TAXONOMIC REVIEW OF *ASTRANTHIUM INTEGRIFOLIUM* (ASTERACEAE: ASTEREAE)

Guy L. Nesom

Botanical Research Institute of Texas
509 Pecan Street
Fort Worth, Texas 76102-4060, U.S.A.

ABSTRACT

Astranthium integrifolium (Michx.) Nutt. has been treated as comprising two taxa (var./subsp. *integrifolium* and var. *triflorum*/subsp. *ciliatum*) or simply as a single species without formal infraspecific designation. The two taxa are completely allopatric and separated by features of vegetative, floral, and cypselar morphology. Consistent with taxonomic ranking of other *Astranthium* species pairs, these two taxa are treated here at specific rank: *Astranthium integrifolium* sensu stricto and **Astranthium ciliatum** (Raf.) Nesom, comb. nov. A neotype is selected for *Bellis ciliata* var. *triflora* Raf. (= *A. ciliatum*).

RESUMEN

Astranthium integrifolium (Michx.) Nutt. se ha tratado comprendiendo dos taxa (var./subsp. *integrifolium* y var. *triflorum*/subsp. *ciliatum*) o simplemente como una sola especie sin designación formal infraespecífica. Los dos taxa son completamente alopátricos y se separan por la morfología vegetativa, floral, y de la cipsela. De acuerdo con el rango taxonómico de otros pares de especies de *Astranthium*, estos dos taxa se tratan aquí con rango específico: *Astranthium integrifolium* sensu stricto y **Astranthium ciliatum** (Raf.) Nesom, comb. nov. Se selecciona un neotipo para *Bellis ciliata* var. *triflora* Raf. (= *A. ciliatum*).

The genus *Astranthium* Nutt. includes 12 species (De Jong 1965), all but three of them restricted to Mexico. *Astranthium integrifolium* (Michx.) Nutt. occurs in northeastern Mexico, but its range is mostly in the central U.S.A. Larsen (1933) and De Jong (1965) treated eastern and western population systems of *A. integrifolium* (Fig. 1) as var. *integrifolium* and var. *ciliatum* (Raf.) Larsen, respectively, or as subsp. *integrifolium* and subsp. *triflorum* (Raf.) De Jong. Shinners (1950) added a third taxon at varietal rank, *A. integrifolium* var. *robustum* Shinners, which subsequently was raised to specific rank by De Jong (1965). Since De Jong's treatment, Texas botanists have maintained *A. robustum* (Shinners) De Jong as a Texas endemic (Fig. 1), but the taxonomy of the more broadly distributed *A. integrifolium* sensu lato has not been critically reevaluated. De Jong's geographic and morphological delimitation of the '*integrifolium* complex' has been accepted in national checklists (e.g., Kartesz 1999), but Cronquist (1980) treated both geographic segments as *A. integrifolium* without formal recognition of infraspecific taxa. Other floristic accounts have dealt

