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## CHROMOSOME NUMBERS OF SPERMATOPHYTES, MOSTLY CALIFORNIAN

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Studies of chromosomes are normally confined to limited taxonomic groups, for very good reasons. Studies thus restricted are not only apt to yield more accurate results than those concerned with a wide variety of plants, but the patterns within these groups may become obvious with relatively little effort. One unfortunate effect of this kind of orientation, however, has been that many groups of plants have never or very rarely been examined cytologically, and many interesting facts thus remain unknown.

The superb living collections of California plants at the Rancho Santa Ana Botanic Garden have provided the nucleus of this study. Each is associated with a voucher collected in the field at the time of the original collection. These have been supplemented by selected collections of wild plants, mostly from California and adjacent areas. In general, meiotic material has been fixed in one of the variants of Carnoy's solution and squashed in acetocarmine. Observations of meiosis in pollen mother cells have provided the bulk of the information on chromosome numbers presented here. Occasionally, we have obtained chromosome numbers from mitotic divisions, either in floral material or in root-tips.

The present study reports chromosome numbers for 144 collections of 121 taxa. Included are what we believe to be the first reports for *Pectocarya*, *Oxystylis*, *Idahoa*, *Acanthomintha*, *Pogogyne*, *Salazaria*, *Pickeringia*, *Adenostoma*, *Cneoridium*, *Anemopsis*, *Galvesia*, *Mohavea* and *Plectritis*. Also included are first counts for 79 species and 8 additional subspecies and varieties, including such prominent members of the California flora as *Epipactis gigantea*, *Toxicodendron diversilobum*, *Sambucus mexicana*, *Cercidium floridum*, *Salix lasiolepis*, *Platanus racemosa*, *Staphylea bolanderi*, and *Styrax officinalis*. Our counts for *Cleome lutea*, *C. serrulata*, *Fouquieria splendens*, *Lyonothamnus*, *Simmondsia* and *Psoralea macrostachya* differ from previous reports, which in all except perhaps the second and fifth cases we believe to have been approximations only or in error. Our earlier report for *Erysimum capitatum* subsp. *bealianum* is shown to have been in error. We believe that the present article includes the first accurate report of a chromosome number in the family Fouquieriaceae. Additional comments are found under the species concerned,

with apparently new counts being indicated by an asterisk. The voucher specimens are deposited in various herbaria, as indicated by the standard abbreviations.

We would like at this time to express our appreciation to David M. Bates, for his count of *Mohavea* and the fixed material of *Eriogonum thomasii*; to Henry J. Thompson, for fixed material of his collection of *Dalea*; to Lauramay Dempster, for fixed material of *Quercus*; to Theodore L. Hanes, for his material of *Adenostoma sparsifolium*; to Reid Moran, for fixed material of *Penstemon*; and to Percy C. Everett, of the Rancho Santa Ana Botanic Garden, for his very kind cooperation in this project. This work has been supported in part by Grant 2G-365-R1 from the U. S. Public Health Service—National Institutes of Health.

## GYMNOSPERMAE

### EPHEDRACEAE

*EPHEDRA VIRIDIS* Cov.  $n = 14^*$ . Lake of the Woods, Mount Pinos Recreation Area, Kern Co., Calif., *Kyhos 62-140* (DS, RSA). At meiotic metaphase I this plant formed 9 pairs, a chain of 6, and a chain of 4 chromosomes. Apparently the first North American species to be counted.

## MONOCOTYLEDONAE

### CYPERACEAE

*ELEOCHARIS MONTEVIDENSIS* Kunth var. *PARISHII* (Britt.) V. Grant.  $2n = 5_{II}^*$ . Cajon Canyon, San Bernardino Co., Calif., *Raven 16706* (DS).

### GRAMINEAE

*EHRHARTA ERECTA* Lam.  $2n = 12_{II}$ . Weed in botanical garden, University of California, Los Angeles, Calif., *Kyhos 62-128* (DS).

*SCHISMUS BARBATUS* (L.) Thell.  $2n = 6_{II}$ . Claremont, Los Angeles Co., Calif., *Raven 16879* (DS).

### LILIACEAE

*CALOCHORTUS INVENUSTUS* Greene.  $2n = 7_{II}^*$ . About 2.5 miles from summit of Mt. Pinos on road to McGill Campground, Kern-Ventura Co. line, Calif., *Hill in 1962* (DS).

*DICHELOSTEMMA PULCHELLUM* (Salisb.) Greene.  $2n = 9_{II}$ . West Los Angeles, Los Angeles Co., Calif., *Kyhos 62-45* (DS).  $2n = 18_{11}$ . Palos Verdes, Los Angeles Co., Calif., *Kyhos 62-11* (DS).

