Paneroa, a New Genus of Eupatorieae (Asteraceae) from Mexico

Edward E. Schilling
Department of Ecology and Evolutionary Biology, University of Tennessee, 569 Dabney Hall, Knoxville, Tennessee 37996, U.S.A. eschilling@utk.edu

Abstract. The new genus *Paneroa* E. E. Schilling (Asteraceae, Eupatorieae) from the Mixteca Alta region in the state of Oaxaca, Mexico, is described and illustrated, and a new combination, *P. stachyofolia* (B. L. Robinson) E. E. Schilling, is made. The genus is characterized by its alternate, sessile leaves, 4-ribbed phyllaries, short coroniform pappus, and clavate style appendages. Molecular phylogenetic analyses show that the genus is distinct from *Ageratum* L., in which the species was originally described, and is closely related to other genera including *Conoclinium* DC. and *Fleischmannia* Schultz Bipontinus. It occurs in a floristic region that is characterized by numerous endemics.

Key words: *Ageratum*, Asteraceae, Eupatorieae, IUCN Red List, Mexico, Mixteca Alta, *Paneroa*.

A survey of molecular variation for the ITS and ETS spacer regions revealed that *Ageratum stachyofolium* B. L. Robinson was not only distinct but was placed relatively distant from the rest of the sampled species of *Ageratum* L. (E. E. Schilling, J. L. Panero & B. Crozier, unpublished data). The survey of *Ageratum* was conducted to obtain outgroup data for a comprehensive analysis of *Conoclinium* DC., and the result prompted a more detailed investigation of the placement of *A. stachyofolium* using a broader array of chloroplast DNA sequences. The results of the molecular phylogenetic studies confirmed the distinctiveness of *A. stachyofolium*, which had already been noted from morphological analyses. Based on these results, a new Mexican genus *Paneroa* E. E. Schilling is described herein.

Paneroa E. E. Schilling, gen. nov. Basionym: *Ageratum* sect. *Stachyofolium* M. F. Johnson, Ann. Missouri Bot. Gard. 58: 79. 1971. TYPE: *Paneroa stachyofolia* (B. L. Robinson) E. E. Schilling.

Genus novum *Agerato* L. affine quoad pappum coroniformem, a quo foliis alternis, phyllariis 4-costatis, et stylis conspicue clavatis differt.

Paneroa stachyofolia (B. L. Robinson) E. E. Schilling, comb. nov. Basionym: *Ageratum stachyofolium* B. L. Robinson, Proc. Amer. Acad. Arts 36: 476. 1901. TYPE: Mexico. Oaxaca: vic. of La Parada, 19 Aug. 1894, *E. W. Nelson 991* (holotype, GH; isotypes, F not seen, K not seen, US). Figure 1.

Perennial herbs, 30–88 cm tall, stems terete, striate, reddish green, sericeous, trichome density increasing distally, trichomes on stem and other vegetative parts simple, multicellular, somewhat sinuous, 0.2–1 mm. Leaves alternate throughout or sometimes opposite proximally and alternate distally, sessile or nearly so, blades 30–50 × 11–25 mm, smaller distally, elliptic, base obtuse to cuneate, apex widely acute to rounded, margin somewhat revolute, crenate, adaxial surfaces green, sericeous; abaxial surfaces pale green, densely white sericeous, subsessile-glandular trichomes numerous and scattered throughout the surface. Capitulescences terminal, of 7 to 17 heads in a compact to somewhat open corymbose cluster; peduncles 1–75 mm, densely sericeous, bracteolate; heads discoid, hemispheric, erect, 8–11 × 8–10 mm; receptacle epaleate. Phyllaries 30 to 35 in 2 closely overlapping series, 5–6.5 × 0.5–0.7 mm, linear to somewhat spatulate, 4-ribbed, apex acute, surface white pilose, with scattered subsessile glandular trichomes; flowers ca. 100 per head, corollas funnelform, creamy white, 3.2–3.5 mm, tubes ca. 1.5 mm, sparsely pilose with scattered subsessile glands; throats ca. 1.5 × 0.5 mm at proximal end broadening to ca. 1 mm wide at distal end, lobes 0.5–0.7 mm, papillose on inner surfaces; anthers ca. 0.7 mm, whitish, anther appendages ca. 0.1 mm, rounded, about as wide as long; styles ca. 11 mm, creamy white, glabrous, the branches ca. 5 mm, papillose, conspicuously clavate. Cypselae black, 2.2–3 mm, prismatic, tapering to base, with 5 ribs, glabrous, carpopodium not strongly differentiated; pappus coroniform, whitish tan, 0.3–0.5 mm, margin entire to obscurely dentate.

