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CHROMOSOME NUMBERS IN THE COMPOSITAE. VI. ADDITIONAL MEXICAN AND GUATEMALAN SPECIES.

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The present contribution is essentially a continuation of several papers, the latest of which (Turner *et al.*, 1961a)

dealt with chromosome counts from species of southern Mexico and Guatemala.

Chromosome counts were made from pollen-mother-cell squashes as outlined by Turner and Johnston (1961). Voucher specimens (table 1) are deposited at the University of Texas Herbarium; these were collected during the year 1961. The tribal and subtribal arrangements listed in table 1 follow those of Hoffmann (1894).

While most of the identifications are our own we would like to acknowledge the kind assistance of Dr. Kittie Parker and Dr. Arthur Cronquist for the identification of certain difficult taxa.

EUPATORIEAE — *Eupatorium* ($x = 10, 17$). Chromosome counts for the 7 species listed in table 1 are consistent with the basic numbers obtained for the approximately 40 other species examined (Turner *et al.*, 1961b). *E. pycnocephalum* ($n = 10, 20$), a widespread, highly variable species, apparently consists of diploid and tetraploid races, some of these being in close proximity to each other (cf. *King 4242* and *4243A*, table 1).

Piqueria ($x = 12, 11$). The 2 species listed in table 1 are diploid with $n = 12$; Turner and Johnston (1961) have reported one other species, *P. laxiflora*, to be diploid with $n = 11$.

Mikania cf. *gonzalezii* ($n = 17$) is the second species of the genus to be counted. Other workers have reported the widespread species, *M. scandens*, to be diploid with $2n = 38$ (Darlington and Wylie, 1956) or $2n = 36$ (Mangenot and Mangenot, 1958).

Chromosome counts for the species of *Ageratum* ($n = 10, 20$), *Brickellia* ($n = 9$) and *Oxylobus* ($n = 16$) are consistent with the basic numbers obtained for these genera by other workers (Turner *et al.*, 1961a; Gaiser, 1953; Beaman *et al.*, 1962). The chromosome count for *Trichocoronis wrightii* ($n = 15$) is a first report for the genus.

ASTEREAE — *Aster bimater* ($n = 5$) is related to *A. lima* Lindl.; it apparently belongs to the Section Aster (subsection Homophylli) as treated by Gray (1886). Chromosome

[1]This study was supported by National Science Foundation Grant 9025.

numbers on a base of $x = 5$ occur in the sections Oxytripolum (annuals and biennials) and Aster (perennials) of the genus *Aster*. In the former section only counts of $n = 5$ or 10 are known while the latter has species with both $n = 5$ and $n = 9$. *A. exilis* var. *australis* ($n = 5$) belongs to the section Oxytripolum; several additional counts of the species (all $n = 5$) were reported by Turner *et al.* (1961b; cited as *A. subulatus* Michx.).

Erigeron ($x = 9$) — The chromosome numbers of the several species listed in table 1 are consistent with the basic number obtained for numerous other taxa (Montgomery and Yang, 1960). *E. scaposus* with $n = 9$II, 18II, and 27 (9II and 9I) is a widespread, variable species, apparently consisting of diploid, tetraploid and triploid races.

Psilactis ($x = 4$, 9, 8?). Chromosome counts for the 2 species listed in table 1 are particularly interesting in that they parallel the multibasic condition found in *Aster* (Turner *et al.*, 1961b). Meiotic figures of *P. brevilingulata* with $n = 9$ appeared to be unequivocal for at least one collection *(King 2939)* but for the other collections listed the counts might have been 8II and 2 fragments as indicated for the Powell and Edmondson collection (the 2 "fragments" taking less stain than the well defined bivalents, but occurring together at meiosis as if they were pairing). As in *Chrysopsis* ($x = 5$, 4 and 9) and in *Aster* ($x = 5$ and 8, 9) the species of *Psilactis* with the lower basic number has relatively large chromosomes. *Psilactis* is composed of only 4 or 5 species, these restricted to the southwestern United States and Mexico. It is a closely knit group of doubtful affinity; Gray in his original description of the genus placed it "between Dieteria [= *Machaeranthera*] and Aster, except from the want of pappus in the ray. . . ." Superficially, at least in habit, the species centering about *P. brevilingulata* and *P. asteroides* appear closest to the genus *Aster*, section Aster or Oxytripolium, both of which, as indicated above, have species with $n = 5$. However, an inclusive morphological study of *Psilactis* (Turner & Horne, unpublished) shows the relationship of *Psilactis* to be closer to *Machaeranthera*, particularly through *P. coulteri* which is a

good match for *Machaeranthera parviflora* Gray, as indicated by Gray in his original description of this latter species.

Chromosome numbers for the species of *Haplopappus, Heterotheca, Machaeranthera, Solidago* and *Xanthocephalum* (table 1) are consistent with the basic numbers previously reported for these genera (Turner, 1961b; Darlington and Wylie, 1956; Solbrig, 1961).

INULEAE — Chromosome counts for the species of *Gnaphalium* ($n = 7, 14$) and *Pluchea* ($n = 10$) are consistent with the basic numbers reported for these genera by previous workers.

HELIANTHEAE — Melampodinae — *Polymnia* ($n=16, 17$). Mr. J. E. Wells of Ohio State University is currently studying the genus and has found yet other species with $n = 15$ (personal communication). Chromosome counts for *Berlandiera* ($n = 15$), *Parthenium* ($n = 18$) and *Dugesia* ($n = 18$) are consistent with counts reported for these genera by previous workers (Turner and Johnston, 1956; Turner *et al.*, 1961a).

ZINNINAE — *Heliopsis buphthalmoides* ($n = 28$). A collection of this species from Oaxaca, Mexico was reported to be diploid with $n = 14$ by Turner *et al.* (1961b). Fisher (1957) reported counts for 6 other taxa of the genus; all were diploid with $n = 14$. *Philactis* is a genus with perhaps 2 or 3 species. *P. nelsonii* ($n = 28$) is probably a tetraploid on a base of $x = 14$ since the genus is closely related to *Heliopsis*.

Zinnia maritima ($n = 13$). Previous published counts for species of *Zinnia* have been $n = 10, 11, 12, 19$, and 21 (Torres, 1961). The meiotic figures for *Z. maritima* were particularly clear (Fig. 11). A collection of *Z. angustifolia* from San Luis Potosi was reported as diploid with $n = 11$ by Turner *et al.* (1961b); the Nayarit collection of this species (table 1) was found to be diploid with $n = 12$, agreeing with counts obtained for the species by Torres (personal communication). *Zinnia* is obviously a multibasic taxon with $x = 10, 11, 12, 13, 19$ and 21. (The latter two counts are probably derived through amphiploidy or else through

aneuploid loss and gain respectively from a tetraploid on a base of $x = 10$.)

Sanvitalia ($x = 8$). A number of chromosome counts have been reported for this genus; all have been diploid or tetraploid on a base of $x = 8$ (Turner *et al.*, 1961a; 1961b).