### ORCHIDACEAE

*EPIPACTIS GIGANTEA* Dougl.  $n = 20^*$ . 4.6 miles east of Downieville, Sierra Co., Calif., *Raven 19611* (DS).

*HABENARIA DILATATA* (Pursh) Hook. var. *LEUCOSTACHYS* (Lindl.) Ames.  $n = 21^*$ . 4.6 miles east of Downieville, Sierra Co., Calif., *Raven 19612* (DS).

*HABENARIA ELEGANS* (Lindl.) Boland.  $2n = 21_{II}^*$ . 6.3 miles south of Lower Lake, Lake Co., Calif., *Raven 17912* (DS).

## DICOTYLEDONAE

### ACANTHACEAE

*BELOPERONE CALIFORNICA* Benth.  $2n = 14_{II}$ . About 2 miles north of summit of Yaqui Pass, San Diego Co., Calif., *Kyhos 62-8* (DS).

## ANACARDIACEAE

*TOXICODENDRON DIVERSILOBUM* (Torr. & Gray) Greene.  $2n = 15_{II}^*$ . Cambria, San Luis Obispo Co., Calif., *Raven 18746* (DS).

## BERBERIDACEAE

*BERBERIS AMPLECTENS* (Eastw.) Wheeler.  $2n = 14_{II}^*$ . Cuyamaca Mountains 3 miles from Julian on the road to Cuyumaca Lake, San Diego Co., Calif., *Wolf 9892* (RSA), progeny.

## BORAGINACEAE

*CYNOGLOSSUM GRANDE* Dougl.  $2n = 12_{II}^*$ . Just south of Lake San Andreas, San Mateo Co., Calif., *Raven 18744* (DS).

*PECTOCARYA LINEARIS* DC. var. *FEROCULA* I. M. Johnst.  $2n = 24_{II}^*$ . 12 miles west of Paterson on road to Mount Hamilton, Stanislaus Co., Calif., *Breedlove 4859* (DS), progeny.

*PECTOCARYA PENICILLATA* (H. & A.) A. DC.  $2n = 12_{II}^*$ . Foothill woodland 7.6 miles south of Coarsegold, Madera Co., Calif., *Raven 18751* (DS).

## BUXACEAE

*SIMMONDSIA CHINENSIS* (Link) C. K. Schneid.  $2n = 26_{II}$ . Potrero Grade, San Diego Co., Calif., *Stark 607* RSA), progeny. Stebbins and Major (Ecol. Monogr. 35: 12. 1965 reported  $2n = ca. 100$  for this species, based on observations of numerous dividing pollen mother cells from an individual cultivated at the Santa Barbara Botanic Garden (Stebbins, pers. comm.). The origin of this individual is not known (R. Philbrick, pers. comm.), but plants or populations with  $n = 52$  should be sought in the field.

## CALYCERACEAE

*ACICARPHA TRIBULOIDES* Juss.  $2n = 8_{II}$ . Cultivated, University of California, Los Angeles, Calif., *Hill in 1963* (DS).

## CAPPARIACEAE

*CLEOME ISOMERIS* (Nutt.) Greene (*ISOMERIS ARBOREA* Nutt.).  $2n = 20_{II}$ . 8 miles west of Essex, San Bernardino Co., Calif., *Everett & Balls 21533* (RSA), progeny.

*CLEOME LUTEA* Hook.  $2n = 17_{II}$ . Winnemucca, Humboldt Co., Nev., *Raven 18538* (DS); near Big Pine, Inyo Co., Calif., *Raven 17557* (RSA). Presumably the plant of this species from Mesa Co., Colo., reported by Rollins (Lloydia 2: 111. 1939) as having a chromosome number of  $n = ca. 16$ , actually had the same number as the plants reported here.

*CLEOME SERRULATA* Pursh.  $n = 17$ . Snake Range, White Pine Co., Nev., *Breedlove 5832* (DS); Palisade, Eureka Co., Nev., *Raven 11252* (RSA). From a collection of this species from Uinta Co., Wyoming, Rollins (loc. cit.) reported  $n = 16$ .

*OXYSTYLIS LUTEA* Torr. & Frém.  $2n = 20_{II}^*$ . Near Shoshone, Inyo Co., Calif., *Raven 12874* (UC).

## CAPRIFOLIACEAE

*SAMBUCUS MEXICANA* Presl.  $2n = ca. 36^*$ . 8 miles southeast of Livermore on the Mines Road, Alameda Co., Calif., *Raven 18762* (DS).

## COMBRETACEAE

*TERMINALIA CATAPPA* L.  $2n = 12_{II}$ . Chatham Bay, Cocos Island, Costa Rica, *Wiggins 18937* (DS).

