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EUPATORIUM PALUDICOLA, SP. NOV. (ASTERACEAE):
A NEW SPECIES FROM THE COASTAL PLAIN
OF NORTH AND SOUTH CAROLINA

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ABSTRACT. *Eupatorium paludicola* (Asteraceae) is a new species from the Atlantic Coastal Plain of North and South Carolina. It resembles *E. leucolepis* (DC.) Torr. & A. Gray, from which it is most readily distinguished by very narrow (2–4.5 mm wide) ascending-recurved to erect-incurved leaves, and by shorter involucre, pappi, and cypselae. It inhabits isolated, herb-dominated wet depressions with variable hydrology such as clay-based Carolina bays.

Key Words: Asteraceae, Carolina bay, Carolina Coastal Plain, *Eupatorium leucolepis*, *E. paludicola*

While surveying a small, herb-dominated Carolina bay near Kingsburg in Florence County, South Carolina, in July 1998, R. D. Porcher noticed an unusual looking *Eupatorium* that resembled *E. leucolepis* (DC.) Torr. & A. Gray but with much narrower and strongly ascending to erect leaves. Subsequent searches of other wet depressions and herbarium specimens identified a total of eight localities: five in North Carolina, two in South Carolina, and one, Stateline Prairie Bay, shared by North and South Carolina. A macromorphological analysis revealed several distinctive characters separating the new *Eupatorium* from *E. leucolepis* (Schilling et al. 2007). Subsequent molecular studies corroborated the macromorphological findings, with both recommending recognition at the rank of species.

TAXONOMIC TREATMENT

Eupatorium paludicola E.E. Schill. & LeBlond, *sp. nov.* TYPE: UNITED STATES. North Carolina: Scotland Co., South Carolina: Marlboro Co., Stateline Prairie Bay, herbaceous Carolina bay located on the North Carolina and South Carolina state line 2.5 mi. S-SW of Hasty on secondary road 1622, 6 Oct 1998, R.J. LeBlond 5056 & B.A. Sorrie (HOLOTYPE: US; ISOTYPES: NCU, MO, TENN, USCH). Figure 1.

Eupatorio leucolepi similis sed rhizomatibus longioribus, foliis ascendentibus angustioribus minus dense pubescentibus, et involucri pappi ac cypselae brevioribus differt.

Plants perennial, rhizomatous, rhizomes to 17 cm long and 4 mm thick, noded, with broad deltoid scales about 2 mm long at nodes, internodes 4–7 mm long; primary rhizome, caudex, and stem form a continuous 90° curve, caudex hardly thickened, with flexible roots

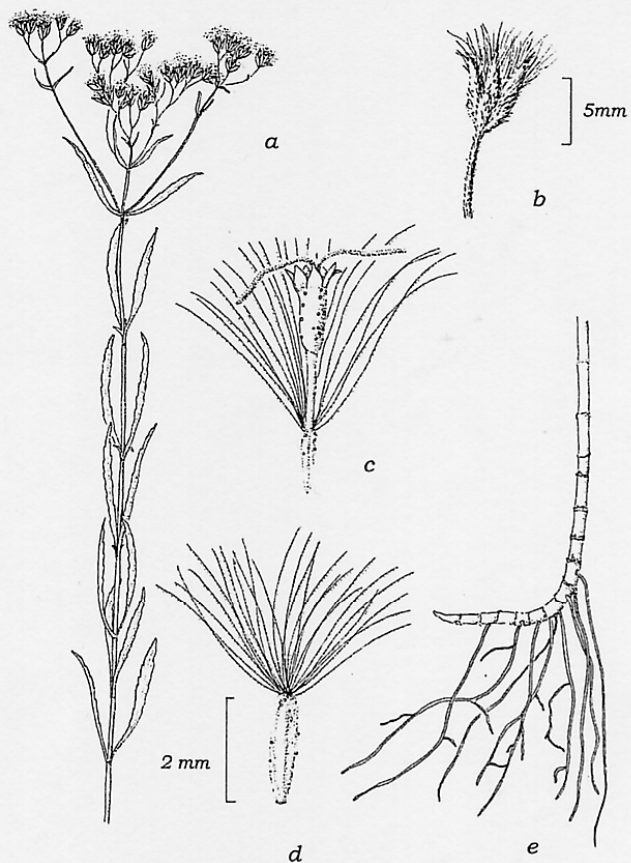


Figure 1. *Eupatorium paludicola*. a. Upper stem and inflorescence; b. Floral head and peduncle; c. Disk corolla, pappus, and immature cypsel; d. Pappus and mature cypsel; e. Subterranean rhizome, caudex, and lower stem. Drawn by Dorothy S. Wilbur-Brooks from R.J. LeBlond 5056 & B.A. Sorrie.

