex acute to acuminate, at the base cuneate to rounded, with both surfaces sparsely to moderately pilose; margins sharply serrate to serrulate and ciliate. Peduncles 0.5–6.5 cm long, moderately to densely appressed to spreading pilose, sometimes with glandular capitate trichomes intermixed, often furnished with one or a pair of linear, pilose bracts, 2–4 cm long, 0.5–1 cm wide. Heads 0.3–0.7 cm tall, 0.7–2 cm wide. Involucre 2–3 seriate, campanulate to hemispherical, glabrous or sparsely glandular pilose; outer phyllaries ovate to oblong-elliptic, 2.5–4 mm long, 1.2–1.8 mm wide, with the margins scarious, hyaline or purple, minutely laciniate-ciliate; inner phyllaries narrowly ovate, 2–4.5 mm long, 0.6–1.2 mm wide, somewhat convex, at the apex attenuate. Receptacle 1–2 mm tall, 1–2 mm diam. Pales 1.8–3.5 mm long, deeply trifid. Ray florets 8–13; ligules rectangular to cuneate-oblong, 3–7 mm long, 1.3–4 mm wide, glabrous or sparsely and minutely pilose dorsally, with the lobes obtuse, 0.2–1 mm long; tubes 1–2 mm long; achenes narrowly obconical, 1.2 mm long, 0.4–0.5 mm diam, glabrous, epappose. Disc florets 30–65; throats 1.7–2.5 mm long, 1 mm diam, minutely pilose; lobes 0.5 mm long; tubes 0.6–0.7 mm long; anthers 1 mm long, with appendages narrowly ovate; achenes like those of the ray florets. Chromosome number, $n = 8$.

DISTRIBUTION. Known from Sinaloa and neighboring Durango, Mexico, in moist ravines and along north-facing slopes in the pine-oak zone (Figure 8), 300–2400 m. Flowering from September to November.

This species appears to be an annual (rather than perennial as reported by Longpre, 1970) with a slender taproot and many secondary fibrous roots.

One specimen, *Ortega 4456,* differs from the others by having smaller heads, fewer florets per head and glandular capitate trichomes on the peduncles. All three of these features are known to vary in several other species, and it is likely that the *Ortega* specimen is an indication that the imperfectly known *Galinsoga durangensis* also shows the morphological variability recorded elsewhere in the genus.

The recent recognition of several new species (Fay, 1973; McVaugh, 1972; and the present paper) has dissolved the generic boundaries reported by Longpre (1970) for *Tricarpha.* Deeply trifid pales, scarious phyllary margins, and shallowly lobed ray corollas were features used as generic markers for *Tricarpha* (Longpre, 1970). All of these characters are present, either singly or in various combinations, in many species of *Galinsoga* (e.g., *G. parviflora, G. triradiata,* and *G. longipes* of sect. *Galinsoga, G. filiformis* of sect. *Stenocarpha, G. elata, G. formosa,* and *G. mollis* of sect. *Elata*). In addition, Urbatsch and Turner (1975) have pointed out that at least two species of *Sabazia, S. humilis* (HBK.) Cass. and *S. multiradiata* (Seaton) Longpre, also have deeply trifid pales and a few species have scarious phyllary margins.

Galinsoga durangensis has no vegetative or floral features which would exclude it from *Galinsoga,* and in addition has the acute, serrate leaves, small achenes, and large heads on long peduncles characteristic of the species of *Galinsoga* sect. *Elata.* Although *Tricarpha durangensis* is properly transferred to *Galinsoga, T. purpusii* (Brandg.) Longpre with its sharply acute phyllaries in 3 or 4 series, long disc and ray corollas, long anthers, and shiny achenes seems best moved to *Sabazia,* a course recently followed by Urbatsch and Turner (1975).

SPECIMENS EXAMINED. **Mexico.** DURANGO: La Bajada Tamazula, *Ortega 4456* (US). SINALOA: 5 mi NE of La Cienega, *Breedlove & Kawahara 17044* (MICH); below

Buenas Juntas, 5 mi NW of Los Ornos, *Breedlove & Thorne 18222* (MICH); 21.9 mi NE of Santa Lucia, *Keil & Canne 8860* (OS).

4. **Galinsoga mollis** McVaugh, Contr. Univ. Michigan Herb. **9:** 414. *t. 26.* 1972. TYPE: **Mexico:** Jalisco, 20–22 km S of Talpa de Allende, headwaters of a west branch of Rio de Talpa, 1200–1450 m, 28–30 Mar 1965, *McVaugh 23300* (Holotype, MICH!; isotypes, DUKE! ENCB! NY!).

Annual (?) herbs to 1.5 m tall. Stems green to reddish-green, pilose with short trichomes to 0.3 mm long, intermixed with trichomes to 2 mm long. Leaves with petioles to 1.5 cm long or sessile to subsessile, sometimes alternate near the capitulescence; blades elliptic-lanceolate, 1–15 cm long, 0.5–4 cm wide, at the apex acuminate, at the base attenuate to rounded, with both surfaces pilose; margins remotely denticulate. Peduncles 1.5–4.5 cm long, densely appressed pilose. Heads 0.6–0.9 cm tall, 1.5–2 cm wide. Involucre subglobose, 2–3 seriate, glabrous, outer phyllaries narrowly to broadly ovate, flattened, 1.5–3.5 mm long, 1.2–3 mm wide; innermost phyllaries broadly elliptic, ovate to slightly obovate, convex, 3–3.8 mm long, 2–2.8 mm wide, at the apex obtuse, with the margins scarious. Receptacle 1.5–2.8 mm tall, 2–2.5 mm diam. Pales narrowly oblong, convex, entire or with 1–2 short lateral lobes, at the apex obtuse or sometimes acute, outermost pales to 3.5 mm long, to 1 mm wide, joined at the base in pairs to an adjacent phyllary; inner pales to 3 mm long, 0.4–0.6 mm wide. Ray florets 8; ligules obovate, 4–8 mm long, 2.5–4 mm wide, with the lobes acute to obtuse; tubes 2 mm long; achenes obpyramidal, 1.2–1.5 mm long, 0.6 mm diam, dorsally convex, ventrally angular, glabrous, at the apex truncate, epappose. Disc florets 125–150; throats 2 mm long, 1 mm diam, with the lobes 0.5 mm long; tubes 1 mm long; anthers to 1.2 mm long, with the appendage narrowly ovate; achenes obconical, angular, 1–1.3 mm long, 0.5 mm diam, glabrous, epappose. Chromosome number unknown.

DISTRIBUTION. Known only from steep mountainsides in the pine forest of Jalisco, Mexico, where it is abundant at the type locality. Figure 8.

Galinsoga mollis was the first of the tall-statured, large- and few-headed Galinsogas to be recognized (McVaugh, 1972). Until

the present work it has existed as an unusual species in a genus traditionally characterized by small herbs with numerous heads only a few millimeters in diameter. However, as the genus is presently perceived, *G. mollis* falls clearly into sect. *Elata* where it shares the features of many disc florets, long ray ligules and few-headed capitulescence with the other taxa.

The size and soft pubescence of *Galinsoga mollis* remain unique in the genus, and this species is the only member of sect. *Elata* that lacks deeply trifid pales. Morphologically, *G. mollis* seems more remote from the other three species in the section than these latter species do from each other.

II. **Galinsoga** section **Stenocarpha** (S. F. Blake) Canne, comb. et stat. nov.

Stenocarpha S. F. Blake, Bull. Misc. Inform. no. **7:** 348. 1915.

Plantae 10–40 cm altae; folia caulina et basalia; pedunculi 0.5–10 cm longi, filiformes; capitula in cymis laxis; paleae interiores lineares, integrae, 0.2–0.4 mm latae; flosculi radii 8–10, ligulis 2.6–4.5 mm longis, rectangularibus; flosculi disci ca 66, faucibus corollarum 0.7–1.1 mm longis. TYPE SPECIES: *Galinsoga filiformis* Hemsl.

5. **Galinsoga filiformis** Hemsl. Diagn. Pl. Nov. **2:** 34. 1879.
TYPE: **Mexico:** Sinaloa, Cerro de Pinal, Dec 1848, *Seemann 1473* (Holotype, K!).

Stenocarpha filiformis (Hemsl.) S. F. Blake, Contr. Gray Herb. **52:** 57. 1917.
Stenocarpha filipes S. F. Blake, Bull. Misc. Inform. no. 7: 348. 1915.[1]

Stenocarpha filiformis (Hemsl.) S. F. Blake var. *genuina* S. F. Blake, Contr. Gray Herb. **52:** 57. 1917. *nom. illegit.*, based on the type of *Galinsoga filiformis* Hemsl.

Galinsoga filiformis Hemsl. var. *epapposa* Robins., Proc. Am. Acad. Arts **43:** 42. 1907. TYPE: **Mexico:** Durango, San Ramón, 21 Apr-18 May 1906, *E. Palmer 127* (Holotype, GH!; isotypes, MO! NY! UC! US!).

Stenocarpha filiformis (Hemsl.) S. F. Blake var. *epapposa* (Robins.) S. F. Blake, Contr. Gray Herb. **52:** 57. 1917.

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[1]When Blake (1915) first established *Stenocarpha* and made the transfer from *Galinsoga*, he mistakenly used the epithet *filipes*. The correction was made by Blake when he published the name *S. filiformis*.

Annual herbs, 10–40 cm tall. Stems erect, branches sparsely pilose. Leaves sessile or with petioles to 8 mm long, blades at the apex acute to obtuse, at the base attenuate; margins entire or minutely denticulate; blades of basal leaves broadly to narrowly elliptic or obovate, 0.8–4 cm long, 0.5–2.3 cm wide, with the upper surface green or reddish and pilose, with the lower surface green and glabrous to sparsely pilose; cauline leaves sessile or with petioles to 3 mm long, blades narrowly ovate to narrowly elliptic, 1.5–6 cm long, 0.2–1.4 cm wide, with both surfaces glabrous to sparsely pilose. Peduncles 0.5–10 cm long, filiform, sparsely to densely pilose, often subtended by narrowly elliptic bracts, 3–10 mm long, 1–2 mm wide, at the apex acute to obtuse, at the base attenuate. Heads 1.8–4.3 mm tall, 5–8.5 mm wide. Involucre campanulate; outer phyllaries 3, narrowly ovate, 1–2.2 mm long, 0.3–1.3 mm wide, glabrous, at the apex obtuse; inner phyllaries ovate to narrowly ovate, 1.6–2.7 mm long, 0.8–1.5 mm wide, glabrous, at the apex acute to obtuse, with the margins minutely laciniate and narrowly scarious. Receptacle narrow, 1.5–2.6 mm tall, 0.6–1.5 mm diam. Pales linear to linear-obovate, 2–2.5 mm long, 0.2–0.4 mm wide, entire, at the apex acute. Ray florets 8–10, corollas white; ligules rectangular, 2.6–4.5 mm long, 1.2–1.6 mm wide, with the lobes 0.3 mm long, obtuse; tubes 0.6–0.7 mm long; achenes subterete to somewhat angular, 0.5–0.8 mm long, 0.2–0.3 mm diam, glabrous and epappose or strigose and with a pappus of 5 obtuse, fimbriate scales alternating with 5 aristate scales to 0.7 mm long. Disc florets ca 66, throats 0.7–1.1 mm long, 0.4–0.7 mm diam; tubes 0.3–0.6 mm long; anthers 0.5–0.8 mm long, with the appendage ovate; achenes like those of the ray florets. Chromosome numbers, $n = 8, 9$.

DISTRIBUTION. Restricted to the states of Sinaloa and Durango, Mexico (Figure 10), 300–1700 m. Flowering from September to May.

The paucity of cauline leaves and the presence of basal leaves occur regularly only in *Galinsoga filiformis*. The only collection known to have abundant cauline leaves is the progeny of *Breedlove 1668* grown in a greenhouse. Elsewhere in the genus I have seen basal leaves only in greenhouse plants grown from a Mexican collection of *G. quadriradiata* (*Keil & Canne 9179*).

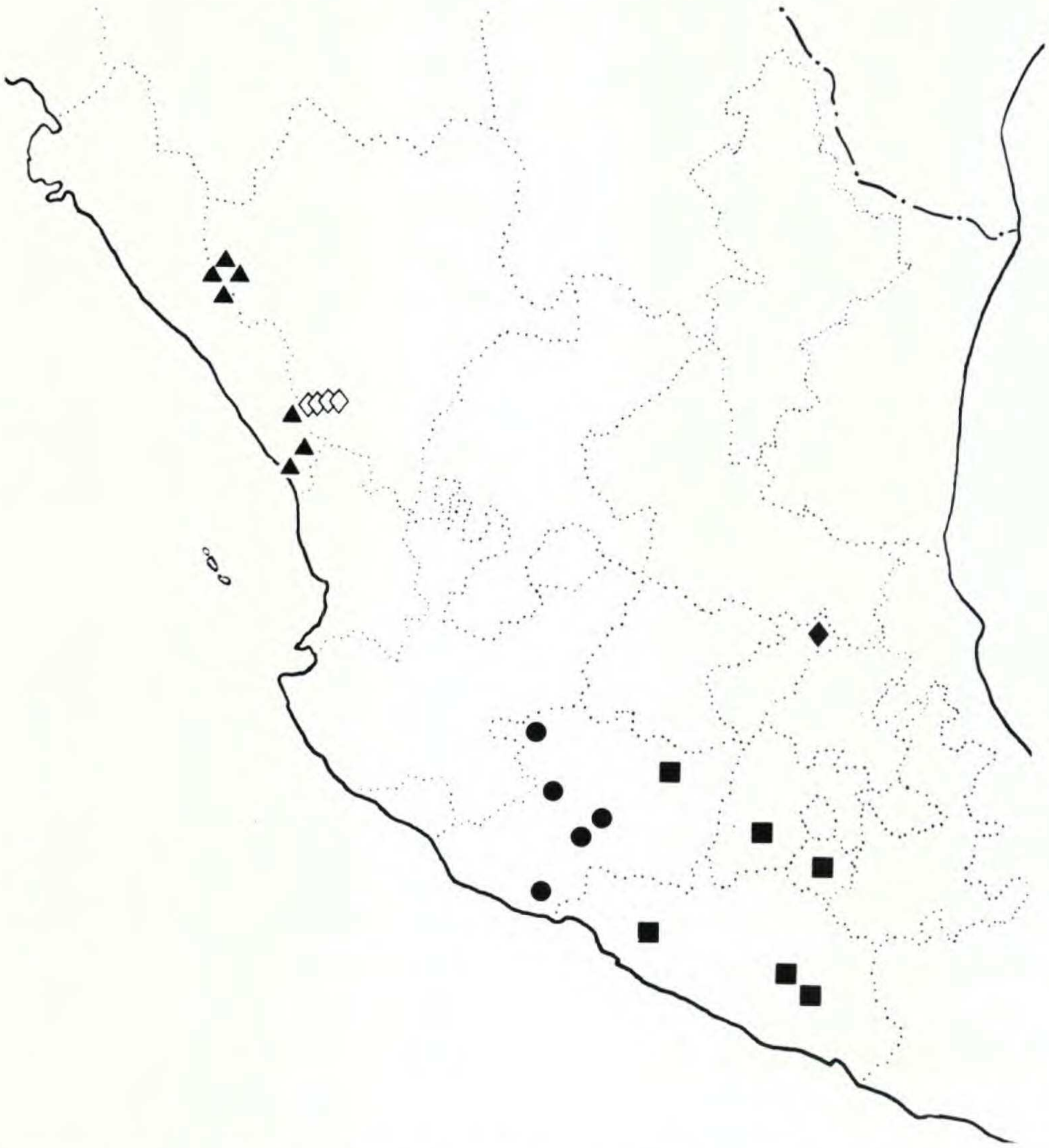

Figure 10. **Mexican distributions of Galinsoga.** Map of Mexico indicating the distributions of *Galinsoga filiformis* (triangles), *G. glandulosa* (solid diamond), *G. longipes* (squares), *G. subdiscoidea* (open diamonds), and *G. triradiata* (dots).

Galinsoga filiformis is placed in a separate section because it is a morphologically well defined taxon which shows no obvious close relationship with any other species. *Galinsoga filiformis* is the only species in the genus with the pales less than 0.4 mm wide, filiform peduncles, narrowly ovate phyllaries, and basal leaves. It was the occurrence of these unique character states which prompted S. F. Blake (1915) to establish the genus *Stenocarpha* for *G. filiformis* Hemsl. However, except for the basal leaves, these character states are quantitative extensions of characters found within *Galinsoga*.

Other features are shared with several members of sect. *Galinsoga* and sect. *Elata*. *Galinsoga filiformis* has the small head size and habit of taxa in sect. *Galinsoga* but possesses the long peduncles, ray corolla number and shape of species in sect. *Elata*.

REPRESENTATIVE SPECIMENS: **Mexico.** DURANGO: La Bajada, municipality of Tamazula, *Ortega 628* (MEXU); La Bajada, Tamazula, *Ortega 4427* (GH, US). SINALOA: Cofradía, near Culiacán, 26 Oct 1904, *Brandegee s.n.* (US), 28 Oct 1904, *Brandegee s.n.* (UC), 31 Oct 1904, *Brandegee s.n.* (GH); Rosario, ca 33 mi E of Concordia, *Breedlove 1668* (DS); Mesa Malquesón, Cerro Colorado, *Gentry 5139* (UC); Capadero, Sierra Tacuichamona, *Gentry 5584* (GH); Manzanitla, *Ortega 901* (US); Rosario, Cacalotán, *Ortega 7134* (F, US); vicinity of Rosario, *Rose, Standley, & Russell 14607* (US).

III. **Galinsoga** section **Galinsoga.**

Galinsoga Ruiz & Pavon, Prodr. 110. *t. 24.* 1794. TYPE SPECIES: *Galinsoga parviflora* Cav.