## CONVOLVULACEAE

*CUSCUTA DENTICULATA* Engelm.  $2n = 15_{II}^*$ . Along Highway 78, 0.5 miles inside of boundary of Anza-Borrego State Park, San Diego Co., Calif., *Kyhos 62-23* (DS).

*CUSCUTA INDECORA* Choisy.  $n = 15^*$ . 2 miles north of Cartago, Inyo Co., Calif., *Anderson 1998* (RSA).

## CRUCIFERAE

ARABIS SPARSIFLORA Nutt. var. CALIFORNICA Rollins.  $2n = 22^*$ . 4 miles north of Claremont, Los Angeles Co., Calif., *Everett & Balls 22955* (RSA), progeny. At meiotic metaphase I, this plant formed 7 bivalents and 8 univalents, suggesting the presence of apomixis.

CAULANTHUS COOPERI (S. Wats.) Pays.  $2n = 14_{II}^*$ . About 2 miles west of junction of Highway 78 with road to Yaqui Pass, San Diego Co., Calif., *Kyhos 62-7* (DS).

CAULANTHUS COULTERI S. Wats.  $2n = 14_{II}^*$ . 3 miles south of Ozena Guard Station on U.S. Highway 399, Ventura Co., Calif., *Hill x-32* (DS).

DITHYREA CALIFORNICA Harv.  $n = 10$ . Near Thousand Palms turnoff, Riverside Co., Calif., *Raven 11421* (DS).

DITHYREA WISLIZENII Engelm.  $n = 9^*$ . 10.4 miles northeast of Peñasco, Sonora, *Raven 11684* (DS).

ERYSIMUM CAPITATUM (Dougl.) Greene.  $2n = 18_{II}$ . Moist north slope in Gaviota Pass, 150 ft., Santa Barbara Co., Calif., *Breedlove 1775* (DS); 4 miles north of Claremont, 1800 ft., Los Angeles Co., Calif., *Everett & Balls 22864* (RSA), progeny. The second collection had a fragment in addition to its 18 bivalents. *Erysimum capitatum* var. *bealianum* (Jeps.) Rossbach was reported by Raven (Madroño 15: 49. 1959) as having  $n = 16$ ; a re-examination of the original slide has shown that this report was erroneous, and the plant examined had  $n = 18$ .

IDAHOA SCAPIGERA (Hook.) Nels. & Macbr.  $2n = 16^*$ . Oregon State line on U. S. Highway 97, Siskiyou Co., Calif., *Raven 18763* (DS). This collection was grown at Stanford and was entirely cleistogamous, the styles being exposed only by the expanding fruit.

LEPIDIUM DENSIFLORUM Schrad. var. PUBICARPUM (A. Nels.) Thell.  $2n = 16_{II}$ . Along Highway 78, 0.7 miles inside the east entrance to Anza-Borrego State Park, San Diego Co., Calif., *Kyhos 62-24* (DS).

## ERICACEAE

CHIMAPHILA UMBELLATA (L.) Barton var. OCCIDENTALIS (Rydb.) Blake.  $2n = 26^*$ . 2 miles west of McCall, Valley Co., Ida., *Raven 18514* (DS). The same number as recorded for var. *umbellata* in the Old World.

VACCINIUM OVATUM Pursh.  $2n = 12_{II}$ . 2.5 miles east of Fort Bragg on road to Willits, Mendocino Co., Calif., *Everett & Balls 18610* (RSA), progeny.

## EUPHORBACEAE

ACALYPHA CALIFORNICA Benth.  $2n = 10_{II}^*$ . Harbison Canyon, San Diego Co., Calif., *Wolf 9490* (RSA), progeny. All previously reported species of this large genus have had chromosome numbers based on  $x = 7$ .

## FAGACEAE

QUERCUS AGRIFOLIA Née.  $2n = 12_{II}$ . Claremont, Los Angeles Co., Calif., *Balls 18263* (RSA). This plant was apparently heterozygous for the nucleolar organizer.

QUERCUS AGRIFOLIA Née, introgressed by *Q. WISLIZENII* A. DC. (not  $F_1$ ).  $2n = 12_{II}$ . Orinda, Contra Costa Co., Calif., *Dempster in 1963* (UCSB). Meiosis regular. Determined by C. H. Muller.

## FOUQUIERIACEAE

FOUQUIERIA SPLENDENS Engelm.  $2n = 12_{II}$ . Road to Borrego Springs about 3 miles from Highway 78, San Diego Co., Calif., *Kyhos 62-62* (no voucher). The only previous report of chromosome numbers in this small family has been that of Johansen (Am. Jour. Bot. 23: 95-99. 1938), who reported  $n = 8$  in this species,  $2n = 16$  in *F. peninsularis*, and  $2n =$  ca. 16 in *F. burragei*. In view of the known unreliability of chromosome counts by Johansen (cf. Lewis et al., *Aliso* 4: 81. 1958) and the fact that he mentioned that his material of *Fouquieria* was "not in the most satisfactory condition" (Johansen, op. cit., p. 99), we believe that it would be wise to disregard his counts. It is extremely interesting to note that  $n = 12$  is the only chromosome number known in Tamaricaceae, with which Fouquieriaceae have often been grouped.