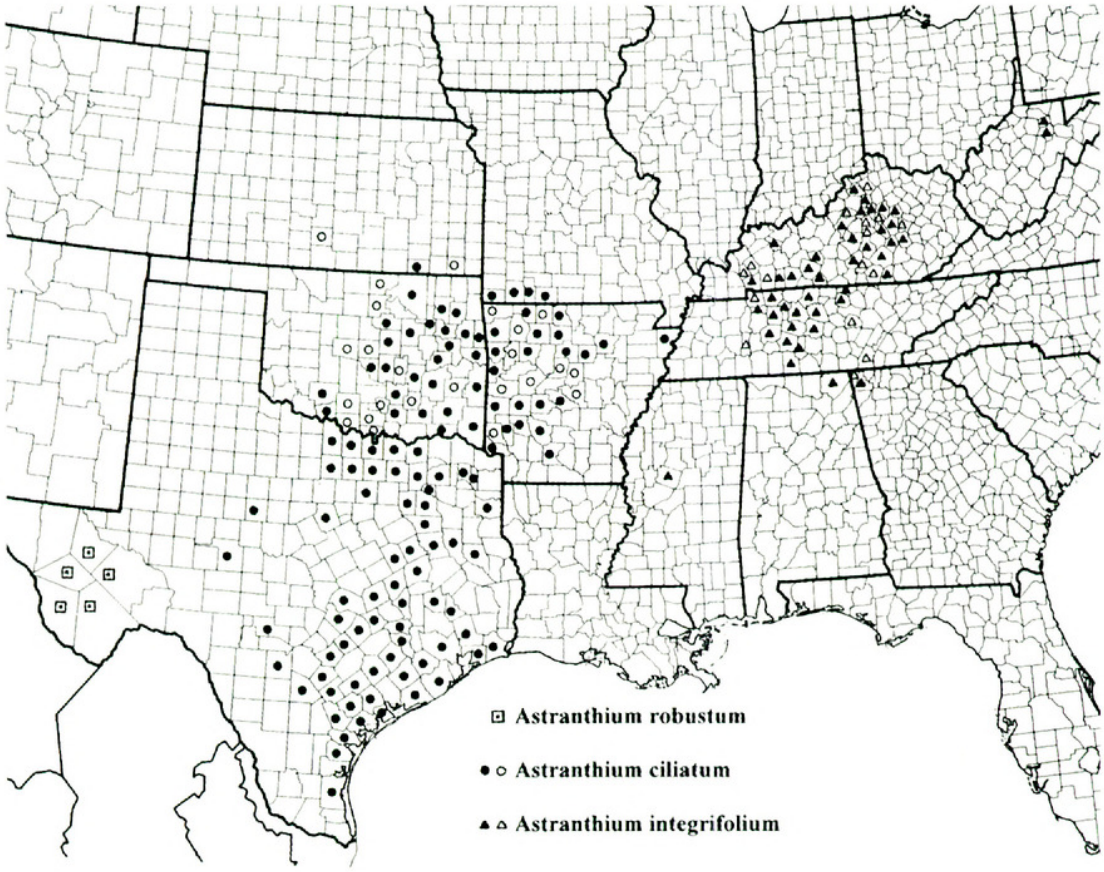

Fig. 1. Geographic distribution of *Astranthium integrifolium*, *A. ciliatum*, and *A. robustum*. Squares and solid circles and triangles are from specimens at KY, MO, SMU-BRIT, TEX-LL, and VDB. Open symbols are from published sources (De Jong 1965; Chester et al. 1997; Great Plains Flora Association 1977; Smith 1988; USDA, NRCS 2001). Populations of *A. ciliatum* also occur in Mexico (Nuevo León and Tamaulipas).

with only one or the other of the two taxa. Accounts for Oklahoma and Arkansas (e.g., Taylor & Taylor 1994; Smith 1994) also have referred to *A. integrifolium* without finer taxonomic distinction, while those for Texas and the Great Plains have recognized infraspecific variants (e.g., Correll & Johnston 1970; Barkley 1986; Diggs et al. 1999).

A reevaluation of *Astranthium integrifolium* sensu lato indicates that the two previously recognized geographic segments are allopatric and distinguished by vegetative, floral, and cypselar features. Consistent with taxonomic ranks of other *Astranthium* species (see comments below), the two taxa are treated here at specific rank.

TAXONOMY

1. Astranthium ciliatum (Raf.) Nesom, comb. nov. *Bellis ciliata* Raf., New Fl. N. Amer. 2:24. 1837. *Astranthium integrifolium* (Michx.) Nutt. var. *ciliatum* (Raf.) Larsen, Ann. Missouri Bot. Gard. 20:35. 1933. *Astranthium integrifolium* (Michx.) Nutt. subsp. *ciliatum* (Raf.) De Jong, Michigan State Univ. Mus. Publ. Biol. Ser. 2:504. 1965. LECTOTYPE (De Jong 1965): USA.

TEXAS. AUSTIN CO.: San Felipe de Austin, 1835, *T. Drummond II. 221* (NY website photo!, as "*Bellis integrifolia* Michx."; ISOLECTOTYPES: K, NY, P, PH).

Bellis ciliata Raf. var. *triflora* Raf., New Fl. N. Amer. 2:25. 1837. *Astranthium integrifolium* (Michx.) Nutt. var. *triflorum* (Raf.) Shinners, Sida 2:348. 1966. NEOTYPE (selected here): USA. TEXAS. Fannin Co., 4 mi N of Bonham, sandy ditch bank, 10 Jun 1945, *L.H. Shinners 7842* (SMU!).

Rafinesque noted that "it [presumably '*Bellis ciliata*'] has also a var. *triflora*, with leaves all acutish and only 3 [ray] flowers. The folioles of the perianthe are lanceolate acuminate in all the sp. not linear as Hooker says, the seeds are obovate pubescent." Because Rafinesque noted that his new species, *Bellis ciliata*, occurs "in Texas and probably extending to Louisiana and Arkansas," it seems reasonable to infer that *Bellis ciliata* var. *triflora* also was based on a Texas collection, perhaps from Drummond, whose collections provided the basis for the description of *B. ciliata*. De Jong (1965) also made this inference in noting that the type locality of var. *triflora* was "Texas." Rafinesque, however, provided no indication of the type, and no type material of var. *triflora* has been found or cited in previous literature.