Plants 1.5–75 cm tall; leaves cauline; peduncles absent to 5(–7) cm long, slender; heads in tight to open cymose clusters; inner pales narrowly obovate and entire to broadly lanceolate and bifid to trifid, 0.3–1.5 mm wide; ray florets 0–5(–9), with ligules absent or to 6 mm long, 0–3.5 mm wide, quadrate to obovate; disc florets 5–70(–100), with corolla throats 0.7–1.6 mm long.

6. **Galinsoga longipes** Canne, sp. nov. Figure 11.

Herbae annuae, 18–55 cm altae. Caules erecti, simplices vel ramosi, internodiis 3–12.5 cm longis, rubri-virides, pilosi trichomatibus multicellulosis usque 2 mm longis. Folia petiolis 0.1–2 cm longis, rubris; laminae anguste ovatae, 1.8–4.3 cm longae, 0.8–2.3 cm latae, pilosae utrinque, apice acuto vel aliquantum attenuato, basi rotundata vel cuneata; margines serrati vel serrulati. Pedunculi 1–7.1 cm longi, pilosi trichomatibus multicellulosis adpressis et effusis, eglandulosis. Capitula 0.4–0.6 cm alta, 0.6–1.5 cm lata. Involucrum campanulatum; phyllaria exteriora 2–3 mm longa, 1–1.7 mm lata, glabra, marginibus scariosis; phyllaria interiora 3–3.7 mm longa, 2–2.5 mm lata, glabra, marginibus scariosis. Receptaculum 2.5 mm altum, 1.3 mm diametro. Paleae extimae anguste ovatae, 2–2.8 mm longae, 1–1.6 mm latae, apice acuto vel obtuso, junctae ad basim binatim ad phyllarium contiguum; paleae interiores lanceolatae, attenuatae, 1.7–2.5 mm longae, 0.3–0.7 mm latae,

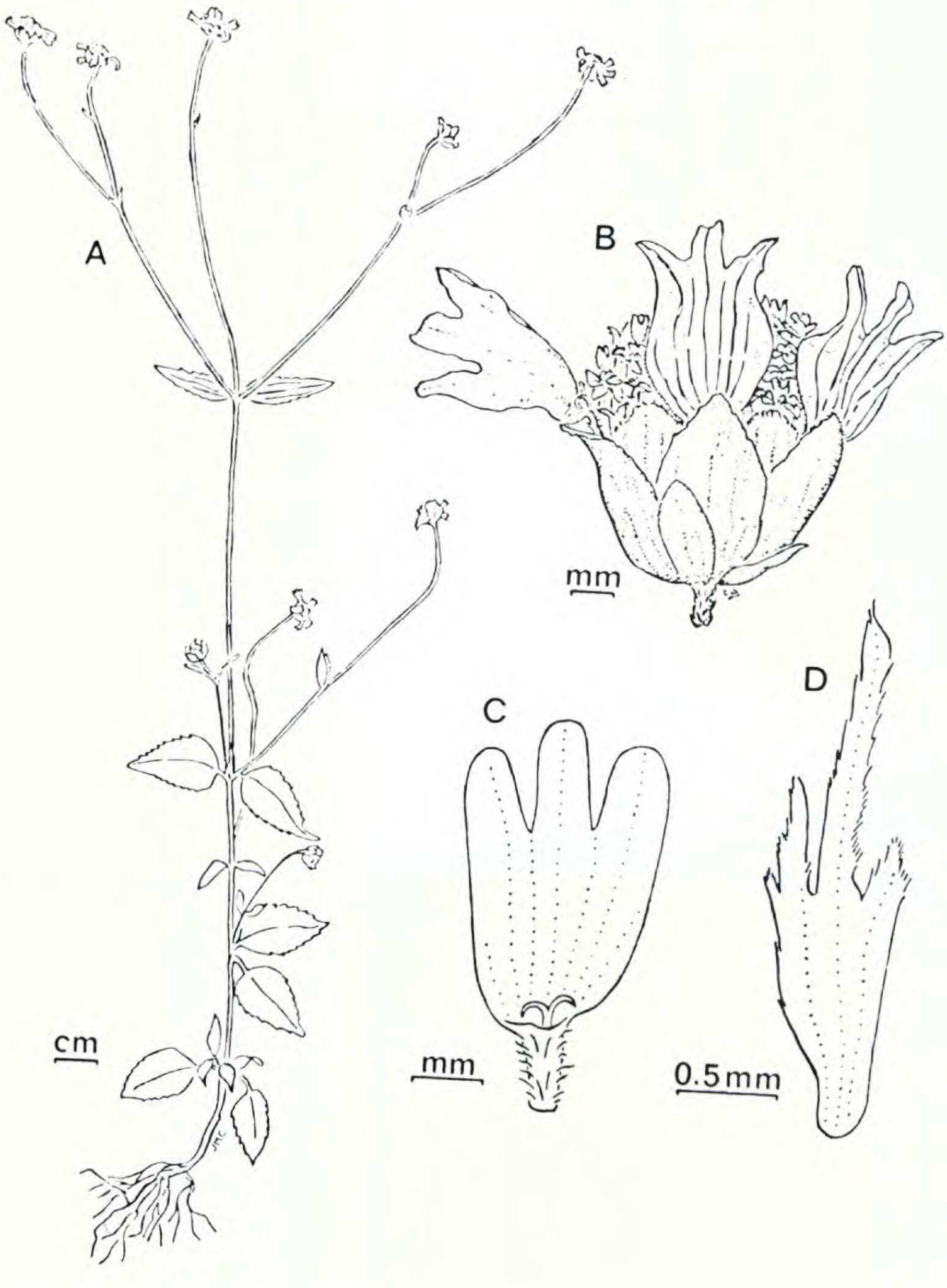

Figure 11. **Galinsoga longipes.** A, habit; B, head; C, ray corolla; D, inner pale. All *Cronquist 10308;* A and B (DUKE), C and D (US).

integrae vel aliquot lobo laterali acuto. Flosculi radii 5, corollis albis, venis purpureis; ligulae 2.5–6 mm longae, 2–3.5 mm latae, sparse brevipilosae in venis dorsalibus, lobis 3; tubi 1.5 mm longi; achenia 1.3 mm longa, 0.5 mm lata, glabra, epapposa. Flosculi disci 35–100, corollis luteis; fauces 1.3–1.5 mm longae, 0.7–1 mm diametro, lobis 0.4 mm longis, acutis; tubi 0.4–0.6 mm longi; antherae brunneolae, 0.8 mm longae, appendice ovata; achenia 0.8–1 mm longa, 0.4 mm lata, glabra, epapposa vel strigosa et pappi squamellae ca 20 inequales obovatae, laciniatae, obtusae vel 3–5 squamellis aristatis interspersis. Chromosomatum numerus ignotus.

TYPE: **Mexico:** Michoacán, ca 23 mi E of Morelia, 9 Oct 1965, *A. Cronquist 10308* (Holotype, NY!; isotypes, CAS! DUKE! ENCB! MEXU! MICH! MSC! TEX! US! WIS!).

DISTRIBUTION. Restricted to the pine-oak woodlands of the mountains of west-central Mexico (Figure 10), 1600–2440 m. Flowering from September to February.

Although distinguished by differences in peduncle and achene pubescence, ray corolla number and shape, and pale shape, *Galinsoga longipes* most closely resembles *G. triradiata.* Plants of *Anderson & Laskowski 4373* particularly bear a strong vegetative likeness to *G. triradiata.* Representatives of both species possess the tall stature and elongate internodes for which *G. longipes* was named. Similarly, both taxa are characterized by a few-headed capitulescence with heads on elongate peduncles and by compact involucres greatly exceeded in length by the ray ligules.

The elongate internodes and peduncles, and the few-headed capitulescence are features shared with species in sects. *Stenocarpha* and *Elata. Galinsoga longipes* and *G. triradiata* are placed in sect. *Galinsoga,* however, because they have small heads with small florets, usually less than 70 disc florets and five or fewer ray florets, and representatives of both species are known to flower when only a few centimeters tall.

SPECIMENS EXAMINED. **Mexico.** GUERRERO: 32–40 km W of Chilpancingo, near Omiltemi, *Anderson & Laskowski 4373* (MICH); Pilas, *Hinton et al. 10471* (ENCB, LL, MICH, US); El Voladerito, cerca de Coxtlahuacán, *Rzedowski 30273* (ENCB). MEXICO: local of Rincón, *Hinton 2431* (BM, F, GH, NY, US). MORELOS: Cempoala, *Lyonnet 802* (US).

7. **Galinsoga triradiata** Canne, sp. nov. Figure 12.

Herbae annuae, usque ad 75 cm altae. Caules erecti, internodiis usque 13 cm longis, virides-rubri, pilosi; trichomata multicellulosa effusa usque ad 2 mm longa trichomatibus immixtis glandulosis capitatis. Folia subsessilia vel petiolis 0.2–1 cm longis; laminae ovatae, 1.5–6.5 cm longae, 0.6–2.5 cm latae, pilosae utrinque, apice acuto, basi cuneata vel rotundata; margines serrati. Pedunculi 0.5–6 cm longi. Capitula 0.4–0.6 cm alta, 0.6–1.3 cm lata. Involucrum biseriatum, campanulatum; phyllaria exteriora 4, anguste triangulata-ovata, 1.2–1.8 mm longa, 0.7–1 mm lata, glandulosa pilosa, apice acuto, marginibus scariosis et minute laciniatis; phyllaria interiora ovata, convexa, 2.8–3.3 mm longa, 1.8–2 mm lata, glandulosa pilosa, marginibus scariosis. Receptaculum 1.4–1.8 mm alta, 0.9–1 mm diametro. Paleae extimae ovatae, junctae ad basim terni ad phyllarium contiguum, 2 mm longae, 1 mm latae; paleae interiores lineares vel anguste oblanceolatae, 2–2.3 mm longae, 0.3–0.5 mm latae, apice obtuso, aliquando rubro, marginibus subtiliter laciniatis. Flosculi radii 3–4 (–5), corollis albis, aliquando dorsaliter purpureis; ligulae obovatae, 3.5–6 mm longae, 4–7 mm latae, pilosae in venis dorsalibus, lobis 3, ca 1/2 ligulae longitudinis, obtusis; tubi 0.6–0.8 mm longi; achenia 1–1.4 mm longa, 0.5–0.6 mm diametro, glabra vel trichomatibus brevibus obtusis 4-cellularibus, epapposa. Flosculi disci 25–35, corollis luteis; fauces 1–1.5 mm longae, 0.8–1 mm diametro, lobis 0.3–0.4 mm longis; tubi 0.3–0.5 mm longi; antherae brunneolae, 0.6–0.8 mm longae, appendice ovata; achenia acheniis radiorum similia. Chromosomatum numerus ignotus.

TYPE: **Mexico:** Michoacán, northwestern foothills of Cerro Tancítaro, 13–14 km S of Peribán de Ramos, 1650–1700 m, 29 Nov 1970, *R. McVaugh 24828* (Holotype, MICH!; isotypes, DUKE! ENCB! LL! NY!).

DISTRIBUTION. Known from the pine-oak forests in the mountains of Michoacán, Mexico (Figure 10) where the species occurs in locally abundant colonies, 1100–1700 m. Flowering in October and November.

The specific epithet, *triradiata,* was chosen to emphasize the characteristic three-rayed condition of the heads. This species is

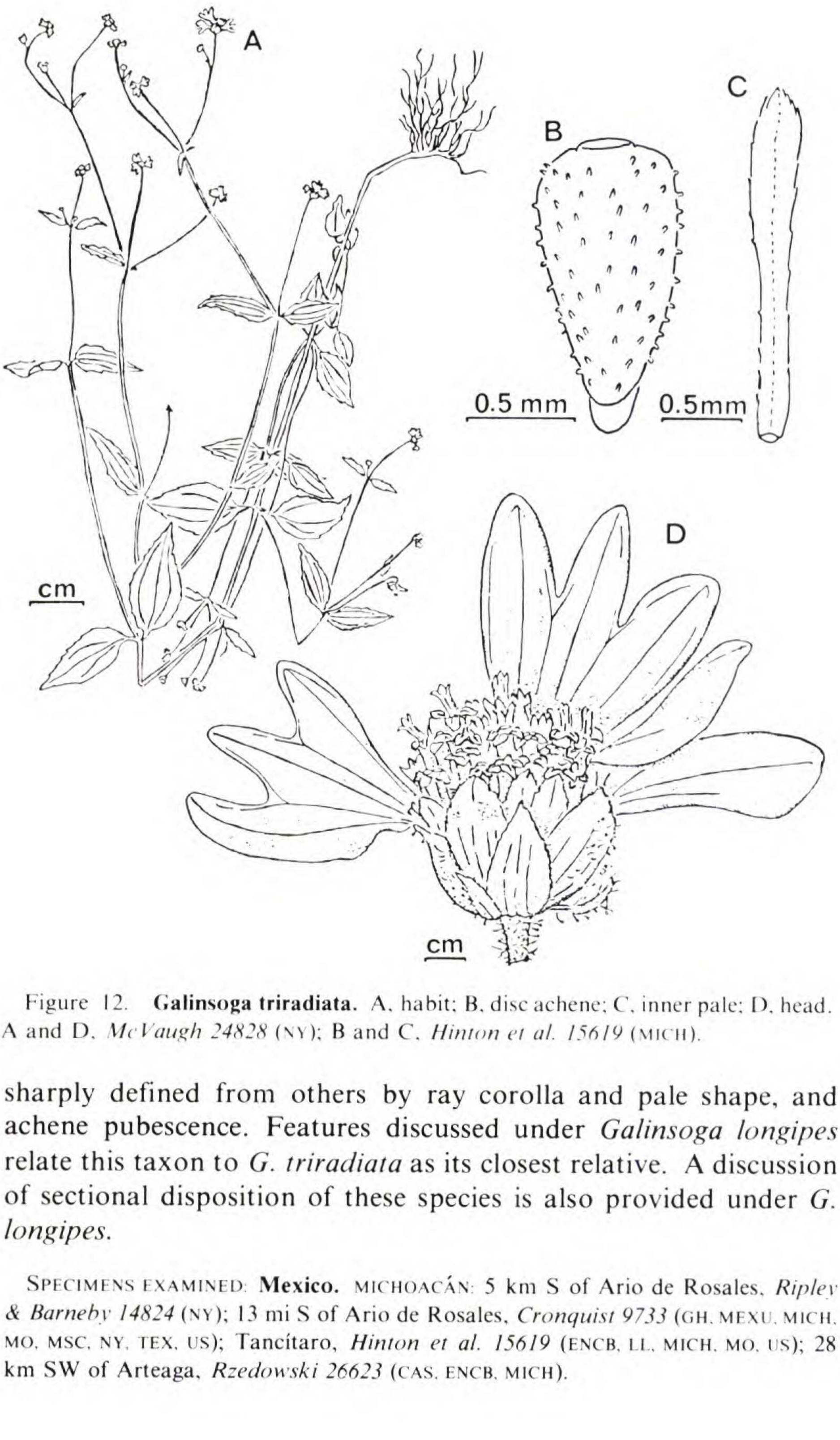

Figure 12. **Galinsoga triradiata.** A, habit; B, disc achene; C, inner pale; D, head. A and D, *McVaugh 24828* (NY); B and C, *Hinton et al. 15619* (MICH).

sharply defined from others by ray corolla and pale shape, and achene pubescence. Features discussed under *Galinsoga longipes* relate this taxon to *G. triradiata* as its closest relative. A discussion of sectional disposition of these species is also provided under *G. longipes*.

SPECIMENS EXAMINED: **Mexico.** MICHOACÁN: 5 km S of Ario de Rosales, *Ripley & Barneby 14824* (NY); 13 mi S of Ario de Rosales, *Cronquist 9733* (GH, MEXU, MICH, MO, MSC, NY, TEX, US); Tancítaro, *Hinton et al. 15619* (ENCB, LL, MICH, MO, US); 28 km SW of Arteaga, *Rzedowski 26623* (CAS, ENCB, MICH).

8. **Galinsoga caligensis** Canne, sp. nov. Figure 13.

Herbae annuae, 3–40 cm altae. Caules erecti vel decumbentes, rubri, glabri vel sparse pilosi prope basin usque moderate vel dense pilosi in ramis superis trichomatibus adpressis et effusis usque ad 1 mm longis. Folia petiolis 1–7 (–10) mm longis; laminae ovatae vel lanceolatae-ovatae, 1.5–4 (–6) cm longae, 0.4–2.5 cm latae, pilosae utrinque apice acuto, basi rotundata; margines ciliati, integri vel serrati. Pedunculi 0.8–5 cm longi. Capitula 5–6 (–9) mm alta, 8–10 mm lata. Involucrum biseriatum, campanulatum; phyllaria exteriora 2, ovata vel lanceolata-ovata, 2–3 (–3.8) mm longa, 0.6–1.5 mm lata, marginibus minute laciniatis et scariosis, glabris vel sparse pilosis; phyllaria interiora 5, ovata, 3–4.5 mm longa, 1.7–2.5 mm lata, glabra, aliquando purpurascentia, marginibus minute laciniatis et scariosis. Receptaculum 1.5–1.8 mm altum, 1.5 mm diametro. Paleae extimae ovatae-lanceolatae, 3.5–4 mm longae, 1–1.5 mm latae, junctae ad basim binatim ad phyllarium contiguum; paleae interiores lanceolatae, 2–3.8 mm longae, 0.5–1.2 mm latae, integrae vel aliquanto trifidae. Flosculi radii 5–8, corollis albis; ligulae 2–3.8 mm longae, 1.6–3 mm latae, lobis 3(–4); tubi 0.8–1.9 mm longi; achenia obconica, 1.4–1.7 mm longa, 0.5–0.6 mm diametro, glabra, epapposa. Flosculi disci 35–75; fauces 1.2–1.6 mm longae, 1 mm diametro, minute pilosae, lobis 0.4 mm longis; tubi 0.5–0.7 mm longi; antherae brunneolae, 1 mm longae, ad staminodia reductae vel absentes in seriem extremam flosculorum discorum, appendice ovata-oblonga; achenia anguste obconica, 1–1.3 mm longa, 0.4–0.6 mm diametro, glabra vel strigosa; pappi absentes vel squamellae lanceolatae, laciniatae, aristatae, 1.2–2 mm longae. Chromosomatum numerus ignotus.

