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CHROMOSOME NUMBER DETERMINATIONS IN FAM. COMPOSITAE, TRIBE ASTEREAE. VI. WESTERN NORTH AMERICAN TAXA AND COMMENTS ON GENERIC TREATMENTS OF NORTH AMERICAN ASTERS

JOHN C. SEMPLE, CHUNSHENG XIANG[1], JIE ZHANG[2], MARK HORSBURGH, AND RACHEL COOK

Department of Biology, University of Waterloo,
Waterloo, Ontario N2L 3G1, Canada
e-mail: jcsemple@sciborg.uwaterloo.ca; recook@sciborg.uwaterloo.ca
[1]Current Address: Microarray Facility, Laboratory of Genetics,
National Institute of Health,
Bethesda, MD 20892-4094
[2]Current Address: C. & C. International Group Inc.,
706 Willow Wood Place,
Waterloo, Ontario N2T 2T7, Canada

ABSTRACT. Chromosome numbers are reported for 238 individuals of 79 taxa and one hybrid from 19 genera from western Canada and the western United States. The majority of the reports are for asters (109) reported in this paper under the generic names *Canadanthus, Eucephalus, Eurybia, Oreostemma, Sericocarpus,* and *Symphyotrichum* (including *Virgulus*) and goldenrods (97) under *Solidago* and *Euthamia.* Nearly all counts confirm previous reports for the taxa; some reports are first counts for one or more of the four Canadian provinces and territories and thirteen western states of the United States sampled. The following first reports are included: *Eurybia conspicua* (*Aster conspicuus*), $2n = 126$; *Solidago simplex* var. *nana,* $2n = 18$; *Symphyotrichum falcatum* var. *falcatum,* $2n = 30$; and *S. yukonense,* $2n = 10$. The following new combinations are proposed: *Heterotheca sessiliflora* var. *echioides, H. sessiliflora* var. *fastigiata,* and *Oreostemma alpigenum* subsp. *haydenii.*

Key Words: Compositae, Astereae, chromosome numbers, *Aster, Erigeron, Eucephalus, Eurybia, Oreostemma, Sericocarpus, Solidago, Symphyotrichum,* cytotaxonomy

Determining the distribution patterns of cytotypes requires numerous counts from the range of a taxon. The determinations listed below are reported as contributions to such studies. This is the sixth in a continuing series of general reports on Astereae by the first author's laboratory (Semple 1985; Semple and Chmielewski 1987; Semple et al. 1989, 1992, 1993).

MATERIALS AND METHODS

Meiotic counts were made from pollen mother cells dissected from buds fixed in the field in 3:1 EtOH : glacial acetic acid and subsequently stored under refrigeration in 70% EtOH. Mitotic counts were made from root tip cells taken from transplanted wild rootstocks or from seedlings grown from achenes collected in the wild. Root tips were pretreated in saturated paradichlorobenzene for 2–3 hr., fixed in Acetic Alcohol Fixative (3:1 EtOH : glacial acetic acid) and hydrolyzed in 1N HCl for 30 min. at 60°C before squashing. Anther sacs containing PMCs and meristematic root tips were squashed in 1% acetic orcein, and counts of chromosomes were made from freshly prepared material. When preserved, permanent slides were made as described by Semple et al. (1981) and remain in the possession of J.C.S.

Vouchers for all counts are deposited in WAT. Identifications were made by J.C.S. Nomenclature for members of *Haplopappus sensu lato* follows Lane and Hartman (1996). In some cases, voucher specimens did not fit a published taxon description in one or more minor traits, such as amount of pubescence; these cases are indicated by the "aff." qualifier in the Appendix.

NOMENCLATURE

The following combinations are made here.

Heterotheca sessiliflora (Nutt.) Shinners var. **echioides** (Benth.) Semple, *comb. et stat. nov.* Based on *Chrysopsis echioides* Benth., Bot. Voy. Sulphur 25. 1844. *Chrysopsis villosa* (Pursh) Elliott var. *echioides* (Benth.) A. Gray, Syn. Fl. N. Amer. 1(2): 123. 1884. *Heterotheca echioides* (Benth.) Shinners, Field & Lab. 19: 71. 1951. *Heterotheca sessiliflora* subsp. *echioides* (Benth.) Semple, Phytologia 73: 450. 1992. TYPE: U.S.A. California: Bodegas, 1841, *Hinds s.n.* (HOLOTYPE: K!).

Heterotheca sessiliflora (Nutt.) Shinners var. **fastigiata** (Greene) Semple, *comb. et stat. nov.* Based on *Chrysopsis fastigiata* Greene, Pittonia 3: 296. 1898. *Chrysopsis villosa* var. *fastigiata* (Greene) H. M. Hall, Univ. Calif. Publ. Bot. 3: 43. 1907. *Heterotheca fastigiata* (Greene) V. L. Harms, Brittonia 26: 61. 1974. *Heterotheca sessiliflora* subsp. *fastigiata*

(Greene) Semple, Phytologia 73: 451. 1992. TYPE: U.S.A. California: San Bernardino Mts., 1000–1500 ft. (not 10,000–15,000 ft. as in protologue), 15 Oct 1895, *S. B. Parish 3815* (HOLOTYPE: NDG!; ISOTYPES: CAS!, GH!, UC!, US!)

Oreostemma alpigenum (Torr. & A. Gray) Greene subsp. **haydenii** (Porter) Semple, *comb. et stat. nov.* Based on *Aster haydenii* Porter, Cat. Pl. 485 in W. J. Hayden, Prelim. Rep. U.S. Geol. Surv. Montana: 485. 1872. *Oreastrum haydenii* (Porter) Rydb., Mem. New York Bot. Gard. 1: 398. 1900. *Oreostemma haydenii* (Porter) Greene, Pittonia 4: 224. 1900. *Aster alpigenus* (Torr. & A. Gray) A. Gray subsp. *haydenii* (Porter) Cronquist, Leafl. W. Bot. 5: 77. 1948. *A. alpigenus* var. *haydenii* (Porter) Cronquist, Vasc. Pl. Pacific NorthW. 5: 76. 1955. *Oreostemma alpigenum* var. *haydenii* (Porter) G. L. Nesom, Phytologia 74: 313. 1993. TYPE: U.S.A. Wyoming: Terr. Yellowstone R., Upper Falls, 27 Aug 1871, *F. V. Hayden 15* [LECTOTYPE, Cronquist (Leafl. W. Bot. 5: 77. 1948): US, not seen; ISOLECTOTYPES: G, GH!, PA].