Small capitula with relatively few and small ray florets are commonly produced late in the season in *Astranthium integrifolium* and *A. ciliatum*, but I have seen no plants with fewer than six florets. Plants of the neotype were described as producing 6–8 ray florets. It seems likely that the capitulum observed and described by Rafinesque had lost several ray florets during collecting, mounting, or handling.

Astranthium integrifolium (Michx.) Nutt. var. *rosulatum* Larsen, Ann. Missouri Bot. Gard. 20:36. 1933. TYPE: UNITED STATES. TEXAS. Matagorda Co.: Matagorda, sandy prairies, 5 Mar 1914, *E.J. Palmer 4855* (HOLOTYPE: MO!). Shinners (1950) accurately noted that the presence of rosulate clusters of leaves reflects early growth stages of a single plant.

2. Astranthium integrifolium (Michx.) Nutt., Trans. Amer. Philos. Soc., ser. 2, 7:312. 1841. *Bellis integrifolia* Michx., Fl. Bor. Amer. 2:131. 1803. TYPE: UNITED STATES. [TENNESSEE] "Cumberland," *A. Michaux s.n.* (HOLOTYPE: P, fide De Jong 1965). De Jong (pp. 434–435) inferred from historical accounts that Michaux probably made the collection in June 1795 in the vicinity of Nashville. Michaux himself (1803) noted that the species occurred "ad ripas rivulorum et in collibus umbrosis Tennassée." "Cumberland" is the only geographic reference on the holotype.

Distinctions between *Astranthium integrifolium* and *A. ciliatum* are in the following contrasts.

Plants fibrous-rooted; basal and lower cauline leaves 3–6 cm long × 7–22 mm wide; involucres 3.5–6 mm high; ray corollas (6–)8–17 mm long; cypselae (1.4–)1.6–2 (–2.2) mm long × 0.9–1.1 mm wide, surface minutely papillate-pebbly with linear striations barely discernible, glabrous or sometimes sparsely glochidiate-pubescent near the apex, or (in northern Kentucky and West Virginia) glochidiate-pubescent over the whole surface _____ **Astranthium integrifolium**

Plants slender-taprooted, rarely fibrous-rooted; basal and lower cauline leaves 1.5–4 (–5) cm long × 3–11(–14) mm wide; involucres (2–)2.5–4.5 mm high; ray corollas (4–)6–10(–12) mm long; cypselae 1–1.6 mm long × 0.6–0.8 mm wide, surface with minute longitudinal striae but otherwise nearly smooth, not papillate-pebbly, sparsely to densely glochidiate-pubescent from base to apex _____ **Astranthium ciliatum**

The morphological distinction of *Astranthium integrifolium* and *A. ciliatum* corresponds with their geography, as mapped in Figure 1. The two are essentially completely separate in distribution: *A. ciliatum* occurs west of the Mississippi

River, *A. integrifolium* to the east. The disjunct outlier in Holmes Co., Mississippi (*Woodson and Anderson 1555*, MO!), is typical *A. integrifolium*; the outlier in Mississippi Co., Arkansas (*Pyle 669*, TEX!), is typical *A. ciliatum*.

Astranthium integrifolium was first reported for West Virginia by Duppstadt (1992), without citation of vouchers. Details are given below. The limited, disjunct distribution and the occurrence primarily along roadsides suggest that this extended population system might be of recent origin, perhaps by accidental dispersal from Kentucky, but the habitats appear to be otherwise natural.

Collections examined: **WEST VIRGINIA. Barbour Co.:** along Pleasant Creek Public Hunting Area road, extending 1.5 mi, both sides of road into Taylor Co., 26 May 1991, *Bush s.n.* (WVA); Pleasant Creek Hunting & Fishing Area, roadside, 6 Jun 1991, *Clarkson s.n.* (WVA); along Co. Road 10, between Hwy 119 and Tygart Lake, N side of Pleasant Creek in Pleasant Creek Public Hunting Area; area of *Prunus*, *Liriodendron*, *Acer*, *Cornus*, and *Crataegus*, with much invasive *Rosa multiflora* and *Lonicera maackii*; *Astranthium* locally abundant in grassy habitats on roadsides, roadbanks, and adjacent fields, 3 Jun 2002, *Nesom FW154* (BRIT, GH, KY, NCU, OS, TENN, TEX, UARK, US, WVA). **Taylor Co.:** along Pleasant Creek Public Hunting Area road, extending 1.5 mi, both sides of road into Barbour Co., 2 Jun 1991, *Baer s.n.* (WVA).

