BATOPILASIA (ASTERACEAE: ASTEREEAE),
A NEW GENUS FROM CHIHUAHUA, MEXICO

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ABSTRACT

The Mexican species Erigeron byei Sundberg & Nesom is excluded from Erigeron and subtribe Conyzinae and treated as the monotypic genus Batopilasia Nesom & Noyes, gen. nov., and species Batopilasia byei (Sundberg & Nesom) Nesom & Noyes, comb. nov. Batopilasia byei at least superficially resembles the phylogenetically isolated North American genera Boltonia and Chloracantha in morphology. DNA studies indicate that Batopilasia and Boltonia are closely related and suggest that Boltonia is closely related to Chloracantha. The new genus apparently is restricted to the area of the Barranca del Cobre in southwestern Chihuahua, Mexico. A technical description, illustration, and distribution map are provided.

RESUMEN

La especie mexicana Erigeron byei Sundberg & Nesom se excluye de Erigeron y de la subtribu Conyzinae y se trata como género monotípico Batopilasia Nesom & Noyes, gen. nov., y especie Batopilasia byei (Sundberg & Nesom) Nesom & Noyes, comb. nov. Batopilasia byei se parece al menos superficialmente en su morfología a los géneros norteamericanos filéticamente aislados Boltonia y Chloracantha. Los estudios de DNA indican que Batopilasia y Boltonia están muy relacionados y sugieren que Boltonia está muy relacionada con Chloracantha. El nuevo género aparentemente está restringido al área de Barranca del Cobre en el suroeste de Chihuahua, México. Se ofrecen una descripción técnica, una ilustración y un mapa de distribución.

In the original description of Erigeron byei (Sundberg & Nesom 1990), it was regarded as most similar to E. ortegae Blake (= Aster spinosus Benth.) and E. oxyphyllus Greene, these three species constituting Erigeron sect. Spinosi (E. ortegae, the type). A number of essential differences have since been recognized between E. oxyphyllus and E. ortegae, and the latter has been segregated as the monotypic genus Chloracantha (Nesom et al. 1991; Sundberg 1991). Erigeron oxyphyllus has been treated as a member of the primarily Californian E. foliosus Nutt. group (Erigeron sect. Linearifolii, Nesom 1992 = sect. Pycnophyllum; see Nesom & Noyes 1999). Nesom et al. (1991) noted that although "the evolutionary affinities of E. byei may yet prove to lie with [Chloracantha], outside of Erigeron, there is

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insufficient evidence at present ...” to justify its exclusion, and E. byei has been maintained in an isolated position within Erigeron. Recent study of molecular variation in the tribe Astereae (Noyes & Rieseberg 1999), however, provides evidence that the origin of E. byei lies outside the phylogenetic nexus of Erigeron and Conyza and their closest relatives.

**Relationship to Erigeron and Conyzinae**

Erigeron byei was originally placed in Erigeron because of its perceived resemblance to E. ortegae and E. oxyphylus, but after the recognition of the infra-generic relationship of the latter (within Erigeron sect. Pycnophyllum) and the transfer of the former to Chloracantha, E. byei has no close similarity to any other species of Erigeron and does not fit into any previously circumscribed section (Nesom 1989). The small, few-flowered heads and the subterete, multinerved cypselas, in particular, are unusual in Erigeron, although no single morphological character is sufficient to exclude the species from the genus.

Molecular studies by Noyes and Rieseberg (1999) and Noyes (2000) include representative species of Erigeron and close relatives (63 Erigeron, representing 20 sections; 6 Conyza; 2 Aphanostephus; 1 each of Apopyros, Neja, and Hysteroneca) and delimit a monophyletic group that corresponds to the Conyzinae of Nesom (1994), with three exceptions: (1) the North American genus Aphanostephus arose from within the group, apparently in a sister relationship to Erigeron belliioides DC. (and presumably its close relatives), a species native to the Carribean Islands—these two groups in a sister relationship with a group of species including E. quercifolius Lam.; (2) African species of Conyza are placed within subtribe Grangeinae rather than Conyzinae; and (3) E. byei is related to species outside of the Conyzinae. As so delimited, the species and genera of Conyzinae encompass considerable morphological diversity, but E. byei is the only New World species to be excluded.

**Relationship to Chloracantha and Boltonia**

The hypothesis that Erigeron byei is closely related to Chloracantha was based on their shared rhizomatous habit, cauline leaves much reduced in size and distribution, persistently green-glabrate stems and leaves, erect buds, distinctly similar phyllaries (thin-herbaceous, apically rounded to obtuse, with three, prominent, orange-resinous nerves), and delinate collecting appendages of the disc corolla style branches. Boltonia also shares this combination of habitual and capitular features.