TYPE: **Peru:** Lima, Dist. Pachacamac, Atacongo, among rocks in arid valley, 180 m, 14 Oct 1935, *Y. Mexia 4045* (Holotype, UC!; isotypes, GH! MO! US!).

DISTRIBUTION. Common to abundant among the rocks along the bases and slopes of the desert hills of coastal Peru (Figure 16), 70–600 m. Flowering from late July to November.

Galinsoga caligensis is endemic to the coastal desert region of western Peru. There, local dense fogs accumulate over the hills and dunes during the late winter months, August to October, saturating the air and soil with moisture. These areas, called lomas,

Figure 13. **Galinsoga caligensis.** A, habit; B, inner pale; C, ray floret; D, head. A and D, *Ferreyra 9534* (F); B and C, *Macbride 5952* (F).

support an interesting flora (Weberbauer, 1945) including this new species. The specific epithet, *caligensis,* was chosen because the taxon is known only from the foggy lomas.

One collection (*Vargas 4690*) is different from the others. None of the specimens in this collection contains a complete plant, but the branch on one of the sheets is 41 cm long, indicative of a plant far larger than others known to the species. The leaves are more narrowly elongate with sharply serrate margins and the phyllaries more attenuate. Because only one collection is known and especially because the principal differences are vegetative, I have not recognized the *Vargas 4690* collection at a formal taxonomic rank.

Galinsoga caligensis shows no obvious strong relationship to other Galinsogas. The rather long peduncles and the open capitulescence are unlike those of other South American species. The pappus, inner pales and ray ligules are like those of *G. quadriradiata,* but in other respects the two species differ.

SPECIMENS EXAMINED. **Peru.** LIMA: parte alta de Atocongo, *Cerrate 2388* (OS, USM); lomas de Atocongo, 32 km S of Lima, *Cerrate 2738, 2771* (OS, USM); lomas de Quilmana entre Mala y Cañete, *Ferreyra 223,* (OS, USM); *Ferreyra 6323* (US); lomas de Lurin, *Ferreyra 9534* (OS, USM); lomas de Doña Maria, *Ferreyra, Cerrate, & Tovar 16571* (OS, USM); lomas de Atocongo, *Grant 7499* (F, NY, US); Lurin, *Macbride 5952* (F, US); lomas de Lachay, *Ochoa 598* (F, GH); lomas de Atocongo, *Stork, Horton, & Vargas 9291* (GH, UC); Lachay, near Chancay, *Tovar 378* (OS, USM); lomas de Lachay, *Vargas 4690* (CAS, F); hills of Asia, *Vargas 9305* (GH, UC).

9. **Galinsoga quadriradiata** Ruiz & Pavon, Syst. Veg. **1:** 198. 1798. TYPE: **Peru:** Lima, Lima and Chancay, 6 Jul-10 Aug 1781, *H. Ruiz & J. A. Pavon s.n.* (Holotype, MA; photograph of holotype, OS!; probable isotype, P!).

Galinsoga parviflora Cav. subsp.[here designated] *quadriradiata* (Ruiz & Pavon) Pers. Syn. Pl. **2:** 472. 1807. For a discussion of the uncertain status of Persoon's infraspecific taxa see Boivin (1962) and Chater & Brummitt (1966).

Galinsoga parviflora Cav. var. *quadriradiata* (Ruiz & Pavon) Poiret in Lamarck, Encyc. Meth. Supp. **2**(2): 701. 1812.

Galinsoga parviflora Cav. var. *discoidea* Ascherson & Garcke, Fl. Brandenberg **1:** 314. 1860, *pro syn.*

Galinsoga parviflora Cav. f. *discoidea* (Ascherson & Garcke) Thell. Allg. Bot. Z. Syst. **21:** 6. 1916.

Wilborgia urticaefolia HBK. Nov. Gen. Sp. Pl. **4:** 257. *t. 389.* 1818. TYPE: **Ecuador:** "Crescit juxta villam Marchionis de Miraflores, inter Mulalo et Pansache, alt. 1700 hex. (Regno Quitensi.)," Jun 1802, *F. H. A. von Humboldt & A. J. Bonpland 3055* (Holotype, P; photographs of holotype, F! GH! US!).

Jaegeria urticaefolia (HBK.) Spreng. Syst. Veg. **3:** 590. 1826.

Sabazia urticaefolia (HBK.) DC. Prodr. **5:** 497. 1836.
Baziasa urticaefolia (HBK.) Steud. Nomencl. Bot. **1:** 192. 1840.
Galinsoga urticaefolia (HBK.) Benth. in Örsted, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn p. 102. 1852.
Stemmatella urticifolia (HBK.) O. Hoffm. ex Hieron., Bot. Jahrb. Syst. **28:** 603. 1901.
Vargasia caracasana DC. Prodr. **5:** 676. 1836. TYPE: **Venzuela:** Caracas, 1830, *M. Vargas 267* (Holotype, G-DC; photograph of holotype, US!; isotype, P!).
Galinsoga parviflora Cav. var. *caracasana* (DC.) A. Gray, Smithsonian Contr. Knowl. **5:** 98. 1853.
Galinsoga caracasana (DC.) Sch.-Bip. Bull. Soc. Bot. France **12:** 80. 1865.
Galinsoga quadriradiata Ruiz & Pavon var. *quadriradiata* f. *vargasiana* Thell. Allg. Bot. Z. Syst. **21:** 14. 1916. Based on type of *Vargasia caracasana* DC.
Galinsoga quadriradiata Ruiz & Pavon var. *hispida* (DC.) Thell. f. *vargasiana* (Thell.) Mosseray ex Brenan, Bot. Soc. Exch. Club Brit. Isles **12:** 94. 1939.
Galinsoga ciliata (Raf.) S. F. Blake f. *vargasiana* (Thell.) Lousley, Watsonia **1:** 240. 1950.
Adventina ciliata Raf. New Fl. N. Am. **1:** 67. 1836. TYPE: unknown, not at PH.
Galinsoga ciliata (Raf.) S. F. Blake, Rhodora **24:** 35. 1922. Combined incorrectly as *Galinsoga cilata* (Raf.) Blake.
Galinsoga parviflora Cav. γ *hispida* DC. Prodr. **5:** 677. 1836. TYPE: **Mexico:** "in Mexico circa urbem," 1 Aug 1827, *J. L. Berlandier 615* (Lectotype, P!; isolectotype, G-DC).
Galinsoga hispida (DC.) Hieron. Notizbl. Konigl. Bot. Gart. Berlin **19:** 15. 1907, *non* Benth. 1845. *nom. illegit.*
Galinsoga quadriradiata Ruiz & Pavon var. *hispida* (DC.) Thell. Allg. Bot. Z. Syst. **21:** 11. 1916.
Galinsoga aristulata Bicknell, Bull. Torrey Bot. Club **43:** 270. 1916. Based on the type of *G. parviflora* Cav. var. *hispida* DC. The new specific epithet was supplied by Bicknell due to the previous publication of *G. hispida* Benth.
Galinsoga hispida Benth. Bot. Voy. Sulph. 119. 1845. TYPE: **Ecuador:** Guayaquil, 1841, *R. B. Hinds s.n.* (Lectotype chosen, K!; photograph of lectotype, US!).
Galinsoga brachystephana Otto, Index Sem. Hort. Berol. 1840. *nom. nud.*
Viborgia brachystephana (Otto) Heynh. Nomencl. Bot. Hort. **2:** 707. 1846. *nom. illegit.*
Galinsoga brachystephana Otto ex Heer & Regel, Index Semin. Hort. Turic, anno 1846 coll. 1847. TYPE: "Hort. Berol." *s.d. E. Regel s.n.* (Probable holotype, ZT!).
Galinsoga hispida Benth. var. *purpurascens* Fenzl. Del. Sem. Hort. Vindob. Advers. Bot. Stirp. e Sem. 1849 et 1850. p. 2. 1851. *nom. superfl.* Published as a new name for *Galinsoga brachystephana* Otto ex Heer & Regel but treated as a variety of *G. hispida* Benth.

Galinsoga quadriradiata Ruiz & Pavon var. *quadriradiata* f. *purpurascens* (Fenzl) Thell. Allg. Bot. Z. Syst. **21:** 15. 1916.

Galinsoga hispida Benth. var. *albiflora* Fenzl. Del. Sem. Hort. Vindob. Advers. Bot. Stirp. e Sem. 1849 et 1850. p. 2. 1851. *nom. nud.*

Galinsoga quadriradiata Ruiz & Pavon var. *quadriradiata* f. *albiflora* Fenzl ex Thell. Allg. Bot. Z. Syst. **21:** 15. 1916. TYPE: **Costa Rica:** "prope San Jose ad fossam in campis sabanas dictis," 5 Jun 1875, *H. Polakowsky 1* (in part), (Lectotype chosen, BM!). Thellung's description of the taxon was quoted from a description by G. Hieronymus (1901). The type at BM contains a specimen of *G. quadriradiata* and a fragment of *Jaegeria hirta* (Lag.) Less.

Galinsoga humboldtii Hieron. Bot. Jahrb. Syst. **28:** 618. 1901. TYPE: Locality and date not indicated, *F. H. A. von Humboldt & A. J. Bonpland s.n.* (Holotype, B, destroyed; photographs of holotype, NY! US!, fragment of type, US!).

Stemmatella lehmannii Hieron. Bot. Jahrb. Syst. **28:** 602. 1901. TYPE: **Colombia:** Cauca, vicinity of Popayán, *s.d. F. C. Lehmann 5667* (Holotype, B, destroyed; fragment of type, US!).

Stemmatella urticifolia (HBK.) O. Hoffm. ex Hieron. var. *eglandulosa* Hieron. Bot. Jahrb. Syst. **36:** 487. 1905. TYPE: **Peru:** near Cutervo, Apr 1879, *Jelski 609* (Holotype, B?).

Galinsoga bicolorata St. John & White, Rhodora **22:** 99. 1920. TYPE: **Mexico:** Chiapas, near Tumbala, 4000–5500 ft., 20 Oct 1895, *E. W. Nelson 3356* (Holotype, GH! isotype, US!).

Sabazia urticaefolia (HBK.) DC. var. *venezuelensis* Steyerm. Fieldiana, Bot. **28:** 672. 1953. TYPE: **Venezuela:** Lara, slopes of mountain between Santo Domingo and Los Quebraditos, south of Las Sabanetas, above Humocaro Bajo, 8 Feb 1944, *J. A. Steyermark 55379* (Holotype, F; isotype, US!).

Galinsoga eligulata Cuatr. Revista Acad. Colomb. Ci. Exact. **9:** 241. 1954. TYPE: Columbia: Caldas, Chinchiná, "Centro Nacional de Investigaciones del Café" 22 Nov 1946, *J. Cuatrecasas 23098* (Holotype, F! photograph, US!).

Ageratum perplexans M. F. Johnson, Ann. Missouri Bot. Gard. **58:** 80. 1971. TYPE: **Bolivia:** Yungas, 1890, *A. Miguel Bang 235* (Holotype, MICH!; isotypes, GH! MO! MSC! NY! US! WIS!). The sheets at GH, MSC, and WIS contain specimens of *Galinsoga parviflora* Cav. as well as *G. quadriradiata* Ruiz & Pavon.

Galinsoga × *Plikeri* Giacomini, Atti Ist. Bot. Univ. Pavia **9:** 186. 1950. TYPE: unknown. *nom. illegit.* Published as a hybrid of *G. ciliata* (Raf.) S. F. Blake and *G. parviflora* Cav. without Latin diagnosis or designation of type. The Italian description is that of *G. quadriradiata.*

Annual herbs to 62 cm tall. Stems erect or spreading, sparsely pilose below to densely strigose and pilose above with multicellular trichomes, often with red, glandular capitate trichomes intermixed on the younger branches and peduncles. Leaves with petioles 0.2–6 cm long; blades broadly to narrowly ovate, 1.6–9.5 cm long, 0.5–5.5 cm wide, at the apex acute to obtuse, at the base cuneate to rounded, with both surfaces sparsely to densely pilose; margins ciliate, serrulate to coarsely serrate, or crenate-serrate. Peduncles

0.2–5.2 cm long. Heads 3–8 mm tall, 2.1–10 mm wide. Involucre campanulate to cylindro-campanulate, glabrous or with scattered glandular capitate trichomes; outer phyllaries 1–3, unequal, narrowly to broadly ovate or lanceolate, 0.9–3 mm long, 0.5–2.2 mm wide, with the margins entire to minutely laciniate; inner phyllaries ovate, 2.5–4 mm long, 1.5–2.7 mm wide, with the margins minutely laciniate and scarious above the middle. Receptacle 0.8–2.3 mm tall, 1–2.5 mm diam. Outer pales broadly elliptic to obovate, 2–3 mm long, 0.6–1.8 mm wide, joined in groups of 2 or 3 at the base to an adjacent phyllary; inner pales lanceolate to oblanceolate, 1.8–3.3 mm long, 0.4–1 mm wide, entire to shallowly and irregularly trifid. Ray florets 5, rarely 4 or 8, with the corollas white to reddish-purple, or white with reddish veins; ligules 0.9–2.8 mm long; 0.7–2.5 mm wide, or rarely absent, obovate to quadrate, occasionally bilabiate with 1 or 2 oblong inner lobelets to 1.2 mm long; tubes 0.5–1.2 mm long; achenes 1.3–1.8 mm long, 0.5–0.8 mm diam, glabrous or strigose, epappose or with the pappus coroniform, of a few bristles, or 8–20 elliptic to obovate, fimbriate, often aristate, white scales, 0.2–1.4 mm long. Disc florets 15–65, corollas sometimes with reddish-purple lobes and throats, throats 0.8–1.5 mm long, 0.4–0.7 mm diam; tubes 0.3–0.5 mm long; anthers 0.5–0.7 mm long with the appendage ovate; achenes somewhat angular, 1.1–1.6 mm long, 0.5–0.8 mm diam, strigose, epappose or with a pappus of a few narrow, fimbriate scales or usually 20, lanceolate or somewhat oblanceolate, fimbriate, usually aristate scales to 1.5 mm long. Chromosome numbers, n = 16, 24, 32.

DISTRIBUTION. Apparently native to central Mexico, but now weedy in most temperate and subtropical areas of the New World and Europe. The species is found also in parts of Nepal, Japan, the Philippines, and Africa (Figure 14), 150–3270 m. Flowering the year round or until the first killing frost.

Galinsoga quadriradiata is the most morphologically variable species in the genus. This variability may be due to several causes. Presumably, the taxon underwent initial divergence and speciation in the mountainous areas of Mexico where populations experienced considerable geographical isolation and subsequently developed reproductive isolation to varying degrees. This resulted in the formation of rather discreet morphological units. The development of self-fertility in *G. quadriradiata* (known to occur now;

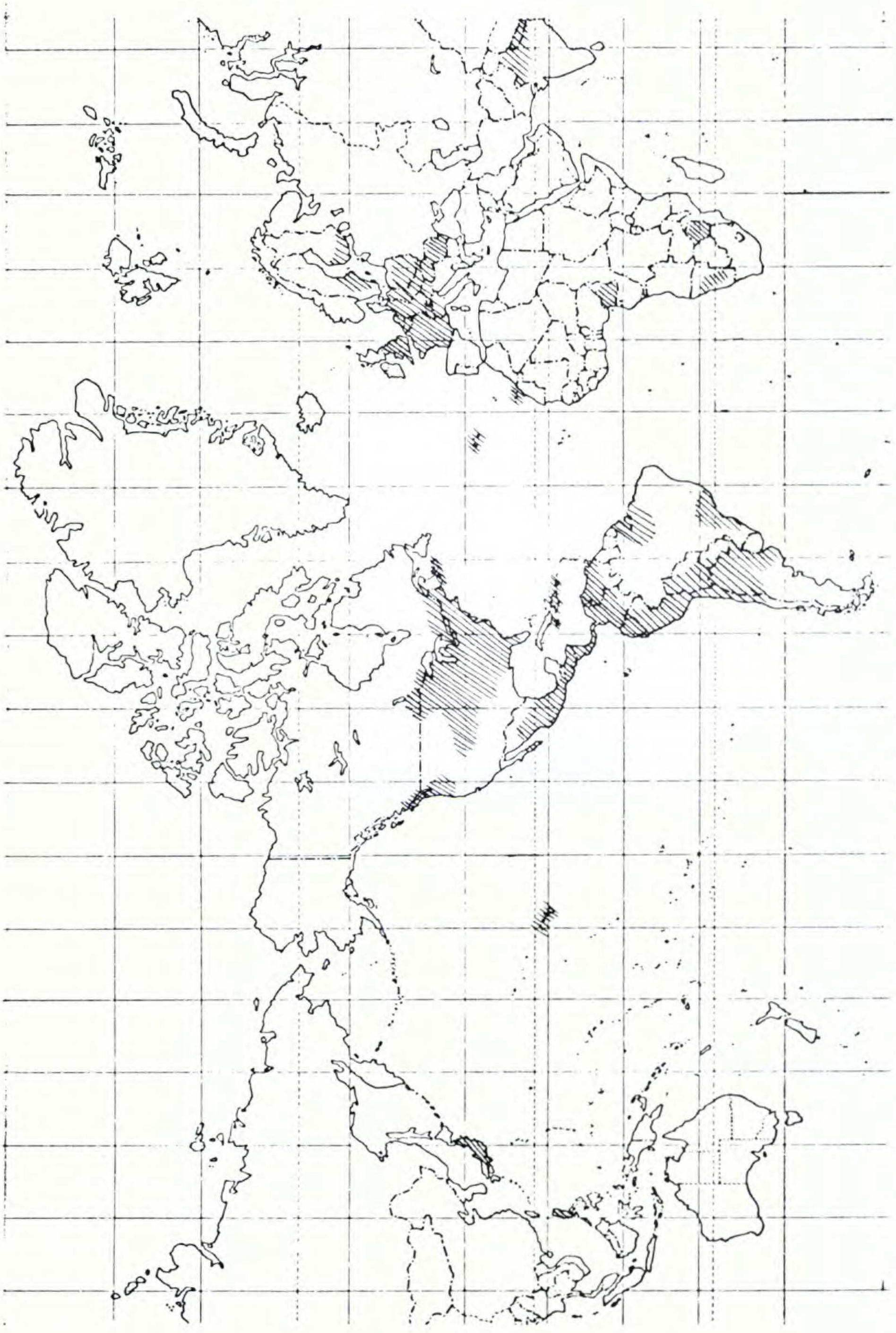

Figure 14. **World distribution of Galinsoga quadriradiata.**

Canne, unpubl.) undoubtedly enhanced the taxon's ability to colonize new locals. Also, plants of *G. quadriradiata* can flower when very young (e.g., when only a few centimeters tall) and continue to do so throughout the growing season. The large number of heads per plant in continuous production throughout the growing season represents an enormous reproductive potential.