RESULTS AND DISCUSSION

Chromosome numbers for 238 individuals of 79 taxa and one hybrid from 19 genera from western Canada and the western United States are reported in the Appendix. The majority of the reports are for asters and goldenrods (206); all location and voucher data are previously unpublished with the exception of one correction for a report for *Solidago nemoralis* subsp. *decemflora* (Semple et al. 1993 as *10181* in error and listed as *Semple & Zhang 10184* in the Appendix). Populations were sampled in four provinces and territories in Canada and 13 states in the United States. In total, 109 reports are for asters listed in this paper under the generic names *Canadanthus, Eucephalus, Eurybia, Oreostemma, Sericocarpus,* and *Symphyotrichum* (including *Virgulus*) and 97 goldenrods listed under *Solidago* and *Euthamia.* Nearly all counts confirm previous reports for the taxa and most are presented without comment. Included in the Appendix are the following first reports: *Eurybia conspicua,* $2n = 126$; *Solidago simplex* var. *nana,* $2n = 18$; *Symphyotrichum falcatum* var. *falcatum,* $2n = 30$; and *S. yukonense,* $2n = 10$. A number of the counts are first reports for the taxon or ploidy level of a taxon

for a particular province or state (e.g., *Oreostemma alpigenum* subsp. *alpigenum* from Oregon, $2n = 18$).

Generic limits of North American asters. In previous papers in this series, asters were placed in one of two genera: *Aster sensu lato* and *Virgulus* Raf. In this paper, a very different classification of the asters has been adopted. Xiang (1994) and Xiang and Semple (1996) presented data on chloroplast DNA restriction site variation that demonstrated conclusively that the genus *Aster sensu* Jones (1980) and *sensu* Semple and Brouillet (1980a) was polyphyletic. Nesom (1994b) presented a revised overview of the asters and made a large number of combinations in a number of the segregate genera that he recognized on morphological grounds. Other combinations had been proposed in previous papers (Nesom 1993a, 1993b, 1993c; Nesom and Leary 1992). Semple et al. (1996) proposed an alternative nomenclature in which many of the species Nesom placed in the genera *Canadanthus, Eurybia,* and *Symphyotrichum* (including *Virgulus*) were retained in *Aster,* while they accepted the need to recognize *Doellingeria, Eucephalus, Ionactis, Oreostemma,* and *Oclemena* as separate genera. The 1996 scheme is rejected here in favor of the nomenclature adopted in this paper, which by and large accepts Nesom's genera for the following reasons. In a gene sequence study testing Nesom's subtribal hypotheses (Nesom 1994a), Noyes and Rieseberg (1999) presented data that clearly demonstrated how unrelated *Symphyotrichum* is to *Aster* in the strictest sense within the tribe Astereae. They found that *Oreostemma* and *Doellingeria* are not closely related to *Aster sensu stricto*, as had Xiang and Semple (1996). As well, Xiang and Semple (1996) showed that the western North American genus *Eucephalus* is related to the eastern North American species of *Doellingeria*; Noyes and Rieseberg (1999) did not include species of *Eucephalus* in their study. Noyes and Rieseberg (1999) also showed that *Sericocarpus* is not part of *Aster sensu stricto.* Xiang and Semple (1996) found that the lectotype species *A. amellus* L. was closely related to the "eurybian" asters, which thus were thought to be best retained in the genus *Aster.* Noyes and Rieseberg (1999; nuclear DNA) did not include any "eurybian" asters in their study, but in contrast to Xiang and Semple (1996; chloroplast DNA) did find *A. amellus* to be closely related to Old World and South American genera in the tribe and not the North Amer-

ican taxa. The karyotype of *A. amellus* and those of the "eurybian" asters were found to be quite distinct (recent observations by J.C.S.); the karyotype of *A. amellus* is similar in size to that of *A. ageratoides* subsp. *ovatus* illustrated in Tara (1972), both with chromosomes larger than North American asters. Thus, after reconsideration of the morphology of the "eurybian" asters, *A. amellus,* and several other Eurasian species, and review of Nesom's morphological observations on generic limits, we have chosen to accept inclusion of the western asters related to "*A.*" *sibiricus* in *Eurybia* as proposed by Nesom (1994b). We also have followed Nesom's (1994b) proposal to treat *A. modestus* as *Canadanthus modestus,* although it could be included in a broadly defined *Symphyotrichum* (Semple et al. 1996; Xiang and Semple 1996). Thus, there are both morphological and molecular studies supporting the multi-generic treatment of the asters followed in this paper. Traditional treatments of *Aster* in the broad sense rest on plesiomorphies rather than true synapomorphic traits to define the genus; *Aster sensu lato* has never really been a well-defined genus. Each segregate genus as accepted here is well-defined by morphological and nucleic acid synapomorphies. A re-examination of the karyotypes of species in each genus is needed in light of the other strong evidence to determine if cytological data also are consistent with these data.

To facilitate the transition from the nomenclature accepted in previous papers in this series to what we believe will ultimately become the generally accepted nomenclature, the older names are given in brackets in the Appendix. This transition, admittedly, may be very slow in coming even though the experimental data strongly support a revised treatment. Such is the conservative nature of floristic taxonomy.

Cytotaxonomy of *Symphyotrichum yukonense*. The phylogenetic position of *Symphyotrichum yukonense* is clarified by the first chromosome number report for the species ($2n = 10$; Appendix). The mitotic karyotype of *Semple & Semple 10624* (WAT) was observed to consist of five homologues indistinguishable at the light microscope level from the published karyotype of *S. ericoides* (Semple 1976; reported as *Aster ericoides*). This is the "virguloid" karyotype shared by all $x = 5$ members of *Symphyotrichum* subg. *Virgulus* (Semple and Brouillet 1980b, under the generic name *Lasallea*; Semple et al. 1983). This is a straight-

forward case of classical cytotaxonomic methods being sufficient to resolve a phylogenetic question because the karyotype is so obviously "virguloid." Had the chromosome number been $2n = 18$, then other methods would likely have been required to reveal the phylogenetic relationships of the species. In the protologue of the species, Cronquist (1945) considered *S. yukonense* to be related to *S. novae-angliae* ($2n = 10$) and *Canadanthus modestus* ($2n = 18$) based on similar involucre traits and only superficially similar to *S. campestre* (all species discussed under the generic name *Aster*). Hultén (1968) suggested that *S. yukonense* was close to *Aster pygmaeus* Lindl. *in* Hook. [synonyms: *A. sibiricus* L. subsp. *pygmaeus* (Lindl. *in* Hook.) Löve & Löve; *Eurybia pygmaea* (Lindl. *in* Hook.) G. L. Nesom]. Jones (1980) included *S. yukonense* in subg. *Virgulus* with a "?" and the comment "perhaps = *campestris*". Semple and Brouillet (1980a) did not comment on the species and did not include it in their emended treatment of *Lasallea* Greene, which was subsequently replaced by the older name *Virgulus* Raf. (Reveal and Keener 1981). Nesom (1994a) transferred the species from *Aster* to *Symphyotrichum* without comment, although its inclusion in the latter genus in subsect. *Polyligulae* (Semple) G. L. Nesom is obviously implicitly based on Nesom's recognition of its morphological similarities to the other species he included: *S. novae-angliae* (type), *S. campestre, S. fendleri,* and *S. oblongifolium.* The karyotypes ($2n = 10$) of *S. novae-angliae, S. campestre, S. fendleri,* and *S. oblongifolium* are essentially identical to that of *S. yukonense. Canadanthus modestus* ($2n = 18$) is the type species of Nesom's monotypic genus *Canadanthus*; its karyotype is distinct from the $x = 8$ karyotypes of *Symphyotrichum* subg. *Symphyotrichum* and the $x = 5$ karyotypes of the virguloid asters of *S.* subg. *Virgulus* (Semple 1984; Semple and Brouillet 1980b; Semple et al. 1983). Based on the karyotype and observations on morphology of *S. yukonense* in the field, it seems likely that the species is derived from *S. campestre,* which has been observed growing near lakes in western North America. Small population sizes and a marginal habitat for a virguloid aster resulted in the evolution of a distinct diminutive species endemic to a few locations in the Yukon and Alaska. Long distance dispersal by birds may account for its original arrival in the far north and subsequent disjunct distribution.