## HYDROPHYLLACEAE

PHACELLA EGENA Greene.  $n = 22$ . Triunfo Canyon, Santa Monica Mountains, Los Angeles Co., Calif., *Raven 15404* (LA).

## HYPERICACEAE

HYPERICUM CONCINNUM Benth.  $2n = 8_{II}^*$ . 6.3 miles south of Lower Lake, Lake Co., Calif., *Raven 17913* (DS).

## LABIATAE

ACANTHOMINTHA OBOVATA Jeps.  $2n = 19_{II}^*$ . Near Hernandez, San Benito Co., Calif., *Raven 15090* (RSA).

LEPECHINIA CALYCINA (Benth.) Epl.  $2n = 17_{II}$ . Near San Marcos Pass, Santa Barbara Co., Calif., *Balls 23307* (RSA), progeny. The same number was reported for each of the four California species by Epling (Brittonia 6: 352-364. 1948).

MONARDELLA ROBISONII Epling.  $2n = 21_{II}^*$ . Joshua Tree National Monument, Riverside Co., Calif., *Raven 15495* (DS).

MONARDELLA UNDULATA Benth.  $2n = 21_{II}^*$ . Burton Mesa, Santa Barbara Co., Calif., *Raven 15513* (DS).

POGOGYNE SERPYLLOIDES (TORR.) A. Gray.  $2n = 19_{II}^*$ . Near Buena Vista, Amador Co., Calif., *Raven 18352* (DS). It was difficult to be absolutely certain of the chromosome number in this and the following species, which have very few pollen mother cells and are probably highly autogamous. The number we counted is the same as that in the related *Acanthomintha*.

POGOGYNE ZIZYPHOROIDES Benth.  $2n = 19_{II}^*$ . 4 miles north of Chico, Butte Co., Calif., *Raven 18357* (DS).

SALAZARIA MEXICANA TORR.  $2n = \text{ca. } 50_{II}$ . 7 miles southeast of the crossing of Burro Creek, Mohave Co., Ariz., *Raven 17365* (DS). The gametic chromosome number of this plant was almost certainly between  $n = 50$  and  $n = 52$ . All of the pairs were very small, but there was a great difference in size between them, and it is possible that one or two rings of four were present.

## LEGUMINOSAE

ASTRAGALUS BREWERI A. Gray.  $n = \text{ca. } 12^*$ . Lakeport, Lake Co., Calif., *Raven 18167* (DS).

ASTRAGALUS DIDYMOCARPUS H. & A. var. DIDYMOCARPUS.  $2n = 12_{II}$ . Kettleman Hills, Kings Co., Calif., *Raven 16981* (RSA).

ASTRAGALUS DIDYMOCARPUS H. & A. var. OBISPOENSIS (Rydb.) Jeps.  $2n = 13_{II}^*$ . 7.5 miles north of Santo Tomás, Baja California, *Raven 17051* (DS). The same number is known in var. *dispermus* (A. Gray) Jeps. Further cytological work on this species is desirable.

ASTRAGALUS LEUCOPSIS (TORR.) T. & G.  $2n = 11_{II}$ . Little Harbor, Santa Catalina Island, Los Angeles Co., Calif., *Wolf 10889* (RSA), progeny.

ASTRAGALUS RAVENII Barneby.  $2n = 22^*$ . Sawmill Pass, Inyo Co., Calif., *DeDecker in 1959* (NY), progeny.

CASSIA ARMATA S. Wats.  $2n = 14_{II}^*$ . East of Daggett, San Bernardino Co., Calif., *Raven 18975* (DS).

CERCIDIUM FLORIDUM Benth.  $2n = 14_{II}^*$ . State Highway 69, 1.4 miles north of Happy Valley Road (15.4 miles south of New River), Maricopa Co., Ariz., *Kyhos 62-102* (DS).

DALEA CALIFORNICA S. Wats.  $2n = 10_{II}^*$ . Whatewater Wash, Riverside Co., Calif., *Raven 17115* (DS). All species of *Dalea* in which the claws of the petals are free or adnate only to the base of the stamen tube (Rydberg's segregate genera *Psorodendron* and *Psorothamnus*) appear to be characterized by chromosome numbers on the base  $x = 10$ . All chromosome numbers previously reported for the genus have been based on  $x = 7$ . One of the species with adnate petals, *D. parryi*, although it clearly belongs with the much larger, predominantly herbaceous group characterized by  $x = 7$ , has  $n = 10$  also.

