CHROMOSOME COUNTS IN MEXICAN *ERIGERON*

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ABSTRACT

Chromosome numbers are reported for 75 populations of 19 species of *Erigeron* from Mexico and 4 populations of 1 species from Arizona. First reports for the species are given for *E. fraternus, E. polycephalus, E. strigulosus,* and *E. wislizeni,* and new ploidy levels are reported for *E. coronarius* var. *durangensis, E. janivultus, E. forreri, E. pubescens,* and *E. versicolor. Erigeron gilensis* and *E. mimegletes* are treated as synonyms of *E. versicolor,* a species previously considered to be endemic to south-central Mexico. Comments on morphological variability in *E. versicolor, E. longipes, E. pubescens,* and several other species are provided.

Field studies of Mexican Asteraceae by De Jong in July–August of 1965 and Nesom in August 1977 included collections of material for chromosome number determinations of various species of *Erigeron* (Table 1). The counts, made by the respective collectors, are reported here for the first time. Almost all were determined from flower buds as meiotic counts at or near metaphase I; those of *E. griseus* (Nesom 618), *E. karvinskianus, E. pubescens* (De Jong 1565), and the four collections of *E. versicolor* from Arizona were determined as mitotic counts from germinating root tips. A complete set of De Jong vouchers remains with the collector; other nearly complete ones are at OS and MEXU; a partial set is at TEX. Nesom vouchers are at TEX, MEXU, and various others.

A generalization that quickly becomes apparent when assembling data on chromosome numbers in *Erigeron* is that many species of the genus, including those geographically widespread as well as those restricted in distribution, have more than one ploidy level. In some cases, polyploidy may be correlated with increased morphological variability, probably reflecting the influence of hybridization; this may be true for *E. pubescens* (as noted below), *E. calcicola,* and *E. flagellaris.* In other species, there is apparently no increased morphological variability in the polyploids and no evidence suggestive of interspecific hybridization. Variation in chromosome num-

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ber is known to exist within populations of some species (e.g., *E. potosinus*: Nesom 1978). In the following comments, we discuss several of the Mexican species in which variability in chromosome number is known.

Discussion

Erigeron coronarius and E. janivultus. Diploids and tetraploids previously have been reported for *E. coronarius* var. *coronarius* and diploids for *E. coronarius* var. *durangensis* (Nesom 1990). We report the presence of tetraploids among the populations of var. *durangensis.* Only a diploid chromosome count for the closely related *E. janivultus* has previously been available (Beaman and Turner 1962; see Nesom 1990), but this species also comprises diploids and tetraploids, as reported here.

Erigeron delphinifolius. This species appears to be diploid over its relatively wide geographic range (counts from Edo. Mexico, Tlaxcala, Durango: De Jong and Longpre 1963; Turner et al. 1961; Turner et al. 1962; Turner et al. 1973), except for a single report of a tetraploid plant from the eastern periphery of its range (San Luis Potosi: Harms 1969). Considerable morphological variability exists within the species. (Nesom 1989b).

Erigeron forreri. Diploids, hexaploids, and octoploids are reported for this species (De Jong and Longpre 1963; Keil and Stuessy 1977; the present report). Tetraploids have not been reported but should be expected. There does not appear to be notable morphological variation among populations of this species, which occurs in Durango and southern Chihuahua.

Erigeron galeottii. Diploids are known from Oaxaca, Edo. Mexico, and Michoacan; tetraploids have been reported more commonly and are known from Edo. Mexico, Distrito Federal and Michoacan (Beaman et al. 1962; De Jong and Longpre 1963; Stoutamire and Beaman 1960; Turner et al. 1961; the present report). A disjunct population of *E. galeottii* in southern Chihuahua apparently is diploid, based on an examination of pollen (Nesom unpubl.). The species is variable in growth habit, orientation of stem vestiture, leaf size, shape, and degree of marginal serration or crenation, and capitular size. The plants tend to be initially monocephalous, with a few additional heads commonly produced later.

Erigeron longipes. With the present report and previous observations on this species (Turner et al. 1961; Turner et al. 1962), diploids are known from Puebla and Oaxaca, tetraploids from Chiapas, Oaxaca, Edo. Mexico, Distrito Federal, Michoacan, Hidalgo, and San Luis Potosi, and triploids from Edo. Mexico. A report of diploid

TABLE 1. CHROMOSOME COUNTS IN MEXICAN *ERIGERON*. Collection numbers preceded by "N" are Nesom; all others are De Jong. First reports for the species are marked by an asterisk.

