CHROMOSOME COUNTS OF COMPOSITAE FROM THE UNITED STATES, MEXICO, AND GUATEMALA

DAVID J. KEIL AND TOD F. STUESSY

Chromosome numbers can be extremely useful in systematic studies, particularly for helping to reveal evolutionary relationships. For the past fifteen years numerous chromosome reports from plants have been published, especially in the Compositae, and these counts have been compiled in several major sources (Darlington & Wylie, 1955; Cave, 1958-65; Ornduff, 1967-69; Fedorov, 1969; Moore, 1970-72). However, a rapid glance through these references indicates not only that many species never have been counted, but also that many taxa are known only from a single plant in one population. In view of the common occurrence of euploid and aneuploid races in plants as illustrated by several detailed investigations (e.g., Lewis, 1962, 1970; Stuessy, 1971a), it is desirable to have several to many counts from each species before accurate judgments can be made regarding evolutionary relationships (Stuessy, 1971b; Kovanda, 1972; Strother, 1972). The present paper helps to remedy these deficiencies in the Compositae by: (1) reporting first chromosome counts for several genera, species, and varieties; and (2) reporting additional populational chromosome counts for taxa documented previously.

MATERIALS AND PROCEDURES

The meiotic chromosomal material for this study was collected during the past several years by the senior and junior authors on various field excursions. Immature capitula were killed and fixed in modified Carnoy's fluid (4 chloroform: 3 absolute alcohol: 1 glacial acetic acid) and refrigerated in the laboratory until later prepared by con-

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ventional acetocarmine squash techniques. Voucher spec-
imens collected by Keil and assistants are on deposit in the
herbarium of The Ohio State University (OS); vouchers
collected by Stuessy are in the herbarium of the University
of Texas at Austin (TEX).

RESULTS

The chromosome counts obtained in the present study
are listed in Table 1. First counts are reported for two
genera, 16 additional species, and one variety; 112 addi-
tional counts are for taxa counted previously, seven of
which are new numbers. The first counts for genera are
from Epaltes Cass. \(n = 10\) and Tricarphe Longpre
\(n = 8\), and first counts for species are in Bidens L.,
Calea L., Guardiola Cerv. ex H. & B., Machaeranthera
Nees, Melampodium L., Otopappus Benth., Sclerocarpus
Jacq., Tridax L., and Zaizuzania Pers.

DISCUSSION

Because many of the counts presented here corroborate
previous chromosomal reports, the discussions are restricted
either to first counts or to new reports for genera, species,
or varieties. The order of commentary will follow the se-
quene of tribes in the classification of Hoffmann (1890-94),
which is the same as that used in Table 1. References for
statements regarding the range of chromosomal variation
within genera will not be given; documentation for these
counts comes from the several major sources cited in the
introduction to this paper.

EUPATORIEAE. Counts for three herbaceous species of
Stevia Cav. represent new reports. Stevia elatior H.B.K.
is cited here as \(n = 12_{11} \& 12_{1}\) (Fig. 1), whereas the two
previously recorded numbers have been \(n = 34_{1}\) (Powell &
Turner, 1963) and \(n = 33_{1}\) (Grashoff, Bierner, & North-
ington, 1972). Our count for Stevia origanoides H.B.K.,
reported here as \( n = 11 \) (Fig. 2), is the first for this taxon at what appears to be the diploid level; the previous counts were \( n = 34 \) and \( n = 43 + 1 \) (Grashoff et al., 1972). *Stevia plummerae* A. Gray var. *durangensis* Robins, has been reported before only once by Grashoff et al. (1972) as \( n = 17 \), but our count is \( n = 44 \) (Fig. 3). As pointed out by Grashoff et al. (1972), it is common to find varying meiotic chromosomal associations and numbers in species that have apomictic races, as are present in these three taxa. It is not surprising, therefore, that our reported counts add to this chromosomal diversity.

**ASTEREEAE.** Several previous counts have been reported for *Erigeron karvinskianus* DC.: \( 2n = 32 \) (Carano, 1921; Battaglia, 1950); \( 2n = 36 \) (Fagerlind, 1947; Larsen, 1953, 1954; Kliphuis & Wieffering, 1972); \( n = 9 \) and \( n = 27 \) (Turner, Ellison, & King, 1961); and \( n = 27 \) (Turner, Powell, & King, 1962). Considering the variation in chromosome number that has been documented previously in this species, as well as our new report of \( n = 51 \) & \( 17 \) (Fig. 4), it is likely that *E. karvinskianus* is apomictic through at least part of its range from Mexico to northern South America (Solbrig, 1962). It is interesting that our count comes from a population very near the locality cited by Turner et al. (1961) for their counts of \( n = 9 \) and \( n = 27 \).