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APPENDIX

CHROMOSOME NUMBER DETERMINATIONS OF ASTEREAE

Chromosome number determinations of Astereae from Canada and the United States are arranged alphabetically by species. *Ah* = T. Ahmed; *Ch* = J. Chmielewski; *Hd* = S. Heard; *S* = J. Semple; *S & S* = J. and B. Semple; *Su* = Bambang Agus Suripto; *Xg* = ChunSheng Xiang; *Zh* = Jie Zhang. When voucher specimens did not fit a published taxon description in one or more minor traits, the "aff." qualifier is used.

Canadanthus modestus (Lindl.) G. L. Nesom [*Aster modestus* Lindl.]. —$2n = 18$. CANADA. Alberta: City of Fox Creek, Hwy. 3, *Emery & Emery 15*. British Columbia: Cassier Hwy. (KP275), along Beaverpond Creek, just N of Ningunsaw Summit, *S & S 10633*; Yellowhead Hwy. (Hwy.-16) E of Hazelton (KP302), 2 km W of China Creek, *S & S 10636*; Hwy.-16, vicinity of rest area, ca. 11 km E of Burns Lake, *S & S 10638*; Hwy.-16 10 km S of Macbride, by Holmes River, *S & S 10639*. U.S.A. Idaho: Idaho Co., SW of Lolo Pass, DeVoto Mem. Cedar Grove, *S & Xg 10309*. Montana: Broadwater Co., E of Townsend, Belt Mts., For. Rd.-423, *S & Xg 10328*; Gallatin Co., N of Bozeman and W of Wilsall, Gallatin Nat'l. For., For. Rd.-642 by Sixteen Mile Creek, *S & Xg 10244*; Missoula Co., NE of Lolo Pass, Lee Creek, S of Lolo Hot Springs, *S & Xg 10311*. Oregon: Clackamas Co., Mt. Hood Nat'l. For., For. Hwy.-42, Clackamas Meadow, *S & Xg 10269*. Washington: Chelan Co., US-12 below Stevens Pass, above For. Rd.-6970, *S & Xg 10296*; Clallam Co., Olympic Peninsula, E of Forks, junct. For. Hwy.-29 and For. Rd.-2932 (T29N R12W S6), *S & Xg 10281*; Whatcom Co., Mt. Baker, N side, WA-542, *S & Xg 10290*; Yakima Co., WA-410 4.1 km W of Mt. Ranier Nat'l Park, *S & Xg 10307*.

Chrysothamnus viscidiflorus (Hook.) Nutt. var. *lanceolatus* (Nutt.) Greene. —$2n = 9_{II}$. U.S.A. Utah: Summit Co., just E of UT-150 on For. Rd., 10.0 km S of state line, *S, Su & Ah 9212*.

C. viscidiflorus (Hook.) Nutt. var. *puberulus* (D. C. Eaton) Jepson. —$2n = 18_{II}$. U.S.A. Utah: Salt Lake–Wasatch Co. line, UT-90, pass E of Brighton, *S, Su & Ah 9250*.

Corethrogyne filaginifolia (Hook. & Arn.) Nutt. —$2n = 5_{II}$. U.S.A. California: San Benito Co., New Idria Mine Camp 2 Pit, *S, Su & Ah 9357*.

Ericameria bloomeri (A. Gray) J. F. Macbr. var. *bloomeri*. —$2n = 18_{II}$. U.S.A. California: Sierra Co., Nichols Mill Rd. (For. Rd.-15) 2.3 km E of Yuba Pass Rd. (For. Rd.-12), *S, Su & Ah 9328*.

Erigeron arenarioides (D. C. Eaton) A. Gray. —$2n = 9_{II}$. U.S.A. Utah: Salt Lake Co., UT-190 E of Midvale, Big Cottonwood Canyon, Wasatch Nat'l For., Mill B. Picnic Area, *S, Su & Ah 9242*.

E. caespitosus Nutt. —$2n = 9_{II}$. U.S.A. Wyoming: Albany Co., E of Laramie, ridge by Happy Jack Rd., S of Lincoln Monument on I-80, *S & S 10360*. —$2n = 18$. Montana: Carbon Co., SW of Red Lodge, For. Rd.-421 at Wyoming Creek, in Limber Pine Nat'l. For. Campground (T9S R19E S8), *S & Xg 10237*.

E. compositus Pursh. —$2n = 18$. U.S.A. Wyoming: Albany Co., Snowy Mts., WY-130, Libby Flats Observation Tower, *S & Zh 10408*. —$2n = 36$. Colorado: Pitkin Co., Independence Pass, *S & Zh 10458*.

E. glaucus Ker Gawl. —$2n = 9_{II}$. U.S.A. California: Marin Co., Tomales Pt., lower cliffs at McClures Beach, *S, Su & Ah 9330*.

E. peregrinus (Pursh) Greene var. *callianthemus* Cronquist. —$2n = 36$. U.S.A. Wyoming: Park Co., US-12, 2 km E of Long Lake, Beartooth Range, *S & Zh 10426*.

E. peregrinus (Pursh) Greene var. *dawsonii* Greene. —$2n = 36$. U.S.A.

Washington: Whatcom Co., Mt. Baker, Ptarmigan Ridge Trail, *S & Xg 10293*.

E. peregrinus (Pursh) Greene var. *scaposus* (Torr. & A. Gray) Cronquist. —$2n$ = 18. U.S.A. Oregon: Hood River Co., Mt. Hood, along creek below tree line, below Eliot Glacier, *S & Xg 10275*. Washington: Whatcom Co., Mt. Baker, Ptarmigan Ridge Trail, *S & Xg 10295*.