A mosaic of populational variability probably formed as early colonization continued. Eventually, however, through natural and later, man-influenced disturbances, formerly isolated variants came into contact and hybridization occurred across weakly formed reproductive barriers. The advent of agriculture and road building must have significantly aided colonization of this now weedy, morphologically plastic, and genetically heterogeneous taxon.

In its native areas of the New World, two morphological variants of *Galinsoga quadriradiata* can be distinguished, although both are internally variable. The first variant, which extends from northern South America through the United States into Canada, tends to have a short conic receptacle, entire inner pales, glandular capitate trichomes, and peduncles to about 2 cm long. The second variant ranges from Durango, Mexico south through Central America into Colombia, and in its purest form has a tall conic receptacle, shallowly and irregularly trifid pales, aglandular trichomes and peduncles 2–3.5 cm long.

The two variants occur sympatrically in Mexico and Central America, and at least some plants in 50% of the populations from which I collected in Mexico and Guatemala were clearly intermediate in morphology. Pollen from the intermediate plants (in lactophenol cotton blue) showed a range of stainability from 36%–98%. Microsporocytes routinely had meiotic irregularities including multivalent formation, anaphase bridges and fragments, and lagging chromosomes (Figure 6). The presence of two and three anaphase bridges and fragments of differing sizes may indicate that some of the Mexican and Guatemalan intermediate plants are heterozygous for at least two chromosomal inversions. The range of morphological intergradation, pollen viabilities, and meiotic irregularities suggest that the intermediate plants probably are to some extent F_1 hybrids, but also later generation hybrids and backcrosses.

The morphological variability of *Galinsoga quadriradiata* is further complicated by a pink to red-rayed variant which occurs

from Chiapas, Mexico, into South America. The Mexican and Central American members of this form are known to be tetraploid at $n = 16$. Specimens collected in Peru were uniformly hexaploid at $n = 24$ except for one population at $n = 32$.

Morphologically the pink-rayed variant is similar to other plants of *Galinsoga quadriradiata*, but it tends to have coarsely crennate-serrate leaves, cylindro-campanulate involucres, and ray ligules which project at right angles from the head. Accurate identification of this form is made difficult because the involucre shape, and particularly the ligule position, are obscured when the plants are pressed. Ray corolla color varies from white to deep reddish-purple in living plants and in some cases the white or pink color changes to dark red when plants are pressed and dried.

Definition of the variant is clouded by extensive intergradation with both of the white-rayed variants in southern Mexico, Central America and northern South America where all three morphic types occur as weeds. The mode of origin of the higher polyploid levels ($n = 24$ & 32) is unknown, but the Peruvian plants at the higher ploidy levels are the most distinctive members of this rather weakly defined pink-rayed group.

The lengthy synonymy for *Galinsoga quadriradiata* is certainly a reflection of the taxon's morphological variability. No infraspecific taxa are presently recognized due to the extensive intergradation among the variants discussed here. There is little geographical separation of the morphic forms other than white-rayed members tend to be mostly North American and pink-rayed members tend to be mostly South American. This trend by itself is not only unworthy of formal recognition but is valid only for the New World. Dispersal of *G. quadriradiata* to the Caribbean Islands and the Old World (Figure 14) has thoroughly intermixed the three variants in these regions.

One case of intergeneric hybridization involving *Galinsoga quadriradiata* is suspected from herbarium material. Collections made in Chiapas, Mexico (*Ton 982, 1263, 1277*) are morphologically intermediate between *G. quadriradiata* and *Sabazia sarmentosa* Less. var. *sarmentosa*. *Galinsoga quadriradiata* and *Sabazia sarmentosa* differ in quantitative features of the heads but also in that *S. sarmentosa* is perennial with stems arising from a caudex while *G. quadriradiata* is an annual lacking a caudex. *Sabazia sarmentosa* is characterized by reddish brown anthers and usually has

larger heads on long peduncles. *Galinsoga quadriradiata,* on the other hand, has yellow anthers and small heads on short peduncles. The leaves, involucres, pales, achenes, and pappus scales of the two species are similar.

The putative hybrids have the decumbent, weak stems and peduncle length of *Sabazia sarmentosa* but head size and clustering more characteristic of *Galinsoga.* Pollen from the putative hybrids is of varying sizes and many of the grains are misshapen. No pollen at all was found in anthers inspected from *Ton 1263* (MO). No mature achenes were seen on any of the plants. Longpre (1970) reported the chromosome number of *S. sarmentosa* var. *sarmentosa* as $n = 24$. *Galinsoga quadriradiata* from Chiapas has been counted as n = ca 16 (Turner, Powell, & King, 1962). The difference in polyploid levels as well as genetic differences undoubtedly account for the apparent sterility of the hybrids.

Galinsoga quadriradiata is also implicated in an interspecific hybridization with *G. subdiscoidea.* Details of this situation are discussed under the latter species.

REPRESENTATIVE SPECIMENS:[1] **Canada.** BRITISH COLUMBIA. New Westminster Dist.: Vancouver, *Bird 178* (BM). ONTARIO. Manitoulin Dist.: Gore Bay, *Montgomery & Shumovich 1258* (OAC). **Costa Rica.** CARTAGO: Cartago, *Stork 1064* (F, GH, US). **Dominican Republic.** Sapotén, *Liogier 15051* (NY). **El Salvador.** CHALATENANGO: Los Esesmiles, *Tucker 1039* (F, LL, MICH, NY, UC, US). **Guatemala.** CHIMALTENANGO: Chimaltenango, *C 35*;* 4 km E of Chimaltenango, *C 46*;* 9.3 km SE of Patzun, *C 47*;* 10 km W of Patzun, *C 48*.* ESCUINTLA: 2 km N of Palin, *C 30*.* GUATEMALA: Guatemala City Airport, *C 31*;* 22.4 km W of Guatemala City Airport, *C 32*;* Lake Amatilan, *C 37*, C 38*;* 6 km S of Villa Nueva, *C 40*.* SACATEPEQUEZ: ca 5 km W of Guatemala-Sacatepequez boundary, *C 28*;* 6.2 km SE of Antigua, *C 29*;* 5.5–6.6 km SW of jct rd. to Antigua and Rte. CA1, *C 33*, C 34*;* 7 km S of Antigua, *C 44*.* SOLOLA: 19.2 km W of Patzun, *C 50*;* 8.8 km W of San Lucus of Toliman, *C 51*;* E of San Lucas, *C 52*.* **Honduras.** COMAYAGUA: vicinity of Siguatepeque, *Standley 56521* (F, US). **Mexico.** BAJA CALIFORNIA: the Laguna, *Jones 27758* (UC). CHIAPAS: San Cristobal las Casa, *Breedlove & Raven 13278* (DS, ENCB, LL, MICH, NY, US). CHIHUAHUA: Quicorichi, *Gentry 1935* (GH, MO, TEX, UC, US). COAHUILA: Saltillo, *Palmer 790* (BM, F, GH, MO, NY, US). DURANGO: 10.5–12.7 mi SW of La Ciudad, *KC 8872*, KC 8889*, KC 8890*;* 14 mi SW of La Ciudad, *KC 8943*;* GUERRERO: 0.3 mi N of Puente Huajgutla, *KC 9106*;* Taxco, *KC 9111*;* JALISCO: 1.2 mi NW of Magdalena Airport, *KC 9006*;* 25.8–27.5 mi SE of Magdalena Airport, *KC 9017–2*,* 4.9 mi SE of Arenal, *KC 9019*.* MEXICO: 3.2 mi N of Tenancingo,

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[1] *Canne* = *C*, *Canne & Hruschak* = *CH*, *Canne & Schunke* = *CS*, *Keil & Canne* = *KC*. Chromosome vouchers at OS are indicated by *($n = 16$), †($n = 24$) and §($n = 32$).

KC 9091;* 11.5 mi N of Ixtapan de la Sal, *KC 9092**. MICHOACAN: 11.4 mi N of Uren, *KC 9051-1*;* 17.2 mi E of Zamora, *KC 9054*;* 26.7 mi E of Zamora, *KC 9055*;* 2.6 mi E of La Vesca, *KC 9056*;* 4.4 mi W of jct rd. to Coeneo & Rte. 15, *KC 9057*;* 54 mi E of Zamora, *KC 9058*;* 1 mi E of Quiroga, *KC 9071*;* 10 mi E of Quiroga, *KC 9072*;* 14 mi E of Morelia, *KC 9076*;* 2.8 mi W of jct rd. to Zinapecuaro & Rte. 15, *KC 9077*;* 4.7 mi W of jct rd. to Los Azufres & Rte. 15, *KC 9078;* 0.8 mi E of jct Rte. 122 & Rte. 15, *KC 9079*;* 1.8 mi S of Tuxpan, *KC 9080*;* 3 mi E of Zitacuaro, *KC 9083*;* 12 mi E of Zitacuaro, *KC 9084**. MORELOS: Cuernavaca, *KC 9144*, KC 9145-2**. NAYARIT: La Atarjea, *Mexia 882* (BM, CAS, DS, GH, MO, NY, UC, US). PUEBLA: 22.7 mi E of Puebla-Mexico boundary, *KC 9170-2**. SAN LUIS POTOSI: Xilitla, *Rzedowski 10516* (ENCB). SINALOA: 1.2 mi E of Santa Lucia, *KC 8836*;* 3 mi E of Sta. Rita, *KC 8838**. VERACRUZ: 0.5 mi W of bridge between Cordoba & Orizaba, *KC 9179*;* 5.6 mi SE of Yanga, *KC 9180*;* SE of Jalapa Enriques, *KC 9186*;* ca 4 mi NW of Jalapa Enriques, *KC 9187*;* 5.4 mi E of road to Las Vigas on Rte. 140, *KC 9198*;* 2–12.6 mi E of Tezuitlan, *KC 9200*, KC 9201*, KC 9202**. **Nicaragua.** GRANADA: Volcan Mombacho, *Narvaez 3893* (NY, UC). . **Panama.** CHIRIQUI: Bajo Chorro, *Davidson 135* (F, GH, MO). **Puerto Rico.** Reserva Forestal de Toro Negro, *Stimson 1467* (DUKE, GH, MICH, UC, US). **United States.** ALABAMA: Mobile Co., Mobile, 10 Aug 1898, *Mohr s.n.* (US). ARKANSAS: St. Francis Co., Forest City, *McDaniel 1528* (NY). COLORADO: Boulder Co., Boulder, *Ewan & Ewan 14398* (TEX, UC, US). CONNECTICUT: Fairfield Co., Newtown, *Eames 201* (GH, MICH, MSC). FLORIDA: Leon Co., Tallahassee, 17 Jun 1926, *Harper s.n.* (NY, US). GEORGIA: Polk Co., Rockmart, *CH 105* (OS). HAWAII: Hawaii Co., Kilauea Volcano, *Fosberg 39311* (US). ILLINOIS: Cook Co., Chicago, *Gates 12548* (DS, TEX, US). INDIANA: Marion Co., Indianapolis, *Friesner 18115* (GH, NY, TEX, US). IOWA: Polk Co., Des Moines, *van Bruggen 2483* (US). KANSAS: Coffey Co., 7 mi N of Westphalia, *Magrath & Robinson 6764* (ENCB). KENTUCKY: Edmonson Co., Mammoth Cave, *CH 103**. Hart Co., jct Rte. US 31E & Ky 936, *CH 101*;*Horse Cave, *CH 102**. Jefferson Co., Louisville, *CH 97**. Nelson Co., New Haven, *CH 100**. Oldham Co., S. Oldham, *CH 96**. Simpson Co., Franklin, *CH 104**. Trimble Co., Bedford, *CH 95**. MAINE: Penobscot Co., Orono, *Gregory 508* (DS, NY). MARYLAND: Frederick Co., Thurmont, *CH 140*;* Emmitsburg, *CH 141-2**. MASSACHUSETTS: Middlesex Co., Winchester, *Smith, Schubert, & Rouleau 892* (ARIZ, CAS, DS, DUKE, FSU, GH, LL, MICH, MO, MSC, NY, UC, US, WIS). MICHIGAN: Washtenaw Co., Ann Arbor, *McVaugh 23636* (MICH). MINNESOTA: Cass Co., Leech Lake, *Stevens 2755* (UC, US). MISSOURI: Jackson Co. Kansas City, *Bush 8157* (GH, UC, US). NEBRASKA: Lancaster Co., Lincoln, *Kiener 16975* (GH). NEW HAMPSHIRE: Cheshire Co., 2 mi W of Jaffrey Center, *Gregory 503* (DS, NY). NEW JERSEY: Somerset Co., Watchung, *Moldenke 8908* (BM, MO, NY). NEW YORK: Cattaraugus Co., Machias, *CH 173*;* between Ellicottville & Great Valley, *CH 174**. Chemung Co., Reeds, *CH 164*;* Elmira, *CH 165*;* Livingston Co., Avon, *CH 170**. Monroe Co., Penfield, *CH 168*;* Henrietta, *CH 169*;* Schuyler Co., Watkins Glen, *CH 166**. Wyoming Co., Perry, *CH 171*;* Arcade, *CH 172**. Yates Co., Dresden, *CH 167**. NORTH CAROLINA: Buncombe Co., S of Asheville, *CH 121*;* 2 mi NW of Fairview, *CH 122*;* 10.6 mi SE of Fairview, *CH 123**. Burke Co., Morganton, *CH 126*;* N of Morganton, *CH 127**. Granville Co., Oxford, *CH 129**. Haywood Co., near Maggie, *CH 120**. Henderson Co., 3.8 mi N of N.C.-S.C. border, Rte. US 25, *CH 109*;* Hendersonville, *CH 110**. Iredell Co., 2 mi W of Statesville, *CH 128**.

Jackson Co., Cashiers, *CH 114**; Sylvia, *CH 117**; 1.6–3.7 mi S of Cherokee, *CH 118**, *CH 119**. Macon Co., Highlands, *CH 115**; N of Gneiss, *CH 116**. Rutherford Co., 11.1 mi SE jct US 74 with NC 9N, *CH 124**; 5 mi S of jct US 64 N & NC 226, *CH 125**. Transylvania Co., Penrose, *CH 111**; 10.9 mi SW of Penrose, *CH 112**; 2.6 mi E of jct US 64, *CH 155**. Northumberland Co., Dalmatia, *CH 153**, Sunbury, *CH 154**. Sullivan Co., Mildred, *CH 160**. Westmoreland Co., 2 mi E of jct US 119 & 22 with PA 981, *CH 187**; 11.4 mi W of jct US 119 & 22 with PA 981, *CH 188**. York Co., Thomasville, *CH 144**; Yorktown, *CH 145**. SOUTH CAROLINA: Grenville Co., 4.8 mi E of jct S.C. 414 and S.C. 253, *CH 107–1**; 3.3 mi N of jct US 25 & S.C. 414, *CH 108**. Spartanburg Co., Spartanburg, *CH 106**; Campobello, *CH 107–2**. VERMONT: Windham Co., Jamaica, *Moldenke 8712* (BM, MO, NY). VIRGINIA: Albemarle Co., 4.4 mi E of jct US 250 & Interstate 64, *CH 135**; Monticello, *CH 136**. Amherst Co., Clifford, *CH 131**. Campbell Co., Lychburg, *CH 130**. Loudon Co., Leesburg, *CH 139**. Orange Co., 4.7 mi SW of Orange, *CH 137**. WEST VIRGINIA: Barbour Co., 6.6 mi NW of jct W. VA. 76 & US 250, *CH 65**. Doddridge Co., 7.3 mi E of jct US 50 & W. VA. 18, *CH 62**. Fayette Co., 6.2 mi E of jct US 60 & US 19, *CH 76**; Lookout, *CH 77**. Greenbrier Co., White Sulfur Springs, *CH 73**; 4.6 mi W of Lewisburg, *CH 74**; Rupert, *CH 75**. Harrison Co., Salem College, *CH 64**. Kanawha Co., 8.7 mi NW of Charleston, *CH 79**. Pocahontas Co., 28 mi N of Frost, *CH 71**. Putnam Co., 0.6 mi S of jct W. VA. 62 & W. VA. 34, *CH 80**. Randolph Co., Elkins, *CH 68**; 10.5 mi S of Elkins, *CH 69**; 19.8 mi S of Elkins, *CH 70–1**. Richie Co., 0.3 mi S of jct US 50E & W. VA. 31, *CH 60**; Harrisville, *CH 61**. Wood Co., Parkersburg, *CH 59**. **Argentina.** JUJUY: Jujuy, *Everdam & Beetle 22413* (GH). **Bolivia.** COCHABAMBA: Incachaca, *Steinbach 5741*, (F, GH, MO, NY, US). **Brazil.** MINAS GERAIS: Vicosa, *Irwin 2035* (NY, TEX, UC, US). **Chile.** without locality, 1790, *Haenke s.n.* (F). **Colombia.** CUNDINAMARCA: 4 km WNW of Caqueza, *King & Guevara 5869* (F, NY, US). **Ecuador.** AZUAY: 14 km W of Cuenca, *King 6655* (US). **Peru.** CUZCO: Machu Picchu, *C 274*†, *C 276*†; Machu Picchu train station, *C277*†; *C278*†. HUANUCO: Tingo Maria, *C 217*†; *C 220*†; Fundo San Semond, *CS 197*†; *Chinchao, CS 200*†; Carpish Pass, *CS 201*§; *Chullqui, CS 203a*†; Cotosh, *CS 206*†; LaEsperanza, *CS 209a*†; Cueva de las Lechuzas, *CS 222*†; Rio Bella near Cueva de las Lechuzas, *CS 223*†. JUNIN: Santa Rosa de Ocopa, *CS 237*†; Oreja de Capelo, *CS 263*†, *CS 264*†. **Venezuela.** Distrito Federal, El Avila, *Williams & Alston 28* (BM, F, NY, US).