*Machaeranthera coulteri* (A. Gray) Turner & Horne (as *Psilactis coulteri* A. Gray) was reported as \( n = 5 \) by Solbrig, Anderson, Kyhos, Raven, and Rüdenberg (1964). However, based on the recent revision of *Machaeranthera* by Turner and Horne (1964), the geographic location of the voucher for the count seems more appropriate for *M. arida* Turner & Horne than for *M. coulteri*. The latter species, as recently interpreted, is known only from the vicinity of Guaymas, Sonora, where our voucher was collected. Our first count of \( n = 5 \) (Fig. 5) for *Machaeranthera coulteri* is particularly interesting because in the previously mentioned revision of sect. *Psilactis* of the genus (Turner & Horne, 1964; cf. their
Figs. 1-22. Camera lucida drawings of meiotic chromosomes of species of Compositae. Diplotene, Fig. 18; diakinesis, Figs. 5, 7-10, 12, 15, 19-21; metaphase I, Figs. 1, 3, 4, 6, 11, 14, 16, 17; metaphase II, Figs. 2 (one half of cell shown), 13. All figures same scale. Bivalents black, univalents white. KC = Keil & Canne, KM = Keil & McGill, K = Keil. Fig. 1, Stevia elatior, K 9396, n = 121 & 121; Fig. 2, Stevia origenoides, KC 8884, n = 11; Fig. 3, Stevia plummerae var. durangensis, KC 8927-1, n = 441; Fig. 4, Erigeron karwinskianus, KC 9178, n = 51 & 171; Fig. 5, Machaeranthera coulteri, KC 8637, n = 5; Fig. 6, Epanthes mexicana, KC 9211, n = 10; Fig. 7, Bidens
riparia var. refracta, KC 8710, n = 12; Fig. 8, Guardiola platyphylla, KM 8558, n = 12; Fig. 9, Melampodium appendiculatum, KC 8706A, n = 10; Fig. 10, Otopappus imbricatus, KC 9112, n = 16; Fig. 11, Parthenium incanum, KM 7765A, n = 1811 & 181; Fig. 12, Sclero-
carpus spatulatus, KC 8671A, n = 11; Fig. 13, Sigesbeckia jorullensis, 
KC 8902, n = 30; Fig. 14, Simsia eurylepis, KC 9231, n = 17; 
Fig. 15, Simsia grayi, KC 9081, n = 17; Fig. 16, Spilanthes phane-
rectis, KC 9035, n = 41; Fig. 17, Tricarpha durangensis, KC 8860A, 
n = 8; Fig. 18, Tridax tenuifolia var. microcephala, KC 8808, n = 9; 
Fig. 19, Zaluzania grayana, KM 8379A, n = 17; Fig. 20, Schkuhria 
pinnata var. guatemalensis, K 9402A, n = 10; Fig. 21, Senecio 
runcinatus, KC 9192, n = 22; Fig. 22, Pinaropappus roseus, KC 9177, 
n = 20II & 11.
Fig. 3), *M. coulteri* on morphological grounds was placed in the $x = 5$ cytophyletic group along with *M. arida* and *M. crispa* (Brandg.) Turner & Horne, both known chromosomally as $n = 5$. More recently *M. arizonica* Jackson & R. R. Johnson and *M. parviflora* A. Gray have been added to this group and both species have been counted as $n = 5$ (Jackson & Johnson, 1967). This first chromosomal report for *M. coulteri* substantiates its phyletic association with these other species. All other taxa in sect. *Psilactis* are known chromosomally as either $n = 4$ or $n = 9$ (Turner & Horne, 1964).

**INULEAE.** The first report for *Epaltes* (*E. mexicana*), $n = 10$ (Fig. 6), is in keeping with its present subtribal disposition in the Plucheinae. Of the related genera of the same subtribe (Hoffmann, 1890-94) that are known chromosomally (*Blumea* DC., *Plucheia* Cass., *Pterigeron* (DC.) Benth., *Pterocaulon* Ell., *Sphaeranthus* L., and *Tessaria* Ruiz & Pav.), all are based on $x = 10$ except *Blumea* which appears multibasic with $x = 9, 10$, and 11. On morphological and geographical grounds, in our opinion, *Epaltes mexicana* Less. is quite similar to some species of *Plucheia*, the former differing mainly in its smaller heads and flowers and in its epappose achenes. As emphasized by Bentham (1873) and Godfrey (1952), the generic boundaries in the Plucheinae are not well defined and perhaps should be re-evaluated.

**HELIANTHEAE.** *Bidens riparia* is reported for the first time as $n = 12$ (Fig. 7) in a genus that has most frequently counted numbers of $n = 12, 24$, and 36 (clearly based on $x = 12$).

The first count for *Calea zacatechichi* Schlecht., $n = ca. 19$, is in keeping with previous reports for other species of the genus ($n = 9, 16, 18, 19, 24, 32$). According to the most recent revision of the Mexican and Central American taxa (Robinson & Greenman, 1896), *C. zacatechichi* is most closely related to *C. nelsonii* Robins. & Greenm. which has been counted as $n = ca. 18$ (Turner *et al.*, 1962). The
morphological and chromosomal heterogeneity within *Calea* and the absence of a recent revision of the entire genus suggest that a thorough modern study is much needed.

*Guardiola*, a genus of about ten species, has been placed traditionally in the subtribe Melampodiinae (Hoffmann, 1890-94). However, recent studies by the junior author suggest that on morphological and cytological evidence it belongs more properly in the Coreopsidinae (Stuessy, 1973). Our first count of $n = 12$ (Fig. 8) for *G. platyphylla* A. Gray is consistent with the recent reports of $n = 12$ for both *G. tulocarpus* A. Gray (Grashoff et al., 1972) and *G. mexicana* H. & B. (Solbrig, Kyhos, Powell, & Raven, 1972), and with the base number of $x = 12$ for several other members of this subtribe.\(^3\)

The count of $n = 10$ (Fig. 9) is a first report for *Melampodium appendiculatum* Robins. In a recent revision of the genus (Stuessy, 1972) this species is placed in series *Cupulata* of sect. *Melampodium*; three other related species (*M. cupulatum* A. Gray, *M. rosci* Robins., and *M. tenellum* Hook. & Arn.) also are known chromosomally as $n = 10$ (Stuessy, 1971b). The addition of this new count increases the number of species surveyed within the genus to 27 out of 37.