DALEA EMORYI A. Gray.  $2n = 10_{II}^*$ . 0.8 miles southeast of Kane Springs, Imperial Co., Calif., *Raven 17380* (RSA); along Highway 66, 0.5 miles east of turnoff to Twenty-nine Palms, San Bernardino Co., Calif., *Kyhos 62-129* (DS).

DALEA FORMOSA TORR.  $2n = 7_{II}^*$ . 1 mile north of Camp Verde on Highway 69, Ariz., *Kyhos 62-106* (DS).

*DALEA FREMONTII* Torr. var. *FREMONTII*.  $2n = 10_{II}^*$ . Marble Canyon, Inyo Mountains, Inyo Co., Calif., *Raven 17549* (DS); 1.8 miles east of Darwin on road to Wash and Darwin Falls, 4300 ft., Inyo Co., Calif., *Thompson 3271* (DS).

*DALEA FREMONTII* Torr. var. *MINUTIFLORA* (Parish) L. Benson.  $n = 20^*$ . 13 miles east of Shoshone on road to Pahrump, Inyo Co., Calif., *Kyhos 62-134* (DS).

*DALEA PARRYI* Torr. & Gray.  $2n = 10_{II}^*$ . Along Highway 69 at New River, Ariz., *Kyhos 62-103* (DS).

*DALEA POLYADENIA* Torr. ex S. Wats.  $2n = 10_{II}^*$ . About 10 miles north of Bishop on U. S. Highway 395, Inyo Co., Calif., *Hill 48163* (DS).

*DALEA SCHOTTII* Torr. var. *PUBERULA* (Parish) Munz.  $2n = 10_{II}^*$ . 0.7 miles east on Ocotillo Wells, San Diego Co., Calif., *Kyhos 62-78* (DS); 2.2 miles east of Ocotillo Wells, San Diego Co., Calif., *Kyhos 62-77* (DS).

*KENNEDYA PROSTRATA* Ait.  $2n = 11_{II}^*$ . Cultivated, botanic garden, University of California, Los Angeles, Calif., *Hill in 1964* (DS).

*LATHYRUS LAETIFLORUS* Greene var. *LAETIFLORUS*.  $2n = 7_{II}^*$ . Mulholland Drive 0.9 miles west of Beverly Glen Boulevard, Los Angeles, Calif., *Kyhos 62-12* (DS). The plant investigated exhibited a bridge and fragment at meiotic anaphase I, suggesting the presence of a paracentric inversion.

*LOTUS ARGOPHYLLUS* (A. Gray) Greene var. *ARGOPHYLLUS*.  $2n = 7_{II}^*$ . 3 miles south of Ensenada, Baja California, *Raven 17010* (DS); about 2 miles east of Alpine Cafe on Palms to Pines Highway, San Jacinto Mountains, Riverside Co., Calif., *Kyhos 62-79* (DS).

*LOTUS ARGOPHYLLUS* (A. Gray) Greene subsp. *ORNITHOPUS* (Greene) Raven.  $2n = 7_{II}$ . West side of Isthmus Harbor, Santa Catalina Island, Los Angeles Co., Calif., *Wolf 10888* (RSA), progeny; San Clemente Island, Los Angeles Co., Calif., *Raven 17149* (RSA), *17281* (RSA).

*LOTUS BENTHAMII* Greene.  $2n = 7_{II}^*$ . State Highway 1, 11.8 miles northwest of San Luis Obispo-Monterey Co. line, Monterey Co., Calif., *Balls 23550* (RSA), progeny.

*LOTUS GRANDIFLORUS* (Benth.) Greene.  $2n = 7_{II}^*$ . Stunt Road, 2.2 miles from junction with Mulholland Highway, Santa Monica Mountains, Los Angeles Co., Calif., *Kyhos 62-81* (DS), *62-26* (RSA).

*LOTUS RIGIDUS* (Benth.) Greene.  $2n = 7_{II}^*$ . Highway 78 near junction of road to Yaqui Pass, San Diego Co., Calif., *Kyhos 62-25* (DS), *62-26* (RSA).

*LOTUS SALSUGINOSUS* Greene var. *SALSUGINOSUS*.  $2n = 7_{II}^*$ . Mulholland Highway 1.4 miles north of junction with Las Virgenes Road, Los Angeles Co., Calif., *Kyhos 62-74* (DS); Backus Road 8 miles from junction with U. S. Highway 101, Los Angeles Co., Calif., *Kyhos 62-48* (DS).

*LOTUS SALSUGINOSUS* Greene var. *BREVIVEXILLUS* Ottley.  $2n = 7_{II}^*$ . San Felipe Wash, San Diego Co., Calif., *Kyhos 62-60* (DS).