E. speciosus (Lindl.) DC. —$2n$ = 18. U.S.A. New Mexico: Lincoln Co., W of Alto, NM-532 at Oak Grove Campground, *S & Hd 8119*. Wyoming: Johnson Co., Powder River Pass, Middle Fork Clear Creek Campground, *S & Xg 10207*.

E. subtrinervis Rydb. —$2n$ = 18. U.S.A. Wyoming: Carbon Co., NW of Battle Mt., For. Rd.-801 by For. Rd.-801.18, ca. 10 km N of WY-70, *S & Zh 10415*.

E. ursinus D. C. Eaton. —$2n = 9_{II}$. U.S.A. Colorado: Pitkin Co., Independence Pass, *S & Zh 10456*.

Eucephalus breweri (A. Gray) G. L. Nesom [*Aster breweri* (A. Gray) Semple]. —$2n = 9_{II}$. U.S.A. California: Nevada Co., I-80, Donner Summit Rest Area, W of Donner Lake, *S & S 10359*.

E. engelmannii (D. C. Eaton) Greene [*Aster engelmannii* (D. C. Eaton) A. Gray]. —$2n = 9_{II}$. U.S.A. Washington: Chelan Co., W of Merrit, Merrit Lake Trail Rd., just S of US-12, *S & Xg 10297*.

E. glaucescens (A. Gray) Greene [*Aster glaucescens* (A. Gray) S. F. Blake]. —$2n = 9_{II}$. U.S.A. Washington: Klickitat Co., NW of Husum, W of Mt. Baldy, ca. 3 km W of WA-141 on gravel side rd., *S & Xg 10273*.

E. glaucus Nutt. [*Aster glaucodes* S. F. Blake]. —$2n = 9_{II}$. U.S.A. Colorado: Garfield Co., 6 km S of county line, CO-139 just N of Douglas Pass, *S & Zh 10444*; Pitkin Co., CO-82 6.6 km E of Aspen, *S & Zh 10448*. Utah: Salt Lake Co., E of Midvale, UT-190, Big Cottonwood Canyon, *S, Su & Ah 9244*. Wyoming: Teton Co., E of Hoback Junction, US-191 2 km E of Hoback campground, *S & Zh 10439*.

E. ledophyllus (A. Gray) Greene var. *covillei* (Greene) G. L. Nesom [*Aster ledophyllus* A. Gray var. *covillei* (Greene) Cronquist]. —$2n = 9_{II}$. U.S.A. Oregon: Jefferson Co., US-20 just E of Santiam Pass, woods, 4800 ft. el., *S & Xg 10262*.

Eurybia conspicua (Lindl.) G. L. Nesom [*Aster conspicuus* Lindl.]. —$2n$ = ca. 108. CANADA. Alberta: Hwy.-43 16.4 km W of Little Smoky, *S & S 10608*. U.S.A. Montana: Broadwater Co., E of Townsend, Belt Mts., For. Rd.-423, *S & Xg 10323, S & Xg 10330*. Washington: Chelan Co., US-97 22.2 km S of US-2, *S & Xg 10303*. —$2n$ = 126. CANADA. Alberta: Hwy.-16, vicinity of rest area ca. 11 km E of Burns Lake, *S & S 10637*.

E. merita (A. Nelson) G. L. Nesom [*Aster meritus* A. Nelson]. —$2n$ = 36. U.S.A. Montana: Carbon Co., US-212 N of Beartooth Pass, vicinity of hairpin turn, *S & Xg 10232*; below summit near tree line, *S & Zh 10421*; 2.8 km W of Cooke City, *S & Zh 10431*; SW of Red Lodge, For. Rd.-421 at Wyoming Creek, in Limber Pine Nat'l. For. Campground (T9S R19E S8), *S & Xg 10234*. Wyoming:

Johnson Co., US-16 just W of Powder River Pass, *S & Xg 10219*; Washakie Co., Big Horn Mts., US-16 1.8 km S of county line (T48N R86W S6), *S & Xg 10221*.

E. radulina (A. Gray) G. L. Nesom [*A. radulinus* A. Gray]. —$2n = 9_{II}$. U.S.A. California: Contra Costa Co., Charles Tilden Reg. Park, Vollmer Peak, *S, Su & Ah 9340*.

E. sibirica (L.) G. L. Nesom [*Aster sibiricus* L.]. —$2n = 18$. CANADA. British Columbia: Buckinghorse, Buckinghorse Prov. Park, along river, *S & S 10615*. Yukon Territory: Hwy.-2 ca. 20 km E of Dawson City, banks of Klondike River, *S & S 10628*; Klondike Loop Hwy., W of Stewart Crossing (KP543), *S & S 10627*; between Whitehorse and Haines Junction, Alaska Hwy. (KP1557), banks of Mendenhall River, *S & S 10625*.

Euthamia occidentalis Nutt. —$2n = 18$. U.S.A. California: Plumas Co., Taylorville, County Park, gravel bars of Indian Creek, *S, Su & Ah 9308*; San Benito Co., W of Hernandez, Coalinga Rd. by Laguna Creek, *S, Su & Ah 9348*. Nevada: Humboldt Co., NV-140, 31 mi. SE of Denio, N of Jackson Mt., vicinity of irrigation ditch, *S, Su & Ah 9288*.

Grindelia squarrosa (Pursh) Dunal. —$2n = 6_{II}$. U.S.A. Utah: Salt Lake Co., UT-190 E of Midvale, lower end of Big Cottonwood Canyon, *S, Su & Ah 9240*.

Gutierrezia sarothrae (Pursh) Britton & Rusby. —$2n = 4_{II}$. U.S.A. Wyoming: Carbon Co., WY-130 at Co. Rd.-209, 2.3 km E of WY-230, *S & Zh 10410*.

Heterotheca fulcrata (Greene) Shinners var. *senilis* (Wooton & Standl.) Semple. —$2n = 9_{II}$. U.S.A. New Mexico: Doña Ana Co., E slope of Organ Mts., SE of Organ, *S & S 10510*.

H. oregona (Nutt.) Shinners var. *scaberrima* (A. Gray) Semple. —$2n = 9_{II}$. U.S.A. California: Monterey Co., W of Greenfield, gravel bars of Arroyo Seco River by Hwy. G-16 bridge, *S & S 10478*.

H. sessiliflora (Nutt.) Shinners var. *echioides* (Benth.) Semple. —$2n = 9_{II}$. U.S.A. California: Ventura Co., SE of Venticopa, *S et al. 5634*.

H. sessiliflora (Nutt.) Shinners var. *fastigiata* Semple. —$2n = 9_{II}$. U.S.A. California: Los Angeles Co., N of Claremont, Mt. Baldy Rd. just S of L.A. Nat'l. For. boundary, *S & Ch 8629*.