The first generic report for *Otopappus* (*O. seaber* S. F. Blake) has been published recently by Solbrig et al. (1972) as $n = 16$. Our first report for *O. imbricatus* (Sch.-Bip.) S. F. Blake of $n = 16$ (Fig. 10) confirms this chromosomal level for the genus. The related genera *Salmea* DC. and *Notoptera* Urb. (Blake, 1915) are known respectively as $n = 18 + 2$ frag. (Turner et al., 1962) and $n = ca. 15 & 16$ (Turner et al., 1962; Turner & King, 1964), although very few taxa have been examined from each.

\(^3\)The count published by Solbrig et al. was listed for *G. atriplicifolia* A. Gray, but in the most recent published revision of the genus (Robinson, 1899) this epithet is regarded as synonymous with *G. mexicana*.

\(^4\)(e.g., *Bidens* L., *Coreopsis* L., *Cosmos* Cav., *Glossocardia* Cass., *Thelesperma* Less.)
Parthenium L., and particularly *P. argentatum* A. Gray, has been studied extensively for many years (cf. Hammond & Polhamus, 1965), including a comprehensive revision by Rollins (1950). *Parthenium incanum* H.B.K. has been reported previously as having a polyploid series of \( n = 18, 27, 36, \) and 45, but our new count is \( n = 18_{II} & 18_{I} \) (Fig. 11). This interploid number could represent the product of hybridization between *P. incanum* and other species of the genus that grow in the vicinity, such as *P. argentatum*, but our voucher specimens show no morphological indication of such intergradation. Alternatively, the meiotic configuration could indicate a hybrid between \( n = 18 \) and \( n = 36 \) cytotypes of the same species. The plants under consideration also could be apomictic, a condition that is known to occur in populations in the northern range of *P. incanum* (Rollins, 1950) where our material was collected.

The count of \( n = 11 \) (Fig. 12) for *Sclerocarpus spatulatus* Rose is consistent with previously reported numbers of \( n = 11, 12, 14, \) and 18 in the genus as recently defined by Feddema (1971). The closely related genus, *Aldama* LaLlave & Lex., is known chromosomally as \( n = 17 \) (Turner *et al.*, 1962; Powell & Cuatrecasas, 1970; Feddema, 1971).

*Sigesbeckia* L. of the subtribe Helianthinae is a small genus of less than ten species. It is worthwhile to mention that a close morphological resemblance exists with *Trigonospermum* Less. (McVaugh & Anderson, 1972; Stuessy, 1973) and perhaps also with *Rumfordia* DC., the former of the subtribe Melampodiinae and the latter of the Helianthinae. Our count of \( n = 15 \) is a first report for *S. agrestis* Poepp. & Endl. All but two other reports in the genus \([n = 12 \) (Subramanyam & Kamble, 1967) and \( 2n = 20 \) (Hsu, 1967) for *S. orientalis* L.] have been either \( n = 15 \) or \( n = 30 \). Intraspecific euploidy is known to occur in *S. orientalis* (Mehra, Gill, Mehta, & Sidhu, 1965) and it is now documented for *S. jorullensis* H.B.K. by our counts of \( n = 15 \) and 30 (Fig. 13). Only one count of \( n = 15 \) (Solbrig *et al.*, 1972) has been recorded previously for this species.
Of the approximately 35 species of *Sim sia* recognized by various authors (Blake, 1913, 1917, 1928; Cuatrecasas, 1954; Robinson & Brettell, 1972), ten have been counted from morphologically diverse parts of the genus, and all counts have been \( n = 17 \). Our first counts of \( n = 17 \) (Figs. 14 & 15) for *S. eurylepis* S. F. Blake and *S. grayi* Sch.-Bip. ex S. F. Blake emphasize the chromosomal uniformity within the genus.

*Spilanthes* with approximately 60 species (Moore, 1907) is a taxonomically complex genus much in need of revisionary attention. It appears to belong in the subtribe Galinsoginae rather than in the Helianthinae as traditionally placed (Hoffmann, 1890-94). Chromosomally the situation also is complex. Even though only six species have been counted, four base numbers, \( x = 7, 12, 13, \) and 16, are present. Our first report of \( n = \text{ca.} 45 \) for *S. ocymifolia* (Lam.) A. H. Moore adds another chromosomal level to the already chromosomally diverse sect. “Salivaria” (= sect. *Spilanthes*) known with \( n = 7, 12, 16, \) and 26. All previous reports for sect. *Aemella* (Rich.) DC. have been clearly based on \( x = 13 \) (only \( n = 13 \) and \( n = 26 \) counts reported). Our new report of \( n = 41 \) (Fig. 16) for *S. phaneractis* (Greenm.) A. H. Moore increases the chromosomal diversity of this section as well.