In the Noyes and Rieseberg (1999) analysis, Erigeron byei is positioned as the sister genus to Boltonia and this pair of taxa is then most closely related to Symphyotrichum, Oreostemma, and genera of subtribe Machaeranthineae. Chloracantha was not included in their analysis, but phylogenetic proximity between Boltonia and Chloracantha had earlier been suggested by cpDNA analyses of Astereae—in the context of broader sampling, Morgan (1990) observed that Chloracantha is most closely related to the goldenaster group (subtribe Chrysopsideae), while Suh (1989) observed the same relationship between Boltonia and the goldenasters. A close relationship between Boltonia and goldenasters, based on cpDNA evidence, is not corroborated by ITS sequence data
from nuclear ribosomal DNA (Noyes & Rieseberg 1999), but the suggestion remains that *Boltonia* and *Chloracantha* are closely related. A long-standing hypothesis of close relationship between *Boltonia* and the Asian genus *Kalimeris* was rejected by Gu and Hoch (1997) on morphological grounds and by Noyes and Rieseberg (1999), based on molecular evidence.

*Boltonia* remains a genus strongly isolated in morphology (see Cronquist 1980 and Anderson 1987 for taxonomic summaries), differing from *Erigeron byei* in having mostly cauline leaves, conical or convex receptacles, phyllaries with a thick, raised, orangish midrib, short-tubed disc corollas, cypselas broadly elliptic to elliptic-obovate, strongly flattened and broadly winged or unwinged, with a nerve at each margin, these often with conspicuous, orangish oil ducts, and pappus absent or short-corneate, also with several small bristles and 2(−4) much longer, thickened, barbellate awns.

*Chloracantha* differs from *Erigeron byei* primarily in vegetative features—taller stature, thick rhizomes, perennial and ligneous stems with thorns and axillary buds, lack of persistent basal leaves—but also in larger heads and greater number of flowers. The similarities of *Erigeron byei* and *Chloracantha* in their suberet, 4−5-nerved cypselas and pappus of barbellate bristles are probably primitive (plesiomorphic), compared to the highly derived (apomorphic) fruiting features of *Boltonia*.

In summary, although the divergent taxonomic position of *Erigeron byei* was suspected at its original description, based on morphology, its relatively generalized features make it difficult to place the species. In overall morphology, however, *E. byei* is notably similar to the genus *Chloracantha*, and molecular evidence indicates that it is closely related to *Boltonia* and perhaps *Chloracantha*. On the basis of its morphological isolation within *Erigeron* and its unambiguous molecular-phylogenetic placement outside of the Conyzinae, we treat *E. byei* as a monotypic genus.

**Batopilasia** Nesom & Noyes, gen. nov. Type: *Batopilasia byei* (Nesom & Sundberg) Nesom & Noyes

*A Chloracantha* similis vestimento fere glabo, foliis caulinis amplitudine valde redactis, gemmis erectis, phyllariis tenui-herbaceis nervis tribus aurantiaciis, flosculis radii laminis albis brevibus cincinnatis, flosculis disci rami stylare appendicibus deltatis, et achenis 4−5-nervatis sed differt statura multo minore, habitu cespitoso ab rhizomatibus tenuibus vel ramis caudicis rhizomiformibus, foliis basaliis persistentiis in rosulis coarctatis, capitulis minoribus, et flosculis radii paucioribus. Ab *Erigeron Gymza* et affinibus late separatus datis molecularibus.

**Batopilasia byei** Nesom & Noyes, comb. nov. (Fig. 1) Basionym: *Erigeron byei* Sundberg & Nesom, Phytologia 69:278. 1990.

Perennial, cespitose, glabrous herbs from a system of thin, ligneous, rhizome-like caudex branches. Stems 7−20 cm tall, usually with 1−2 ascending branches near midstem. Basal leaves persistent in rosettes, sessile, narrowly elliptic-oblancoleate, 8−26 mm long, 1−2 mm wide, entire, 1-nerved or faintly 3-nerved, with a mucronulate apex, the cauline leaves few and sharply reduced in size to linear bracts 1−4 mm long. Heads 5−8 mm wide, erect in bud, solitary on nearly naked peduncles 5−10 cm long; phyllaries in 3−4 strongly graduated series, elliptic-oblancoleate with obtuse to acute apices, thin-herba-
Habit and morphological details of Batopilasia byei.

Ray flowers 9–18, fertile, the corollas white, drying white or purplish, 5–7 mm long, the lamina 1.4–2 mm wide, coiling at the tips. Disc flowers 24–29, fertile, the corollas 3.5–4.2 mm long, not inflated or indurated, lobes triangular-deltate, erect; style branches with deltate collecting appendages 0.1–0.2 mm long. Cypselas sparsely strigose, cylindrical and terete to slightly flattened, 1.8–2.5 mm long, 0.4–0.5 mm wide, with (2–)4(–5) thin, orange nerves; pappus of 15–27 barbellate bristles 2.9–3.8 mm long and a few outer setae 0.1–0.5 mm long. Chromosome number, 2n = 18 (Sundberg & Nesom 1990).

The genus is named for the region of southwestern Chihuahua to which it apparently is restricted. The known populations of Batopilasia (as cited in Sundberg & Nesom 1990) occur in Municipio Batopilas, within a radius of about 25–30 kilometers, south of the town of Creel and in the general area of the Barranca del Cobre (Fig. 2). The plants grow on steep rocky slopes, commonly in rock crevices and ledges in arroyos and canyons, in pine-oak woodlands at 2000–2400 meters elevation, flowering May through July. The epithet commemorates Robert Bye, botanist and ethnobotanist who has had a long-standing and active interest in the flora of Chihuahua.
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REFERENCES