The subtribe Zinninae, as treated by Hoffmann (1894), includes only 6 genera: *Philactis* (including *Grypocarpha;* Blake, 1930), *Heliopsis, Aganippea, Tragoceros, Sanvitalia* and *Zinnia.* Five of the 6 genera have been counted and basic chromosome numbers of $x = 8$, 10, 11, 12, 13 and 14 have been established (excluding the chromosome counts of a presumed polyploid origin). At least two obvious hypotheses may be tentatively proposed to account for this sequence of numbers: (1) That the genera have been derived through progressive aneuploid gain from an ancestral base of $x = 8$ or else the reverse has occurred from an ancestral base of $x = 14$. In either case one would have to assume that, contrary to the situation in many other composite genera, the hypothetical taxa on a base of $x = 9$ were lost from the sequence. Another hypothesis may be proposed which avoids this difficulty, this being that $x = 4$ is the ancestral basic number of the subtribe, the numbers $n = 8$, $n = 12$ being tetraploid and hexaploid respectively, chromosome numbers of $n = 11$, 10 and 13, 14 being derived through both aneuploid gain and loss.[3]

VERBESININAE — *Aldama dentata* Less. (Not *Aldama dentata* Llave & Lex.) This species has been treated as belonging to the genus *Sclerocarpus* by several workers where it is called *S. schiedianus* because of the earlier name, (*S. dentata* (Llave & Lex.) B. & H. ex Hemsl.). Morphologically *Aldama dentata* Less. is quite different from *Sclerocarpus* proper, lacking the conspicuous clawed rays of the latter genus and possessing in addition rather distinct achenes and involucral bracts. As indicated in table 1,

[3]Any number of alternate numerical hypotheses could be proposed, one of the most provocative being that suggested by Satô (1960). He postulates that the ancestral chromosome number ("protokaryotype") for the plant kingdom might be $x = 2$, presumably the major phyletic lines becoming established on this base. Obviously with such a low basic number one could assume, on numerical grounds at least, that *all* higher numbers are polyploids from such a base, the odd numbers simply being aneuploid derivatives.

Aldama dentata Less. has a chromosome number of $n = 17$, while true *Sclerocarpus* has chromosome numbers of $n = 11$, 12 and 14 (table 1). *Aldama dentata* Less. appears to be closest to species of the genus *Rhysolepis* (the generic name *Aldama*, being based on *Aldama dentata* Llave & Lex., is synonymous with *Sclerocarpus*). It differs from *Rhysolepis* in being a smaller plant with less pronounced and fewer involucral bracts and smaller flowers, but they are very much alike in floral morphology. While the species of *Rhysolepis* (only 2 have been described) have not been examined for chromosome numbers, what appears to be an undescribed species *(King 3645)* has a number of $n = 17$.

In any case, some disposition of *Aldama dentata* Less. (= *Sclerocarpus schiedianus*) should be made other than its inclusion in *Sclerocarpus;* in our opinion, this is suggested by both the morphological and chromosomal evidence.

Sclerocarpus ($x = 11$, 12, 14). This genus is in much need of critical revision (Mr. Feddema of the University of Michigan is currently undertaking such a study). The species are quite variable, both morphologically and chromosomally. Turner (1960a) previously reported the chromosome number of *S. uniserialis* ($n = 12$); this species is apparently closely related to *S. dentatus* which, as indicated in table 2, has populations and/or individuals with chromosome numbers of both $n = 11$ and 12.

Spilanthes ($x = 13$). Chromosome counts of the several collections listed in table 1 indicate that *S. americana* ($n = 13$, 26, 39) consists of diploid, tetraploid and hexaploid races and/or taxa. One other species, *S. decumbens*, has been reported as diploid with $n = 13$ (Darlington and Wylie, 1956).

Viguiera ($x = 8$, 17, 18). Heiser and Smith (1955) and Heiser (1960) reported counts of $n = 18$, 17 and 8 for species of this genus. Turner (1960) and Turner *et al.* (1961) reported several counts of *V. dentata* as $n = 17$. *V. longifolia* ($n = 8$), table 1, is closely related to *V. multiflora* which Heiser and Smith reported as $n = 8$. In our opinion the lower number is probably a relictual feature, perhaps being the same as or close to the ancestral diploid number

of the phylad which gave rise to *Viguiera* and related genera. It will be interesting to see if this chromosomal hiatus holds as additional species are examined. Blake (1918) recognized 143 species for the genus but to date only 7 species have been counted.

Wedelia ($x = 11, 12$). The only previous chromosome report for this genus has been that of Turner and Irwin (1960) for the South American *W. brasiliensis* (Spreng.) Blake ($n = 29 \pm 1$). The genus, as presently circumscribed, is multibasic and apparently includes polyploids.

Zexmenia ($x = 10, 11, 14$). Heiser and Smith (1955) have reported one other species, *Z. frutescens* (Mill.) Blake, to be diploid with $n = 11$. With only 5 of the approximately 30 species reported to date (table 1), it appears likely that additional basic numbers will be added to this multibasic series.

Chromosome counts for *Helianthus* ($x = 17$), *Perymenium* ($x = 15$), *Tithonia* ($x = 17$) and *Verbesina* ($x = 16, 17, 18$) are consistent with the basic numbers reported for these genera by other workers (Darlington and Wylie, 1956; Turner *et al.*, 1961a; 1961b).

The chromosome counts for species of *Hymenostephium* ($n = 17$), *Iostephane* ($n = 17$), *Notoptera* ($n = 15$), *Podochaenium* ($n = 17$), and *Salmea* ($n = 18$) are first reports for these genera. Beaman and Turner (unpublished) have obtained chromosome numbers of $n = 9$ for other species of *Jaegeria*, thus the two species with $n = 18$ (table 1) are tetraploids.

COREOPSIDINAE — *Coreopsis mutica* ($n =$ ca. 24, 26). This species is a shrub up to 3 meters high; while the counts are only approximate they do indicate the species to be tetraploid since most taxa in the genus are on a base of $x = 12, 13, 14$ (Turner, 1960b). Chromosome counts for the species of *Dahlia* ($n = 18$) and *Cosmos* ($n = 12$) are consistent with the basic numbers established by other workers (Darlington and Wylie, 1956).

GALINSOGINAE — *Calea integrifolia* ($n =$ ca. 16) — Turner *et al.* (1961b) reported a chromosome count of $n =$ ca. 17 for this species. No certain count could be made from the

present collection, but the meiotic figures appeared to be $n = 15$ or 16, the latter count being obtained more frequently. The chromosome count for *C. trichotoma* ($n = 18$) is the first unequivocal count for the genus.

Sabazia sp. nov. ($n = 18$) — Turner and Johnston (1961) have reported the only other species count, *S. humilis* ($n = 4$).

Galinsoga parviflora ($n = 8$, 16). This species has heretofore been reported as diploid with $n = 8$ (Haskell and Marks, 1952); the 6 collections from southern Mexico and Guatemala listed in table 1 were tetraploid, while the 2 collections from Central Mexico were diploid. Haskell and Marks recognized 2 species in the *G. parviflora* complex in the British Isles (both introduced): *G. ciliata* (Raf.) Blake ($n = 16$) and *G. parviflora* ($n = 8$). Fernald (1950) recognized 4 species as belonging to the complex in the northeastern United States maintaining both *G. parviflora* and *G. ciliata*. Most authors have distinguished between the latter 2 taxa by a combination of technical features such as stem pubescence, absence or presence of a pappus on the ray florets, etc. (Fernald, 1950; Clapham *et al.*; etc.). The several characters used to distinguish these 2 taxa are, in our opinion, slight and while they might hold for the introduced populations in Britain, they do not hold singly or in combination for the Mexican material (nor apparently for the material from temperate North and South America, although there is a tendency for more glabrate forms in temperate latitudes; specific recognition of such races hardly seems warranted in view of the widespread, weedy nature of the taxon).