ERIGERON CALCICOLA Greenm.		
1807:	2n = 18II	NUEVO LEON: N of La Escondida at KMs 76-77, on hwy toward Dr. Arroyo
1817:	2n = 36II	COAHUILA: ca. 1 km W of Atenco, W of Saltillo on Hwy 140 toward Torreon (at KMs 424-425)
ERIGERON CORONARIUS Greene		
Var. CORONARIUS		
1763:	2n = 18II	CHIHUAHUA: ca. 18 mi W of Cd. Chihuahua toward Cuauhtemoc
1775:	2n = 9II	CHIHUAHUA: ca. 2 mi E of Tejolocachic toward Cd. Guerrero
Var. DURANGENSIS Nesom		
1755:	2n = 18II	DURANGO: between Canatlan and Guatimape at KM 32-33, J.G. Aguillera to Guatimape
ERIGERON DELPHINIFOLIUS Willd.		
1519:	2n = 9II	EDO. MEXICO: N side of Hwy 136 between KMs 60 and 61, on side road
1615:	2n = 9II	EDO. MEXICO: Hwy 115, between Tlalmanalco and Amecameca (KMs 50 and 51)
1749:	2n = 9II	DURANGO: KM 980 on Hwy 40, Durango to Mazatlan
1750:	2n = 9II	DURANGO: KM 968 on Hwy 45, N of Cd. Durango
1758:	2n = 9II	DURANGO: KM 26 on road from J.G. Aguillera to Guatimape
1759:	2n = 9II	DURANGO: 3.5 km NW of J.G. Aguillera, toward Guatimape
N613:	2n = 9II	DURANGO: 1 mi WSW of Cd. Durango on Hwy 40
ERIGERON FLAGELLARIS A. Gray		
1764:	2n = 27II	CHIHUAHUA: ca. 5 mi SE of Tejolocachic
1770:	2n = 9II	CHIHUAHUA: 6.3 mi NE of Madera toward San Jose Babicora
ERIGERON FORRERI (Greene) Greene		
1733:	2n = 27II	DURANGO: between KMs 1102 and 1103 on Hwy 40
N622:	2n = 9II	DURANGO: 24 mi WSW of Cd. Durango on Hwy 40
N4438:	2n = 27II	DURANGO: 10 km W of El Salto along Hwy 40
ERIGERON FRATERNUS Greene*		
N623:	2n = 9II	DURANGO: 24 mi WSW of Cd. Durango on Hwy 40
N633a:	2n = 9II	CHIHUAHUA: ca. 10 mi WSW of Madera on logging road
N633b:	2n = 9II	CHIHUAHUA: ca. 24 mi WSW of Madera on logging road
N4487:	2n = 18II	CHIHUAHUA: ca. 43 km SW of La Junta
ERIGERON GALEOTTII (A. Gray ex Hemsl.) Greene		
1468:	2n = 9II	OAXACA: Llano de las Flores, Hwy 175
1492:	2n = 18II	EDO. MEXICO: between KMs 61 and 62, old Puebla-Mexico hwy
1501:	2n = 18II	EDO. MEXICO: between KMs 54 and 55, old Puebla-Mexico hwy