DISCUSSION

De Jong (1965, p. 510) observed that "The two subspecies [of *Astranthium integrifolium*] are separated from one another by quantitative characters and may be recognized throughout their respective ranges. The occasional failure of a single character is compensated for by other characters. The key differences between the two subspecies hold true when they are grown in the greenhouse under uniform conditions." Nevertheless, De Jong noted that in Arkansas, subsp. *ciliatum* "overlaps" and "hybridizes" with subsp. *integrifolium* (p. 474 and p. 505). "The number of specimens which are thought to be putative hybrids is relatively numerous, but not enough specimens are available from different localities to assess the pattern of variation accurately" (p. 511). "The recognition of subspecies rather than varieties is prompted by the considerable ranges of subsp. *integrifolium* and subsp. *ciliatum* and the relatively narrow zone of intergradation" (p. 510).

Intergrades between *Astranthium integrifolium* and *A. ciliatum* were cited by De Jong (1965) from Arkansas (e.g., *Demaree 16912*-SMU!, *Harvey 45*-MO!, SMU!, *Engelmann 129*-MO!), Oklahoma (not seen), and Missouri (e.g., *Bush 7534*-MO!, *Steyermark 22642*-MO!). He did not specify the nature of the intergradation, but from sheets annotated by him, it can be inferred that this was primarily an interpretation of root morphology and general vigor (stem height and leaf size). The 'intergrades' cited from these states (all within the range of *A. ciliatum*, as recognized here) tend to be fibrous-rooted rather than taprooted, but rare plants from Texas (e.g., Gonzales Co., *Turner 3711*-SMU; Harrison Co., *Orr 182*-SMU) also are weakly fibrous-rooted; all of these are interpreted here

as population variants rather than intergrades, because they belong with *A. ciliatum* in involucral height, ray corolla length, and especially in cypselar size, surface morphology, and vestiture. The same is true for two Arkansas collections cited by De Jong as *A. integrifolium* subsp. *integrifolium* (Hot Springs Co., *Soulard s.n.*-MO!; Washington Co., *Harvey s.n.*-MO!) and for Missouri collections annotated as "aff. subsp. *integrifolium*" (e.g., *Palmer 39297*-MO!, *Palmer 39483*-MO!, *Steyermark 10393*-MO!). Some Arkansas collections cited by De Jong as intermediate between the subspecies were annotated by him simply as "*A. integrifolium* subsp. *ciliatum*" (e.g., *Bush 929*-MO!, *Palmer 5992*-MO!).

Robust plants of *Astranthium ciliatum* are similar in habit to *A. integrifolium*, and depauperate plants of *A. integrifolium* are similar in habit to *A. ciliatum*. The Arkansas collections interpreted by De Jong as "subsp. *integrifolium*" or as reflecting hybridization were made around Hot Springs (Hot Springs Co.) and Fayetteville (Washington Co.). These plants are generally taller than average for the species (up to 32 cm tall) and have leaves that range larger, and some have fibrous roots, but in involucral size, ray length, and cypselar morphology, they belong with *A. ciliatum*. Cypselae of plants from Arkansas and Missouri also range longer (1.1–1.6 mm) than in Texas and Oklahoma (1–1.2 mm). Whether the larger sizes of these plants might reflect convergence or an ancestral similarity with *A. integrifolium* sensu stricto is not clear. Even though various features overlap in variation, features of cypselar morphology (vestiture and epidermal surface) provide consistent distinction between the two taxa, especially with recognition of the disjunction in their geographic ranges, and I have not seen any plant that could be regarded as intermediate.

In summary, the present study finds that there is no unequivocal evidence for hybridization between plants of *Astranthium integrifolium* and *A. ciliatum*. In fact, their allopatric distribution allows no opportunity for genetic interchange, and differences in cypselar morphology suggest that isolation is complete.