HELENIEAE — *Schkuhria anthemoides* ($n = 20$). Chromosome counts for 2 South American species, *S. pinnata* ($n = 10$) and *S. multiflora* ($n = 11$), have been reported by other workers (Darlington and Wylie, 1956). As indicated in table 1, the North American populations of *S. pinnata* are apparently tetraploid.

Perityle microglossa ($n =$ ca. 46 ± 4). The chromosome number of a Texas collection of this species was reported as $n = 36$ by Turner and Ellison (1960).

Galeana pratensis ($n = 9$). This is the first chromosome count reported for the genus.

SENECIONEAE — *S. imparipinnatus* ($n = 23$). Chromosome counts for most species of the genus *Senecio* have been on a base of $x = 5$; however at least 2 other species are known with counts of $n = 23$ (Turner *et al.*, 1961b).

Neurolaena lobata ($n = 11$). Counts for this genus have not been reported previously.

MUTISIEAE — *Trixis radialis* ($n = 27$). Only 11 of the approximately 66 genera in the tribe Mutisieae have been counted. Including *Trixis*, 4 of the 11 are unibasic with $x = 27$; the unusually high basic number is apparently polyploid in origin, presumably from an ancestral base of $x = 9$ (the haploid number, $n = 9$, is not known in those members of the tribe studied to date, but the Australian genus *Trichocline* has been reported as $n = 18$).

SUMMARY

Chromosome counts for species of *Piqueria* ($n = 12$), Mexican and Guatemalan Compositae representing 133 taxa (131 species and 2 varieties) distributed in 66 genera. Counts of approximately *100* of the species are reported for the first time including the following genera: *Calea*, $x = 18$; *Galeana*, $x = 9$; *Hymenostephium*, $x = 17$; *Iostephane*, $x = 17$; *Jaegeria*, $x = 9$; *Neurolaena*, $x = 11$; *Notoptera*, $x = 15$; *Philactis*, $x = 28$; *Podochaenium*, $x = 19$; *Psilactis*, $x = 4, 9, (8?)$; *Rhysolepis*, $x = 17$; *Salmea*, $x = 18$; *Tragoceros*, $x = 11$; *Trichocoronis*, $x = 15$; *Trixis*, $x = 27$; and *Wedelia*, $x = 11, 12$.

Chromosome counts for species of *Piqueria* ($n = 12$), *Mikania* ($n = 17$), *Polymnia* ($n = 17$), *Zinnia* ($n = 13$), *Sclerocarpus* ($n = 11, 14$), *Wedelia* ($n = 11, 12$) and *Zexmenia* ($n = 10, 14$) differ from the reported basic numbers as determined from other species in these genera. When appropriate the chromosomal information has been related to systematic problems. BOTANY DEPARTMENT AND THE PLANT RESEARCH INSTITUTE, UNIVERSITY OF TEXAS, AUSTIN.