Table 1. Continued

1618:	2n = 18II	EDO. MEXICO: Puerto El Guarda (KM 24-25) on Hwy 130, Mexico to Toluca
1652:	2n = 18II	EDO. MEXICO: ca. 6 km E of Bosencheve (KM 124) on Hwy 15, Toluca to Morelia
1654:	2n = 9II	MICHOACAN: 15 km W of Cd. Hidalgo on Hwy 15
ERIGERON GRISEUS (Greenm.) Nesom		
1730:	2n = 9II	DURANGO: 2 km E of La Ciudad on Hwy 40 (between KMs 1106 and 1107)
N618:	2n = 18	DURANGO. ca. 25 mi WSW of Cd. Durango on Hwy 40
ERIGERON JANIVULTUS Nesom		
1542:	2n = 9II	HIDALGO: 2.3 mi S of Cuyamaloya
1651:	2n = 18II	EDO. MEXICO: W of Toluca on Hwy 15
1634:	2n = 18II	EDO. MEXICO: 1 km N of Marboro (KM 117-118), S of Ixtlahuaca on Hwy 55
1651:	2n = 18II	EDO. MEXICO: W of Toluca (KMs 112-113) on Hwy 15
ERIGERON KARVINSKIANUS DC.		
1443:	2n = 27	CHIAPAS: just E of San Cristobal las Casas on Hwy 190
1446:	2n = 36	CHIAPAS: E of San Cristobal las Casas on Hwy 190, KM 1135
1483:	2n = 27	OAXACA: ca. 20 km N of Ixtlan de Juarez on Hwy 175
ERIGERON LONGIPES DC.		
1403:	2n = 9II	OAXACA: N side of Cieneguillas on Hwy 190, between KMs 417 and 418
1425:	2n = 18II	CHIAPAS: 5.2 mi E of Teopisca on Hwy 190
1452:	2n = 9II	OAXACA: between KMs 36 and 37 on Hwy 175, Oaxaca to Tuxtepec
1457:	2n = 9II	OAXACA: 2 km E of Ixtlan de Juarez
1503:	2n = 18II	DIST. FEDERAL: SE of Cd. Mexico along Ixtapalapa-Los Reyes road, near XEW TV station
1575:	2n = 18II	SAN LUIS POTOSI: El Porvenir (KM 247) on Hwy 80, Cd. del Maiz to Huizache
1577:	2n = 18II	SAN LUIS POTOSI: Barbarita (KM 242) on Hwy 80, Cd. del Maiz to Huizache
1600:	2n = 9II	PUEBLA: between El Carmen and Zacatepec on Hwy 136
1624:	2n = 18II	EDO. MEXICO: N of Toluca (KM 85) on Hwy 55
1655:	2n = 18II	MICHOACAN: within city of Morelia, toward Sta. Maria
1658:	2n = 18II	MICHOACAN: 1.8 mi of Ario de Rosales, toward Villa Escalente
ERIGERON METRIUS Blake		
1781:	2n = 9II	NUEVO LEON: base of Lopez Mateos rock relief on Hwy 60, E of Iturbide toward Linares
ERIGERON POLYCEPHALUS (Larsen) Nesom*		
1686:	2n = 9II	JALISCO: 7.3 mi SW of Atenquique, lumber road above Tonila

TABLE 1. CONTINUED

ERIGERON POTOSINUS Standley		
1787:	2n = 9II	NUEVO LEON: Cerro Potosi at KMs 19-20, ca. 10,200 ft
ERIGERON PUBESCENS Kunth		
1520:	2n = 27II	EDO. MEXICO: N side of Hwy 136 between KMs 60 and 61, on side road
1565:	2n = 27	SAN LUIS POTOSI: between KMs 32 and 33 on Hwy 86 toward Rio Verde
1568:	2n = 9II	SAN LUIS POTOSI: El Milagro (at KM 37) on Hwy 86 toward Rio Verde
1586:	2n = 18II	HIDALGO: Puerto de Trancas (between KMs 216 and 217) on Hwy 85
1593:	2n = 18II	PUEBLA: 26 km S of Zacatlan on Hwy 119
1643:	2n = 36II	EDO. MEXICO: S of Ixtlahuaca on Hwy 55, at KM 98
1791:	2n = 18II	NUEVO LEON: Cerro Potosi at KMs 19-20, ca. 10,200 ft
1793:	2n = 18II	NUEVO LEON: Cerro Potosi at KMs 14-15, ca. 9500 ft
1800:	2n = 27II	NUEVO LEON: ca. 7 km N or Puerto Cieneguillas on Hwy 60, toward Dr. Arroyo
1803:	2n = 9II	NUEVO LEON: near Puerto Cieneguillas at KM 31, Hwy 60 toward Dr. Arroyo
ERIGERON SEEMANNII (Sch.-Bip.) Greene		
N624:	2n = 9II	DURANGO: ca 24 mi WSW of Cd. Durango at Rio Mimbres
ERIGERON STRIGULOSUS Greene*		
N4499:	2n = 18II	CHIHUAHUA: 12.8 km N of Madera
ERIGERON VERSICOLOR (Greenm.) Nesom		
1640:	2n = 36II	EDO. MEXICO: S of Ixtlahuaca on Hwy 55, at jct to Los Reyes
1766:	2n = 27II	CHIHUAHUA: 3 mi NW of Tejolocachic
1771:	2n = 36I	CHIHUAHUA: 3.9 mi NE of Madera toward San Jose Babicora
N628:	2n = 27I	CHIHUAHUA: 13 mi W of Cuauhtemoc on Hwy 16
N637:	2n = 27I	CHIHUAHUA: 0.5 mi E of Madera on Hwy 16
N459:	2n = 18	ARIZONA: Apache Co., 12 mi WSW of Eagar on Hwy 73
N460A:	2n = 36	ARIZONA: Apache Co., 12 mi WSW of Eagar at jct of Hwys 78 and 373
N464A:	2n = 36	ARIZONA: Apache Co., 5.2 mi SW of Alpine on Hwy 666
N466:	2n = 36	ARIZONA: Apache Co., 4.5 mi N of Alpine on Hwy 180
ERIGERON WISLIZENI (A. Gray) Greene*		
1767:	2n = 9II	CHIHUAHUA: 6.3 mi NE of Madera toward San Jose Babicora
1768:	2n = 9II	CHIHUAHUA: 6.3 mi NE of Madera toward San Jose Babicora
N635:	2n = 9II	CHIHUAHUA: 15 mi WSW of Madera
N639:	2n = 9II	CHIHUAHUA: 1 mi W of Babicora