H. villosa (Pursh) Shinners var. *scabra* (Eastw.) Semple. —$2n = 9_{II}$. U.S.A. Utah: Salt Lake Co., UT-190 E of Midvale, Big Cottonwood Canyon, Mill B. Picnic Area, *S, Su & Ah 9247*.

Isocoma menziesii (Hook. & Arn.) G. L. Nesom var. *menziesii*. —$2n = 6_{II}$. U.S.A. California: San Benito Co., New Idria Rd., Griswald Canyon, S of Panoche, *S, Su & Ah 9358*.

Machaeranthera canescens (Pursh) A. Gray var. *latifolia* (A. Nelson) S. L. Welsh. —$2n = 4_{II} + 1_{II}$ supernumeraries. U.S.A. Utah: Salt Lake Co., UT-190 at pass E of Brighton, Wasatch Co. line, *S, Su & Ah 9249*.

M. gracilis (Nutt.) Shinners. —$2n = 2_{II}$. U.S.A. New Mexico: Grant Co., frontage rd. just W of Separ Exit on I-10, *S & S 10507*.

Oreostemma alpigenum (Torr. & A. Gray) Greene subsp. *alpigenum*

[*Aster alpigenus* (Torr. & A. Gray) A. Gray subsp. *alpigenus*]. —$2n$ = 18. U.S.A. Oregon: Hood River Co., Mt. Hood, Cooper Spur Trail below Eliot Glacier, *S & Xg 10271*.

O. alpigenum (Torr. & A. Gray) Greene subsp. *haydenii* (Porter) Semple [*Aster alpigenus* (Torr. & A. Gray) A. Gray subsp. *haydenii* (Porter) Cronquist]. —$2n$ = 18. U.S.A. Wyoming: Park Co., Bear Tooth Mts., Gardner Lake Trail trailhead, *S & Zh 10419*; US-212 2 km E of Long Lake, *S & Zh 10424*.

Pyrrocoma apargioides (A. Gray) Greene. —$2n = 6_{II}$. U.S.A. California: Plumas Co., Sierra Valley, A-24 just W of CA-49, 8 km N of Loyalton, *S, Su & Ah 9315*.

P. lanceolata (Hook.) Greene. —$2n = 12_{II}$. U.S.A. Nevada: Elko Co., 17 mi. NE of Ruby Valley, by NV-229 in dry bed of Franklin River, E of Ruby Dome, *S, Su & Ah 9366*.

P. racemosa (Nutt.) Torr. & A. Gray var. *racemosa*. —$2n = 6_{II}$. U.S.A. California: San Benito Co., Clear Creek Rd. 4.65 km E of Coalinga Rd., *S, Su & Ah 9350*.

Sericocarpus oregonensis Nutt. subsp. *californicus* (Durand) Ferris [*Aster oregonensis* (Nutt.) Cronquist subsp. *californicus* (Durand) Keck]. —$2n = 9_{II}$. U.S.A. California: Placer Co., I-80, Rest Area E of Gold Run, *S & S 10358*.

S. oregonensis Nutt. subsp. *oregonensis*. [*Aster oregonensis* (Nutt.) Cronquist subsp. *oregonensis*]. —$2n = 9_{II}$. U.S.A. Oregon: Marion Co., W of Detroit, Hall Ridge Rd., Willamette Nat'l. For. (T10S R5E S17), *S & Xg 10267*.

Solidago altissima L. var. *gilvocanescens* (Rydb.) Semple. —$2n$ = 18. CANADA. Manitoba: S of Winnipeg, MB-75 1 km N of Hwy.-305, NW of Ste. Agathe, *S 10645*. —$2n$ = 36. U.S.A. Wyoming: Carbon Co., S of Arlington, ca. 2.3 km S of I-80, Rocky Creek Trail, *S, Su & Ah 9208, S, Su & Ah 9210*; Crook Co., W of Moorcroft, I-90-bus. right-of-way, *S & Xg 10193*.

S. californica Nutt. —$2n$ = 18. U.S.A. California: Kern Co., CA-155 1.6 km E of Glennville, *S & Ch 8947*; CA-178 between Onyx and Weldon, *S, Su & Ah 9365*; Plumas Co., CA-89 10.5 km NW of Greenville, *S, Su & Ah 9303*; Taylorville, County Park, edge of Indian Creek, *S, Su & Ah 9307*; San Benito Co., W of Sweetwater Spring, Coalinga Rd., Lorenzo Vasques Canyon, ca. S of Black Mt. radio tower, *S, Su & Ah 9346*; Shasta Co., W of Fall River Mills, CA-299, 2.5 km E of Pit River, *S, Su & Ah 9300*.

S. canadensis L. subsp. *elongata* (Nutt.) Keck. —$2n$ = 18. U.S.A. California: Modoc Co., NE of Alturas, US-395 ca. 2 km S of Joseph Creek Rd., along N. Fork Pit River, *S, Su & Ah 9295, S, Su & Ah 9296, S, Su & Ah 9297*. Washington: Clallam Co., Olympic Pen., E of Forks, For. Rd.-2932 (T29N R12W S17, NE corner), *S & Xg 10279*; Grays Harbor Co., N of Hoguiam, US-101 (MP100) 14.6 km S of Humptulips River, *S & Xg 10278*; Whatcom Co., N of Mt. Baker, WA-542 S of Silver Fir Campground, *S & Xg 10289*. —$2n$ = 36. CANADA. British Columbia: E of Hazelton, Yellowhead Hwy.(16), KP302, 2 km W of China Creek, *S & S 10635*.

S. canadensis L. subsp. *salebrosa* (Piper) Keck. —$2n$ = 18. U.S.A. Colorado: Gunnison Co., 3.3 km W of Crested Butte, Kebler Pass Rd., *S & Hd 7754*. Idaho: Owyhee Co., W of Silver City, Silver City Rd. E of strip mine, along Jordan Creek, *S & Xg 10258*. Wyoming: Carbon Co., S of Arlington, ca. 2.3 km S of I-80, Rocky Creek Trail, *S, Su & Ah 9209*. —$2n$ = 36. U.S.A. Montana: Carbon Co., MT-78 1.6 km NW of Red Lodge, *S & Xg 10239*. —$2n$ = 54. CANADA. Alberta: AB-43 E of Grand Prairie, W of Bezanson, *S & S 10612*. U.S.A. Montana: Broadwater Co., E of Townsend, Belt Mts., For. Rd.-423 at Edith Lake Rd., *S & Xg 10324*. Utah: Salt Lake Co., E of Midvale, UT-190, Big Cottonwood Canyon, *S, Su & Ah 9245*; Summit Co., UT-150 (MP 5.5) W of Kamas, *S, Su & Ah 9238*. Washington: Chelan Co., NW of Leavenworth, US-2 0.8 km SE of WA-207 (Coles Corner), *S & Xg 10298*, *S & Xg 10299*. Wyoming: Uintah Co., WY-150 ca. 11.5 km S of Evanston, by creek S of Bear River, *S, Su & Ah 9211*.