Austria. VIENNA: Wien, 1959, *Guglia s.n.* (CAS, FSU, WIS). **Belgium.** WEST FLANDERS: Wervik, 1939, *Desphmques s.n.* (MO, UC, US). **Czechoslovakia.** CENTRAL BOHEMIA: Pruhonice, *Devl 92* (NY, TEX, UC). **Denmark.** JUTLAND: Pinds Mole near Aarhus, *Nielsen & Pedersen 484* (DS). **Finland.** NYLANDI: Helsinki, 18 Aug 1960, *Erkamo s.n.* (UC). **France.** BASSES-PYRENEES: Bayonne, *Jallu 5534* (CAS). **Netherlands.** UTRECHT: Utrecht, *Leeuwenberg 394* (WIS). **Poland.** KRAKOW: Krakow, *Trzcinska 184* (MO, MSC, NY, UC). **Portugal.** AZORES: São Miguel, *Dolman 398* (BM). **Switzerland.** near Milchbuck, 27 Oct 1931, *Koch s.n.* (DS). **England.** SURREY: Kew, *Summerlayes 1286* (NY, TEX). **West Germany.** BAVARIA: Munich, 20 Aug 1929, *Ganz s.n.* (CAS). **Cameroon.** EAST CAMEROON: Wakwa, *Amshoff 457* (A). **Southwest Africa.** WINDHOEK: Windhoek, *Giess 233* (NY). **India.** UTTAR PRADESH: Dehra Dun, *Duval 2878* (US). **Japan.** TOKYO: Tokyo, 20 Oct 1952, *Suzuki s.n.* (UC). **Nepal.** Kathmandu, *Bhatt 113* (UC). **Philippines.** LUZON: Baguio, *Steiner 855* (US).

10. **Galinsoga boliviensis** Canne, sp. nov. Figure 15.

Herbae annuae, 7.5–14 cm altae. Caules erecti, ramosi, virides-rubri, pilosi. Folia petiolis 2–10 mm longis; laminae ovatae vel ovatae-lanceolatae, 1.3–4 cm longae, 0.5–1.8 cm latae, pilosae utrinque, apice acuto, basi rotundata; margines ciliati, integri vel remote serrulati. Pedunculi 0.1–1.3 cm longi. Capitula 4–5 mm alta, 4–7 mm lata. Involucrum campanulatum; phyllaria exteriora ovata-lanceolata, 2.5–3.6 mm longa, 1.2–2.8 mm lata, marginibus infra medium minute laciniatis et scariosis; phyllaria interiora ovata, usque 4.5 mm longa, glabra vel sparse pilosa, marginibus infra medium minute laciniatis et scariosis. Receptaculum 1.3 mm altum, 1.5 mm diametro. Paleae extimae ovatae-lanceolatae, 3–3.7 mm longae, 1–1.6 mm latae, junctae ad basim binatim ad phyllarium contiguum; paleae interiores lanceolatae, 3–3.3 mm longae, 0.8–1 mm latae, integrae vel aliquantum trifidae. Flosculi radii 5, corollis albis; ligulae 1.4–2.3 mm longae, 2 mm latae, lobis 2–3; tubi 0.8–1 mm longi; achenia obconica, 2–2.3 mm longa, 0.8 mm diametro, apice sparse strigosa, epapposa. Flosculi disci ca 26, corollis luteis; fauces 1.3 mm longae et 0.7 mm diametro, lobis 0.3–0.4 mm longis, acutis, papillosis; tubi 0.3–0.5 mm longi; antherae brunneolae, 0.7–0.8 mm longae, appendice oblonga, ca 1/3 antherae longitudinis; achenia subteretia, anguste obconica, 1.7–2 mm longa, 0.5 mm diametro, strigosa vel glabra; pappi absentes vel squamellae ca 15, inequales, lanceolatae, fimbriatae, aristatae, 1.3–2 mm longae. Chromosomatum numerus ignotus.

TYPE: **Bolivia:** Chuquisaca, Prov. Oropeza, Villa Maria, ca 10 km NE of Sucre, ca 2850 m, 12 Apr 1963, *D. Ugent & M. Cardenas 4944* (Holotype, WIS!).

DISTRIBUTION. Known only from the type locality where it was collected on the "margins of a weedy wheat field and surrounding thickets, with *Solanum boliviense, S. pachytrichum, Tagetes, Cerastium, Medicago, Rumex* and *Brassica,* 19° 1′S; 65° 10′ W". Figure 16.

The occurrence of *Galinsoga boliviensis* in a disturbed habitat and the weediness of the associated genera suggest that this species may also be weedy in the Bolivian Andes. Verification of this must await field studies, but the large number of heads per plant and the moderate number of achenes produced per head (ca 26)

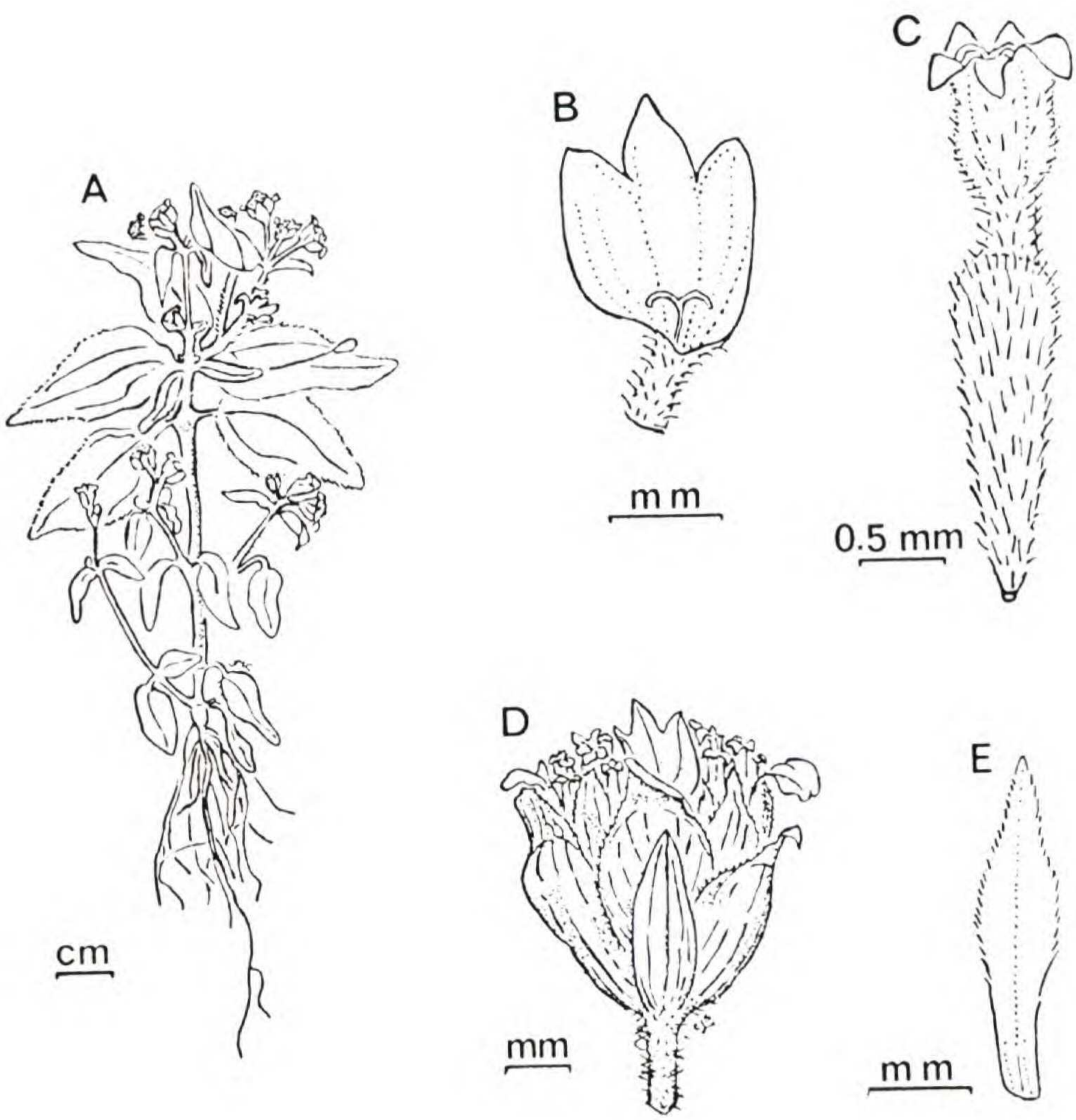

Figure 15. **Galinsoga boliviensis.** A, habit; B, ray corolla; C, disc floret; D, head; E, inner pale. All *Ugent & Cardenas 4944* (WIS).

represent a substantial reproductive potential. Judging from the presence of fully mature heads in addition to numerous buds in the capitulescence, it would appear that *G. boliviensis* flowers over an extended period of months as is true for other species in sect. *Galinsoga*. The specific epithet refers to this species' restricted distribution in Bolivia.

The short conical receptacle, nearly entire lanceolate pales, short disc corolla tube, aristate pappus scales, and the moderate to dense pubescence of the stem and peduncles are indicative of an alliance with *Galinsoga quadriradiata*.

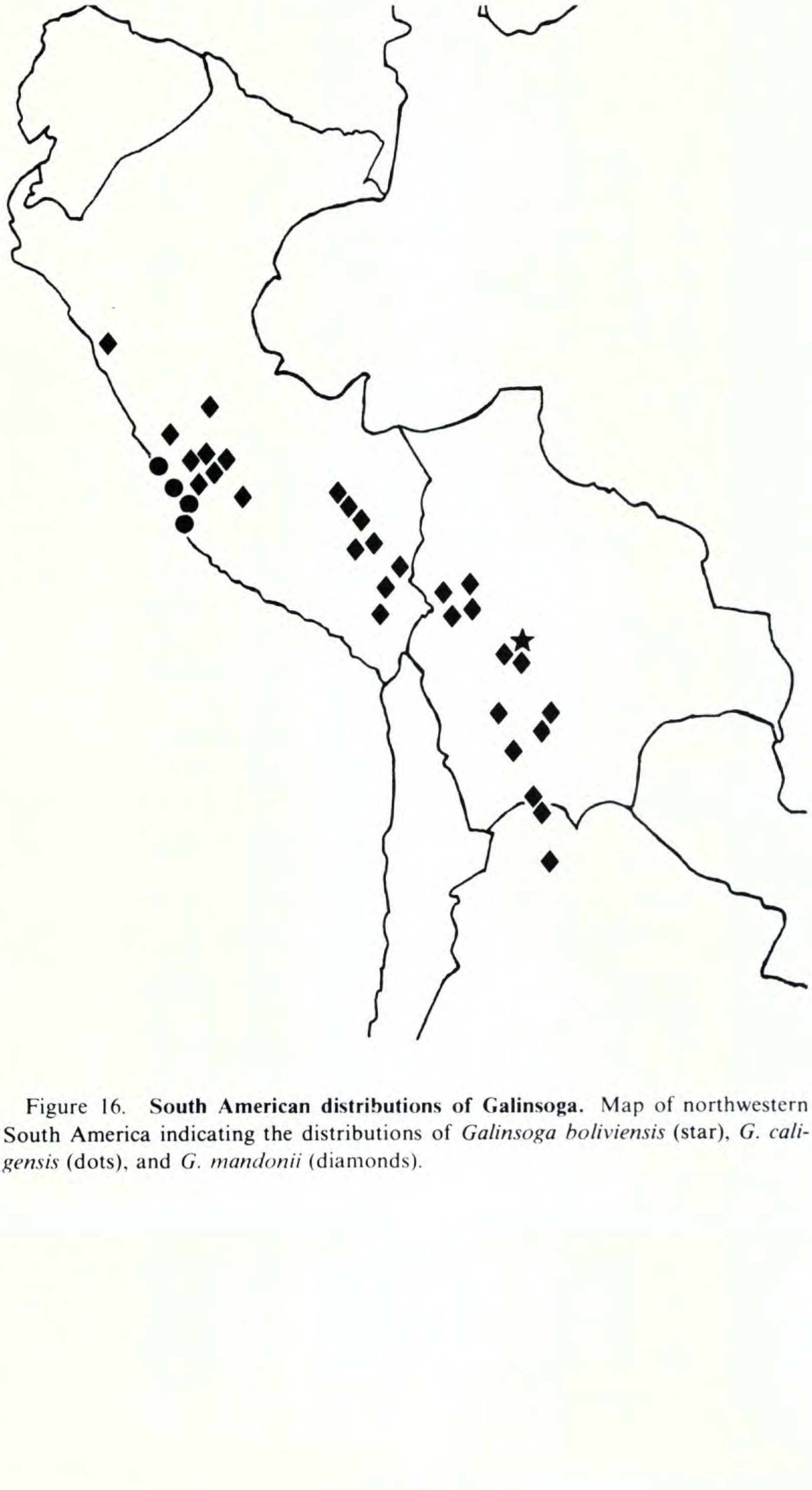

Figure 16. **South American distributions of Galinsoga.** Map of northwestern South America indicating the distributions of *Galinsoga boliviensis* (star), *G. caligensis* (dots), and *G. mandonii* (diamonds).

11. **Galinsoga subdiscoidea** Cronquist, Mem. New York Bot. Gard. **12:** 288. *t. 2.* 1965. TYPE: **Mexico:** Durango, Sierra Madre Occidental, ca 10 mi W of El Salto, ca 8800 ft, 2 Oct 1962, *A. Cronquist 9583* (Holotype, NY!; isotypes, F, GH! MEXU, MICH! MO! MSC! TEX! US!).

Annual herbs, 2–12 cm tall. Stems nearly glabrous below to sparsely puberulent above. Leaves with blades tapering at the base and connate around the stem or with petioles to 1 mm long; blades elliptic, lanceolate, or oblanceolate, 4–22 mm long, 1–5 mm wide, with both surfaces puberulent, at the apex acute, at the base attenuate; margins entire to denticulate. Peduncles 0.5–8 mm long, puberulent. Heads 2–3.7 mm tall, 1.5–4.5 mm wide, often subtended by a bract, 3–6.5 mm long, 0.3–1.5 mm wide. Involucre subuniseriate, campanulate to hemispherical; phyllaries elliptic to ovate, 2–3.5 mm long, 0.8–1.7 mm wide, glabrous, greenish or deep purple, with the margins minutely laciniate and sometimes scarious. Receptacle ca 0.5 mm tall. Pales narrowly ovate, 2.2–3 mm long, 0.6–0.8 mm wide, entire or with 1–2 small, lateral lobes, at the apex acute to obtuse, outer pales weakly or not at all joined to adjacent phyllaries. Ray florets 0–5, corollas white or greenish; ligules lacking or 0.5–1 mm long, 0.2–0.5 mm wide, sometimes with small staminodes present, with the lobes 1–3, obtuse; tubes 0.8 mm long; achenes 1–1.2 mm long, 0.7–0.8 mm diam, strigose, at the apex truncate, pappus of 8–10 spathulate, fimbriate, yellowish scales to 1 mm long. Disc florets 11–20, corollas greenish-yellow; throats cupulate, 0.7–0.8 mm long, 0.8–1 mm diam, glabrous or sparsely minutely pilose near the tubes, with the lobes 5 or rarely 4, to 0.4 mm long, acute, recurved; tubes 0.5–0.8 mm long; anthers 0.5–0.6 mm long, with the appendage ovate; achenes and pappus like those of the ray. Chromosome number, $n = 8$.

DISTRIBUTION. Known from the Sierra Madre Occidental, state of Durango, Mexico near the towns of La Ciudad and El Salto (Figure 10), ca 2950 m. Flowering in September and October.

Galinsoga subdiscoidea, like most other Galinsogas, has a distribution in Mexico that falls within the range of *G. quadriradiata* and *G. parviflora. Galinsoga subdiscoidea* is particularly well distinguished from its Mexican neighbors by its diminutive habit and by the shapes of its leaves, disc corollas and pappus scales. The

disc corollas have a characteristic green color and the spathulate pappus scales are a distinctive pale yellow.