Distribution, habitat, and IUCN Red List category. *Paneroa stachyofolia* is a rare species that occurs in open pine-oak woodlands in the Mixteca Alta region in the state of Oaxaca, Mexico. This area harbors numerous endemics, including one endemic genus (*Ainea* Ravenna), several near endemic genera (*Fosteria* Molseed, *Gibasoides* D. R. Hunt, and

 doi: 10.3417/2007173

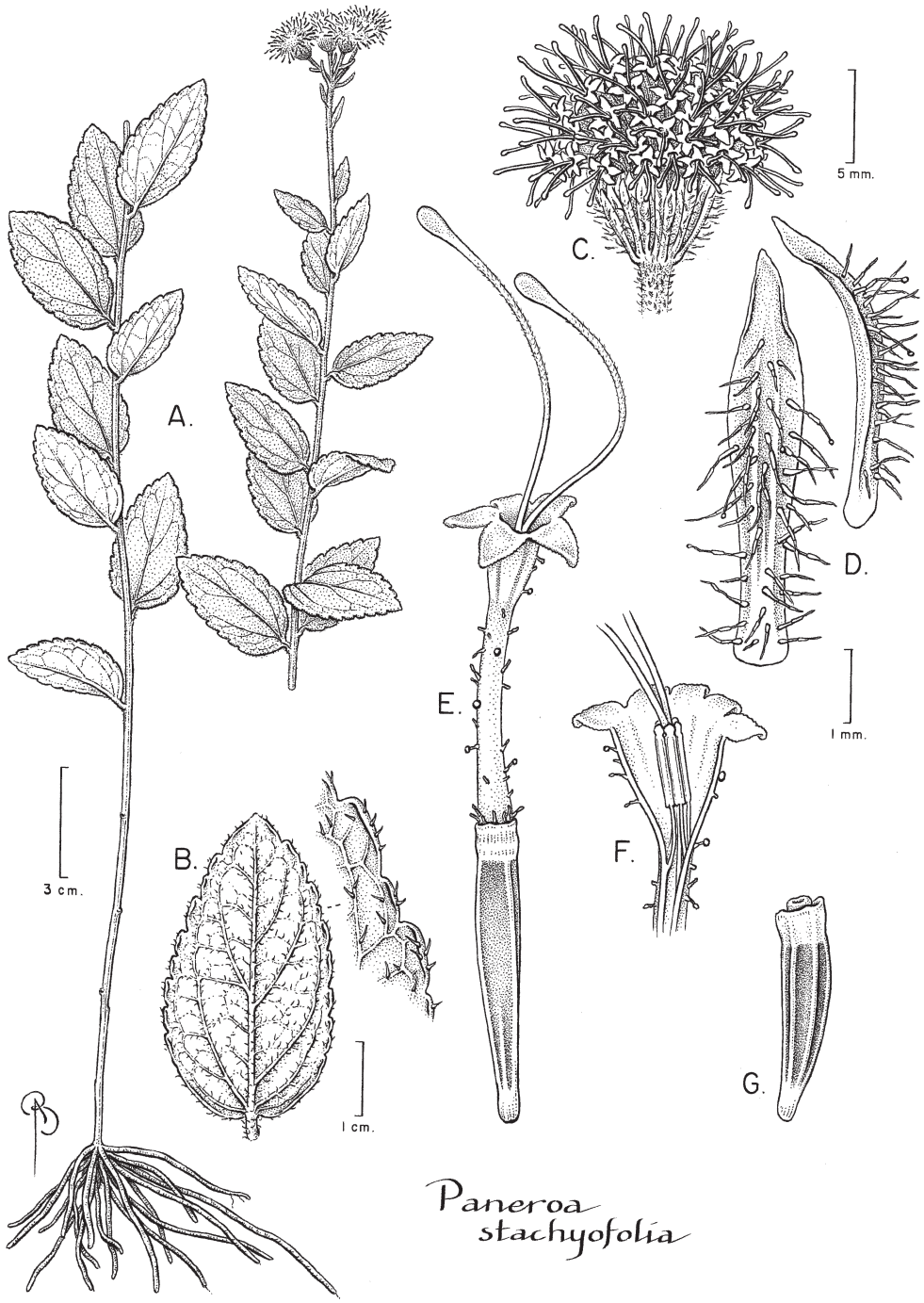

Figure 1. *Paneroa stachyofolia* (B. L. Robinson) E. E. Schilling. —A. Habit. —B. Leaf with detail of margin. —C. Head. —D. Phyllary, abaxial and lateral views. —E. Corolla. —F. Detail of corolla and androecium. —G. Cypsela. Drawn from *Panero & Calzada 5894* (TEX).

Pseudocranichis Garay), and numerous endemic species (García-Mendoza et al., 1994). The area is characterized by a diversity of relatively mesic highland habitats that are surrounded by xerophytic areas, conditions that have apparently encouraged the development of distinctive taxa, particularly in the herbaceous perennials that make up over half of the species there (García-Mendoza et al., 1994). Endemics

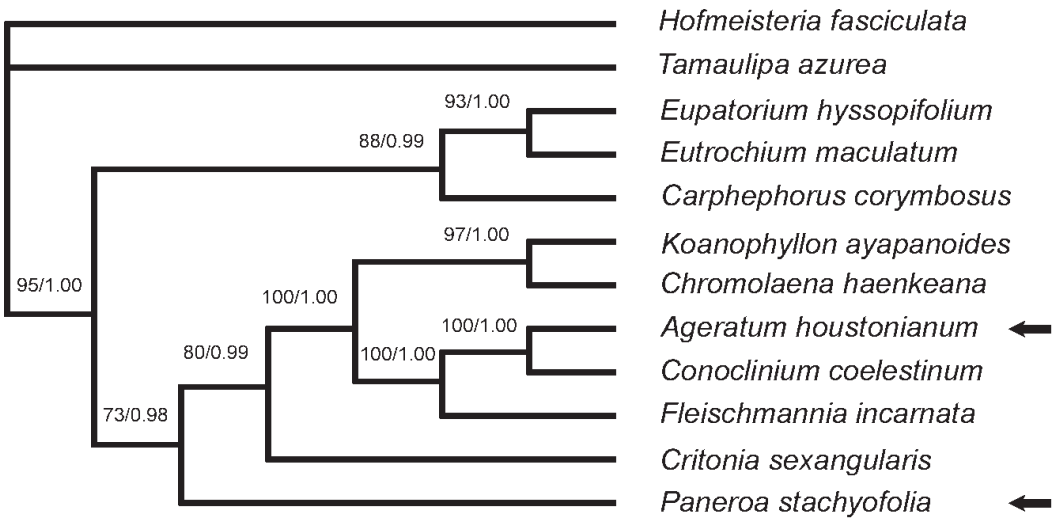

Figure 2. Single most parsimonious tree (length = 346 steps; consistency index [CI] = 0.91; retention index [RI] = 0.78) from analysis of chloroplast DNA data (total of 4200 aligned base pairs) for *Paneroa* and related genera, with bootstrap support (1000 replicates)/Bayesian posterior probabilities shown above branches, showing the placement of *Paneroa* relatively distant from *Ageratum* (arrows). Voucher data for chloroplast DNA sequence data used to prepare the tree are provided in Appendix 1.

continue to be described (e.g., Panero & Villaseñor, 1996, 1997, 1998) as the area receives additional botanical attention. Prior to the relatively recent collections of the new genus listed as paratypes below, *P. stachyofolia* was known only from the type collection, and it must be viewed as a relatively uncommon species. Based on its restriction to an area entirely within the state of Oaxaca, its somewhat sporadic occurrence, and its relatively small population sizes, *P. stachyofolia* should be classified as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The genus is named in honor of José L. Panero (University of Texas at Austin, b. 1959), who has made numerous contributions to the knowledge of Asteraceae systematics and of the Mexican flora through his indefatigable fieldwork, expert eye, and passionate pursuit of botanical science.