S. *confinis* Nutt. —$2n$ = 18. U.S.A. California: San Bentio Co., W of Hernandez, Coalinga Rd. at Laguna Creek, *S, Su & Ah 9347*.

S. gigantea Aiton ("*shinnersii*" morph). —$2n$ = 54. U.S.A. Montana: Broadwater Co., Belt Mts., E of Townsend, banks of East Fork of Deep Creek, For. Rd.-423, *S & Xg 10329*; Gallatin Co., N of Bozeman and W of Wilsall, Gallatin Nat'l. For., For. Rd.-642, along Sixteenmile Creek, *S & Xg 10243*; Powell Co., MT-20 17.7 km W of Lincoln, *S & Xg 10312*.

S. aff. *gigantea* Aiton. —$2n$ = 54. U.S.A. California: Modoc Co., NE of Alturas, US-395 ca. 2 km S of Joseph Creek Rd., along North Fork of Pit River, *S, Su & Ah 9294*.

S. guiradonis A. Gray. —$2n$ = 18. U.S.A. California: San Benito Co., Clear Creek Rd. 4.6 km N of Coalinga Rd., *S, Su & Ah 9351-A*; 3.5 km S of New Idria, junct. of Clear Creek Rd. and Saw Mill Creek Rd., San Carlos Creek, *S, Su & Ah 9356-C*.

S. lepida DC. —$2n$ = 36. CANADA. Yukon Territory: Alaska Hwy. (KP1400.3), NW of Jakey, 23 km S of Judas Creek, *S & S 10622*. —$2n$ = 54. CANADA. British Columbia: Alaska Hwy. (BC-97) 13.0 km W of Toad River, *S & S 10618*; Little Smoky, just S of town, *S & S 10607*.

S. missouriensis Nutt. —$2n$ = 18. U.S.A. Idaho: Owyhee Co., Owyhee Mts., Silver City Range, Silver City Rd. 22 km SE of ID-78, *S & Xg 10257*. Nevada: Humboldt Co., NV-140 31 mi. SE of Denio, N of Jackson Mt., vic. of irrigation ditch, *S, Su & Ah 9290*. Wyoming: Crook Co., E of Sundance, US-14 right-of-way by I-90 exit, *S & Xg 10187*; Park Co., US-212 7 km W of WY-296, *S & Zh 10430*. —$2n$ = 36. Montana: Broadwater Co., E of Townsend, W slopes of Belt Mts., For. Rd.-423, *S & Xg 10316*; Carbon Co., SW of Red Lodge, For. Rd.-421 at Wyoming Creek, in Limber Pine Nat'l. For. Campground, *S & Xg 10233*. Nevada: Elko Co., Ruby Mts., E of NV-227, Soldier Creek Trail, lower el., near end of jeep trail, *S, Su & Ah 9272*; mid el., *S, Su & Ah 9277*; upper mid el., *S, Su & Ah 9279*, *S, Su & Ah 9280*. Wyoming: Carbon Co., S of

Arlington, vicinity of gravel rd. by I-80 exit, *S, Su & Ah 9204*; Johnson Co., N of Buffalo, E of Lake Smet, Bellus Rd. (T52N R82W S13), *S & Xg 10195*; W of Buffalo, US-16 (MP83) 5.5 km E of Hunter Rd., *S & Xg 10205*.

S. mollis Bartl. var. *mollis*. —$2n = 18_{II}$. U.S.A. Wyoming: Crook Co., E of Sundance, US-14, vicinity of entrance to I-90, *S & Xg 10188*. —$2n = 36$. South Dakota: Minnehaha Co., NW of Humbolt, SD-38 3.5 km W of SD-19, *S & Xg 10181*.

S. multiradiata Aiton. —$2n = 18$. CANADA. British Columbia: Cassier Hwy. ca. 25 km S of Dease Lake, KP460, S of Gnat Summit, *S & S 10632*. U.S.A. Colorado: Pitkin Co., Independence Pass, *S & Zh 10460*. Utah: Summit Co., W of Kamas, UT-150 along Slate Creek, *S, Su & Ah 9228*; UT-150, East Fork Bear River Campground, *S, Su & Ah 9215*; Duchnesne Co. line, peak W of Highline Trailhead on UT-150, *S, Su & Ah 9227*. Washington: Clallam Co., S of Port Angeles, Olympic Mts., between Eagle Pt. and Obstruction Peak, *S & Xg 10287*. Wyoming: Albany Co., Snowy Mts., WY-130 18 km W of Centennial, rd. to Sugarloaf Rec. Area, *S & Zh 10406;* Carbon Co., Battle Mt., WY-70, Battle Pass, *S & Zh 10414*. —$2n = 36$. Montana: Carbon Co., N of Beartooth Pass, US-212 near hairpin turn, 8155 ft. el., *S & Xg 10231*. Wyoming: Park Co., Beartooth Range, US-212 E of Beartooth Pass, Beartooth Loop above Gardner Lake (T58N R104W S29), *S & Xg 10227*; US-212 E of Long Lake, *S & Zh 10423*.

S. nana Nutt. —$2n = 18$. U.S.A. Utah: Summit Co., W of Kamas, UT-150 along Slate Creek, *S, Su & Ah 9235*.

S. nemoralis Aiton subsp. *decemflora* (DC.) Brammall *ex* Semple. —$2n = 18_{II}$. U.S.A. Colorado: Sedgwick Co., S of Julesburg, US-385 just S of I-76, *S & Zh 10472*. South Dakota: Minnehaha Co., NW of Humboldt, SD-38 3.5 km W of SD-19, *S & Zh 10184* [published in Semple et al. 1993 in error as *10181*, see *S. mollis* above]

S. parryi (A. Gray) Greene. —$2n = 18$. U.S.A. New Mexico: McKinley Co.–Valencia Co. line, N of Grants, San Mateo Spring Canyon, SW of Springs (T12N R7W S7), *S, Su & Ah 9371*; Valencia Co., Cebolleta Mts., Mt. Taylor ca. 10,700 ft. el. (T12N R7W S20), *S, Su & Ah 9378*. Utah: Salt Lake Co., Brighton, *S, Su & Ah 9248*; Summit Co., UT-150 (MP38) ca. 30 km S of Wyoming state line, *S, Su & Ah 9222*. Wyoming: Carbon Co., Battle Mt., WY-70, Battle Pass, *S & Zh 10413*.