Two collections, *Cronquist 9586* (ENCB, GH, MICH, MO, TEX) and *Keil & Canne 8928* (OS), both collected just west of the town of El Salto, Durango, are especially interesting. The plants in these collections are 2.5–29 cm tall, have glandular capitate trichomes, achenes 1.3–2 mm long with oblanceolate disc pappus scales and a much reduced pappus on the ray achenes. Plants of the *Keil & Canne 8928* collection were counted as $n = 24$. Except for the deviation in chromosome number and the morphological features listed above, the plants from these two collections are clearly allied to *Galinsoga subdiscoidea,* specimens of which were collected at the same time in both instances. The broad, greenish disc corollas, oblanceolate, yellowish pappus scales, obpyramidal disc achenes, and narrow, subsessile leaves of these plants could be derived from only *G. subdiscoidea.* Both collections are interpreted to be of hybrid origin from a cross with *G. subdiscoidea* and another *Galinsoga.*

A likely possibility for the other parent is *Galinsoga quadriradiata,* which is common along roadsides near El Salto (*Keil & Canne 8889, 8890, 8943*). Features of the leaves, corollas and pappus which characterize the putative hybrid are intermediate between those of *G. subdiscoidea* and *G. quadriradiata.* The hexaploid condition in the hybrid may have been derived through allopolyploidy from the diploid *G. subdiscoidea* and the tetraploid *G. quadriradiata.* Verification of this presumed origin via greenhouse crosses and karyotype studies has been hindered because repeated atttempts to germinate achenes of *G. subdiscoidea* have failed.

The plants from the *Cronquist 9586* and the *Keil & Canne 8928* collections are interesting not only because of their apparent hybrid origin but also because they bear a striking resemblance to certain collections of *Galinsoga parviflora* from Arizona, New Mexico, and Chihuahua, Mexico (e.g., *Powell & Flyr 1499, Shinners 31049,* and *Pennell 19153*). These specimens of *G. parviflora* lack the characteristic glandular capitate trichomes, the cupulate and greenish disc corollas, and the yellow color of the disc pappus of the putative hybrid, but they approach the hybrid by having broader disc corollas than usual, broader pappus scales (but often acute and more numerous than those of the hybrid), and short stems with small, narrow leaves. The similarity between the hybrid and

the short-statured, small-leaved *G. parviflora* specimens raises the possibility that *G. parviflora* was involved in the cross with *G. subdiscoidea.* This origin would be unlikely, however, because both species are diploids. Further study is needed to determine the parentage and relationships of these hexaploid individuals.

SPECIMENS EXAMINED: **Mexico.** DURANGO: ca 37 km W of El Salto, *Cronquist & Fay 10784* (ENCB, MEXU, NY, US); 7.8 mi SW of La Ciudad, *Keil & Canne 8913** (OS); 4.8 mi SW of La Ciudad, *Keil & Canne 8917** (OS); 6.4 mi NE of La Ciudad, *Keil & Canne 8924** (OS); 15.6 mi NE of La Ciudad, *Keil & Canne 8928–1* (OS).

12. **Galinsoga mandonii** Sch.-Bip. Linnaea **34:** 529. 1866. TYPE: **Bolivia:** La Paz, Larecaja, vicinity of Sorata, 3200 m, Mar 1860, *G. Mandon 76* in part (non Feb 1859) (Holotype, P!, fragment of holotype, US!; isotypes, GH! NY!).

Galinsoga mandonii Sch.-Bip. Bull. Bot. Soc. France **12:** 80. 1865. *nom nud.*

Galinsoga unxioides Griseb. Symb. Fl. Argen. 198. 1879. TYPE: **Argentina:** Prov. Salta, "in radice montis Nevado del Castillo," 18 Mar. 1873, *E. G. Lorentz & G. Hieronymus 167* (Holotype, GOET?; isotypes, B, US!; photographs of B isotype, NY! US!).

Galinsoga calva Sch.-Bip. Bull. Bot. Soc. France **12:** 80. 1865. *nom. nud.* Based on *G. Mandon 80 & 81.* A fragment of *Mandon 80* at US is *G. mandonii.* The *Mandon 81* specimens at F, GH, MO, and P are all *G. quadriradiata,* but a specimen at NY is *G. mandonii.*

Galinsoga calva Rusby, Mem. Torrey Bot. Club **3:** 61. 1893. TYPE: **Bolivia:** Talca Chugiaguillo, Apr 1890, *M. Bang 809* (Holotype, NY!; isotypes, BM! GH! MICH! MO! US (2)!). The *Bang 809* specimens were distributed as *Galinsoga calva* Sch.-Bip., a *nomen nudum.* Rusby cited one additional collection, that of *Bang 1148* collected in the vicinity of Cochabamba in 1891. This collection was cited secondarily by Rusby and does not represent a syntype.

Stemmatella congesta Wedd. ex O. Hoffm. Natürl. Pflanzenfam. **4**(5): 231. 1890. TYPE: **Bolivia:** La Paz, Larecaga, vicinity of Sorata, *s.d., G. Mandon 293* (Holotype, P; isotypes, K, NY! US!; fragment of K isotype, GH!).

Galinsoga purpurea St. John & White, Rhodora **22:** 98. 1920. TYPE: **Bolivia:** Cochabamba, Bolivian Plateau in the vicinity of Cochabamba, 1891, *M. Bang 1148* (Holotype, GH!; isotypes, MO! US!).

Annual herbs, 1.5–66 cm tall. Stems simple or branched, internodes often elongate, pilose throughout with appressed to spreading aglandular and a few glandular capitate trichomes to 1 mm long, or rarely glabrous. Leaves sessile or with petioles to 1 cm long, green or deep purple, pilose; blades narrowly ovate to lanceolate, 0.5–5 cm long, 0.3–3.5 cm wide, with both surfaces pilose, at the apex acute, at the base rounded to attenuate; margins ciliate, remotely denticulate to coarsely serrate. Peduncles absent or rarely

to 1.8 cm long, pilose with appressed aglandular trichomes or with spreading glandular capitate trichomes intermixed. Heads 2.5–5 mm tall, 2–6.5 mm wide, in dense clusters subtended by narrowly ovate to lanceolate, attenuate, pilose bracts, 2–20 mm long, 0.6–6 mm wide. Involucre hemispherical to narrowly campanulate; outer phyllaries 2–3, 1.5–3 mm long, 0.8–2 mm wide, glabrous, with the margins entire or ciliate, narrowly scarious or herbaceous, green to deep purple; inner phyllaries ovate to ovate-deltoid, 2.6–3.6 mm long, 1.2–3.5 mm wide, glabrous or sparsely pilose, at the apex green to purple, with the margins minutely laciniate above the middle, entire and scarious below the middle. Receptacle 0.5–1.4(–1.7) mm tall, 0.6–1 mm diam. Outer pales lanceolate to narrowly ovate, 2–4.4 mm long, 0.8–1.7 mm wide, entire to trifid, at the apex often purple, strongly or weakly joined in pairs at the base to an adjacent phyllary; inner pales lanceolate to oblanceolate, 2–4.2 mm long, 0.5–1.5 mm wide, shallowly to deeply trifid, at the apex acute to attenuate; pales occasionally absent in very small heads. Ray florets 3–9, usually 5, corollas white to deep purple; ligules 0.6–1.7 mm long, 0.4–2 mm wide or absent, obovate, with the lobes 2–3 and obtuse, or reduced to a single oblong lobe; tubes 0.8–1.1 mm long; achenes 1.6–2 mm long, 0.5–0.7 mm diam, glabrous or sparsely strigose at the apex, epappose or with a pappus of 1–5 unequal, narrow, laciniate, acute to obtuse scales to 1 mm long. Disc florets ca 5–40, corollas yellow or purple; throats 0.8–1.2 mm long, 0.4–0.6 mm diam, glabrous or minutely pilose, with the lobes 0.2–0.5 mm long, tubes 0.5–0.6 mm long; anthers 0.5–0.6 mm long, with the appendage elliptic; achenes obconical to obpyramidal 1.3–1.5 mm long, 0.5 mm diam, subterete, glabrous or strigose; epappose or with a pappus of 10–20 unequal, lanceolate, fimbriate, obtuse to aristate scales, 1.5–2 mm long. Chromosome number unknown.

DISTRIBUTION. Restricted to the Andean regions of Peru, Bolivia and northernmost Argentina (Figure 16), 2000–4300 m. Flowering from December to September.

A list of plants collected by Mandon was first published by Schultz-Bipontinus (1865) and included the holotype collection of *Galinsoga mandonii* but without description. Schultz-Bipontinus (1866) later published the same list of plants, but this time the holotype collection was indicated as: "*Galinsoga Mandonii* SZ. Bip.,

n. sp. (ach. Calva)." The short reference to smooth achenes is regarded as a diagnosis and, therefore, the name is validly published on the later date.

Most plants collected at elevations of 3,700 m or higher are either procumbent or less than 13 cm tall (e.g., *Pennell 13365, 13479, 13480; Buchtien 105, 4313, 9288; Tovar 212*). The capitula of these depressed, high altitude plants are very small (ca 2 mm wide) and often contain as few as five florets each. The receptacle is usually reduced to a convex structure only 0.5 mm tall, and the inner pales are sometimes lacking. These plants occur only at very high altitudes and throughout the range of *Galinsoga mandonii* in the Peruvian and Bolivian Andes. The plants appear to represent an ecotypic, morphological race which lacks geographical and phyletic unity and, therefore, is not formally recognized here.

Galinsoga mandonii is readily distinguished from other Galinsogas by its sessile, or nearly sessile, clustered heads; stout, blunt or acute pappus scales; dark reddish-purple phyllaries; and rather small sessile leaves separated by long internodes. *Galinsoga mandonii* appears most closely related to *G. parviflora.* Both species usually possess small shallowly lobed ligules and trifid pales, and are similar in pubescence and features of the phyllaries.

Two specimens, *Macbride 3178* and *Mandon 78*, are like *Galinsoga parviflora* in most morphological features but have the pappus and long internodes of *G. mandonii.* Both specimens may be of hybrid origin. Also, the *Tovar 296* collection is like *G. parviflora* in vegetative features but has the firm, acute pappus of *G. mandonii* and perhaps is a hybrid or product of hybrid backcross to *G. parviflora.*

SPECIMENS EXAMINED: **Argentina.** JUJUY: hills of Guairahuasi, *Cabrera & Hernandez 14018* (GH); La Quiaca, 21 Feb 1940, *Meyer s.n.* (GH); La Quiaca from Villazon, *Schreiter 10898* (GH). **Bolivia.** LA PAZ: *Buchtien 105, 699* (US); *Buchtien 4313* (NY); below Obrajes, *Buchtien 4315* (LL, US); *Buchtien 8616, 8617, 8618, 8619* (LL); Miraflores, *Buchtien 9185* (LL); near Miraflores, *Buchtien 9186* (LL); near Obrajes, *Buchtien 9286, 9287* (LL, US); mt. slope, *Buchtien 9288* (LL), *Buchtien 9289* (US); Miraflores, *Buchtien 9434* (LL, US); slopes near Obrajes, *Buchtien 9435, 9436* (LL, US); near La Paz, *Julio 230* (GH, US); vicinity of Sorata, *Mandon 76*, in part (MICH, MO, NY); Sorata, *Mandon 81* (NY). CHUQUISACA: Sucre, *Cardenas 572* (NY); Punilla, ca 15 km NW of Sucre, *Ugent & Cardenas 4925* (WIS); Villa Maria, ca 10 km NE of Sucre, *Ugent & Cardenas 4946* (WIS). COCHABAMBA: Forancali, *Cardenas 2440* (US); Cochabamba, *Julio 1179* (US); Cochabamba, 26 Mar 1892, *Kuntze s.n.* (NY). ORURO: Pazña, *Buchtien 1586* (US); Cotaña, *Buchtien 4795* (US). POTOSÍ: Potosí,

Cardenas 247 (GH). **Peru.** ANCASH: Tallenga, *Ferreyra 7489* (US); Chacchash, near Chiquian, *Ferreyra 7577* (US). CUZCO: near Tinta, Temple of Viracocha, *Cook & Gilbert 210* (US); Ollantaytambo, *Cook & Gilbert 368, 483, 526, 640* (US); Cuzco, *Gunther 11671* (US); ruins of Sacsahuaman, near Cuzco, *Ugent & Ugent 3761* (WIS); Sacsahuaman, *Vargas 2602* (F); Hda. C'uyo, *Vargas 11199* (US). HUANUCO: 15 mi SE of Huanuco, *Macbride & Featherstone 2101* (US); Mito, *Macbride & Featherstone 1582* (F, US). HUANCAVELICA: Checcyana, 4 km E of Conaica, *Tovar 185* (US); Bunbunya, *Tovar 212* (US). JUNIN: Tarma, *Kunkel 323* (US); Tarma, *Killip & Smith 21805* (F, NY, US); La Oroya, *Macbride & Featherstone 946* (F). LA LIBERTAD: Agallpampa, *López 864* (US). LIMA: Rio Blanco, *Killip & Smith 21741* (F, GH, NY, US); Matucana, *Macbride & Featherstone 149, 150, 315* (F, US); Viso, *Macbride & Featherstone 573* (F, US); near Chosica, *Weberbauer 5359* (F, GH, US). PUNO: Chuquibambilla, *Pennell 13365* (F, GH, NY, US); Araranca, *Pennell 13479* (F, GH, NY, US); *Pennell 13480* (F, NY); Lampa, *Ranto-Hind P660* (NY); Sicuani, *Ranto-Hind P692* (NY); Salcedo, *Soukup 845* (F, GH, UC, US); Juliaca, *Stafford 467* (F).

13. **Galinsoga parviflora** Cav. Icon. Descr. Pl. **3:** 41. *t. 281.* 1795. TYPE: seen by Cavanilles at the Botanic Garden in Paris, later at the Botanic Garden in Madrid, grown from seed sent from Peru by D. Dombey (Holotype, MA: photograph of holotype, OS!).

Galinsoga quinqueradiata Ruiz & Pavon, Syst. Veg. **1:** 198. 1798. *nom. superfl.* Based on the type of *Galinsoga parviflora* Cav.

Galinsoga parviflora Cav. f. *quinqueradiata* (Ruiz & Pavon) Thell. Allg. Bot. Z. Syst. **21:** 6. 1916. *nom. illegit.*

Wiborgia acmella Roth, Catal. Bot. **2:** 112. 1800. TYPE: known to Roth as a garden plant introduced from Peru and later recognized by Roth as a synonym of *G. parviflora* Cav. in Catal. Bot. **3:** 78. 1806 (Holotype destroyed). According to Dr. Karl Otto Meyer (*in litt.*), Roth's herbarium was originally at Staatliches Museum für Naturkunde und Voreschichte, Oldenburg, Germany, but was later transferred to Berlin and destroyed there during war.

Vigolina acmella (Roth) Poiret in Lamarck, Encyc. Meth. **8:** 613. 1808.

Wiborgia parviflora (Cav.) HBK. Nov. Gen. Sp. **4:** 256. 1818.

Galinsoga laciniata Retz. in D. G. F. Hoffm. Phytogr. Blätt. **1:** 46. 1803. TYPE: no data available, but the notation "HL" in Retizus' handwriting on the back of the type specimen is considered by botanists at LD to indicate that the plant had been grown at the Botanic Garden, Lund (Holotype, LD!).

Sabazia microglossa DC. var. *microglossa,* Prodr. **5:** 497. 1836. TYPE: **Mexico:** "in montanis circa Mexico ad S. Augustinum," 26 Aug 1827, *J. L. Berlandier 733* (Holotype, G-DC; photograph of holotype, US!).

Sabazia microglossa DC. *β puberula* DC. Prodr. **5:** 497. 1836. TYPE: **Mexico:** "circa Mexico in montanis," Sep 1827, *J. L. Berlandier 910* (Holotype, G-DC; photograph of holotype, US!).

Adventina parviflora Raf. New Fl. N. Am. **1:** 67. 1836. TYPE: unknown, not at PH. Rafinesque's description of *Adventina* and the specific description of *A. parviflora* leave no doubt that he was describing *Galinsoga parviflora* Cav.

Galinsoga parviflora Cav. var. *semicalva* A. Gray, Smithsonian Contr. Knowl.

5: 98. 1853. TYPE: **New Mexico:** Coppermines, 6 Oct 1851, *C. Wright 1268* (Holotype, GH!; isotypes, GH! MO! NY!).

Galinsoga semicalva (A. Gray) St. John & White, Rhodora **22:** 100. 1920.

Galinsoga hirsuta Baker, Curator's Rep. Thirsk Nat. Hist. Soc. 1861. 13. 1862. TYPE: **England:** Surrey, Kew Bridge, 1861, *A. Irvine s.n.* (Holotype, K). Dr. J. E. Lousley has seen the Irvine specimen and verified its identity as *G. parviflora* (*in litt.*).

Stemmatella sodiroi Hieron. Bot. Jahrb. Syst. **28:** 601. 1901. TYPE: **Ecuador:** "crescit in region interandina," Sodiro 31/1 (Holotype, B; fragment of holotype, (?) US!; photographs of holotype, NY! US!).

Galinsoga parviflora Cav. var. *genuina* Thell. f. *subeglandulosa* Thell. Allg. Bot. Z. Syst. **21:** 8. 1916. TYPE: **Switzerland:** Zurich, 1 Aug 1917, *A. Thellung s.n.* (Lectotype chosen, Z!).

Galinsoga parviflora Cav. var. *genuina* Thell. f. *parceglandulosa* Thell. Allg. Bot. Z. Syst. **21:** 8. 1916. TYPE: **Australia:** New South Wales, Cumberland Co., Erworben, 1913, *T. V. Alkin s.n.* (Lectotype chosen, Z!).

Galinsoga semicalva A. Gray var. *percalva* S. F. Blake, Jour. Wash. Acad. Sci. **30:** 472. 1940. TYPE: **Arizona:** Pima Co., Santa Rita Mts., 20 Sep-4 Oct 1902, *D. Griffiths & J. J. Thornber 162* (Holotype, US!; isotype, NY!).

Galinsoga sphaerocephala Jones ex S. F. Blake, Contr. U. S. Natl. Herb. **29:** 130. 1945. *nom. illegit.*

Galinsoga parviflora Cav. var. *adenophora* Thell. Allg. Bot. Z. Syst. **21:** 9. 1916. TYPE: **Brazil:** São Paulo, 17 Oct 1905, *A. Usteri s.n.* (Lectotype chosen, ZT!; isolectotype, P!).