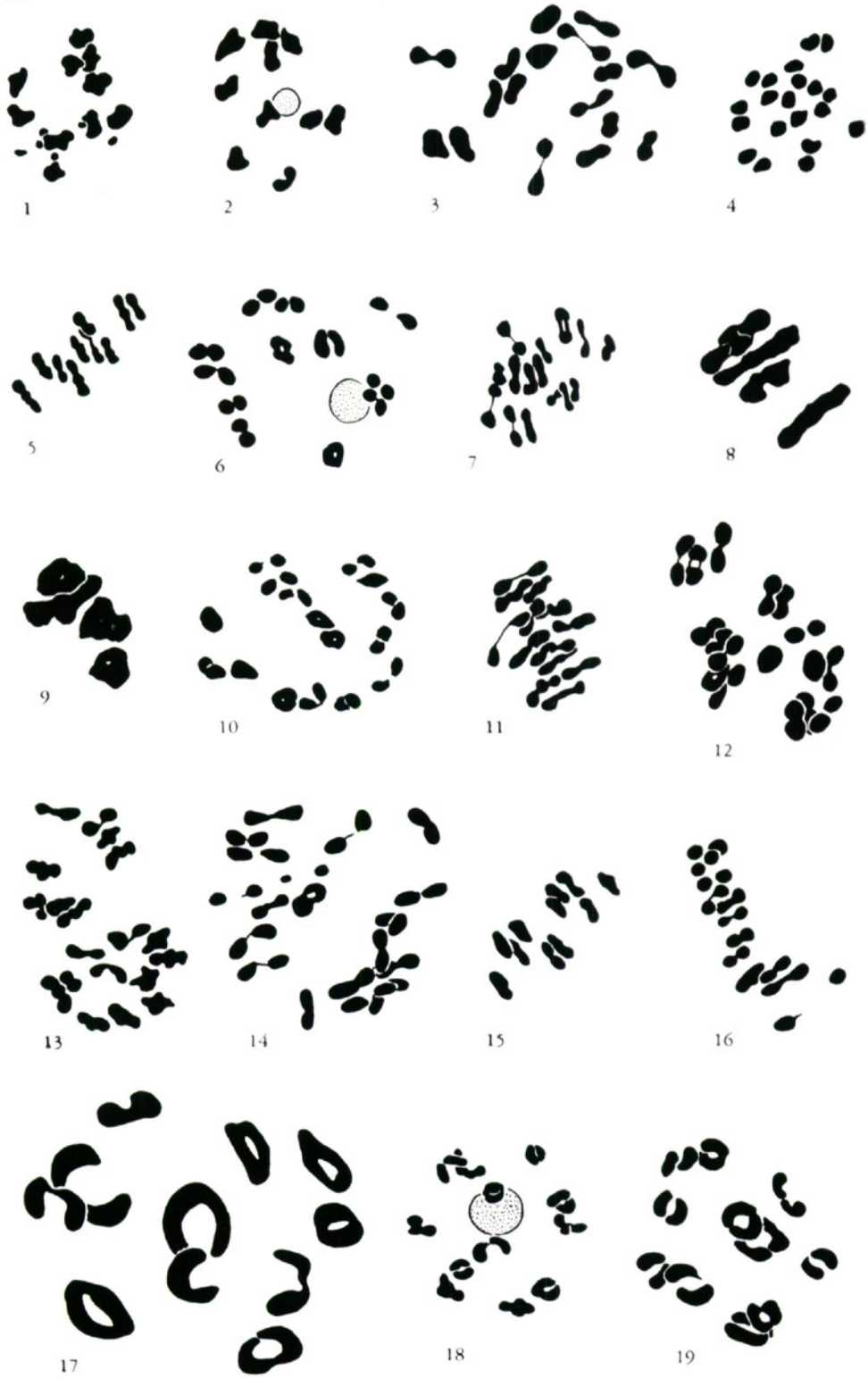
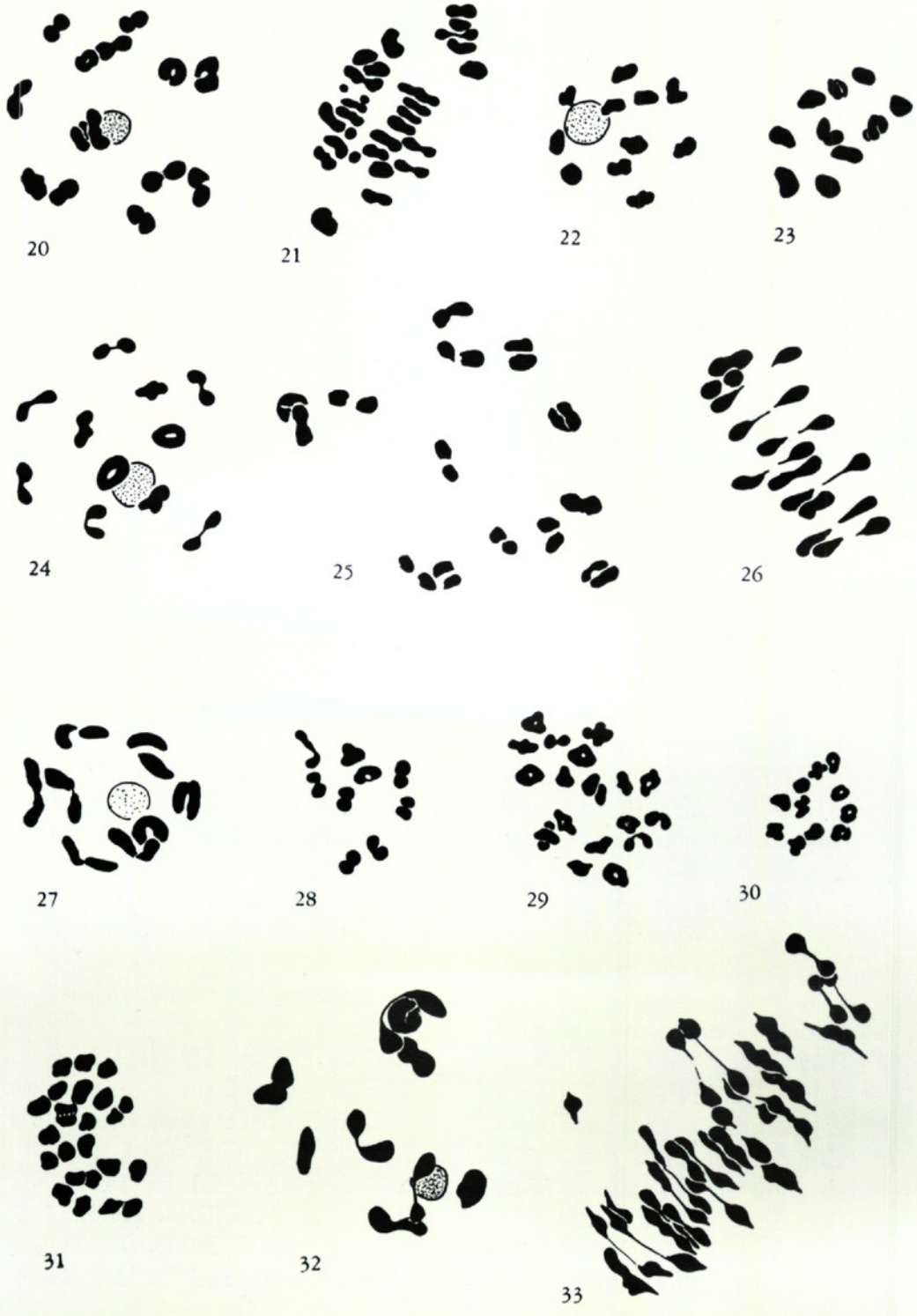


Fig. 1-33. Meiotic chromosomes of species of Compositae. — Fig. 1. *Ageratum corymbosum* ($n = 10 + 6$ fragments) — Fig. 2. *Eupatorium morifolium* ($n = 10$) — Fig. 3. *Eupatorium petiolare* ($n = 17$) — Fig. 4. *Eupatorium pycnocephalum* ($n = 20$) — Fig. 5. *Eupatorium pycnocephalum* ($n = 10$) — Fig. 6. *Piqueria pilosa* ($n = 12$) — Fig. 7. *Trichocoronis wrightii* ($n = 15$) — Fig. 8. *Machaeranthera gymnocephala* ($n = 4$) — Fig. 9. *Psilactis* cf. *asteroides* ($n = 4$) — Fig. 10. *Polymnia* cf. *apus* ($n = 16$) — Fig. 11. *Zinnia maritima* ($n = 13$) — Fig. 12. *Iostephane heterophylla* ($n = 17$) — Fig. 13. *Podochaenium eminens* ($n = 19$) — Fig. 14. *Salmea scandens* ($n = 18 + 2$



fragments) — Fig. 15. *Sclerocarpus dentatus* ($n = 11$) — Fig. 16. *Sclerocarpus dentatus* ($n = 12$) — Fig. 17. *Sclerocarpus* cf. *divaricatus* ($n = 11$) — Fig. 18. *Sclerocarpus* cf. *frutescens* ($n = 12$) — Fig. 19. *Sclerocarpus* cf. *phyllocephalus* ($n = 11$) — Fig. 20. *Sclerocarpus sessilifolius* ($n = 14$) — Fig. 21. *Spilanthes americana* ($n = 26 + 4$ fragments) — Fig. 22. *Wedelia filipes* ($n = 11$) — Fig. 23. *Zexmenia* cf. *aurea* ($n = 10$) — Fig. 24. *Zexmenia costaricensis* ($n = 11$) — Fig. 25. *Zexmenia pringlei* ($n = 14$) — Fig. 26. *Zexmenia virgulata* ($n = 11$) — Fig. 27. *Sabazia* sp. nov ($n = 8$) — Fig. 28. *Galeana pratensis* ($n = 9$) — Fig. 29. *Schkuhria anthemoides* ($n = 20$) — Fig. 30. *Neurolaena lobata* ($n = 11$) — Fig. 31. *Senecio imparipinnatus* ($n =$ ca. 23) — Fig. 32. *Arctotis stoechadifolia* ($n = 9$) — Fig. 33. *Trixis radialis* ($n = 27$). x ca. 2000.

