

hirsute-tomentose; buds hirsute; leaves to 13 cm long and 1.5 cm wide, linear-oblong, apex narrowly acuminate, sub-aristate, base narrowly cuneate, margins minutely and irregularly revolute, attenuate-dentate, the teeth narrow, sub-aristate, and directed forward; upper surface glabrous, dark green and slightly glossy, lower surface pale green, dull, and sparsely stellate-pubescent; secondary veins 6–9 on a side; petiole 10–15 mm long, sparsely stellate to glabrate, the petiole and midrib (especially on the under side of the leaf) yellowish; stipules caducous, linear, 7–8 mm long, lightly hirsute. No flowers or fruit have been observed.

Holotype: California, Yuba Co., Challenge Experimental Forest, ca. 1 mile N of Challenge, elevation 2675 ft., *J. M. Tucker* s. n., May 22, 1963 (DAV).

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CHROMOSOME NUMBERS IN SOME NORTH AMERICAN SPECIES OF THE GENUS *CIRSIUM*. II. WESTERN UNITED STATES

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As was suggested in the previous paper of this series (Ownbey and Hsi, 1963), chromosome numbers in the North American species of *Cirsium* may contribute substantially to an understanding of the taxonomy and evolution of the genus. At the very least they will be of significant value in the initial arrangement of the species into alliances which will with certain reservations represent natural groups. Our experience to date indicates that morphologically similar species now grouped together frequently have the same or only slightly varying chromosome numbers.

Due to the small and intergrading sizes of the chromosomes of *Cirsium*, i.e., 0.6–3.0 microns in length when fully contracted in the species discussed here, it has not been possible adequately to characterize the karyotypes of the species examined. It is safe to assume that at least one pair of satellite chromosomes can be observed in all species and frequently one or two additional satellite chromosomes are seen. Karyotype evolution in *Cirsium* may lead either to a loss or gain in numbers, but reduction in numbers seems to be the rule. It is usually assumed that 17 is the primitive number in the genome as the preponderance of living species have retained this number. Accessory chromosomes, when present, cannot be identified morphologically in our preparations and for this reason it has been concluded that they are intact or nearly so. A few examples of chromosomal fragments have also been seen.

All of the chromosomal data recorded here is based upon the study of root tip preparations. With few exceptions the root tips were obtained from 7–14 day old seedlings grown under sterile conditions in the laboratory.

Counts for *Cirsium acanthodontum*, *C. rydbergii*, *C. utahense*, *C. wallowense*, *C. pastoris* and *C. arizonicum* are published here for the first time. Earlier counts for the remaining species have been published as follows: *C. brevistylum*, Moore & Frankton (1962); *C. scopulorum*, Moore & Frankton (1965); *C. tweedyi*, Moore & Frankton (1965); *C. coloradense*, Ownbey & Hsi (1963, under *C. foliosum*), Moore & Frankton (1967); *C. scariosum*, Ownbey & Hsi (1963, under *C. foliosum*), Moore & Frankton (1967); *C. tioganum*, Ownbey & Hsi (1963, under *C. foliosum*), Moore & Frankton (1967); *C. ochrocentrum*, Hsi (1960), Ownbey & Hsi (1963); *C. undulatum*, Hsi (1960), Frankton & Moore (1961), Ownbey & Hsi (1963); *C. subniveum*, Ownbey & Hsi (1963); *C. californicum*, Moore & Frankton (1963); *C. occidentale*, Moore & Frankton (1963). The new counts for these species agree closely with the earlier ones except that greater variation in the number of accessory chromosomes is sometimes reported here.

We have arranged the species in the text in the sequence and in the groups proposed by Petrak (1917). Species not known to Petrak, viz., *C. acanthodontum* Blake, *C. brevistylum* Cronq., *C. subniveum* Rydb., *C. wallowense* Peck and *C. pastoris* Howell, are placed in the groups to which they appear to be most closely allied. All American thistles, both native and introduced, belong to the subgenus *Eucirsium*.

Sect. *Echenais*, Subsect. *Americana*

Cirsium acanthodontum Blake. $2n = 32$ (2 plants). Oregon, Curry Co., 11.7 miles N of Agness, Ownbey & Ownbey 3054, MIN. This collection came from near the type locality.

Sect. *Onotrophe*, Subsect. *Crassifolia*

Cirsium rydbergii Petrak. $2n = 34$ (1 plant). Utah, Grand Co., Salt Wash, about one-half mile N of Turnbow Cabin, Arches National Monument, Welsh & Moore 2742, MIN.

Subsect. *Minutiflora*

Cirsium brevistylum Cronq. $2n = 34$ (3 plants). Oregon, Coos Co., 15.5 miles N of Agness, Ownbey & Ownbey 3055, MIN.

Subsect. *Globosa*

Cirsium scopulorum (Greene) Cock. $2n = 34, 35, 36, 37$. Colorado, Clear Creek Co., Mt. Evans, alt. ca. 11,000 ft., Ownbey 3671, MIN, $2n = 34$ (4 plants), $2n = 35$, (1 plant), $2n = 36$ (2 plants), $2n = 37$ (4 plants).

Cirsium tweedyi (Rydb.) Petrak. $2n = 34$ (1 plant). Wyoming, Yellowstone National Park, Sylvan Pass, Ownbey & Ownbey 3071, MIN.

Subsect. *Acaulia*

Cirsium coloradense (Rydb.) Cock. $2n = 34, 36?$ Colorado, La Plata Co., 21.9 miles E of Durango, Route 160, alt. ca. 7200 ft., Ownbey & Hsi 2642, MIN, $2n = 34$ (2 plants), $2n = 36?$ (2 plants).