Annual herbs (2–)10–60 cm tall. Stems green to reddish purple, sparsely spreading pilose below to moderately pilose near the peduncles, sometimes with glandular capitate trichomes intermixed on the uppermost branches. Leaves with petioles to 2.5 cm long; blades broadly to narrowly ovate to lanceolate-ovate, 1–11 cm long, 0.5–7.2 cm wide, at the apex acute to acuminate, at the base cuneate to rounded, with both surfaces sparsely to moderately pilose; margins ciliate, denticulate to coarsely serrate. Peduncles 0.1–4 cm long, moderately to densely pilose with appressed to spreading aglandular trichomes, sometimes with glandular capitate trichomes intermixed. Heads 3.5–5 mm tall, 2–6 mm wide. Involucre glabrous; outer phyllaries persistent, 2–3, unequal, elliptic, oblong to ovate, 1.2–2.2 mm long, 0.6–1.5 mm wide, with margins scarious; inner phyllaries 2.5–3.5 mm long, 1.3–2.6 mm wide, with the margins scarious. Receptacle 0.6–1.7 mm tall, 0.6–1.5 mm diam. Outer pales broadly elliptic to obovate, often 2–3 fused at the base or nearly to the apex and appearing as one, 2.2–2.5 mm tall, 1–2.5 mm wide, 1–4 lobed at the apex, strongly joined in groups of 2–3 at the base to an adjacent phyllary and these persistent; inner pales

obovate or sometimes lanceolate, 2–3.2 mm long, 0.4–1 mm wide, shallowly to deeply trifid, rarely bifid or entire, the innermost pales persistent. Ray florets 3–8, usually 5, with the corollas dull white to pink-purple or white with pink veins; ligules absent or to 1.5 (–2) mm long, 1.5 mm wide, obovate with 2–3 acute lobes or oblong and entire; tubes 0.8–1.1 mm long, achenes 1.5–2.5 mm long, 0.5–0.9 mm diam, glabrous or strigose at the apex, epappose or with a pappus of 5–8 ventral, unequal, narrow, laciniate scales to 1 mm long. Disc florets 8–50, throats 0.8–1 mm long, 0.5–0.7 mm diam, with the lobes 0.2–0.3 mm long, tubes 0.3–0.5 mm long, anthers 0.4–0.6 mm long, with the appendage oblong; achenes somewhat angular, 1.2–2 mm long, 0.5–0.7 mm diam, glabrous and epappose, or strigose and with a pappus of 15–20 oblong, deeply fimbriate, white or gray scales, to 1.9 mm long, at the apex usually obtuse, sometimes acute or acuminate. Chromosome number, $n = 8$.

DISTRIBUTION: A nearly world-wide weed occurring in disturbed habitats and agricultural areas in most temperate and subtropical areas of the New World, Europe, Asia, Africa and Australia (Figure 17), 40–3600 m. Flowering the year round where climate permits or until the first frost.

In his discussion of Asteraceae described by M. E. Jones, S. F. Blake (1945) accepted the name *Galinsoga sphaerocephala* Jones. However, Jones (1933, p. 79) had used the epithet "sphaerocephala" in a confusing set of sentences repeated here: "the ray flowers are white and very short; the pappus is of several oblong scales variously lacerate and pointed. My species, sphaerocephala exaristate, is epappose, but otherwise as in *G. parviflora* and has linear or very narrow leaves." As it appeared in print, Jones' term "sphaerocephala exaristate" would seem to be a polynomial and as such is invalid. The name *Galinsoga sphaerocephala* Jones ex S. F. Blake is also unacceptable as no Latin diagnosis was provided when Blake published in 1945. There are also herbarium specimens, which according to Blake (1945), were labeled by P. A. Munz. These bear the name *Galinsoga* "exaristata," which is the epithet Jones evidently intended to publish. Surely, Jones had in mind two taxa when he published his confusing statements noted above, and as Blake indicated, lines must have been lost when the type was set for the paper.

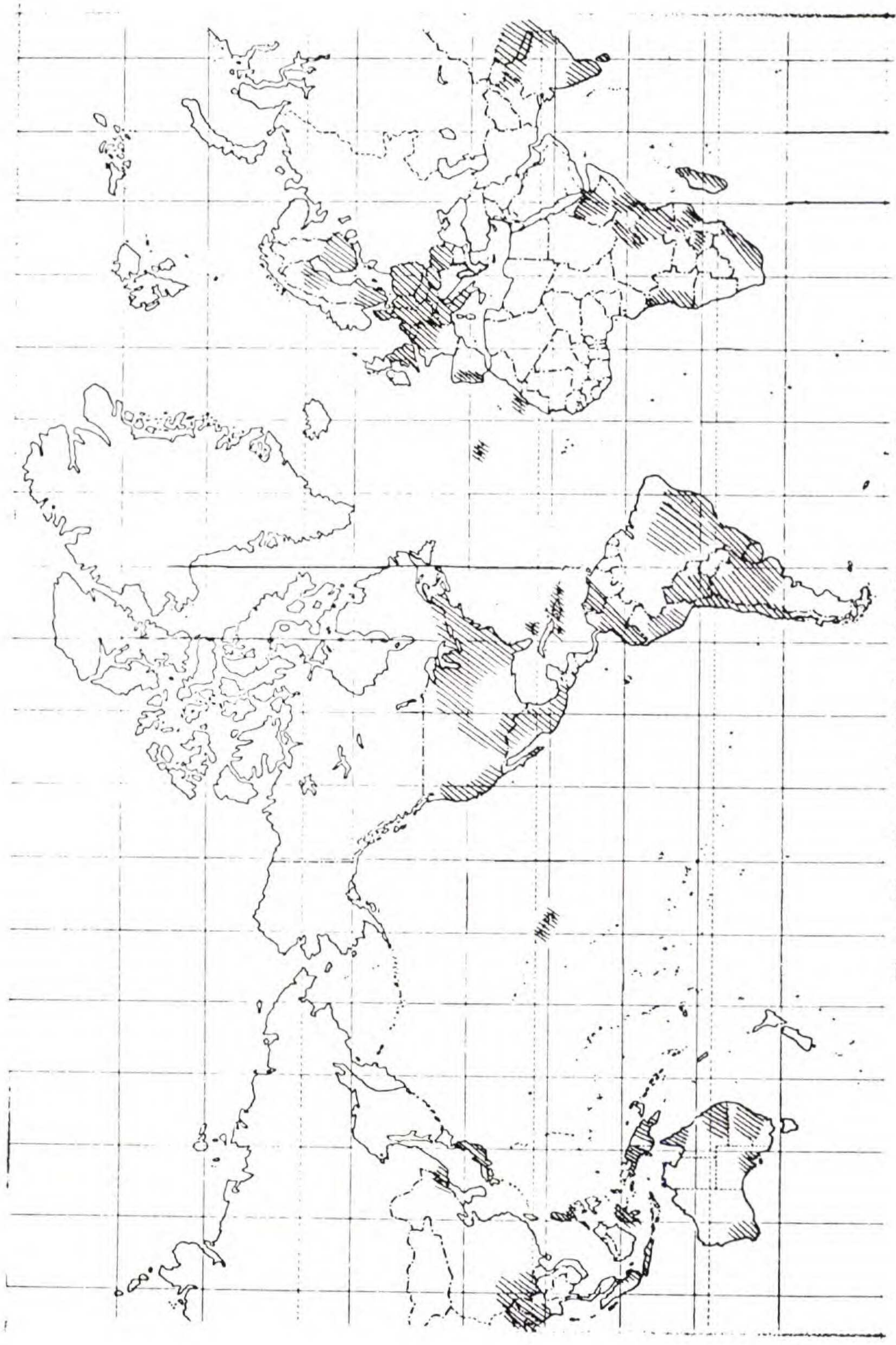

Figure 17. **World distribution of Galinsoga parviflora.**

Galinsoga parviflora is morphologically variable, as might be expected of a widespread weed. One of these variations was recognized by Gray (1853) as *G. parviflora* var. *semicalva* and is characterized by small leaves, usually 5 cm or less in length, somewhat campanulate-throated disc corollas, pappus scales shorter than the disc corolla, and pales more shallowly trifid than is typical. This form is concentrated in Arizona and New Mexico and the neighboring Mexican state of Chihuahua, areas where the more typical form of the species also occurs. Scattered collections are known from other Mexican states at elevations above 1500 m as far south as Distrito Federal. Plants with intermediate morphology are not uncommon.

Because this morphological form intergrades with the typical *Galinsoga parviflora* and its distribution is intermixed with that of the typical form, it is not distinguished as a well defined morpho-geographical unit. As a result, it is not worthy of formal varietal or specific status as has been held in the past (Gray, 1853; St. John & White, 1920). This variant seems best treated as a probable ecotype until field work and greenhouse studies can aid in the determination of morphological stability.

Galinsoga parviflora superficially resembles *G. quadriradiata* and the two have often been confused. They can be distinguished most readily by the characters outlined in Table 2.

Table 2.

Comparison of Galinsoga parviflora & Galinsoga quadriradiata.

G. parviflora	*G. quadriradiata*
1. Plants nearly glabrous to moderately pilose.	1. Plants moderately to densely pilose.
2. Outer phyllaries 2–4, scarious margined, persistent.	2. Outer phyllaries 1–2, margins herbaceous, deciduous.
3. Inner phyllaries and attached pales persistent.	3. Inner phyllaries and attached pales deciduous.
4. Inner pales deeply trifid, the middle lobe usually oblanceolate; late deciduous.	4. Inner pales usually entire, or weakly bifid or trifid; early deciduous.

5. Ray ligule absent to 1.5 (–2) mm long, dull white to pink.
6. Disc pappus of 15–20 blunt to acute, deeply fimbriate, white or gray scales, or absent.
7. Marginal cotyledonary hairs 40–80.
8. $n = 8$.

5. Ray ligule to 2.5 mm long, white to dark purplish-red.
6. Disc pappus of a few to 20 laciniate, acute to aristate, white scales or absent.
7. Marginal cotyledonary hairs 0–12.
8. $n = 16, 24, 32$.

When mixed populations of *Galinsoga parviflora* and *G. quadriradiata* were encountered in the field, neither morphological nor chromosomal indications of hybridization were observed. A widespread variant of *G. quadriradiata* (e.g., *Keil & Canne 9058, Orcutt 4349, Pringle 7345, Ton 1322*) does occur in central Mexico that has trifid pales rather like those in *G. parviflora* that might suggest hybridization, but in other respects this variant is good *G. quadriradiata* (see discussion under this latter species).

Although *Galinsoga parviflora* is known only as a diploid and *G. quadriradiata* only as a polyploid, there is no evidence to indicate that *G. parviflora* was involved directly in the origin of *G. quadriradiata*. A study by Haskell and Marks (1952) substantiates this theory. These authors observed mitotic metaphase figures of *G. parviflora* and *G. quadriradiata* (cited as *G. ciliata* (Raf.) S. F. Blake) and noted that the karyotype of *G. parviflora* contained a pair of metacentric chromosomes with satellites. These chromosomes were not present in the karyotype of *G. quadriradiata*. Conversely, the karyotype of *G. quadriradiata* contained a pair of chromosomes with elongate centric constrictions not present in *G. parviflora*.

REPRESENTATIVE SPECIMENS:[2] **Canada.** ONTARIO. Lanark Co.: Smiths Falls, *Shumovich & McCann 1462* (OAC). **Haiti.** ARTIBONITE: vicinity Ennery, *Leonard 9092* (GH, MO, US). **Mexico.** AGUASCALIENTES: 4 km W of Asientos, *Rzedowski 25066* (DS, MICH). BAJA CALIFORNIA: NE of La Carrerita, *Carter & Chisaki 3575* (DS, MEXU, MICH, UC). CHIHUAHUA: Memelichi, *Gentry 2742* (ARIZ, F, GH, MEXU, MO, UC, US). COAHUILA: Saltillo, *Palmer 790* in part (GH, MEXU, UC, US). COLIMA: without

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[2] *Canne* = *C*, *Canne & Hruschak* = *CH*, *Canne & Schunke* = *CS*, *Keil & Canne* = *KC*. Chromosome vouchers at OS are indicated by *($n = 8$).

locality, *Palmer 1244* (US). DISTRITO FEDERAL: 15 mi N of D.F.-Morelos boundary on Rte. 95d, *KC 9158*;* 28.3 mi N of Morelos-D. F. boundary, *KC 9161*;* 17.7 mi W of Mexico-D. F. boundary, *KC 9162**. DURANGO: 12 mi E of Durango, *Shreve 9163* (ARIZ, GH, MICH, UC). GUERRERO: Taxco, *Abbott 291* (ENCB). GUANAJUATO: 9 mi N of Querétaro state line, *Johnston 4031A* (MEXU, MICH, TEX). JALISCO: 25.8 mi SE of Magdalena Airport, *KC 9017–1* (OS); Atequiza, *KC 9028–1**. MEXICO: 33 mi E of Zitácuaro, *KC 9085–1*;* 3.7 mi W of El Yukon, *KC 9086*;* 6 mi W of Toluca, *KC 9087*;* 5 mi S of jct Rte. 15 & Rte. 55, *KC 9088*;* 0.8 mi S of Tenango, *KC 9090**. MICHOÁCAN: Vista Hermosa, *KC 9040*;* 0.8 mi SE of Ixtlán de los Boros, *KC 9042*;* 7.8 mi N of Zamora R.R. station, *KC 9045*;* 5.2 mi E of Morelia, *KC 9074**. MORELOS: N of Cuernavaca, *KC 9145–1*;* 5.5 mi N of Cuernavaca, *KC 9153**. NAYARIT: La Atarjea, *Mexia 882* (F). NUEVO LEON: Galeana, *Taylor 39* (ARIZ, DS, F, MO, NY, TEX, UC). OAXACA: San Andres Zautla, *Mendoza s.n.* (ENCB). PUEBLA: 2.5 mi E of Puebla-Mexico boundary on Rte. 190d, *KC 9166*;* 12.5 mi E of Puebla-Mexico boundary, Rte. 190d, *KC 9196*;* 33 mi E of Puebla-Mexico boundary, Rte. 190d, *KC 9171*;* jct Mex. Fed Rte. 190d and Rte. 140, *KC 9173*;* 1.3 mi E of jct Rte. 190d & Rte. 140, *KC 9174*;* SAN LUIS POTOSI: near San Luis Potosí, *Parry & Palmer 492* (F, GH, MO, NY, US). SONORA: El Bilito, NE of El Tigre, *White 4810* (MICH). VERACRUZ: 0.4 mi E of Puebla-Veracruz boundary on Rte. 150d, *KC 9175**. ZACATECAS: 6 mi S of Sierra Hermosa, *Shreve 8604* (ARIZ, US). **Puerto Rico.** Municipio Aduntas, Barrio de Guilarte, *Stimson & Montalvo 3928* (DUKE). **United States,** ARIZONA: Apache Co., near Greenlee Co. line on road to Blue, *Gould & Robinson 5129* (ARIZ, NY, UC). CALIFORNIA: Los Angeles Co., Vernon, *Braunton 716* (DS, GH, NY, UC, US). COLORADO: El Paso Co., 1 mi S of Pikeview, *Ewan 14590* (CAS). CONNECTICUT: Fairfield Co., Bridgeport, *Eames 1* (GH). HAWAII: Hawaii Co., Hawaii Volcanoes National Park, *Fosberg 53685* (NY, US). ILLINOIS: Cook Co., Chicago, *Chase 1179* (GH). INDIANA: Fayette Co., 2 mi E of Glenwood, *Friesner 18109* (GH, MICH, NY, TEX, US). KANSAS: Labette Co., bluffs 1 mi N of Oswego, *Rydberg & Imler 364* (NY). KENTUCKY: Jefferson Co., Bradstown, *CH 99–1**. MARYLAND: Frederick Co., Emmitsburg, *CH 141–1*. MASSACHUSETTS: Barnstable Co., Harwich, *Fernald & Long 17614* (GH). MICHIGAN: Branch Co., 1 mi E of Algansee, *Bennett 2646* (US, WIS). MINNESOTA: Hennepin Co., Minneapolis, *Moore 15647* (GH, MO, NY, UC, US). MISSOURI: Jackson Co., Independence, *Bush 406* (NY, US). NEBRASKA: Kearney Co., Minden, 10 Oct 1942, *Hapeman s.n.* (NY, UC). NEW JERSEY: Essex Co., East Orange, *Mackenzie 843* (ARIZ). NEW MEXICO: Lincoln Co., White Mts., *Wooton 501* (BM, NY, UC, US). NEW YORK: Albany Co., Albany, Sep 1867, *Clinton s.n.* (MSC, NY, US). NORTH DAKOTA: Cass Co., Fargo, *Stevens 2029* (NY, UC, US). OHIO: Fayette Co., Washington Court House, *CH 91–1**. OREGON: Multnomah Co.,Portland, *Brandegee s.n.* (GH). RHODE ISLAND: Providence Co., Providence, 18 Jun 1892, *Collins s.n.* (NY). TEXAS: Brewster Co., Chisos Mts., above Boot Springs, *Warnock 9740* (TEX). VERMONT: Chittenden Co., Burlington, Aug 1891, *Howe s.n.* (NY). VIRGINIA: Nelson Co., 5.9 mi N of jct VA 151 & VA 778, *CH 132*;* 7 mi S of jct VA 151 & VA 6, *CH 133–1**. WEST VIRGINIA: Pocahontas Co., 5 mi S of Frost, *CH 72**. **Argentina.** BUENOS AIRES: Villa Rosa, *Brizuela 1464* (TEX, US). **Bolivia.** COCHABAMBA: Cochabamba, *Shepard 266* (GH, US). **Brazil.** GOIAS: ca 5 km S of Corumba de Goias, *Irwin, Souza, & Reis dos Santos 10992* (GH, NY, TEX, US). **Chile.** VALDIVIA: Corral, *Gunckel 4829* (F). **Colombia.** CAUCA: between Popayán and Cajeti, *Cuatrecasas 13827* (F, US).**Ecuador.** PICHINCHA: Quinto Airport, *C 282**. **Peru.**

CUZCO: Machu Picchu, *C 275**. HUANUCO: Concordia, *CS 196**; Chullqui, 116 km S of Tingo Maria, *CS 203b**; Cotosh, *CS 207**; La Esperanza, *CS 209b**, *CS 210**. JUNIN: Santa Rosa de Ocopa, ca 6 km N of Concepcion, *CS 239**; Concepcion, *CS 242**; ca 2 km N of Tarma, *CS 248**, *CS 250**, *CS 253**; Tarma, *C 258**; Acobamba, *CS 259**; Vilcabamba, *CS 260**; Cerro de Carpapata, *CS 262**. LIMA: Lima, *C 280**, *C 281**. **Uruguay.** CERRO LARGO: Palleros, *Gallinal, Aragone, Bergalli, Campal, & Rosengurtt PE-4558* (MO, NY). **Venezuela.** MERIDA: Mucuruba, *Gehriger 185* (F, NY, US).