about 1 mm thick, and offshoot rhizomes from the caudex often present; aerial stems solitary, erect, 2.5–4 mm wide at base, 75–110 cm tall, longitudinally ribbed, ribs rounded, sparsely pubescent proximally, glabrous to glabrate centrally, and moderately to densely pubescent distally and within inflorescence with ascending to appressed hairs 0.1–0.3 mm long; leaves confined to upper half of stem at maturity, opposite, simple, ascending-recurved to erect-incurved, mostly without axillary fascicles, sessile, stiff, brittle when dried, olive-green to brown, linear, flat to conduplicate, larger leaves tapered to base and to narrowly blunt apex, 1–6 cm long by 2–4.5 mm wide; margins shallowly and bluntly toothed, sinuses 0.3–0.9 mm long from distally adjacent margin to tooth apex, entire to sparsely strigose-ciliate; adaxial surface glabrous to sparsely strigose, abaxial surface sparsely to moderately densely strigose, especially proximally and along midvein, hairs 0.1–0.4 mm long, both surfaces resinous-punctate; wider leaves evidently triple-nerved, lateral nerves adjacent to midnerve basally, diverging from midnerve 0.5–0.9 mm above base; capitulescences 4.5–10 cm long (averaging 6.65 cm) by 7–12 cm wide (averaging 8.7 cm), cymose-corymbiform, branches opposite to sub-opposite, diverging at 45° angle from central axis, leaf-like bracts reduced upwards, ultimate branches and peduncles densely pubescent with appressed to ascending hairs; involucre 4.0–5.5 mm long; phyllaries imbricate, outer 1.3–2.5 mm long, inner 3.5–5.0 mm long, green with distinct white hyaline margins and apex, acute-mucronate to acuminate, the abaxial surface moderately-densely to densely pubescent with appressed hairs, resinous-punctate; florets 5, corolla 2.7–3.7 mm long, pappus of bristles 2.7–4.1 mm long, corolla:pappus ratio 0.83–1.00; mature cypselae black, narrowly oblanceolate, 1.6–2.3 mm long.

TOPOTYPES: UNITED STATES. North Carolina: Scotland Co., South Carolina: Marlboro Co., Stateline Prairie Bay, herbaceous Carolina bay located on the North Carolina and South Carolina state line 2.5 mi. S-SW of Hasty on secondary road 1622, 29 Aug 1979, *J.H. Carter III 1470* (NCU); same locality, 18 Jul 1984, *T.D. Nifong 242* (NCU); same locality, 11 Jul 1992, *B.A. Sorrie 6605* (NCSC); same locality, 22 Sep 1998, *J.F. Townsend 1804* (CLEMS); same locality, 6 Oct 1998, *B.A. Sorrie 10014 & R.J. LeBlond* (DUKE, FSU, GH, US).

PARATYPES: UNITED STATES. North Carolina: Hoke Co., Antioch Bay, NE of N.C. Hwy. 211, 0.6 mi. S of jct. with secondary road 1447, 9 Jul 1994,