*Tricarpha* is a genus of two species recently described by Longpre (1970). Our first count for the genus (from *T. durangensis* Longpre) of \( n = 8 \) (Fig. 17) substantiates its presumptive close relationship to *Sabazia* Cass. (\( n = 4, 8, \) and 16) and *Selloa* Kunth (\( n = 8 \)) as mentioned by Longpre (1970). The problem of generic delimitation in the subtribe Galinsoginae, involving *Tricarpha*, *Sabazia* and *Selloa* as well as *Galinsoga* Ruiz & Pavon, *Stenocarpha* S. F. Blake, *Tridax* and *Jaegeria* Kunth, is much in need of further study, despite the appearance in recent years of several excellent revisions (Powell, 1965; Turner, 1965; Torres, 1968; Longpre, 1970). Part of the difficulty in sorting out the proper affinities of all the taxa in the Galinsoginae is that previous workers have been working from the
perspective primarily of a single genus and not from a perspicacious overview of many of the genera within the subtribe. An added difficulty is the absence of a recent revision of Galinsoga (most recent treatment that of Robinson, 1894), the understanding of which clearly is central to sorting out these generic relationships.

Our first report for Tridax tenuifolia Rose, $n = 9$ (Fig. 18), fits well with the established base number of $x = 9$ for sect. Tridax to which T. tenuifolia belongs (Powell, 1965).

Of the 14 species of Zaluzania recognized by Sharp (1935), six have been counted with definite numbers of $n = 16$ and 18. Our first report, $n = 17$ (Fig. 19), for Z. grayana Robins. & Greenm. firmly establishes this as a new chromosomal level for the genus (a previous count of $n = 17 \pm 1$ for Z. montagneafolia Sch.-Bip. was reported by Powell and Turner, 1963).

**HELENIEAE.** Schkuhria pinnata (Lam.) Cabrera has been counted before as $2n = 20$ (Covas and Schnack, 1946), and var. virgata (LaLlave) Heiser of the same species has been reported as $n = ca. 20$ (Turner et al., 1962). Recently McVaugh (1972) transferred S. anthemoides (DC.) Coul. var. guatemalensis (Rydb.) Heiser to S. pinnata, and our counts of $n = 10$ (Fig. 20) for this taxon are the first reports. A count of $n = 11$ (Table 1) was obtained from material tentatively identified as S. anthemoides. However, our voucher specimen differs from the characters of this species as delimited by Heiser (1945) in having more numerous disc florets and large ray florets, as in S. schkuhrioides (Link & Otto) Thellung in Fedde. In pappus structure, though, our plants are much more similar to S. anthemoides than to S. schkuhrioides. This collection may represent a previously undescribed taxon.

**SENECIONEAE.** Our first reports of $n = ca. 30$ for Senecio hartwegii Benth. and $n = 22$ (Fig. 21) for S. runcinatus Less. are consistent with counts reported previously for other taxa of the genus. Thirty-three species of Senecio
have been reported as \( n = 30 \) and six are known with \( n = 22 \). Although the genus is based either on \( x = 5 \) (Barkley, 1962) or \( x = 10 \) (Ornduff, Raven, Kyhos, & Kruckeberg, 1963; Ornduff, Mosquin, Kyhos, & Raven, 1967), the diversity of haploid numbers is great, representing 30 different chromosomal levels from \( n = 5 \) to \( n = \text{ca.} 92 \).

**CICHORIEAE.** The small genus *Pinaropappus* Less. has been counted from only one species, *P. roseus* Less., and the reported counts are \( n = 9 \) and 18 (Darlington & Wylie, 1955; Turner *et al.*, 1961; Powell & Turner, 1963; Powell & Sikes, 1970). Our present count of \( n = 20_{II} \) & \( 1_{I} \) (Fig. 22) is a new report for this taxon. The meiotic configurations of cells in our preparation were irregular with bridges, lagging chromosomes, and varying numbers of univalents.

**ACKNOWLEDGMENTS**

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Table 1. Chromosome counts of Compositae from the United States, Mexico, and Guatemala.