plants of *E. longipes* from Nuevo Leon (considerably north of its known range) was based on an misidentified collection of *E. veracruzensis* Nesom (Sundberg et al. 1986).

Plants of *Erigeron longipes* produce solitary heads with numerous (up to 300), filiform ligules. The leaves may be confined to a basal rosette (=*E. scaposus* DC.) or continue up the stem relatively unreduced in size; the morphological extremes are strikingly different in habit, but intermediates are common. McVaugh (1984) and Rzedowski (1985) identified all forms of the complex as *E. longipes*, and the same course is followed here. Still, as noted by McVaugh, the scapose forms occur mostly in eastern Mexico, although leafy-stemmed plants are intermixed in that region. The limited data on chromosome numbers indicate a tendency for the scapose forms to be diploid, but some diploids have leafy stems. The plants are abundant colonizers, easily located and collected, and a broader, more intensive survey of chromosome numbers and morphological variation would probably prove to be interesting.

Erigeron pubescens. Diploids are presently known only from the northern part of the range of the species (see below); tetraploids and hexaploids are known from both the northern and southern regions, and octoploids are recorded from the southern region in the present report. In previous chromosome reports for this species (both from Hidalgo: Turner et al. 1961; De Jong and Longpre 1963), the observations were of asynaptic meiotic cells of tetraploids.

Plants of *Erigeron pubescens* are characterized as fibrous-rooted perennials that commonly produce numerous stems from the base; they are eglandular, with a strigose vestiture, relatively narrow, evenly distributed cauline leaves, solitary heads, and the ligules have a conspicuous, purple, abaxial midstripe. Plants in the southern region of the species (Puebla, Mexico, Hidalgo, and San Luis Potosi) are relatively uniform in morphology, producing a sparse vestiture, linear leaves, and relatively short peduncles. In the northern region (Tamaulipas, Nuevo Leon, and Coahuila), the phyllaries are more densely hairy, the leaves are broader, and there is a greater tendency for the stems to branch above the base. The northern plants are more variable than the southern, almost certainly reflecting the influence of hybridization with closely related species of sect. *Olygotrichium* Nutt. (Nesom 1989a) that occur commonly in the region: *E. metrius* Blake, *E. modestus* A. Gray, *E. calcicola* Greenm., and *E. divergens* Torr. & Gray. These latter species also show infraspecific variation in ploidy and form an intergradient complex in north-central Mexico (e.g., Zhao and Turner 1993).

Erigeron versicolor. Polyploids are known from populations of *Erigeron versicolor* in each of its three regions of distribution (see below). Diploid, tetraploid, and hexaploid populations are reported

within the western system (=*E. gilensis*) (Pinkava and Keil 1977; the present report); triploid and tetraploid populations are known within the eastern system (=*E. mimegletes*) (Turner and Flyr 1966; Powell and Powell 1978); the report here of an octoploid is the first available chromosome count for *E. versicolor* in the area of its typical populations (the southern system). Previous reports of triploids and tetraploids have been of completely asynaptic meiotic cells, which suggest that the polyploid populations of this species reproduce apomictically.