T.D. Nifong 407 (NCU); same locality, 25 Aug 2004, *E.E. Schilling 04-17 & B.A. Sorrie* (TENN); Arabia Bay, wet savanna with cypress in Carolina bay S of secondary road 1003 0.25 mi. E of secondary road 1432 at Arabia, 9 Sep 2003, *B.A. Sorrie 11166* (GH, NCU); Onslow Co., Starretts Meadow, Camp Lejeune Marine Corps Base, wet savanna with cypress in depression W of N.C. Hwy. 172, 1.75 mi. S of jct. with N.C. Hwy. 24, 22 Aug 1998, *R.J. LeBlond 5035 & J.F. Townsend* (LeBlond pers. herb.); Lyman Road Cypress Savanna, Camp Lejeune Marine Corps Base, wet savanna with cypress in depression S of Lyman Road 2.15 mi. E-SE of jct. with Sneads Ferry Road, 11 Oct 1998, *R.J. LeBlond 5075* (TENN); Scotland Co., small bay N of secondary road 1347 2.98 mi. N of Old Hundred, 29 Aug 1979, *J.H. Carter III 1479* (Weymouth Woods State Natural Area herbarium, Southern Pines, NC); Sandhills Game Land, 17 Frog Pond, periodically ponded small depression N of Gardner Farm Lane and W of Strausburg Road, 20 Oct 1998, *B.A. Sorrie 10028* (BRIT, DUKE, FSE, GA, GH, MO, NCSC, NCU, NY, US). South Carolina: Barnwell Co., Craigs Pond, about 3.2 mi. N of Snelling on road SSR 21, 9 Oct 1998, *R.D. Porcher 2906 & P.D. McMillan* (CITA-CLEMS); Florence Co., Kingsburg Bay, S of road SC 791, 0.75 mi. W of SC 57, 10 Jul 1998, *R.D. Porcher 2861* (CITA-CLEMS); same locality, 2 Aug 1998, *R.D. Porcher 2884 & P.D. McMillan* (CITA-CLEMS); same locality and date, *P.D. McMillan 3060 & R.D. Porcher* (CLEMS); same locality, 21 Aug 1998, *J.F. Townsend 1735, R.D. Porcher & N. Murdock* (CLEMS, USCH); same locality, 6 Oct 1998, *R.J. LeBlond 5062 & B.A. Sorrie* (BRIT, NCU, TENN, LeBlond pers. herb.); same locality and date, *B.A. Sorrie 10015 & R.J. LeBlond* (FSU, GH, NY, US).

DISCUSSION

Eupatorium paludicola most closely resembles *E. leucolepis*, and earlier collections were identified as the latter. Both have narrow opposite leaves, average five florets per head, and have phyllaries with acute-mucronate to acuminate apices. But they consistently differ in several macromorphological characters. These include rhizome presence/length, leaf orientation and width, leaf adaxial surface and margin pubescence, involucre length, pappus length, corolla:pappus ratio; and cypsela length. Carefully collected specimens of *E. paludicola* have rhizomes up to 17 cm long, while *E. leucolepis* usually has none or rarely a short rhizome no more than 2 cm long. Leaves of *E. paludicola* are distinctly narrower than those of *E. leucolepis*, with the widest of the former barely approaching the narrowest of the latter. Leaves of *E. paludicola* ascend at an angle greater than 45° from the horizontal, and are often arched-erect and inwardly curved, including the leaf-like

bracts within the inflorescence. Leaves of *E. leucolepis* are spreading to reflexed, or ascending at less than 45° from the horizontal. The combination in *E. paludicola* of leaves that are both ascending and less than 5 mm wide is unique for the genus.

Eupatorium paludicola (Latin for “a dweller in marshes”) inhabits isolated wet depressions with variable hydrology in the Atlantic Coastal Plain of North and South Carolina. Several are clay-based Carolina bays with perched water tables. These depressions are typically inundated in winter and spring by ground water, and in most years water levels will recede below the surface by summer or fall, though soils remain saturated to moist. Occasionally, the depressions may remain flooded throughout the growing season. These conditions favor graminoids and forbs able to take advantage of an often short growing season, and discourage woody growth; frequently there are no trees at all and few or no shrubs except at the margins. Some of the depressions have open canopies of *Taxodium ascendens* Brongn., and have been classified as the Cypress Savanna community, with treeless depressions classified as the Cypress Savanna Depression Meadow Variant (Schafale and Weakley 1990). These communities are equivalent to the *T. ascendens*/*Panicum hemitomon*-*Polygala cymosa* Woodland (NatureServe 2005), and Cypress-Gum Pond and Drawdown Savanna/Meadow communities of Nifong (1998).