S. rigida L. subsp. *humilis* (Porter) S. B. Heard & Semple. —$2n = 18$. U.S.A. Montana: Carbon Co., MT-78 1.6 km NW of Red Lodge, *S & Xg 10238*. Wyoming: Johnson Co., N of Buffalo, E of Lake Smet, Bellus Rd. (T52N R82W S13), *S & Xg 10196*.

S. simplex Kunth (subsp. *simplex*) var. *nana* (A. Gray) Ringius. —$2n = 18$. U.S.A. Oregon: Hood River Co., Mt. Hood, Cooper Spur Trail below Eliot Glacier, *S & Xg 10270*.

S. simplex Kunth (subsp. *simplex*) var. *simplex*. —$2n = 18$. CANADA. British Columbia: Cassier Hwy. (Hwy.-37) 80 km S of Alaska Hwy., KP643.5, ca. 5 km N of Boya Lake, *S & S 10631*. Yukon

Territory: Alaska Hwy. just N of Haines Junction, *S & S 10623*; Klondike Loop (YT-2), KP270, N of Fox Lake, *S & S 10626*. U.S.A. Colorado: Pitkin Co., CO-82 16 km E of Aspen, just E of For. Rd.-106, *S & Zh 10450*. New Mexico: McKinley Co.–Valencia Co. line, SE of San Mateo, San Mateo Rd., Cibola Nat'l. For. (T12N R7W S5), *S, Su & Ah 9368*; N of Grants, San Mateo Spring Canyon, SW of Springs (T12N R7W S7), *S, Su & Ah 9370*, *S, Su & Ah 9372*; Valencia Co., Cebolleta Mts., Mt. Taylor ca. 10,700 ft. el. (T12N R7W S120), *S, Su & Ah 9379*; 10,500 ft. el., *S, Su & Ah 9380*. Wyoming: Johnson Co., W of Buffalo, US-16 between Pole Creek and Caribou Creek, N of Crazy Woman Campground, *S & Xg 10211*.

S. sparsiflora A. Gray. —$2n$ = 18. U.S.A. New Mexico: Bernalillo Co., NM-14 S of Tijeras, *S, Su & Ah 9382*; Lincoln Co., W of Alto, NM-532 at Oak Grove Campground, *S & Hd 8121*. Wyoming: Fremont Co., WY-287 E of Jeffrey City, Split Rock Historical Marker Site, *S & Zh 10418*. —$2n$ = 36. Colorado: Garfield Co., CO-139 just N of Douglas Pass, 6 km S of county line, *S & Zh 10445*. Utah: Salt Lake Co., E of Midvale, UT-190 3.5 mi E of UT-210, lower end of Big Cottonwood Canyon, *S, Su & Ah 9241*. Wyoming: Teton Co., Gros Ventre Rd. 8 km E of Kelly, Lower Slide Lake Campground, *S & Zh 10437*.

S. spectabilis (D. C. Eaton) A. Gray. —$2n$ = 18. U.S.A. California: Sierra Co., S of Loyalton, Antelope Valley Rd. SW of Sierra Brooks, *S, Su & Ah 9316*.

S. wrightii A. Gray. —2n = 9_{II}. U.S.A. Arizona: Gila Co., near Salt River below US-60 bridge, *S & S 10496*. —2n = 18. Texas: Culberson Co., Guadalupe Mt. Nat'l. Park, Bowl Trail, 7880 ft. el., *S & Hd 8185* (collected under permit from GMNP).

Symphyotrichum ascendens (Lindl.) Nees [syn: *Aster ascendens* Lindl.]. —$2n$ = 26. U.S.A. California: Sierra Co., CA-49 W of Yuba Pass, *S & Hd 8407*; Yuba Pass Rd. ca. 2.5 km N of Nichol Mill Rd., *S, Su & Ah 9323*. —$2n$ = 52. Colorado: Gunnison Co., US-50 just W of Gunnison city limits, by museum, *S & Hd 7750*; E of Somerset, Kebler Pass Rd. 3.0 km E of CO-133, *S & Hd 7785*; 20 km E of CO-133, *S & Hd 7777*. Montana: Broadwater Co., E of Townsend, W slopes of Belt Mts., For. Rd.-423, *S & Xg 10321*. Wyoming: Johnson Co., W of Buffalo, US-16 (MP83) 5.5 km E of Hunter Rd., *S & Xg 10204*. —$2n$ = 52 + 2 supernumeraries. Montana: Broadwater Co., E of Townsend, W slopes of Belt Mts., For. Rd.-423, *S & Xg 10319*.

S. campestre (Nutt.) G. L. Nesom [*Aster campestris* Nutt.]. —$2n$ = 5_{II}. U.S.A. Montana: Beaverhead Co., WSW of Grant, MT-324 S of Lemhi Pass Rd., *S & Xg 10249*. —$2n$ = 10. Montana: Lewis and Clark Co., E of Lincoln, MT-279, Flesher Pass, *S & Xg 10315*.

S. chilense (Nutt.) G. L. Nesom [*Aster chilensis* Nees]. —$2n$ = 48. U.S.A. California: Contra Costa Co., E of Berkeley, Berkeley Hills, Grizzly Peak Rd., *S, Su & Ah 9337*; Del Norte Co., E of Klamath,

bluff along N side of Klamath River, *S & Hd 8516;* Mendocino Co., CA-1, 10 km N of Cleone, *S & Hd 8538.*

S. ciliolatum (Lindl.) Löve & Löve [*Aster ciliolatus* Lindl.]. —$2n$ = 48. CANADA. Alberta: Little Smoky, just S of town on side rd., *S & S 10605.* British Columbia: Alaska Hwy. (BC-97), KP46, near brake test area, *S & S 10614*; 10.8 km W of Smith River bridge, *S & S 10619*; 13.0 km W of Toad River, *S & S 10617*; Buckinghorse, Buckinghorse Prov. Park, *S & S 10616*; Cassier Hwy. (BC-37), KP87, 10.6 km N of Cranberry River bridge, *S & S 10634*; Yellowhead Hwy., McBride, *Emery & Emery 3a.* U.S.A. Wyoming: Washakie Co., Bighorn Mts., Tensleep Canyon, Leigh Campground, *S & Xg 10222.*

S. eatonii (A. Gray) G. L. Nesom [*Aster bracteolatus* Nutt.; *A. eatonii* A. Gray]. —$2n$ = 16. U.S.A. California: Modoc Co., NE of Alturas, flood plain of North Fork of Pit River along US-395, ca. 2 km S of Joseph Creek Rd., *S, Su & Ah 9298.* Montana: Broadwater Co., E of Townsend, Belt Mts., For. Rd.-423 along East Fork of Deep Creek, *S & Xg 10326.* Washington: Chelan Co., NW of Leavenworth, US-2 0.8 km SE of Coles Corner (WA-207), *S & Xg 10300*; Kittitas Co., US-97 10.8 km by rd. W of Swauk Pass, N of Durst Creek Rd. (For. Rd.-9705), *S & Xg 10304.*