<table>
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<th>Taxon</th>
<th>Locality and voucher</th>
<th>Chromosome number (n)</th>
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<tbody>
<tr>
<td><strong>EUPATORIEAE</strong></td>
<td></td>
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<tr>
<td><em>Ageratum corymbosum</em> Zuccag.</td>
<td>MEXICO: Sinaloa: 16.4 mi. NE. of Santa Lucia, KC 8859.</td>
<td>10</td>
</tr>
<tr>
<td><em>Brickellia coulteri</em> A. Gray</td>
<td>MEXICO: Durango: 8.8 mi. S. of Nazareno, KM 8025.</td>
<td>9</td>
</tr>
<tr>
<td><em>Stevia anadenotricha</em> (Robins.) Grashoff</td>
<td>MEXICO: Durango: 12.7 mi. SW. of La Ciudad, KC 8883.</td>
<td>12</td>
</tr>
<tr>
<td><em>Stevia elatior</em> H.B.K.</td>
<td>GUATEMALA: Guatemala: 12.8 km. E. of Cd. Guatemala, K 9396.</td>
<td>12 (Figs. 1 &amp; 2)</td>
</tr>
<tr>
<td><em>Stevia origanoides</em> H.B.K.</td>
<td>MEXICO: Durango: 12.7 mi. SW. of La Ciudad, KC 8884.</td>
<td>11 (Fig. 2)</td>
</tr>
<tr>
<td><em>Stevia plummerae</em> A. Gray</td>
<td>MEXICO: Durango: 9.7 mi. NE. of La Ciudad, KC 8927-1.</td>
<td>44 (Fig. 3)</td>
</tr>
<tr>
<td>var. <em>durangensis</em> Robins.</td>
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<td></td>
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<tr>
<td><em>Stevia salicifolia</em> Cav.</td>
<td>MEXICO: Chihuahua: 9.5 mi. W. of General Triás, KM 8288.</td>
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<tr>
<td>var. <em>salicifolia</em></td>
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<td><strong>ASTEREAЕ</strong></td>
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<tr>
<td><em>Aphanostephus arizonicus</em> A. Gray</td>
<td>MEXICO: Chihuahua: 10.4 mi. S. of Cd. Chihuahua, KM 8263A.</td>
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<td><em>Aphanostephus ramosissimus</em> DC.</td>
<td>MEXICO: Chihuahua: 24 mi. N. of Cd. Chihuahua, S 1097.</td>
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<td><em>Aster exilis</em> Ell.</td>
<td>MEXICO: Sinaloa: 11 mi. NE. of Santa Lucia, KC 8850A.</td>
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</tr>
<tr>
<td>Plant Name</td>
<td>Location Details</td>
<td>Fig No.</td>
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<tr>
<td><em>Aster spinosus</em> Benth.</td>
<td>MEXICO: Coahuila: 5.5 mi. E. of Nazareno, KM 8010.</td>
<td>9</td>
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<tr>
<td><em>Baccharis glutinosa</em> Pers.</td>
<td>MEXICO: Sonora: Arroyo Cuchujaqui on Alamos-Guirocoa rd., KC 8675.</td>
<td>9</td>
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<tr>
<td><em>Conyza sophiaefolia</em> H.B.K.</td>
<td>MEXICO: Sinaloa: 11 mi. NE. of Santa Lucia, KC 8848.</td>
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<tr>
<td>†<em>Erigeron karwinskianus</em> DC.</td>
<td>MEXICO: Veracruz boundary on Rte. 150-D, KC 9178.</td>
<td>5 &amp; 17 (Fig. 4)</td>
</tr>
<tr>
<td><em>Grindelia</em> sp. nov.†</td>
<td>MEXICO: Chihuahua: 2 mi. S. of Cuauhtémoc, S 1041.</td>
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<tr>
<td><strong>Machaeranthera coulteri</strong> (A. Gray) Turner &amp; Horne</td>
<td>MEXICO: Sonora: ca. 15 mi. E. of Guaymas, KC 8637.</td>
<td>5 (Fig. 5)</td>
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<tr>
<td><em>Machaeranthera pinnatifida</em> (Hook.) Shinners</td>
<td>MEXICO: Chihuahua: ca. 2 mi. W. of Parral, S 993.</td>
<td>4</td>
</tr>
<tr>
<td><em>Machaeranthera scabrella</em> (Greene) Shinners</td>
<td>MEXICO: Coahuila: 110 mi. S. of Piedras Negras, KM 7855; 14.9 mi. N. of Rancho Acatita, KM 8079A. UNITED STATES: Texas: PRESIDIO CO.: 15.2 mi. W. of Lajitas, KM 7787.</td>
<td>4</td>
</tr>
<tr>
<td><em>Xanthocephalum sericocarpum</em> A. Gray</td>
<td>MEXICO: Chihuahua: 2 mi. S. of Cuauhtémoc, S 1044.</td>
<td>4</td>
</tr>
</tbody>
</table>