*LOTUS SCOPARIUS* (Nutt.) Ottley var. *BREVIALATUS* Ottley.  $2n = 7_{II}^*$ . Cabazon, Riverside Co., Calif., *Kyhos 62-38* (DS); Highway 74 at Lower San Juan Campground, Santa Ana Mountains, Orange Co., Calif., *Kyhos 62-113* (DS); 1.1 miles east of Banner on Highway 78, San Diego Co., Calif., *Kyhos 62-112* (DS, RSA).

*LOTUS STRIGOSUS* (Nutt.) Greene.  $2n = 7_{II}^*$ . Mulholland Highway 1.1 miles north of junction with Las Virgenes Road, Los Angeles Co., Calif., *Kyhos 62-73* (DS); Lower San Juan Campground, Santa Ana Mountains, Orange Co., Calif., *Kyhos 62-63* (DS); San Felipe Wash 2.4 miles east of turn off Yaqui Pass, San Diego Co., Calif., *Kyhos 62-55* (RSA), *62-56* (DS); Anza-Borrego State Park at Box Canyon Historical Marker, San Diego Co., Calif., *Kyhos 62-27* (DS); Whitewater Canyon, Riverside Co., Calif., *Kyhos 62-41* (DS), *62-42* (RSA).

*LUPINUS ALBIFRONS* Benth.  $2n = 24_{II}^*$ . Santa Cruz Island, Santa Barbara Co., Calif., *Balls & Blakley 23689* (RSA), progeny.

*MEDICAGO ARBOREA* L.  $2n = 16_{II}$ . Cultivated, University of California, Los Angeles, Calif., *Hill in 1964* (DS).

*MELILOTUS INDICA* (L.) All.  $2n = 8_{II}$ . West Los Angeles, Calif., *Kyhos 62-85* (DS).

*PICKERINGIA MONTANA* Nutt.  $2n = 14_{II}^*$ . 12.6 miles south of Lower Lake, Lake Co., Calif., *Raven 17917* (DS). Although this species rarely sets fruit, no meiotic irregularities were observed.

*PSORALEA CALIFORNICA* S. Wats.  $2n = 11_{II}^*$ . San Benito River 5.2 miles south of junction with Clear Creek Road, San Benito Co., Calif., *Raven 18979* (DS, TEX). Two of the pairs were distinctly heteromorphic.

*PSORALEA LANCEOLATA* Pursh.  $2n = 11_{II}^*$ . Northeast of St. Anthony, Fremont Co., Ida., *Raven 19562* (DS, TEX).

PSORALEA MACROSTACHYA DC.  $2n = 11_{II}$ . Guadalupe Creek, Santa Clara Co., Calif., *Raven 19646* (DS, TEX); along Alamitos Creek near New Almaden, Santa Clara Co., Calif., *Raven 19645* (DS, TEX). The chromosome number of this species was reported as  $2n = 20$  by Kreuter (*Planta* 11: 11, 1930), but his observations may have been in error. All north American species appear to have  $n = 11$  (cf. also Turner, *Legumes of Texas*, p. 133-142, 1959), and it would be remarkable if aneuploidy occurred in this species alone.

PSORALEA PHYSODES Dougl.  $n = 11^*$ . 2 miles west of Aetna Springs, Napa Co., Calif., *Raven 19042* (DS, TEX).

PSORALEA TENUIFLORA Pursh.  $2n = 11_{II}^*$ . Fort Collins, Larimer Co., Colo., *Raven 19510* (DS, TEX).

VICIA ANGUSTIFOLIA Reich.  $2n = 6_{II}$ . Stokes Canyon, Santa Monica Mountains, Los Angeles Co., Calif., *Kyhos 62-83* (DS).

## MALVACEAE

SPHAERALCEA ORCUTTII Rose.  $2n = 5_{II}$ . Junction of U. S. Highway 99 with State Highway 78, Imperial Co., Calif., *Kyhos 62-2* (DS).

## OLEACEAE

FRAXINUS DIPETALA H. & A.  $2n = 23_{II}^*$ . Silverado Canyon, Santa Ana Mountains, Orange Co., Calif., *Wolf 6139* (RSA), progeny.

## OROBANCHACEAE

OROBANCHE COOPERI (A. Gray) Heller.  $2n = 24_{II}^*$ . 1.5 miles northeast of Daggett, San Bernardino Co., Calif., *Raven 18976* (DS).

OROBANCHE FASCICULATA Nutt.  $2n = 24_{II}^*$ . 2.5 miles west of junction of U. S. Highways 395 and 50, Washoe Co., Nev., *Raven 17868* (DS).