S. ericoides (L.) G. L. Nesom var. *ericoides* [*Aster ericoides* L. var. *ericoides*]. —$2n$ = 10. CANADA. Alberta: AB-43 E of Grand Prairie, W of Bezanson, *S & S 10609.* —$2n$ = 20. U.S.A. South Dakota: Minnehaha Co., NW of Humboldt, SD-38 3.5 km W of SD-19, *S & Xg 10180.*

S. falcatum (Lindl.) G. L. Nesom var. *commutatum* (Torr. & A. Gray) Nesom [*Aster falcatus* Lindl. var. *commutatum* Torr. & A. Gray]. —$2n$ = 30. CANADA. Alberta: N of Drumheller, Midland Prov. Park, near Red Deer River, *S 10641.* U.S.A. Montana: Broadwater Co., E of Townsend, W slopes of Belt Mts., For. Rd.-423, *S & Xg 10318*; Gallatin Co., N of Bozeman and W of Wilsall, For. Rd. 6.2 km W of MT-86, *S & Xg 10242.* Wyoming: Carbon Co., WY-130 at Co. Rd.-209, 2.3 km W of WY-230, *S & Zh 10411*; Johnson Co., N of Buffalo, E of Lake Smet, Bellus Rd., *S & Xg 10197*; S of Lake Smet, *S & Xg 10200*; W of Buffalo, US-16 5.5 km E of Hunter Rd., *S & Xg 10203*; Washakie Co., Big Horn Mts., Ten Sleep Canyon, Leigh Campground, *S & Xg 10223.*

S. falcatum (Lindl.) G. L. Nesom var. *falcatum* [*Aster falcatus* Lindl. var. *falcatus*]. —$2n$ = 30. CANADA. Alberta: N of Drumheller, Midland Prov. Park, rd. embankment, *S 10643.*

S. foliaceum (Lindl.) G. L. Nesom [*Aster foliaceus* Lindl.]. —$2n$ = 16. U.S.A. Montana: Broadwater Co., E of Townsend, Belt Mts., For. Rd.-423, bank of East Fork of Deep Creek, *S & Xg 10327*; Carbon Co., SW of Red Lodge, For. Rd.-421, Limber Pine Campground, *S & Xg 10235.* Wyoming: Johnson Co., US-16, Powder River Pass, *S & Xg 10213, S & Xg 10217*; Park Co., US-212 E of Beartooth Pass, Beartooth Loop, above Gardner L., *S & Xg 10226*; US-212 2 km E of Long Lake, *S & Zh 10425.* —$2n$ = 32. Nevada: Elko

Co., Ruby Mts., E of NV-227, Soldier Creek Trail, end of jeep trail, by creek, *S, Su & Ah 9269*; upper-mid el., edge of creek, *S, Su & Ah 9281*. —$2n$ = 48. Idaho: Custer Co., SE of Chilly, Trail Creek Rd. at Big Falls Creek Rd., 41.5 km (by rd.) SW of US-93, *S & Xg 10253*. Montana: Carbon Co., SW of Red Lodge, For. Rd.-421, Limber Pine Campground, *S & Xg 10236*. —$2n$ = 64. Oregon: Lake Co., OR-140 6.1 km W of Adel, along river, *S, Su & Ah 9293*. Washington: Whatcom Co., Mt. Baker, Ptarmigan Ridge Trail, *S & Xg 10292*. Wyoming: Johnson Co., E of Powder River Pass, Middle Fork Clear Creek Campground, along creek, *S & Xg 10208*. —$2n$ = 80. Montana: Broadwater Co., E of Townsend, Belt Mts., For. Rd.-423, *S & Xg 10325*. Wyoming: Carbon Co., S of Arlington, ca. 2.3 km S of I-80, Rocky Creek Trail, *S, Su & Ah 9206*.

S. laeve (L.) Löve & Löve var. *laeve* [*Aster laevis* L. var. *laevis*]. —$2n$ = 48. CANADA. Alberta: AB-43 E of Grand Prairie, W of Bezason, *S & S 10611;* Jasper Nat'l. Park, Waterfowl Lake, overflow campground, *Emery & Emery 1*. U.S.A. Montana: Powell Co., MT-200 17.7 km W of Lincoln, *S & Xg 10313*.

S. lanceolatum (Willd.) G. L. Nesom subsp. *hesperium* (A. Gray) G. L. Nesom [*Aster lanceolatus* Willd. subsp. *hesperius* (A. Gray) Semple & Chmiel.]. —$2n$ = 64. CANADA. Alberta: AB-43 E of Grand Prairie, W of Bezeason, *S & S 10610*. U.S.A. Arizona: Coconino Co., US-89 just S of Pine Flat Campground, *S & Ch 9012*. California: Inyo Co., US-395, N end of Big Pine, *S & Hd 8671*; Mono Co., Topaz, ditch by US-395, *S & Ch 8906*. Wyoming: Crook Co., W of center of Moorcroft, I-90 bus., *S & Xg 10194*. —$2n$ = 64 + ca. 6 small supernumeraries. Wyoming: Johnson Co., N of Buffalo, S of Lake Smet (T52N R82W S28), *S & Xg 10199*.

S. lanceolatum subsp. *hesperium* × var. *lanceolatum*. —$2n$ = 48–56 (aneuploid variation on 7x). CANADA. Manitoba: Otterburne, near Rat River, *S 10646*.

S. lanceolatum (Willd.) G. L. Nesom var. *lanceolatum* [*Aster lanceolatus* Willd. subsp. *lanceolatus* var. *lanceolatus*]. —$2n$ = 64. U.S.A. South Dakota: McCook Co., Montrose, SD-38, *S & Xg 10185*.

S. puniceum (L.) Löve & Löve [*Aster puniceus* L.]. —$2n$ = 16. CANADA. Alberta. Just S of Little Smoky, *S & S 10606*.

S. spathulatum (Lindl.) G. L. Nesom [*Aster spathulatum* Lindl.; *A. occidentalis* (Nutt.) Torr. & A. Gray]. —$2n$ = 16. U.S.A. Oregon: OR-242 W of Mckenzie Pass, vic. of Craig Lake, *S & Xg 10261*. —$2n$ = 64. Montana: Missoula Co., NE of Lolo Pass, Lee Creek, S of Lolo Hot Springs, *S & Xg 10310*.

S. yukonense (Cronquist) G. L. Nesom [*Aster yukonensis* Cronquist]. —$2n$ = 10. CANADA. Yukon Territory: S end of Kluane Lake, *S & S 10624*.

Townsendia parryi D. C. Eaton. —$2n$ = 36. U.S.A. Montana: Gallatin Co. For. Rd. 6.2 km W of MT-86, W of Wilsall, *S & Xg 10240*.