**INULEAE**

***Epalttes mexicana* Less. | MEXICO: Veracruz: 33.5 mi. E. of Poza Rica, KC 9211. | 10 (Fig. 6) |
**HELIANTHEAE**

<table>
<thead>
<tr>
<th>Species</th>
<th>Location/Details</th>
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<tr>
<td><em>Ambrosia artemisiifolia</em> L.</td>
<td>UNITED STATES: Illinois: LAKE CO.: Lake Forest College campus, S 1132.</td>
</tr>
<tr>
<td><em>Ambrosia psilostachya</em> DC.</td>
<td>MEXICO: Tamaulipas: ca. 2 mi. SE. of Reynosa, S 774 (ca. 18). UNITED STATES: Texas: KINNEY CO.: 42 mi. NW. of Eagle Pass, S 877a, b.</td>
</tr>
<tr>
<td><em>Ambrosia psilostachya</em> DC.</td>
<td>MEXICO: Chihuahua: 7 mi. NW. of Cuauhtémoc, S 1062a.</td>
</tr>
<tr>
<td><em>Ambrosia psilostachya</em> DC.</td>
<td>UNITED STATES: Texas: BRAZORIA CO.: 12 mi. NE. of Freeport, Turner 5747 (ca. 54); GALVESTON CO.: 60 S. Theresa, Galveston, Miller s.n.</td>
</tr>
<tr>
<td><em>Baltimore recta</em> L.</td>
<td>GUATEMALA: Santa Rosa: 3.5 km. NW. of Culiacapa, K 9403.</td>
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<tr>
<td><em>Bidens pilosa</em> L. var. minor (Blume) Sherff f. minor</td>
<td>MEXICO: Guerrero: 10 mi. S. of Chilpancingo, KC 9126.</td>
</tr>
<tr>
<td><em>Bidens pilosa</em> L. var. radiata Sch.-Bip. in Webb &amp; Berth. f. radiata</td>
<td>MEXICO: Chihuahua: 15.5 mi. W. of Santa Lucia, KM 8304.</td>
</tr>
<tr>
<td><em>Calea urticifolia</em> (Mill.) DC.</td>
<td>GUATEMALA: Guatemala: 6.8 km. NE. of Amatitla, K 9450.</td>
</tr>
<tr>
<td><strong>Calea zacatechichi</strong> Schlecht.</td>
<td>MEXICO: Jalisco: 1.2 mi. NW. of Magdalena airport, KC 9008.</td>
</tr>
<tr>
<td>Species</td>
<td>Location Details</td>
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<tr>
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<tr>
<td>Chrysanthellum mexicanum Greenm.</td>
<td>MEXICO: Nayarit: ca. 18 mi. SE. of Tepic, <em>KC 8965.</em></td>
</tr>
<tr>
<td>Cosmos linearifolius (Sch.-Bip.) Hemsl. var. linearifolius</td>
<td>MEXICO: Durango: 10.5 mi. SW. of La Ciudad, <em>KC 8982.</em></td>
</tr>
<tr>
<td>Cosmos parviflorus (Jaq.) Pers.</td>
<td>MEXICO: Sinaloa: 16.4 mi. NE. of Santa Lucia, <em>KC 8858.</em></td>
</tr>
<tr>
<td>Eclipta alba (L.) Hassk.</td>
<td>MEXICO: Sinaloa: 14.5 mi. S. of Sinaloa-Sonora boundary on Rte. 15, <em>KC 8736.</em></td>
</tr>
<tr>
<td>Flaveria trinervia (Spreng.) C. Mohr.</td>
<td>MEXICO: Jalisco: Ocotelán, <em>KC 9036.</em></td>
</tr>
<tr>
<td><strong>Guardiola platyphylla A. Gray</strong></td>
<td>UNITED STATES: Arizona: COCHISE Co.: ca. 10.5 mi. W. of Coronado Natl. Mem. headqtrs., <em>KM 8558.</em></td>
</tr>
<tr>
<td>Helianthus laciniatus A. Gray</td>
<td>MEXICO: Durango: 2 mi. NW. of Bermejillo, <em>S 940.</em></td>
</tr>
<tr>
<td>Heterosperma pinnatum Cav.</td>
<td>MEXICO: Sinaloa: 3.8 mi. SW. of Santa Lucia, <em>KC 8833.</em></td>
</tr>
</tbody>
</table>

**Melampodium appendiculatum**  MEXICO: Sonora: 0.3 mi. N of Arroyo Cuchujauki on Álamos-Guirocoba rd., KC 8672A; 4.7 mi. E of Arroyo Cuchujauki on Álamos-Milpillas rd., KC 8706A.

Robins.

Melampodium cupulatum A. Gray  MEXICO: Sinaloa: 27.3 mi. S of Sinaloa-Sonora boundary on Rte. 15, KC 8742A.

Melampodium divaricatum (Rich. in Pers.) DC.  MEXICO: Sinaloa: 7.7 mi. SE of Esquinapa, KC 8350.

Melampodium perfoliatum (Cav.) H.B.K.  MEXICO: Jalisco: Ocotlán, KC 9034.

Mellanthea aspera (Jacq.) Small  GUATEMALA: Suchitepequez: 4.5 km. E of puente Madre Vieja, K 9436A.

var. aspera


**Otopappus imbricatus** (Sch.-Bip.) S. F. Blake  MEXICO: Guerrero: 2.6 mi. S of Taxco, KC 9112. 16 (Fig. 10)

Parthenium confertum A. Gray  UNITED STATES: Texas: Presidio Co.: 10 mi. S of Shafter, KM 7764.

var. lyratum (A. Gray) Rollins

†Parthenium incanum H.B.K.

Philactis nelsonii (Greenm.) S. F. Blake  MEXICO: Chiapas: 11 mi. N of Arriaga, S 630. 28

Sanvitalia procumbens Lam.  MEXICO: México: 1.1 mi. N of Ixtapán de la Sal, KC 9093A.
**Sclerocarpus spatulatus** Rose
**Sclerocarpus sessilifolius** Greenm.

**Sigesbeckia agrestis** Poepp. & Endl.
**Sigesbeckia jorullensis** H.B.K.

**Spilanthes**
**Simsia eurylepis**
**Simsia phaneractis**

**Sigesbeckia jorullensis**
**Spilanthes**

**Tragoceros americus** (Mill.)
**Tridax coronopifolia** (Kunth) Hems.

**MEXICO:** Sonora: 2.4 mi. S. of Alamos, KC 8671A.
**MEXICO:** Sonora: 2.4 mi. S. of Alamos, KC 8671A.
**MEXICO:** Nayarit: ca. 18 mi. SE. of Tepic, KC 8963-1.
**MEXICO:** Durango: 9.7 mi. SW. of La Ciudad, KC 8902.
**MEXICO:** Durango: 9.7 mi. SW. of La Ciudad, KC 8902.
**MEXICO:** Veracruz: 10.8 mi. SW. of Panuco, KC 9231.
**MEXICO:** Veracruz: 10.8 mi. SW. of Panuco, KC 9231.