Austria. LOWER AUSTRIA: Thernberg, *Dörfler & Dörfler* 3531 (DS). **Czechoslovakia.** CENTRAL BOHEMIA: Praha-Troja, Oct. 1937, *Deyl s.n.* (GH, UC, US). **Denmark.** JUTLAND: Vendsyssel, Skolehanen, 1 Aug 1930, *Kaad. s.n.* (DS). **East Germany.** BRANDENBURG: Brandenberg, 22 Jun 1900, *Gross s.n.* (NY). **Finland.** NYLANDI: without locality, 17 Aug 1953, *Fortelius s.n.* (FSU). **France.** BASSES-PYRENNEES: Bayonne, *Jallu 6918* (CAS). **Italy.** LOMBARDY: Lecco, 4 Sept 1888, *St. Lager s.n.* (NY). **Netherlands.** GELDERLAND: Wageninger, 8 Jun 1951, *De Vette s.n.* (UC). **Poland.** KRAKOW: Krakow, *Wroblowna 479* (DS, MO, UC, US). **Portugal.** BEIRA ALTA: without locality, *Rainha 5004* (US). **Romania.** OLTENIA: near Craiova, *Olaru & Paun 42* (NY). **Sweden.** STOCKHOLM: Stockholm, Aug 1888, *Thedenius s.n.* (NY). **Switzerland.** TICINO: Bellinzona, *Blake 9109* (LL). **England.** SURREY: Kew, *Nicholson 724* (GH). **Angola.** HUÍLA: **Humpata,** *Pritchard 309* (BM). **Ethiopia.** ERITREA: Asmara, *Pappi 2125* (A, F, MO, NY, US). **Kenya.** NAIROBI: Kismu, *Dummer 1963* (BM, MO). **Madagascar.** Without locality, *Decary 19582* (US). **Mozambique.** MOCAMBIQUE: Vila de Joao Belo, *Balsinhas 2* (BM). **Rhodesia.** MASHONALAND SOUTH: Salisbury, *Brain 4682* (MO). **South Africa.** GOOD HOPE: Grahamstown, *Schlechter 2638* (BM). **Zaire.** KIVU PARK: Rutshuru, *Ghesquiere 3567* (US). **Bhutan.** Tashi Gang Dzong, *Cooper 3121* (BM). **Burma.** ARAKAN: Mt. Victoria, *Cooper 6037* (UC). **Java.** PREANGER: Tjibodas, *Hallier 69* (NY). **India.** MADRAS: Attikan, *Barnes 526* (GH). **Japan.** TOKYO: Tokyo, 18 May 1912, *Fox s.n.* (BM). **Nepal.** DOLI DIST.: Masintola, *Ram 391* (NY). **Philippines.** LUZON: Baguio, *Clemens 18499* (BM, UC). **People's Republic of China.** SIKANG: K'angting, *Smith 10884* (A, BM, MO). **Tibet.** KONGBO: Tatakor, *Ludlow, Sherriff & Taylor 5450* (BM). **U.S.S.R.** PRIMORSK KRAG: Vladivostok and vicinity, *Topping 2473* (US). **Australia.** NEW SOUTH WALES: Kiama, Jan 1856, *Harvey s.n.* (GH). WESTERN AUSTRALIA: Perth, 24 Aug 1905, *Morrison s.n.* (A).

14. **Galinsoga glandulosa** Canne, sp. nov. Figure 18.

Herbae annuae, usque ad 30 cm altae. Caules erecti, ramosi, virides-rubri, pilosi trichomatibus effusis, glandulosis et eglandulosis. Folia petiolis 6–19 mm longis; laminae trullatae vel lanceolatae-ovatae, 1–3.5 cm longae, 0.5–2.5 cm latae, moderate pilosae utrinque; apice acuto, basi truncata; margines irregulariter dentati-serrati. Pedunculi 0.5–3 cm longi, effusi, glandulosi pilosi. Capitula 4–7 mm alta, 5–9 mm lata. Involucrum uniseriatum, campanulatum; phyllaria complanata vel convexa, elliptica-lanceolata 2.5–3.7 mm longa, 1–1.5 mm lata, pilosa, apice acuto et atroviridi, marginibus ciliatis. Receptaculum 1 mm altum, 1 mm diametro. Paleae ellipticae-rhombicae, 1.8–2 mm longae, 1.3 mm latae, ebur-

neae, complanatae vel convexae, marginibus ciliatis, apice abrupte acuminato vel infirme cuspidato. Flosculi radii 5, corollis albis; ligulae obovatae 2.5–3 mm longae et 1.5–2.5 mm latae, glabrae, lobis 0.3–0.6 mm longis, obtusis; tubi 1.3–1.8 mm longi, viriduli; achenia 1–1.2 mm longa, 0.5 mm diametro, strigosa, epapposa. Flosculi disci 15–20, corollis luteis; fauces 1.3–1.5 mm longae, 0.6–0.8 mm diametro, glabri, lobis 0.3–0.4 mm longis, acutis; tubi viriduli, 0.8 mm longi; antherae flavae, 1–1.2 mm longae, appendice ovata et 1–2 glandulis multicellulosis, clavatis; achenia acheniis radiorum similia. Chromosomatum numerus ignotus.

TYPE: **Mexico:** Querétaro, 23.5 mi SW of Xilitla on rd from Jalpan, ca 4500 ft, 9 Nov 1970, *G. L. Webster & G. J. Breckon 16367* (Holotype, DAV!; isotype, MICH!).

DISTRIBUTION. Known only from the type locality where it was collected on limestone in oak woods. Figure 10.

The presence of weakly cuspidate, whitish pales with ciliate margins and a pair of glands on the anther appendages (for which the species was named) mark *Galinsoga glandulosa* as a very distinct species. The relationship of *G. glandulosa* to other *Galinsoga* in sect. *Galinsoga* is obscure. The characters mentioned above plus the relatively long tube of the ray corollas are suggestive of *Tridax*. However, the disc and ray corolla shape, strigose achenes, short, yellow anthers, short, acute style branches, and leaf shape clearly exclude this species from *Tridax*.

EXCLUDED NAMES

Galinsogea alloeocarpa Spreng. Syst. Veg. **3:** 579. 1826. *nom. illegit.* Based on *Allocarpus caracasanus* HBK. Nov. Gen. Sp. Pl. **4:** 291. *t. 395.* 1818. TYPE: **Venezuela:** near Caracas, 450 hex., Nov 1799-Feb 1800, *F. H. A. von Humboldt & A. J. Bonpland s.n.* (Holotype, P). The description and illustration provided by HBK. exclude the taxon from *Galinsoga* because of its woody stem, corolla shape, and pappus type. The species is best placed in *Calea* as suggested by O. Kuntze, Rev. Gen. **1:** 324. 1891.

Galinsogea angustifolia Spreng. Neu. Entd. **2:** 138. 1820. TYPE: **Brazil:** *s.d., Otto s.n.* (Holotype, P!; probable isotype, P!). = **Calea angusta** S. F. Blake, Contr. U. S. Natl. Herb. **26:** 258. 1930.

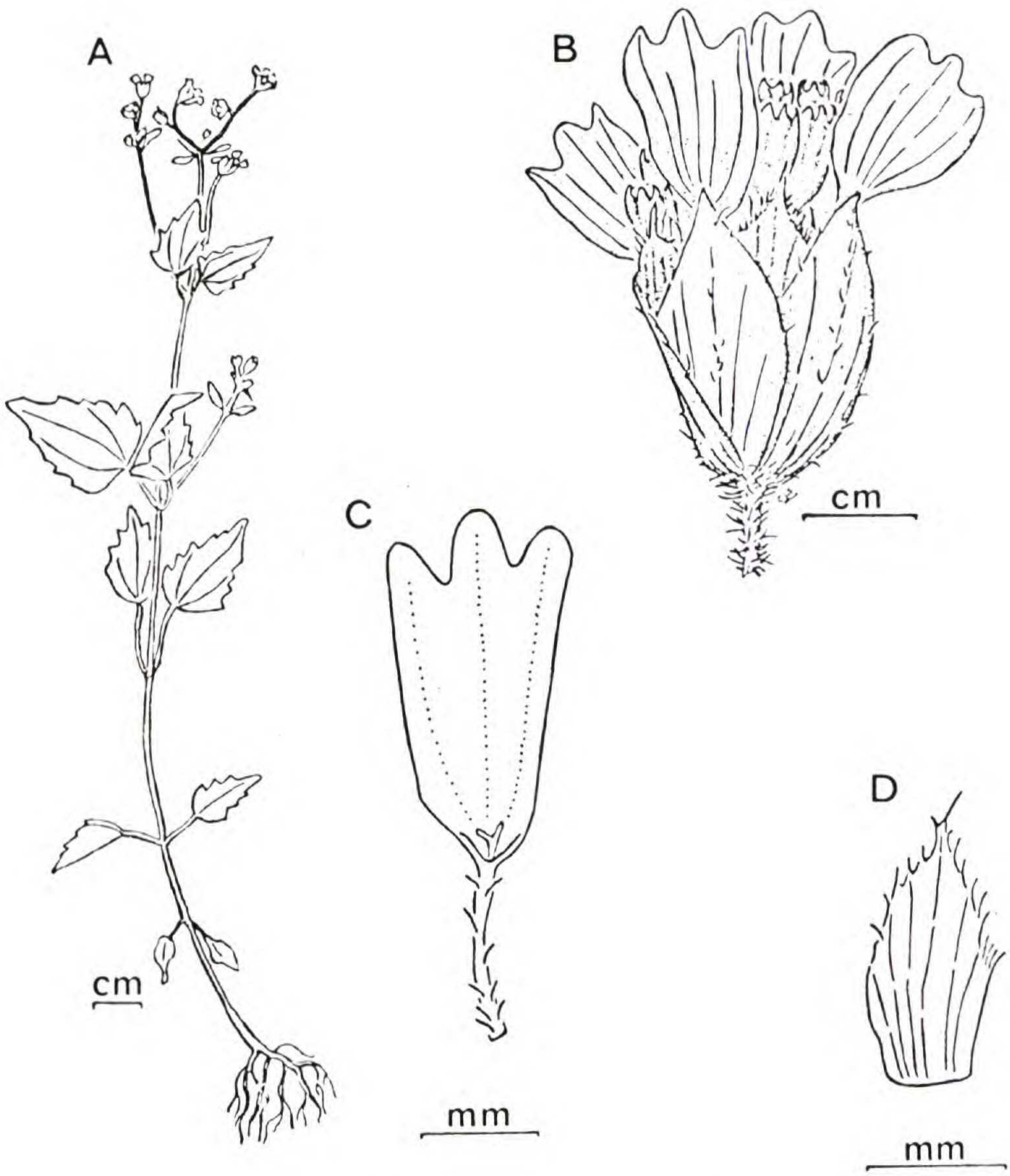

Figure 18. **Galinsoga glandulosa.** A, habit; B, head; C, ray corolla; D, pale. All *Webster & Breckon 16367* (MICH).

Galinsogea brachiata (Lag.) Spreng. Syst. Veg. **3:** 579. 1826. *Mocinna brachiata* Lag. Gen. et Sp. Pl. 31. 1816. TYPE: **Panama:** (Holotype, MA?). Sprengel's description of this shrub clearly excludes the taxon from *Galinsoga.* = **Calea brachiata** (Lag.) DC., *fide* DeCandolle (1836).

Galinsogea dentata Reichb. ex Steud. Nom. Bot. ed. 2. **1:** 656. 1840. *nom. nud.* = **Tridax trilobata** (Cav.) Hemsl. *fide* Powell (1965).

Galinsogea discolor Spreng. Syst. Veg. **3:** 577. 1826. *pro syn.* of *Verbesina atriplicifolia* Pers. TYPE: without data (Holotype, P!). = **Montanoa** sp.

Galinsogea linearifolia (Lag.) Spreng. Syst. Veg. **3:** 579. 1826. = **Gutierrezia linearifolia** Lag. Gen. et Sp. Pl. 30. 1816. *fide* Solbrig (1966). TYPE: "Hab. in N. H." (Holotype, MA?). Sprengel's description of this shrub eliminates it from *Galinsoga.*

Galinsogea megapotamica Spreng. Syst. Veg. **3:** 580. 1826. TYPE: **Brazil:** Rio Grande, *s.d., Sello s.n.* (Holotype, P). This taxon is removed from *Galinsoga* by virtue of its linear, 3 parted leaves as described by Sprengel.

Galinsoga ? oblongifolia (Hook.) DC. Prod. **5:** 677. 1836. *Wiborgia ? oblongifolia* Hook. Bot. Misc. **2:** 226. 1831. TYPE: **Peru:** Lima, Lurin, *s.d., A. Crickshanks s.n.* (Holotype, GL, photograph, US!). = **Eclipta alba** (L.) Hassk.

Galinsogea resinosa Hook. & Arn. Bot. Beechey's Voyage. 32. 1830. TYPE: **Chile:** Coquimbo, *s.d., T. Bridges s.n.* (Holotype, GL, photograph, K!). = **Gutierrezia resinosa** (Hook. & Arn.) S. F. Blake, Contr. U. S. Natl. Herb. **26:** 232. 1930. *fide* Solbrig (1966).

Galinsogea serrata (Lag.) Spreng. Syst. Veg. **3:** 579. 1826. *Mocinna serrata* Lag. Gen. et Sp. Pl. 31. 1816. TYPE: **Mexico:** near Salmanticam, *s.d., Nee s.n.* (Holotype, MA?). Sprengel's description of the species as shrubby with scabrous leaves excludes the taxon from *Galinsoga.*

Galinsoga trifida Pers. Synopsis Plantarum **2:** 472. 1807. TYPE: unknown, not at L. In the original description, the epithet "trifida" is preceded by an asterisk, and as Boivin (1962) and Chater and Brummitt (1966) have pointed out, it is not clear in the majority of cases whether Persoon was indicating subspecies or doubtful species by the use of the asterisk. Persoon described *G. trifida* as having narrow, trifid, lanceolate, dentate leaves. No Galinsogas have divided leaves. The description of *G. trifida* is preceded by one of *G. trilobata* Cav. and Persoon says of *G. trifida,* "Facie antecedentis," (1807, p. 472). Thus Persoon may have suggested that *G. trifida* has affinities with the genus *Tridax* to which *G. trilobata* was transferred by Hemsley (1881). As no

type was indicated and no probable type material has been located, it is not possible to determine the precise affiliation of *G. trifida.* The situation seems best handled by excluding the name from *Galinsoga* on the basis of Persoon's description.

Galinsoga trilobata Cav. Icon. Descr. Pl. **3:** 42. *t. 282.* 1795. TYPE: **Mexico.** (Lectotype, MA). = **Tridax trilobata** (Cav.) Hemsl. Biol. Centr. Amer. Bot.**2:** 208. 1881. *fide* Powell (1965).

Galinsogea uniflora Spreng. Syst. Veg. **3:** 580. 1826. TYPE: **Uruguay:** Montevideo, *s.d., Sello s.n.* (Holotype, P). Sprengel's description of this taxon with linear, scabrous leaves excludes this species from *Galinsoga.*

ACKNOWLEDGMENTS

This revision is based upon a portion of a dissertation submitted to the Graduate School of The Ohio State University, Columbus, in partial fulfillment of the requirements for the Ph.D. degree. Appreciation is extended to Dr. Tod. F. Stuessy for his suggestion of the project and his guidance throughout the study. Thanks are offered to Dr. David J. Keil, Ms. Kathleen Hruschak, and Sr. Jose Schunke for their aid on collecting trips; to Dr. Donald Simpson and Dr. Raymond Ferreyra for assistance with various aspects of the trip to Peru; to Dr. Roland Seymour for making the trip to Guatemala possible; to Dr. Elton Paddock for help with certain meiotic preparations; and Dr. Charles Heiser for collecting *Galinsoga* in Ecuador. I thank the following persons who kindly provided information regarding literature, nomenclature and certain type specimens: Ms. Phyllis Edwards of the British Museum (Natural History); Dr. L. Niklas, Vienna, Austria; Dr. Karl Otto Meyer, Oldenburg, Germany; Dr. Hervé M. Burdet, Geneva, Switzerland; the late J. E. Lousley; and Dr. Ronald L. Stuckey, Columbus, Ohio. Illustrations of capitula of new taxa were prepared by Mrs. Carol Stuessy.

Field work in Mexico, Peru, and the United States was supported by National Science Foundation Grant GB30240. Appreciation is offered to the curators and directors of the following herbaria for loan of specimens (abbreviations after Holmgren & Keuken, 1974); A, ARIZ, BM, CAS, DAV, DS, DUKE, ENCB, F, FSU, GH, K, LD, LL, MA, MEXU, MICH, MO, MSC, NY, OAC, OS, P, TEX, UC, US, USM, WIS, Z, and ZT.

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