## PAPAVERACEAE

DENDROMECON RIGIDA Benth. subsp. RIGIDA.  $2n = 28_{II}$ . Backus Road 10.2 miles west of junction with Mulholland Highway, Santa Monica Mountains, Los Angeles Co., Calif., *Kyhos 62-17* (DS). Stebbins and Major (*Ecol. Monogr.* 35: 11, 1965) reported  $2n = \text{ca. } 54$  for an individual of this species from Moraga Ridge, Contra Costa Co., Calif. (Stebbins, pers. comm.). Doubtless this plant also had  $n = 28$ .

ESCHSCHOLZIA CALIFORNICA Cham.  $2n = 6_{II}$ . Point Dume, Los Angeles Co., Calif., *Kyhos 62-33* (DS).

ESCHSCHOLZIA PARISHII Greene.  $2n = 6_{II}$ . Whitewater Canyon, Riverside Co., Calif., *Kyhos 62-43* (DS). The plant investigated had a bridge and fragment at meiotic anaphase I, suggesting the presence of a paracentric inversion.

## PLANTAGINACEAE

PLANTAGO INSULARIS Eastw.  $2n = 4_{II}$ . State Highway 78, 5.4 miles west of junction with U. S. Highway 99, Imperial Co., Calif., *Kyhos 62-5* (DS).

PLANTAGO SUBNUDA Pilger.  $2n = 48^*$ . Surf, Santa Barbara Co., Calif., *Raven 15507* (RSA), progeny.

## PLATANACEAE

PLATANUS RACEMOSA Nutt.  $2n = 21_{II}^*$ . Claremont, Los Angeles Co., Calif., *Raven 18739* (DS).

## POLYGALACEAE

POLYGALA FISHIAE Parry.  $2n = 9_{II}^*$ . Triunfo Canyon, Santa Monica Mountains, Ventura Co., Calif., *Raven 15403* (LA).

POLYGALA SUBSPINOSA S. Wats. var. HETERORHYNCHA Barneby.  $2n = 38^*$ . Frenchman Flat, Clark Co., Nev., *Raven 18902* (DS). At meiotic metaphase I, this plant formed 18 pairs plus two small chromosomes that separated precociously.



## POLYGONACEAE

*ERIOGONUM THOMASII* Torr.  $2n = 20_{II}^*$ . Box Canyon, Riverside Co., Calif., *Bates 2300* (DS).

*POLYGONUM PARONYCHIA* Cham. & Schlecht.  $2n = 28^*$ . Presidio, San Francisco, Calif., *Mertens 8* (DS), progeny. Although morphologically similar to some species of sect. *Avicularia*, this species was shown by Hedberg (*Svensk Bot. Tidskr.* 40: 371-404. 1946) to have entirely different pollen and to be referred better to sect. *Duravia* S. Wats. All species of sect. *Avicularia* that have been investigated have had chromosome numbers based on  $x = 10$ .

## RANUNCULACEAE

*THALICTRUM POLYCARPUM* (Torr.) S. Wats.  $2n = 14_{II}^*$ . Headwaters of Rocky Creek, Santa Lucia Mountains, Monterey Co., Calif., *Wolf 9555* (RSA), progeny.

## RHAMNACEAE

*RHAMNUS ILICIFOLIA* Kell.  $2n = 12_{II}^*$ . 1 mile southeast of Bootjack, Mariposa Co., Calif., *Wolf 11038* (RSA), progeny.

## ROSACEAE

*ADENOSTOMA FASCICULATUM* Hook & Arn.  $2n = 9_{II}^*$ . Topanga Canyon, Santa Monica Mountains, Los Angeles Co., Calif., *Hill in 1963* (DS).

*ADENOSTOMA SPARSIFOLIUM* Torr.  $2n = 9_{II}^*$ . 15 miles east of Pine Grove on U. S. Highway 80, San Diego Co., Calif., *Hanes in 1962* (DS).

*LYONOTHAMNUS FLORIBUNDUS* A. Gray subsp. *ASPLENIFOLIUS* (Greene) Roven.  $2n = 27_{II}$ . Santa Cruz Island, Santa Barbara Co., Calif., *Wolf 4129* (RSA), progeny. The report of  $2n = 48$  in this species (Stebbins & Major, *Ecol. Monogr.* 35: 12. 1965) was based on a very approximate count of a tree of this variety cultivated in Berkeley (Stebbins, pers. comm.), and it is presumably in error. Judging from the ease with which the strain we are reporting on here hybridizes with Santa Catalina Island material of subsp. *floribundus* when they are cultivated side-by-side at Rancho Santa Ana, and the apparent full fertility of these hybrids, we consider it likely that there is only one chromosome number represented in the genus.