**Spilanthes ocyntifolia** (Lam.)
**Spilanthes pantheractis** (Greenm.)

**Tithonia calva** Sch.-Bip.
**Tragoceros americus** (Mill.)

**MEXICO:** Sonora: 2.4 mi. S. of Alamos, KC 8671A.
**MEXICO:** Nayarit: ca. 18 mi. SE. of Tepic, KC 8963-1.
**MEXICO:** Durango: 9.7 mi. SW. of La Ciudad, KC 8902.
**MEXICO:** Durango: 9.7 mi. SW. of La Ciudad, KC 8902.
**MEXICO:** Veracruz: 10.8 mi. SW. of Panuco, KC 9231.
**MEXICO:** Veracruz: 10.8 mi. SW. of Panuco, KC 9231.

**GUATEMALA:** Alta Verapaz: 4 mi. NE. of San Pedro Carchá, S 595.
**MEXICO:** México: 2 mi. E. of Cuajimalpa, S 672, 673.
**MEXICO:** Durango: 9.7 mi. SW. of La Ciudad, KC 8902.
**MEXICO:** Durango: 9.7 mi. SW. of La Ciudad, KC 8902.
**MEXICO:** Veracruz: 5 mi. N. of Jalapa, KC 9188.
**MEXICO:** Veracruz: 5 mi. N. of Jalapa, KC 9188.

**GUATEMALA:** Guatemala: 6.8 km. NE. of Amatitla, K 9429A.
**MEXICO:** Jalisco: Ocotlán, KC 9035.
**MEXICO:** Sinaloa: 6.8 mi. NE. of Santa Lucía, KC 8845.
**MEXICO:** Jalisco: 2 mi. NW. of Tequila, S 739.

**GUATEMALA:** Guatemala: 6.8 km. NE. of Amatitla, K 9429A.
**MEXICO:** Jalisco: Ocotlán, KC 9035.
**MEXICO:** Sinaloa: 6.8 mi. NE. of Santa Lucía, KC 8845.
**MEXICO:** Jalisco: 2 mi. NW. of Tequila, S 739.

**GUATEMALA:** Guatemala: 6.8 km. NE. of Amatitla, K 9429A.
**MEXICO:** Jalisco: Ocotlán, KC 9035.
**MEXICO:** Sinaloa: 6.8 mi. NE. of Santa Lucía, KC 8845.
**MEXICO:** Jalisco: 2 mi. NW. of Tequila, S 739.

**GUATEMALA:** Guatemala: 6.8 km. NE. of Amatitla, K 9429A.
**MEXICO:** Jalisco: Ocotlán, KC 9035.
**MEXICO:** Sinaloa: 6.8 mi. NE. of Santa Lucía, KC 8845.
**MEXICO:** Jalisco: 2 mi. NW. of Tequila, S 739.

**GUATEMALA:** Guatemala: 6.8 km. NE. of Amatitla, K 9429A.
**MEXICO:** Jalisco: Ocotlán, KC 9035.
**MEXICO:** Sinaloa: 6.8 mi. NE. of Santa Lucía, KC 8845.
**MEXICO:** Jalisco: 2 mi. NW. of Tequila, S 739.
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<th>Plant Name</th>
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<tr>
<td><strong>Tridax</strong></td>
<td>MEXICO: Jalisco: 6.1 mi. E. of Jalisco-Nayarit boundary on Rte. 15, KC 8992.</td>
<td>9</td>
</tr>
<tr>
<td>mexicana A. M. Powell</td>
<td></td>
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<tr>
<td><strong>Tridax</strong></td>
<td>MEXICO: Sinaloa: 44 mi. SE. of Culiacán, KC 8804.</td>
<td>18</td>
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<tr>
<td>procumbens L.e</td>
<td></td>
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</tr>
<tr>
<td><strong>Tridax tenuifolia</strong> Rose var. microcephala Rose</td>
<td>MEXICO: Sinaloa: ca. 40 mi. NW. of Mazatlán, KC 8808.</td>
<td>9 (Fig. 18)</td>
</tr>
<tr>
<td><strong>Zaluzania grayana</strong> Robins. &amp; Greenm.</td>
<td>MEXICO: Coahuila: 5 mi. W. of Saltillo, S 927. ca. 34</td>
<td></td>
</tr>
<tr>
<td><strong>Zinnia angustifolia</strong> H.B.K.</td>
<td>MEXICO: Chihuahua: 36 mi. E. of Cd. Guerrero, KM 8379A. 17 (Fig. 19)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MEXICO: Nayarit: ca. 18 mi. SE. of Tepic, KC 8966.</td>
<td>11</td>
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</table>