Eupatorium paludicola flowers and fruits from mid-August into October. Frequent associates include *Agalinis linifolia* (Nutt.) Britton, *Muhlenbergia torreyana* (Schult.) Hitchc., *Panicum hemitomon* Schult., *P. longifolium* Torr. var. *combsii* (Scribn. & C.R. Ball) Fernald, *Pluchea rosea* R.K. Godfrey, *Rhynchospora filifolia* A. Gray, *R. tracyi* Britton, and *Woodwardia virginica* (L.) Sm. Herb diversity is high in these depressions and several other globally rare species occur with *E. paludicola*, including *Dichanthelium hirstii* (Swallen) Kartesz, *Lobelia boykinii* Torr. & A. Gray ex DC., and *Rhexia aristosa* Britton.

During the course of the study, at four of the *Eupatorium paludicola* sites plants were found with the long rhizomes, leaf size and orientation, and involucre length of *E. paludicola*, but with round-tipped phyllaries and a longer pappus, and averaging longer in corolla and cypsela lengths. Leaves also averaged slightly wider, with a maximum of 5.5 mm compared with 4.5 mm in *E. paludicola*. Molecular analysis determined that these plants were hybrids of *E. paludicola* and *E. mohrii* Greene (Schilling et al. 2007).

By virtue of its distinct, restricted, and well-surveyed habitat, *Eupatorium paludicola* is a rare species whose conservation status is in need of careful evaluation. The identification of hybrids between *E. paludicola* and the widespread *E. mohrii*, which at some sites may be more abundant than *E. paludicola*, suggests that there may be danger of genetic assimilation through hybridization, a threat that needs to be assessed.

The following key distinguishes the narrow-leaved *Eupatorium paludicola* and *E. mohrii* × *E. paludicola* from the wider-leaved *E. leucolepis* and *E. mohrii*.

KEY TO DISTINGUISH *EUPATORIUM PALUDICOLA*

- 1. Phyllary apices acute-mucronate to acuminate (2)
- 2. Rhizomes absent to 2 cm long; leaves (deflexed-) spreading (-ascending), the larger (5-) 6–13 mm wide; leaf margins and adaxial surfaces moderately to densely strigose; involucre 5–8 mm long; pappi (3.3-) 3.9–5.0 mm long; cypselae 2.2–3.5 mm long *E. leucolepis*
- 2. Rhizomes present, 2–17 cm long; leaves usually ascending to erect-incurved, the larger 2–4.5 mm wide; leaf margins and adaxial surface glabrous to sparsely strigose; involucre 4.0–5.5 mm long; pappi 2.7–4.1 mm long; cypselae 1.6–2.3 mm long *E. paludicola*
- 1. Phyllary apices rounded to rounded-mucronate (3)
- 3. Leaves 5–20 mm wide, deflexed to spreading to ascending; pappi 2.5–3 mm long; cypselae 1–2 mm long *E. mohrii*
- 3. Leaves 2.5–5.5 mm wide, ascending to erect-incurved; pappi 4.0–5.4 mm long; cypselae 2.0–3.3 mm long *E. mohrii* × *E. paludicola*

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RELATIONSHIPS OF THE NEW ENGLAND BONESET,
EUPATORIUM NOVAE-ANGLIAE (ASTERACEAE)

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ABSTRACT. Resolution of the systematic relationships of the New England Boneset, *Eupatorium novae-angliae*, has been elusive. This rare species, known from only 15 sites in Massachusetts and Rhode Island, has been demonstrated to be male-sterile and agamosperous, and thus inferred to be polyploid, but its progenitor diploids have not been identified clearly. In a study that hinged on a combination of fieldwork and morphological study together with molecular analysis, we have demonstrated that *E. novae-angliae* contains ITS repeats characteristic of two sexual diploid species of the genus. One is the widespread *E. perfoliatum*, the second is a previously unrecognized endemic to clay-based Carolina bay and depression meadow habitats in the Carolinas, that had been included in *E. leucolepis* and is now recognized as a separate species, *E. paludicola*. The molecular data highlight the distinctiveness of *E. novae-angliae* and underscore the need for efforts to continue to protect it in its native habitat.

Key Words: *Eupatorium*, Asteraceae, ITS sequences, polyploidy, agamospermy