CONSISTENCY IN TAXONOMIC RANK

Morphological distinctions between *Astranthium integrifolium* and *A. ciliatum* are relatively small, but their pattern of relationship and treatment at specific rank are analogous and consistent with the taxonomy of species pairs (as recognized by De Jong 1965) of *Astranthium* found in Mexico. The two are essentially identical in chromosome number ($2n = 8$) and chromosome morphology (De Jong 1965). Their northern distributions and morphological similarity suggest that they have an evolutionary sister relationship. De Jong (p. 523) noted that *A. robustum* ($2n = 6$) "is related to *A. integrifolium*" ... but "the species also shows resemblance to *A. condimentum* and *A. orthopodum* and has the same chromosome number and karyotype as these two species."

The relationship of *Astranthium orthopodum* (B.L. Rob.) E. Larsen and *A.*

condimentum De Jong parallels that of *A. integrifolium* and *A. ciliatum*. They are similar to each other in chromosome number ($2n = 6$) and chromosome morphology and probably are evolutionary sister taxa. Each has a substantial geographic range, but they are allopatric in distribution. They are morphologically separated primarily on the basis of root characters: plants of *A. condimentum* are annuals from a slender taproot; plants of *A. orthopodum* are biennials or short-lived perennials from a fibrous-rooted caudex, sometimes with short rhizomes or basal offsets. Additionally, there are small and overlapping differences in stem orientation and leaf shape and size.

Astranthium splendens De Jong ($2n = 18$) and *A. beamanii* De Jong ($2n = 24$) both apparently have a base chromosome number of $x = 3$ and also probably are evolutionary sister taxa. They are sympatric but grow at different elevations and are otherwise distinguished on the basis of cypselar vestiture (and apparently nothing else): cypselae of *A. splendens* are glochidiate-hairy over the whole surface while those of *A. beamanii* are glabrous or sparsely glochidiate-hairy only near the apex.

ACKNOWLEDGMENTS

Loans of specimens from KY, MO, WKU, and WVA, help of TEX-LL staff during a recent visit, help from Donna Ford-Werntz (WVA) and Bill Grafton in the investigation of the West Virginia plants, and review comments of George Yatskievych are gratefully acknowledged.

REFERENCES

Barkley, T.M. 1986. *Astranthium*. In: Great Plains Flora Association. Flora of the Great Plains. Univ. Press of Kansas, Lawrence. P. 886.

Chester, E.W., B.E. Wofford, and R. Kral. 1997. Atlas of Tennessee vascular plants. Volume 2. Angiosperms: Dicots. Misc. Publ. 13, Center for Field Biology, Austin Peay State University, Clarksville, TN.

Correll, D.S. and M.C. Johnston. 1970. Manual of the vascular plants of Texas. Texas Research Foundation, Renner.

Cronquist, A. 1980. Vascular flora of the southeastern United States, Vol. I. Asteraceae. Univ. of North Carolina Press, Chapel Hill.

De Jong, D.C.D. 1965. A systematic study of the genus *Astranthium* (Compositae, Asteraeae). Michigan State Univ. Mus. Publ. Biol. Ser. 2:429–528.

Diggs, G.M., Jr., B.L. Lipscomb, and R.J. O'Kennon. 1999. Shinners and Mahler's illustrated flora of north central Texas. Sida, Bot. Misc. No. 16.

Duppstadt, W.H. 1992. Updates on the vascular flora of West Virginia: 8. Proc. West Virginia Acad. Sci. 64:15.

Great Plains Flora Association. 1976. Atlas of the flora of the Great Plains. Iowa State University Press, Ames.

Kartesz, J.T. 1999. A synonymized checklist and atlas with biological attributes for the

vascular flora of the United States, Canada, and Greenland. In: Kartesz, J.T. and C.A. Meacham. Synthesis of the North American Flora, North Carolina Botanical Garden, Chapel Hill.

Larsen, E.L. 1933. *Astranthium* and related genera. Ann. Missouri Bot. Gard. 20:23–44.

Michaux, A. 1803. Flora Boreali-Americana. Levrault, Paris.

Shinners, L.H. 1950. Notes on Texas Compositae–VI. Field & Lab. 18:156–159.

Smith, E.B. 1988. An atlas and annotated list of the vascular plants of Arkansas (ed. 2). Dept. of Botany & Microbiology, Univ. of Arkansas, Fayetteville.

Smith, E.B. 1994. Keys to the flora of Arkansas. Univ. of Arkansas Press, Fayetteville.

Taylor, R.J. and C.E.S. Taylor. 1994. An annotated list of the ferns, fern allies, gymnosperms and flowering plants of Oklahoma (ed. 3). Biology Dept. Herbarium, Southeastern Oklahoma State Univ., Durant.

USDA, NRCS. 2001. The Plants Database, Version 3.1 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490, USA. <accessed November 2001>