TABLE 1. SPECIES OF COMPOSITAE EXAMINED FOR CHROMOSOME NUMBER

VERNONIEAE

Vernonia karwinskiana Hort.
$n = 17 \pm 1$ HIDALGO: 9 m. ne. of Jacala. *King 4216.*

EUPATORIEAE

Ageratum corymbosum Zucc.
$n = 10$ CHIAPAS: 23 m. se of Comitán. *King 3045.*
$n = 10^a$ (Fig. 1) PUEBLA: 4 m. w. of Izúcar de Matamoros. *King 2923.*
$n = 10^a$ OAXACA: 14 m. ne. of Huajuapan de Leon. *King 3544.*

Ageratum houstonianum Mill.
$n = 10$ GUATEMALA: 4 miles south of Coban. *King 3311.*
$n = 10$ MORELOS: 11 miles south of Cuernavaca. *King 4160.*

Ageratum latifolium Cav.
$n = 10$ HIDALGO: 12 m. sw. of the Hidalgo-San Luis Potosi state border along route 85. *King 4226.*
$n = 10$ PUEBLA: 6 m. sw. of the Puebla-Veracruz state border along route 130. *King 4140.*

Ageratum paleaceum (Gay) Hemsl. var. *nelsonii* Rob.
$n = 10^a$ CHIAPAS: 7 m. e. of the Chiapas-Oaxaca border along route 190. *King 2751.*

Ageratum cf. *paleaceum* (Gay) Hemsl. var. *paleaceum*
$n = 11 \pm 1$ CHIAPAS: 22 m. s. of Las Cruces. *King 3112.*

Ageratum cf. tomentosum (Benth.) Hemsl.
$n = 10$ CHIAPAS: 10 m. e. of the Oaxaca-Chiapas border along route 190. *King 2981.*

Brickellia robinsonii Nels.
$n = 9$ SAN LUIS POTOSI: 2 m. w. of Xilitla. *King 4292.*

Eupatorium cf. *aschenbornianum* Sch.
$n = 20^a$ GUATEMALA: 7 m. w. of Quezaltenango. *King 3182.*

Eupatorium betonicum Hemsl.
$n = 10$ MORELOS: 4 m. w. of Izúcar de Matamoros. *King 2925.*

Eupatorium cf. *gracilicaule* Sch.-Bip.
$n = 10$ CHIAPAS: 24 m. se. of Comitán. *King 3037.*

Eupatorium morifolium P. Miller
$n = 10$ (Fig. 2) SAN LUIS POTOSI: 6 m. ne. of Xilitla. *King 4248.*

Eupatorium petiolare Moc.
$n = 17$ SAN LUIS POTOSI: Near waterfall at El Salto. *King 3919.*
$n = 17$ (Fig. 3) HIDALGO: 5 m. n. of Actopan. *King 4199.*

Eupatorium pycnocephalum Less.
$n = 20$ (Fig. 4) HIDALGO: 12 m. sw. of the Hidalgo-San Luis Potosi state border along route 85. *King 4224.*
$n = 20$ SAN LUIS POTOSI: 6 m. ne. of Xilitla. *King 4242.*
$n = 20$ SAN LUIS POTOSI: near waterfall at El Salto. *King 3875.*
$n = 20$ VERACRUZ: 7 m. s. of Tampico el Alto. *King 4099.*
$n = 20$ VERACRUZ: 10 m. s.

[a] Indicates one to several fragments.

of Cerro Azul. *King 4119.*

$n = 20$ VERACRUZ: 38 m. s. of Acayucan. *King 2452.*

Eupatorium cf. *pycnocephalum* Less.

$n = 10$ (Fig. 5) SAN LUIS POTOSI: 6 m. ne. of Xilitla. *King 4243A.*

Eupatorium quadrangulare DC.

$n = 10$ SAN LUIS POTOSI: near waterfall at El Salto. *King 3853.*

Mikania cf. *gonzalezii* Rob. & Greenm.

$n = 17$ VERACRUZ: 5 m. w. of Tuxpan. *King 4128.*

Oxylobus glanduliferus (Sch.-Bip.) Gray

$n = 16$ GUATEMALA: 4 m. e. of Totonicapan. *King 3216.*

Piqueria pilosa H. B. K.

$n = 12$ MEXICO STATE: 8 m. n. of San Francisco Cheje. *King 3581.*

$n = 12$ (Fig. 6) 9 m. ne. of San Francisco Cheje. *King 3569.*

Piqueria trinervia Cav.

$n = 12$ CHIAPAS: 19 m. e. of San Cristóbal de Las Casas. *King 2821.*

Trichocoronis wrightii Gray

$n = 15$ (Fig. 7) TAMAULIPAS: 2 m. ne. of Altamire. *King 4034.*

ASTEREAE

Aster bimater Standl. & Steyerm.

$n = 5$ GUATEMALA: 6 m. s. of Huehuetenango. *King 3423.*

Aster exilis var. *australis* Gray

$n = 5$ GUATEMALA: 3 m. e. of Quezaltenango. *King 3205.*

$n = 5$ GUATEMALA: 3 m. s. of Huehuetenango. *King 3418.*

$n = 5$ SINALOA: 4 m. w. of El Palmito. *Powell & Edmondson 909.*

Baccharis glutinosa Pers.

$n = 9$ OAXACA: 1 m. n. of Tamazulapan. *King 2935.*

Baccharis serraefolia DC.

$n = 9$ SAN MARCOS: 4 m. e. of San Marcos. *King 3159.*

Chrysopsis cf. *villosa* (Pursh.) Nutt.

$n = 9$ DURANGO: City limits Durango. *King 3725.*

Conyza canadensis L.

$n = 9$ PUEBLA: 20 m. nw. of Tehuacan. *King 2640.*

Conyza coronopifolia H. B. K.

$n = 9$ CHIAPAS: 1 m. e. of San Cristóbal de Las Casas. *King 2838.*

Conyza sophiaefolia H. B. K.

$n = 9$ GUATEMALA: 3 m. e. of Quezaltenango. *King 3206.*

Erigeron delphinifolius Willd.

$n =$ ca. 9 DURANGO: City limits of Durango. *King 3726.*

$n = 9$ DURANGO: 4 km. n. of Durango. *King 3780.*

Erigeron heteromorphus Rob.

$n = 9$ SAN LUIS POTOSI: Waterfall near El Meco. *M. C. Johnston 5116.*

Erigeron cf. *karvinskianus* DC.

$n =$ ca. 27 GUATEMALA: Between Solola and Panajachel. *King 3224.*

Erigeron repens Greenm.

$n = 9$ VERACRUZ: 10 m. s. of Tampico el Alto. *King 4100.*

Erigeron scaposus DC.

$n = 9$ PUEBLA: 0.5 m. sw. of Tehuacan. *King 2311.*

$n = 18$ OAXACA: 6 m. s. of Tamazulapan. *King 2938.*

Erigeron cf. *scaposus* DC.