This species, which previously has been regarded as endemic to Hidalgo (the type locality) and Edo. Mexico, comprises three widely allopatric population systems. Those from Coahuila, Nuevo Leon, Tamaulipas, and Texas (the eastern system) have been identified as *E. mimegletes* Shinners (the type from Texas), those from Chihuahua, Durango, Arizona, and adjacent New Mexico (the western system) as *E. gilensis* Woot. & Standl. (the type from New Mexico). Plants over the whole range characteristically occur in at least periodically wet habitats, and there are no consistent morphological differences among plants from these areas. All are annual in duration (with a tendency for a longer duration in the western populations) and vary in habit from taprooted to fibrous-rooted, single-stemmed to highly branched from the base, and from ca. 0.1 to 1.0 m in height. Plants from Chihuahua, Durango, Edo. Mexico, and Hidalgo have a greater tendency to be multiple-stemmed from the base, while those in Arizona, Texas, and Coahuila are more commonly single-stemmed. The stem vestiture varies from spreading to antrorsely appressed, the receptacles are conical, and the phyllaries are broadly lanceolate with thin-scarious margins. The pappus is reduced to a minute corona, usually lacking bristles although 1–4 short, caducous bristles are sometimes present on achenes from Arizona plants; the corona in the eastern system usually is reduced to a blunt and smooth rim, while elsewhere it tends to be slightly raised and shallowly erose.

Hybridization between *Erigeron versicolor* and *E. divergens* Torr. & Gray, which occur in close sympatry in southeastern Arizona, may explain the occurrence of bristles in the pappus of *E. versicolor* in that area. A close morphological similarity between the two taxa has been noted by Pinkava and Keil (1977), and diploid plants of the two taxa have been collected in close proximity in the White Mountains of Apache Co., Arizona (Nesom unpublished), where they also may intergrade in other features.

The nomenclature for the species in its broadened sense is summarized by the following:

ERIGERON VERSICOLOR (Greenm.) Nesom, Sida 9:225. 1982.

Achaetogeron versicolor Greenm., Proc. Amer. Acad. Arts 41:255. 1905.

Erigeron gilensis Woot. & Standl., Contr. U.S. Natl. Herb. 16:184. 1913.
Achaetogeron chihuahuensis Larsen ex Blake, J. Washington Acad. Sci. 30:470. 1940.
Erigeron mimegletes Shinners, Wrightia 1:184. 1947.
Erigeron geiseri var. *calcicola* Shinners, Wrightia 1:184. 1947.

Erigeron wislizeni. All populations sampled so far are diploid, but ray color, leaf morphology, and vestiture are notably variable within the species (Nesom 1989b). *De Jong 1767* and *1768* sampled morphologically divergent but immediately adjacent populations.

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REVIEW

California Plant Community Information System. By STEVEN HARTMAN. 1994. NatureBase, 3646 Fairfax, Culver City, California. Diskette Version 1.0, $95.00.

The study of California's vegetation is beginning to enter the computer age. NatureBase of Culver City has made four treatments of the state's vegetation available for DOS users: "Preliminary descriptions of the terrestrial natural communities of California" by Robert Holland, "The map of the natural vegetation of California" by A. W. Küchler, "California plant communities" of P. Munz and D. Keck [El Aliso 2:87–105, 199–202] which also is in Munz's *A California Flora,* and summary of acreages of 32 types done by the California Department of Forestry and Fire Protection.

The Munz and Keck classification, a two-level one of nine vegetation types and 29 plant communities, is known by any botanist who has used *A California Flora.* Kuüchler's map was included in the *Terrestrial Vegetation of California.* The legend lists nine formations with 54 vegetation types. In 1986, Robert Holland, then vegetation ecologist for the Natural Heritage Program of the California Department of Fish and Game, prepared a vegetation clasification for use in the California Natural Diversity Data Base. This classification was never published, though it has been extensively used. [A copy is available from Natural Diversity Data Base, California Department of Fish and Game, 1416 Ninth Street, Sacramento, CA 95814]. This classification is a four-tier one with more than 300 types at the lowest level.

The four classifications are entered separately in the computer program. The Department of Forestry scheme lists types such as Mixed conifer, Red fir, and Redwood. According to the list, Other desert covers the most area of any category in California (20%), followed by Urban-agriculture-water (16%). No descriptions beyond category names are available. For the other classifications, the user is taken though each classification, using a series of screens, to a description of a type at the lowest level. Another screen lists the characteristic species for that type. If the scientific names used in the original vegetation description differ from those used in *The Jepson Manual,* both are given.

The screens act in some ways like as set of keys, but only after the reader knows the classification. In learning a classification, sometimes a book version may be more useful, especially in the more elaborate Holland scheme where reading the descriptions is necessary to pick the appropriate category. In the computer version, the user toggles between screens. It takes seven steps to compare Interior live oak forest with Shrub interior live oak chaparral, for example.

The value of the computer form of this information is best met for those interested in working with the more complicated Holland scheme, and having synonym names for scientific names easily available for people getting use to *The Jepson Manual.* For botanists who want this material available on their computers, here is an easy way to have it.

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