**HELENIEAE**

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<tr>
<th>Plant Name</th>
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<tbody>
<tr>
<td><strong>Bahia absinthifolia</strong> Benth. var. dealbata (A. Gray) A. Gray</td>
<td>MEXICO: Coahuila: 0.2 mi. E. of El Numbre, KM 7963 (ca. 24); 8.9 mi. N. of Rancho Acatita, KM 8073A.</td>
<td>24</td>
</tr>
<tr>
<td><strong>Dyssodia aurea</strong> (A. Gray) Nels. var. polychaeta (A. Gray) M. C. Johnst.</td>
<td>UNITED STATES: Texas: Brewster Co.: Big Bend Natl. Pk., 8.7 mi. N. of headqtrs., KM 7821A.</td>
<td>8</td>
</tr>
<tr>
<td><strong>Dyssodia papposa</strong> (Vent.) Hitchc.</td>
<td></td>
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</tr>
<tr>
<td><strong>Dyssodia pentachaeta</strong> (DC.) Robins. subsp. pentachaeta var. belenidium (DC.) Strother</td>
<td>MEXICO: Puebla: 8 mi. E. of Puebla, KC 9172.</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>MEXICO: Coahuila: 2.1 mi. N. of Rancho Acatita, KM 8066.</td>
<td>16</td>
</tr>
<tr>
<td>Plant Name</td>
<td>Location</td>
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</tr>
<tr>
<td>Gaillardia pachellla Foug.</td>
<td>UNITED STATES: New Mexico: GRANT CO.: 0.3 mi. S. of jctn. Rtes. US 180 &amp; NM 61, KM 8460A.</td>
<td></td>
</tr>
<tr>
<td>Gaillardia pinnatifida Torr.</td>
<td>UNITED STATES: New Mexico: HIDALGO CO.: 14 mi. NE. of Lordsburg, KM 8491A.</td>
<td></td>
</tr>
<tr>
<td>Gaillardia pinnatifida Torr. var.</td>
<td>MEXICO: Chihuahua: 2 mi. S. of Cuauhtémoc, S 1051.</td>
<td></td>
</tr>
<tr>
<td>linearis (Rydb.) Ridd.</td>
<td>GUATEMALA: Jutiapa: 7.3 mi. W. of jctn. Rtes. 3 &amp; CA-1, K 9410. MEXICO: Nayarit: ca. 8 mi. SE. of Tepic, KC 8954-1.</td>
<td></td>
</tr>
<tr>
<td>Galeana pratensis (H.B.K.) Rydb.</td>
<td>UNITED STATES: New Mexico: HIDALGO CO.: 14 mi. NE. of Lordsburg, KM 8492A.</td>
<td></td>
</tr>
<tr>
<td>Hymenoxys richardsonii (Hook.)</td>
<td>MEXICO: Coahuila: La Rosa, KM 7922.</td>
<td></td>
</tr>
<tr>
<td>Cockerell var. floribunda (A. Gray) K. F. Parker</td>
<td>MEXICO: Coahuila: La Rosa, KM 7922.</td>
<td></td>
</tr>
<tr>
<td>Nicollelia edwardsii A. Gray</td>
<td>MEXICO: Veracruz: 4 mi. NE. of Nautla, KC 9207.</td>
<td></td>
</tr>
<tr>
<td>var. robusta (Rydb.) Cory</td>
<td>MEXICO: Coahuila: 0.8 mi. W. of San Raphael, KM 7966.</td>
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</tr>
<tr>
<td>Peectis papposa Harv. &amp; A. Gray</td>
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<tr>
<td>var. grandis Keil</td>
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<td></td>
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<tr>
<td>Porophyllum coloratum (H.B.K.) DC.</td>
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</tr>
</tbody>
</table>
Porophyllum punctatum (Mill.) S. F. Blake

Porophyllum ruderale (Jacq.) Cass., subsp. macrocephalum (DC.) R. R. Johnson

Schkuhria cf. anthemoeidea (DC.) Coult.

*Schkuhria pinnata (Lam.) Cabrera var. guatemalensis (Rydb.) McVaugh

Tagetes filifolia Lag.

Tagetes lucida Cav.

Tagetes micrantha Cav.

Tagetes subulata Cerv.

ANTHEMIDEAE

Artemisia ludoviciana Nutt. subsp. mexicana (Willd.) Keck

SENECIONEAE

Odontotrichum sinuatum (Cerv.) Rydb.

Schistocarphe oppositifolia (Kuntze) Rydb.

MEXICO: Veracruz: 4 mi. NE. of Nautla, KC 9203.


MEXICO: Jalisco: 2.1 mi. NW. of Magdalena airport, KC 8998.

GUATEMALA: Santa Rosa: 3.5 km. NW. of Culiacapa, K 9402A. MEXICO: Nayarit: ca. 8 mi. SE. of Tepic, KC 8956-1.

MEXICO: Sinaloa: 3.8 mi. SW. of Santa Lucia, KC 8834A.

MEXICO: Nayarit: ca. 18 mi. SE. of Tepic, KC 8968-1.

MEXICO: Chihuahua: 2 mi. S. of Cd. Guerrero, KM 8320A.


MEXICO: Durango: 14 mi. SW. of La Ciudad, KC 8941.

MEXICO: Jalisco: 1.2 mi. NW. of Magdalena airport, KC 9011.

MEXICO: Veracruz: 11.8 mi. W. of Tuxpán, KC 9222.

**Senecio hartwegii** Benth.  
MEXICO: **Durango**: 8.3 mi. SW. of La Ciudad,  
*KC* 8906.  
ca. 30

**Senecio runcinatus** Less.  
MEXICO: **Veracruz**: ca. 6 mi. E. of Las Vigas, *KC* 9192.  
22 (Fig. 21)

**MUTISIEAE**  
*Trixis californica* Kellogg  
UNITED STATES: **Texas**: BREWSTER CO.: 12.5 mi.  
N. of Castolón, *KM* 7814.  
27

**CICHORIEAE**  
†*Pinaropappus roseus* Less.  
2011 & 11(Fig. 22)

*Unless indicated otherwise, the reported meiotic chromosome numbers represent bivalents.*

*KC = Keil & Canne; *KM = Keil & McGill; *K = Keil; *S = Stuessy.*


*First report for variety, **species, ***genus.*

†New reported number for taxon.
LITERATURE CITED


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