$n = 18$ MEXICO STATE: 4 m. ne. of San Francisco Cheje. *King 3575.*

Erigeron cf. *scaposus* DC.
$n = 9\,II + 9\,I$ MEXICO STATE: 11 m. e. of the Mexico-Michoacan state border along route 15. *King 3597.*
Erigeron cf. *scaposus* DC.
$n = 9$ OAXACA: 21 m. n. of the junction with route 190. *King 3498.*
Erigeron sp.
$n = 9$ TAMAULIPAS: 9 m. s. of Ciudad Victoria. *King 4537.*
Haplopappus stoloniferus DC.
$n = 4$ CHIAPAS: 5 m. e. of San Cristóbal de Las Casas. *King 2805.*
Heterotheca inuloides Cass. var. *inuloides*
$n = 9$ OAXACA: 40 m. se. of Oaxaca. *King 2897.*
Machaeranthera gymnocephala (DC.) Shinners
$n = 4$ DURANGO: 15 m. sw. of Durango. *King 3738.*
$n = 4$ (Fig. 8) MEXICO STATE: 19 m. w. of Toluca. *King 3594.*
Machaeranthera tanacetifolia (H. B. K.) Nees.
$n = 4$ CHIHUAHUA: 14 m. sw. of Chihuahua City. *Powell & Edmondson 976.*
$n = 4$ DURANGO: 13 m. n. of Durango. *King 3754.*
Psilactis asteroides Gray
$n = 4$ DURANGO: City limits of Durango. *King 3728.*
Psilactis cf. *asteroides* Gray
$n = 4$ (Fig. 9) MEXICO STATE: 22 m. w. of Toluca. *King 3595.*
Psilactis brevilingulata Sch.-Bip.
$n =$ ca. 9 (8 II + 2 frags?) MEXICO STATE: 10 m. w. of Toluca. *Powell & Edmondson 799.*
$n = 9$ OAXACA: 6 m. s. of Tamazulapan. *King 2939.*
$n =$ ca. 9 OAXACA: By the ruins at Monte Alban. *King 2899.*
$n =$ ca. 9 QUERETARO: 18 m. s. of San Luis de la Paz. *Powell & Edmondson 573.*
Solidago velutina DC.
$n = 9$ DURANGO: 71 m. ne. of Durango. *King 3762.*
Solidago wrightii Gray
$n = 9$ DURANGO: 24 m. sw. of Durango. *King 3742.*
Xanthocephalum gymnospermoides (Gray) Benth. & Hook.
$n = 6$ CHIHUAHUA: 0.5 m. w. of Cuahutemoc. *Powell & Edmondson 1000.*
Xanthocephalum humile (H.B.K.) Sch.-Bip.
$n = 4$ MEXICO STATE: 12 m. n. of San Francisco Cheje. *King 3586.*
$n = 4$ MEXICO STATE: 42 km. s. of Mexico City. *King 2903.*
$n = 4$ MORELOS: 15 m. n. of Cuernavaca. *Powell & Edmondson 736.*

INULEAE

Gnaphalium leptophyllum DC.
$n = 7$ MEXICO STATE: 8 m. e. of the Mexico-Michoacan state border along route 15. *King 3598.*
$n = 7$ GUATEMALA: Just west of San Marcos. *King 3131.*
Gnaphalium cf. *leptophyllum* DC.
$n =$ ca. 14 GUATEMALA: 1 m. w. of Quezaltenango. *King 3186.*
Pluchea odorata (L.) Cass.
$n = 10$ HIDALGO: 12 m. sw.

of the Hidalgo-San Luis Potosi state border along route 85. *King 4228.*

Pluchea purpurascens (Sw.) DC.

$n = 10$ NAYARIT: Behind the beach at San Blas. *King 3697.*

HELIANTHEAE

Subtribe Melampodinae

Berlandiera lyrata Benth.

$n = 15$ DURANGO: City limits of Durango. *King 3730.*

Dugesia mexicana Gray

$n = 18$ MEXICO STATE: Mexico City area. *Powell & Edmondson 604.*

$n = 18$ PUEBLA: 14 m. w. of Puebla. *King 3561.*

Parthenium tomentosum DC.

$n = 18$ OAXACA: 23 m. se. of Oaxaca. *King 3482.*

Polymnia cf. *apus* Blake

$n = 16$ (Fig. 10) NAYARIT: 1 m. n. of Tepic. *King 3688.*

Polymnia maculata Cav.

$n = 16$ SAN LUIS POTOSI: 7 m. ne. of Xilitla. *King 4427.*

Polymnia cf. *maculata* Cav.

$n = 17$ GUATEMALA: 1 m. s. of Coban. *King 3306.*

Polymnia oaxacana Sch.-Bip.

$n =$ ca. 16 GUATAMALA: 2 m. w. of Santa Cruz Verapaz. *King 3338.*

Subtribe Ambrosinae

Ambrosia cf. cumanensis H. B. K.

$n =$ ca. 36 MICHOACAN: 21 m. e. of Jiquilpan. *King 3643.*

Ambrosia peruviana Willd.

$n = 18$ GUATEMALA: 4 m. s. of Coban. *King 3313.*

SUBTRIBE Zinninae

Heliopsis buphthalmoides (Jacq.) Dunal.

$n = 28$ GUATEMALA: 9 m. s. of Salama. *King 3263.*

$n =$ ca. 28 CHIAPAS: 10 m. e. of Teopisca. *King 3030.*

Philactis nelsonii (Greenm.) Blake

$n =$ ca. 28 CHIAPAS: 2 m. w. of Chiapas-Oaxaca border along route 190. *King 2878.*

$n = 28$ CHIAPAS: 21 m. ne. of Las Cruces. *King 3446.*

Sanvitalia cf. *procumbens* Lam.

$n = 8$ CHIAPAS: 12 m. e. of Cintalapa. *King 2984.*

Sanvitalia procumbens Lam.

$n = 8$ PUEBLA: 22 m. ne. of Tepeaca. *Powell & Edmondson 639.*

Sanvitalia sp. nov.

$n = 8$ OAXACA: 1 m. n. of Tamazulapan. *King 2929.*

Tragoceros americanum (Mill.) Blake

$n = 11$ JALISCO: 16 m. s. of Guadalajara. *King 3658.*

Tragoceros mocinianus Gray

$n =$ ca. 11 JALISCO: 45 m. w. of Sahuayo. *Powell & Edmondson 850.*

Tragoceros schiedeanus Less.

$n = 11$ JALISCO: 45 m. w. of Sahuayo. *Powell & Edmondson 848.*

Zinnia angustifolia H. B. K.

$n = 12$ NAYARIT: 8 m. se. of Tepic. *King 3672.*

Zinnia elegans Jacq.

$n = 12$ GUERRERO: 5 m. n. of Ocotito on the Chilpancingo Acapulco highway. *Johnston 5988.*

Zinnia leucoglossa Blake

$n = 11$ DURANGO: 14 m. sw. of Durango. *King 3739.*

Zinnia maritima H. B. K.

$n = 13$ (Fig. 11) GUERRERO: 10 m. e. of Acapulco. *King 4180.*

Zinnia peruviana (L.) L.

$n = 12$ OAXACA: 1 m. se. of Oaxaca. *King 3466.*

Zinnia tenella Rob.

$n = 11$ or 12 DURANGO: 15 m. sw. of Durango. *King 3736.*

SUBTRIBE Verbesininae

Aldama dentata Less.

$n = 17$ OAXACA: 9 m. nw. of Oaxaca. *King 3516.*

$n = 17$ NAYARIT: City limits of Tepic. *King 3668.*

$n = 17$ MORELOS: 5 m. se. of Yautepec. *King 2912.*

$n = 17$ PUEBLA: Just se. of the Morelos-Puebla border. *King 2919.*

$n = 17$ VERACRUZ: 19 m. se. of Poza Rica. *King 4137.*

$n = 17$ VERACRUZ: 1 m. s. of Cuitlahuac. *King 2677.*

$n = 17$ OAXACA: Along route 190, just south of Etla. *King 2509.*

Helianthus laciniatus Gray

$n = 17$ DURANGO: City limits of Durango. *King 3756.*

Hymenostephium sp.