Cirsium scariosum Nutt. **2n** = 34, 36. Idaho, Clark Co., 2.4 miles N of Spencer, Ownbey & Ownbey 3067, MIN, **2n** = 36 (1 plant); Montana, Powell Co., 5 miles SW of Avon, Ownbey & Hsi 2908, MIN, **2n** = 34 (3 plants), **2n** = 36? (1 plant); Wyoming, Johnson Co., 13.5 miles W of Buffalo, Route 16, Ownbey & Ownbey 3030, MIN, **2n** = 34 (1 plant).

Cirsium tioganum (Congd.) Petrak. **2n** = 34 (1 plant). Colorado, Jackson Co., 1.3 miles N of Walden, Ownbey & Ownbey 1497, MIN.

Cirsium canescens Nutt. \times *C. tioganum* (Congd.) Petrak. **2n** = 34 (2 plants). Colorado, Jackson Co., 1.3 miles N of Walden, Ownbey & Ownbey 1497a, MIN. The data for this hybrid were earlier published by Ownbey & Hsi (1963) under *C. canescens* Nutt. \times *C. foliosum* (Hook.) DC.

Subsect. *Acanthophylla*

Cirsium ochrocentrum Gray. **2n** = 32, 34. Arizona, Apache Co., 3 miles N of Concho, Baker & Baker 2512, MIN, **2n** = 32 (2 plants), **2n** = 34 (4 plants); Texas, Tom Green Co., 4.4 miles NE of Tankersly Ownbey & Baker 2994, MIN, **2n** = 32 (7 plants). The Arizona collection represents the southwestern race of the species distinguished by its scarlet-red corollas and scarcely decurrent leaves. The Texas collection also appears to represent a recognizable race having unusually small heads, phyllaries and phyllary spines.

Cirsium undulatum (Nutt.) Spreng. **2n** = 26 (4 plants). Texas, Terrell Co., Independence Creek bottoms near Pecos River, Demaree 48442, MIN. This collection comes from the southern periphery of the range of *C. undulatum*. It differs morphologically from typical material in having extensively branched stems and small heads. The phyllaries and anthers are also smaller than usual for the species.

Subsect. *Campylophylla*

Cirsium subniveum Rydb. **2n** = 34, 35, 36. Idaho, Bonneville Co., 0.5 mile W of the Snake River bridge, just W of Swan Valley, Ownbey & Ownbey 3043, MIN, **2n** = 34 (2 plants), **2n** = 36 (1 plant); Lincoln Co., 19 miles S of Carey, Route 26, Ownbey & Ownbey 3046, MIN, **2n** = 34 (3 plants); same locality, Ownbey & Ownbey 3047, MIN, **2n** = 35 (2 plants). The voucher for Ownbey & Ownbey 3047 was aberrant in having glabrous and shining upper surface of the leaves and in the broadly auriculate bases of the principal cauline leaves. The other voucher specimens cited compare closely with the type specimen of *C. subniveum* (Nelson 1070, US).

Cirsium utahense Petrak. **2n** = 30, 32. Arizona, Coconino Co., along Route 180, about 30 miles NW of Flagstaff, Baker & Baker 2511, MIN, **2n** = 32 (5 plants); Yavapai Co., between Cordis Junction and Mayer, Deaver 5962, MIN, **2n** = 30 (2 plants). The distinctions between *C. utahense* and *C. neomexicanum* are not always clear but, following the treatment of *Cirsium* by Howell (1960) for the Pacific States, the voucher specimens are identified as *C. utahense*. The voucher of Baker & Baker 2511 is not typical *C. utahense* in being more thinly pubescent throughout and in having basal and cauline leaves remotely pinnatifid, the segments lanceolate.

Cirsium wallowense Peck. **2n** = 34 (4 plants). Oregon, Wallowa Co., 31 miles N of Enterprise, Ownbey & Ownbey 3060, MIN.

Cirsium californicum Gray. **2n** = 28, 29, 30. California, Mariposa Co., Route 41, Yosemite National Park, 11.8 miles N of the junction of the road to Mariposa Grove, Baker & Baker 2503, MIN, **2n** = 28 (4 plants), **2n** = 29 (1 plant), **2n** = 30 (2 plants).

Cirsium occidentale (Nutt.) Jepson. **2n** = 28, 29, 30. California, Marin Co., along Mt. Tamalpais road, 0.2 mile beyond Mt. Tamalpais State Park, Baker & Baker 2493, MIN. **2n** = 28 (2 plants), **2n** = 29 (1 plant), **2n** = 30 (5 plants).

Cirsium pastoris Howell. $2n = 30, 31, 32, 33$. California, Mendocino Co., 1.6 miles N of Cummings, *Baker & Baker 2491*, MIN, $2n = 30$ (1 plant), $2n = 32$ (2 plants), $2n = 33$ (1 plant); Oregon, Josephine Co., 10 miles N of Grants Pass, Route 99, *Ownbey & Ownbey 3058*, MIN, $2n = 30$ (1 plant), $2n = 31$ (1 plant), $2n = 32$ (5 plants), $2n = 33$ (1 plant).

Sect. *Erythrolaena*, Subsect. *Subcoriacea*

Cirsium arizonicum (Gray) Petrak. $2n = 30$ (5 plants). Arizona, Coconino Co., a few miles NE of Strawberry on the Long Valley road, *Baker & Baker 2509*, MIN.

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