Relationships. Paneroa stachyofolia was recognized as distinctive relative to other species of *Ageratum* by Johnson (1971), who erected a monospecific section for it. King and Robinson (1987) also noted its morphological distinctiveness and retained it in section *Stachyofolium* M. F. Johnson. Results of molecular phylogenetic analyses (Schilling, unpublished data) based on the chloroplast gene coding regions *ndhF* and *matK* and the *trnH-psbA* spacer placed it in a basally diverging position relative to a number of other Mexican genera, including not only *Ageratum* but also *Fleischmannia* Schultz Bipontinus and *Conoclinium* (Fig. 2). No other genus of Eupatorieae exhibits the combination of alternate, sessile leaves, a coroniform pappus, and a glabrous style with clavate style appendages that characterizes *Paneroa*.

Paratypes. MEXICO. **Oaxaca:** Dist. Tlaxiaco, Mun. San Pedro Molinos, 3 Aug. 1994, *J. L. Panero & I. Calzada 4453* (MEXU, TENN, TEX); Dist. Juxtlahuaca, Mun. Santiago Juxtlahuaca, 13 Sep. 1995, *J. L. Panero & I. Calzada 5894* (IZTA, TENN, TEX). The following were brought to my attention by J. L. Villaseñor (pers. comm.) but were not seen: MEXICO. **Oaxaca:** Dist. Teposcolula, 25 July 1982, *A. García Mendoza 1080* (MEXU); Dist. Juxtlahuaca, Mun. San Juan Mixtepec, 3 Sep. 1989, *J. Reyes Santiago 1942* (MEXU); Yucudá, 19 Oct. 1990, *J. Reyes Santiago 2461* (MEXU); Dist. Nochixtlán, Mun. San Miguel Huautla, 13 Aug. 2004, *O. Téllez Valdés 16575* (MEXU).

Acknowledgments. Thanks are given to D. E. Schilling, S. Robertson, and H. Holloway for technical support; to Bobbi Angell for preparing the illustration; to R. Scott and J. L. Villaseñor for critical reviews of the manuscript and to the latter for bringing additional specimens of *Paneroa* to my attention; and to J. May of the University of Tennessee Molecular Biology Resource Facility for help with generation of DNA sequence data. Financial support was provided by grants from the Hesler Fund of the University of Tennessee and from the U.S. National Science Foundation (DEB-0343684).

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Appendix 1. List of vouchers for chloroplast DNA sequence data utilized to prepare Figure 2. Vouchers at TENN unless otherwise noted. GenBank numbers listed as *matK*/*ndhF*/*psbA-trnH*.

Ageratum houstonianum Miller: Cultivated, *E. E. Schilling 95-2*, EU337054/EU337042/EU337031; *Carphephorus corymbosus* (Nuttall) Torrey & A. Gray: U.S.A., Georgia, *E. E. Schilling 2036*, EU337049/EU337037/AY727174; *Chromolaena haenkeana* (DC.) R. M. King & H. Robinson: Mexico, Jalisco, *J. L. Panero 8841*, EU337052/EU337040/EU337029; *Conoclinium coelestinum* (L.) DC.: U.S.A., Arkansas, *E. E. Schilling 04-58*, EU337056/EU337044/EU337033; *Critonia sexangularis* (Klatt) R. M. King & H. Robinson: Mexico, Oaxaca, *J. L. Panero 2970* (TEX), EU337051/EU337039/EU337028; *Eupatorium hyssopifolium* L.: U.S.A., Florida, *K. C. Siripun 02-EUP-157*, EU337047/EU337035/AY727172; *Eutrochium maculatum* (L.) E. E. Lamont: U.S.A., New York, *E. E. Schilling 95-16*, EU337048/EU337036/EU337026; *Fleischmannia incarnata* (Walter) R. M. King & H. Robinson: U.S.A., Tennessee, *E. E. Schilling 95-21*, EU337055/EU337043/EU337032; *Hofmeisteria fasciculata* (Bentham) Walpers: Mexico, Baja California Sur, *J. L. Panero 2817*, EU337046/AF384731/EU337025; *Koanophyllon ayapanoides* (Grisebach) R. M. King & H. Robinson, Cuba, Holguín: *Bennet 7582*, EU337050/EU337038/EU337027; *Paneroa stachyofolia* (B. L. Robinson) E. E. Schilling: Mexico, Oaxaca, *J. L. Panero 4453*, EU337057/EU337045/EU337034; *Tamaulipa azurea* (DC.) R. M. King & H. Robinson: U.S.A., Texas, *E. E. Schilling 1146*, EU337053/EU337041/EU337030.