$n =$ ca. 17 NAYARIT: 11 m. se. of Tepic. *King 3675.*

Iostephane heterophylla var. *dicksonii* (Lindl.) Sharp

$n = 17$ (Fig. 12) SINALOA: 1-2 m. sw. of the Sinaloa-Durango border. *King 3721.*

$n = 17$ DURANGO: 24 m. sw. of Durango. *King 3741.*

Iostephane trilobata Hemsl.

$n = 17$ OAXACA: 10 m. ne. of Oaxaca. *Powell & Edmondson 676.*

Jaegeria hirta Less.

$n = 18$ GUATEMALA: Between Solola and Panajachel. *King 3236.*

Jaegeria pedunculata H. & O.

$n = 18$ NAYARIT: 5 m. se. of Tepic. *King 3670.*

Notoptera tequilana (Gray) Blake

$n =$ ca. 15 JALISCO: 26 m. nw. of Tequila. *King 3664.*

Perymenium cf. *asperifolia* Sch.-Bip.

$n =$ ca. 45 OAXACA: 5 m. n. of the junction with route 190. *King 3488.*

Perymenium cf. *chalarolepis* Rob. & Greenm.

$n = 15$ 1 m. w. of San Marcos. *King 3138.*

Podochaenium eminens (Lag.) Sch.-Bip.

$n = 19$ OAXACA: Along route 175, 10 m. n. of the junction with route 190. *King 3494.*

$n = 19$ (Fig. 13) SINALOA: 5 m. sw. of the Sinaloa-Durango border along route 40. *King 3720.*

Rhysolepis sp. nov.

$n = 17$ MICHOACAN: 2 m. e. of Zamora. *King 3645.*

Salmea scandens (L.) DC.

$n = 18^a$ (Fig. 14) SAN LUIS POTOSI: 2 m. w. of Xilitla. *King 4309.*

Sclerocarpus dentatus (Llave & Lex.) Hemsl.

$n = 12$ COAHUILA: 37 m. s. of Monclova. *Powell & Edmondson 506.*

$n = 11$ (Fig. 15) OAXACA: 49 m. w. of Tehuantepec. *King 3458.*

$n = 12$ (Fig. 16) OAXACA: 1 m. ne. of Huajuapan de Leon. *King 3533.*

$n = 12$ TAMAULIPAS: 2 m. ne. of Altamira. *King 4086.*

$n = 12$ VERACRUZ: 4 m. n. of Tampico el Alto. *King 4094.*

$n = 12$ VERACRUZ: 3 m. s.

of Naranjos. *King 4118.*

$n = 12$ SAN LUIS POTOSI: Just north of the San Luis Potosi-Hidalgo state border. *King 4233.*

Sclerocarpus cf. *divaricatus* (Benth.) Hemsl.

$n = 11$ (Fig. 17) VERACRUZ: 20 m. s. of Acayucan. *King 2733.*

Sclerocarpus cf. *frutescens* Brandegee

$n = 12$ (Fig. 18) OAXACA: 1 m. n. of Tamazulapan. *King 2936.*

Sclerocarpus cf. *phyllocephalus* Blake

$n = 11$ GUATEMALA: 4-5 km. w. of Escuintla. *King 3372.*

$n = 11$ (Fig. 19) CHIAPAS: Along the railroad track to Tapachula at the village of Soconusco. *King 3126.*

Sclerocarpus cf. *phyllocephalus* Blake

$n = 12$ CHIAPAS: 5 m. ne. of Las Cruces. *King 3440.*

Sclerocarpus sessilifolius Greenm.

$n = 14$ (Fig. 20) NAYARIT: 8 m. se. of Tepic. *King 3673.*

Spilanthes americana Hieron.

$n =$ ca. 26 SAN LUIS POTOSI: 6 m. ne. of Xilitla. *King 4245.*

$n = 25 \pm 1$ VERACRUZ: 5 m. n. of Tampico el Alto. *King 4092.*

$n =$ ca. 13 PUEBLA: 6 m. sw. of the Puebla-Veracruz state border along route 130. *King 4141.*

$n =$ ca. 26 HIDALGO: 14 m. ne. of Jacala. *King 4222.*

$n = 26^a$ (Fig. 21) VERACRUZ: 9 m. sw. of Tuxpan. *King 4132.*

$n =$ ca. 26 VERACRUZ: 25 m. se. of Poza Rica. *King 4139.*

$n =$ ca. 26 MORELOS: 5 m. se. of Yautepec. *King 2913.*

Spilanthes americana cf. var. *stolonifera* (DC.) Moore

$n =$ ca. 39 MICHOACAN: 21 m. e. of Jiquilpan. *King 3642.*

Tithonia longeradiata (Berl.) Blake

$n = 17$ GUATEMALA: 10 m. s. of Quezaltenango. *King 3428.*

Verbesina crocata (Cav.) Less.

$n = 18$ MORELOS: 11 m. s. of Cuernavaca. *King 4159.*

Verbesina hypargyrea Rob. & Greenm.

$n =$ ca. 17 CHIAPAS: 18 m. se. of Comitán. *King 3044.*

$n = 17$ OAXACA: 41. m. w. of Tehuantepec. *King 3456.*

$n = 17$ COAHUILA: 14 m. s. of Saltillo. *Powell & Edmondson 538.*

Verbesina seatonii Blake

$n = 17$ MEXICO STATE: 9 m. ne. of San Francisco Cheje. *King 3567.*

Viguiera grammatoglossa DC.

$n = 17$ OAXACA: 27 m. n. of the junction along route 190. *King 3504.*

Viguiera longifolia (Rob. & Greenm.) Blake

$n = 8$ CHIAPAS: Wet fields just west of San Cristóbal de Las Casas. *King 2993.*

Wedelia filipes Hemsl.

$n = 11$ GUATEMALA: Near Panajachel. *King 3239.*

$n = 11$ (Fig. 22) GUATEMALA: Near Panajachel. *King 3246.*

Wedelia parviceps Blake

$n = 12$ GUATEMALA: 9 m.

n. of Salama. *King 3283.*

Zexmenia cf. *aurea* (DC.) B. & H.

$n = 10$ (Fig. 23) JALISCO: 17 m. nw. of Tequila. *King 3663.*

Zexmenia costaricensis Benth.

$n = 11$ (Fig. 24) ALTA VERAPAZ: 11 m. w. of San Cristóbal Verapaz. *King 3347.*

Zexmenia pringlei Greenm.

$n = 14$ (Fig. 25) OAXACA: Just s. of the Oaxaca-Puebla border along route 125. *King 3547.*

Zexmenia virgulata Klatt

$n = 11$ (Fig. 26) GUATEMALA: 10 m. s. of Huehuetenango. *King 3392.*

SUBTRIBE Coreopsidinae

Coreopsis mutica DC.

$n =$ ca. 26 CHIAPAS: 13 m. e. of San Cristóbal de Las Casas. *King 2813.*

$n =$ ca. 24 CHIAPAS: 14 m. w. of San Cristóbal de Las Casas. *King 3082.*

Cosmos diversifolius Otto

$n = 12$ OAXACA: 30 m. nw. of Oaxaca. *King 3525.*

$n = 12$ OAXACA: 29 m. nw. of Oaxaca. *King 3523.*

Dahlia dissecta S. Wats.