## RUTACEAE

*CNEORIDIUM DUMOSUM* (Nutt.) Hook. f.  $2n = 18_{II}^*$ . North of Dulzura Ranch, San Diego Co., Calif., *Stark 604* (RSA), progeny.

## SALICACEAE

*SALIX GOODINGII* Ball.  $2n = 19_{II}^*$ . Cane Springs, Nye Co., Nev., *Raven 18944* (DS).

*SALIX LASIOLEPIS* Benth.  $2n = 38_{II}^*$ . Just south of Lake San Andreas, San Mateo Co., Calif., *Raven 18742* (DS).

## SAURURACEAE

*ANEMOPSIS CALIFORNICA* Hook.  $2n = 22_{II}^*$ . Little Lake, Inyo Co., Calif., *Raven 17539* (RSA); Point Mugu, Ventura Co., Calif., *Raven 14008* (DS). Both American and Asiatic species of the related genus *Saururus* have  $n = 11$ .

## SAXIFRAGACEAE

*CARPENTERIA CALIFORNICA* Torr.  $2n = 20$ . 5 miles from Auberry on road to Pineridge, 4000 ft., Fresno Co., Calif., *Everett 7268* (RSA), progeny. This number underscores the distinctiveness of this attractive Californian endemic genus, as other genera of the "Hydrangeaceae" that have been counted have had  $x = 13, 14, 16, 17$ , and 18.

## SCROPHULARIACEAE

ANTIRRHINUM MULTIFLORUM Penn.  $n = 16_{II}^*$ . Saddle Peak, Santa Monica Mountains, Los Angeles Co., Calif., *Raven 15392* (LA).

ANTIRRHINUM NUTTALLIANUM Benth.  $2n = 16_{II}$ . Ridge above Chinese Harbor, 900 ft., Santa Cruz Island, Santa Barbara Co., Calif., *Breedlove 2793* (DS), progeny (= *Raven 18179*, DS).

GALVESIA JUNCEA (Benth.) Ball.  $2n = 15_{II}^*$ . 14 miles south of San Quintín, Baja, California, *Raven 17026* (RSA).

GALVESIA SPECIOSA (Nutt) A. Gray.  $2n = 15_{II}^*$ . San Clemente Island, Los Angeles Co., Calif., *Peirson 3476* (RSA), progeny (DS).

MOHAVEA CONFERTIFLORA (Benth.) Heller.  $2n = 15_{II}^*$ . Box Canyon, Riverside Co., Calif., *Bates 2297A* (DS).

PENSTEMON ALBOMARGINATUS M. E. Jones.  $2n = 8_{II}^*$ . 21 miles east of Newberry, San Bernardino Co., Calif., *Raven 13900* (RSA).

PENSTEMON CLEVELANDII A. Gray var. ANGELICUS I. M. Johnst.  $n = 8^*$ . Arroyo Estación, Isla Angel da la Guarda, Baja California, *Moran 8580* (SD).

SCROPHULARIA CALIFORNICA Cham. & Schlecht, subsp. CALIFORNICA.  $2n = 48_{II}^*$ . West Los Angeles, Los Angeles Co., Calif., *Raven 15412* (LA). This plant provided excellent metaphase I figures when fixed in 3 parts absolute ethanol : 1 part glacial acetic acid. Taking into account the approximate chromosome numbers published by Shaw (*Aliso 5: 156-158, 1962*), we consider it likely that all North American species except *S. montana* Wooten and possibly *S. marilandica* L. will prove to have  $n = 48$ .

## SOLANACEAE

SOLANUM DOUGLASII Dunal.  $2n = 12_{II}$ . East Whittier, Los Angeles Co., Calif., *Kyhos 62-126* (DS).

## STAPHYLEACEAE

STAPHYLEA BOLANDERI A. Gray.  $2n = 13_{II}^*$ . Near summit of Tollhouse Grade, Fresno Co., Calif., *Frampton in 1956*, progeny (RSA). Apparently the first diploid in this small family to be reported from North America.

## STYRACACEAE

STYRAX OFFICINALIS L. var. FULVESCENS (Eastw.) Munz & Johnst.  $2n = 8_{II}^*$ . Main Divide Road, Santa Ana Mountains, Orange Co., Calif., *Wolf & Stark 4441* (RSA), progeny.

## VALERIANACEAE

PLECTRITIS MACROCERA Torr. & Gray.  $n = 15^*$ . 14.5 miles southeast of Livermore on the Mines Road, Alameda Co., Calif., *Raven 18761* (DS). A new basic number for the Valerianaceae, which underscores the distinctiveness of *Plectritis* from *Valerionella* and other genera. The preparations were excellent.

## VERBENACEAE

VERBENA LASIOSTACHYS Link.  $2n = 7_{II}^*$ . West Los Angeles, Los Angeles Co., Calif., *Raven 15411* (LA).