$n = 18$ MEXICO STATE: Savannah-like forest on route 190 at Llano Grande. *Rock M-351.*

Dahlia scapigera (A. Dietr.) L. & O.

$n = 18$ PUEBLA: 14 m. w. of Texmelucan. *King 3564.*

SUBTRIBE Galinsoginae

Calea integrifolia (DC.) Hemsl.

$n =$ ca. 16 PUEBLA: 5 m. ne. of Villa Juarez. *King 4143.*

Calea nelsonii Rob. & Greenm.

$n =$ ca. 18 CHIAPAS: 10 m. e. of the Oaxaca-Chiapas border. *King 2982.*

Calea cf. *trichotoma* D. Smith

$n = 18$ CHIAPAS: 23 m. se. of Comitán. *King 3043.*

Galinsoga parviflora Cav.

$n =$ ca. 16 CHIAPAS: Just w. of San Cristóbal de Las Casas. *King 2991.*

$n = 16$ GUATEMALA: Along National Route 1, between Solola and Panajachel. *King 3225.*

$n = 16$ GUATEMALA: Along National Route 1, between Solola and Panajachel. *King 3235.*

$n = 16$ MICHOACAN: 2 m. n. of Zitacuaro. *King 3603.*

$n = 16$ MICHOACAN: 5 m. w. of Morelia. *Powell & Edmondson 825.*

$n = 16$ OAXACA: 12 m. ne. of Oaxaca. *Powell & Edmondson 684.*

$n = 8$ MEXICO: 10 m. w. of Toluca. *Powell & Edmondson 804.*

$n = 8$ PUEBLA: 10 m. e. of Puebla. *Powell & Edmondson 624.*

Sabazia sp. nov.

$n = 8$ (Fig. 27) OAXACA: 21 m. n. of the junction with route 190. *King 3499.*

HELENIEAE

Galeana pratensis (H. B. K.) Rydb.

$n = 9$ (Fig. 28) JALISCO: 12 m. nw. Guadalajara. *King 3661.*

$n = 9$ GUATEMALA: 15 m. s. of Rabinal. *King 3363.*

Schkuhria anthemoides var. *wislizeni* (Gray) Heiser

$n = 20$ (Fig. 29) OAXACA: 17 m. se. of Nochistlan. *King 3527.*

Schkuhria pinnata var. *virgata* (Llave) Heiser
$n = 21 \pm 1$ GUATEMALA: 8 m. s. of Huehuetenango. *King 3426.*
$n =$ ca. 20 GUATEMALA: 1 m. s. of Huehuetenango. *King 3413.*
Perityle microglossa Benth.
$n =$ ca. 46 ± 4 SAN LUIS POTOSI: Near the waterfall at El Salto. *King 3877.*

ANTHEMIDEAE

Chrysanthemum parthenium Benth.
$n = 9$ OAXACA: 10 m. n. of the junction with route 190. *King 3495.*

SENECIONEAE

Neurolaena lobata (L.) R. Br.
$n = 11$ (Fig. 30) SAN LUIS POTOSI: 2 m. w. of Xilitla. *King 4276.*
Schistocarpha bicolor Less.
$n = 8$ VERACRUZ: 5 m. ne. of Villa Juarez. *King 4144.*
$n = 8$ HIDALGO: 9 m. sw. of the Hidalgo-San Luis Potosi state border along route 85. *King 4230.*
$n = 8$ SAN LUIS POTOSI: 6 m. generally ne. of Xilitla. *King 4241.*
Senecio cobanensis var. *sublanciniatus* Greenm.
$n =$ ca. 65 GUATEMALA: 11 m. s. of Salama. *King 3270.*
Senecio confusus Britton
$n = 45 \pm 5$ SAN LUIS POTOSI: 2-3 m. w. of El Naranjo. *King 3973.*
Senecio conzatii Greenm.
$n = 20$ OAXACA: Along route 175, 12 m. n. of the junction with route 190. *King 3496.*
Senecio deformis Klatt
$n =$ ca. 20 DISTRITO FEDERAL: El Zarco on route 15, outside Mexico City. *Rock M-412.*
$n = 20$ MEXICO STATE: 8 m. n .of San Francisco Cheje. *King 3583.*
$n = 20$ MEXICO STATE: 11 m. e. of the Mexico-Michoacan state border along route 15. *King 3596.*
Senecio hirsuticaulis Greenm.
$n = 30$ SAN LUIS POTOSI: 17 m. e. of Ciudad del Maiz. *Johnston 5104.*
Senecio imparipinnatus Klatt
$n =$ ca. 23 (Fig. 31) TAMAULIPAS: 4 m. s. of Ciudad Monte. *King 3845.*
Senecio picridis Schaur.
$n = 20$ GUATEMALA: 11 m. w. of Quezaltenango. *King 3191.*
$n = 20$ MORELOS: 3 m. s. of the Morelos-Federal District border along route 95. *King 4151.*
Senecio salignus DC.
$n = 30$ HIDALGO: 1 m. e. of Pachuca. *King 4148.*
$n = 30$ MEXICO STATE: 9 m. sw. of the pyramids at Teotihuacan. *King 4149.*
Senecio toluccanus DC.
$n = 20$ MEXICO STATE: 9 m. ne. of San Francisco Cheje. *King 3574.*
Cacalia sp.
$n =$ ca. 30 JALISCO: 21 m. se. of Guadalajara. *King 3656.*
Cacalia sinuata Llave & Lex.
$n = 30$ DURANGO: 6 m. sw. of Durango. *King 3734.*
Cacalia cf. *tussilaginoides* H. B. K.
$n =$ ca. 25 JALISCO: 3 m. nw. of Guadalajara. *King 3659.*

ARCTOTIDEAE

Arctotis stoechadifolia Berk.
$n = 9$ (Fig. 32) GUATEMALA: 6 m. ne. of Quezaltenango. *King 3210.*

MUTISIEAE

Trixis californica Kellogg
$n = 27$ CHIHUAHUA: 30 m. w. of Chihuahua City. *Powell & Edmondson 1004.*

Trixis radialis (L.) Kuntze
$n =$ ca. 27 CHIAPAS: 9 m. e. of Tuxtla Gutierrez. *King 2768.*
$n = 27$ SAN LUIS POTOSI: Near the waterfall at El Salto. *King 3904.*
$n = 27$ (Fig. 33) SAN LUIS POTOSI: 2 m. w. of Xilitla. *King 4291.*

CICHORIEAE

Lactuca pulchella (Pursh) DC.
$n = 17$ GUATEMALA: 9 m. w. of San Cristóbal Verapaz. *King 3346.*

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CHROMOSOME NUMBERS IN MEXICAN AND GUATEMALAN COMPOSITAE[1]

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The chromosome numbers reported here were obtained from bud material collected by Beaman in the summer of 1960. The counts were made by Turner (except in *Seigesbeckia* which Beaman examined) from pollen mother cell squashes as outlined by Turner and Ellison (1960). The voucher specimens were determined by Beaman, except

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