



# *Botanical Notes*

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## **NEW COMBINATION IN *EUPATORIUM* (ASTERACEAE)**

*Eupatorium* is a genus of tall, perennial herbs (in northeastern North America) with capitula that contain only disk flowers. It has generally been treated in the broad sense (i.e., as including many species; Fernald 1950, Gleason and Cronquist 1991). Morphological, phylogenetic, and phytogeographic studies show that this definition of *Eupatorium* is artificial and that the genus needs to be subdivided in order that the classification system reflects monophyletic (i.e., natural) groups (King and Robinson 1970a, King and Robinson 1970b, Schmidt and Schilling 2000). In New England, species traditionally placed in the genus *Eupatorium* are now distributed over three genera—*Ageratina* (snakeroots), *Eutrochium* (Joe-pye weeds), and *Eupatorium s.s.* (thoroughworts). Hybridization has been an important force in *Eupatorium* and has both created new species and complicated the taxonomy of the genus. Several thoroughwort species that occur in New England are hypothesized to be the products of hybridization (e.g., *E. pubescens* Muhl. ex Willd., also known by its synonym *E. rotundifolium* var. *ovatum*, and *E. torreyanum* Short & Peter, also known by its synonym *E. hyssopifolium* var. *laciniatum*). Both of these hybrid-derived taxa have been treated as varieties of other species, which is an inappropriate manner to classify them (see later discussion). This note discusses aspects of *Eupatorium* taxonomy as rationale for a new combination regarding a New England endemic.

*Eupatorium* is a complex genus due to polyploidy. Several species exist as diploid and autopolyploid races. The diploid members of the species are sexually reproducing plants with fertile pollen, whereas the polyploid members of the species are agamosperous and do not produce pollen in the anthers or produce grossly malformed pollen grains (Sullivan 1976). For example, *E. rotundifolium* L. exists as diploid, triploid, and tetraploid individuals. Members of these different chromosome races are morphologically similar but occupy different geographic ranges. Diploid individuals of *E. rotundifolium* are known only from a small region of Georgia and Florida, while the polyploid plants range as far north as southern New England.

Another factor contributing to the difficulty of *Eupatorium* is hybridization (past and present). Hybrid individuals are agamosperous and, therefore, can produce viable fruit and disperse to new locations. For example, *E. pubescens* is considered to be the product of *E. sessilifolium* L. and *E. rotundifolium* (Gleason and Cronquist 1991, Weakley, *in prep.*). The taxon is known only as pollen-sterile triploids and tetraploids. Interestingly, it has been collected beyond the range of sympatry of the parental species (the hybrid is known from as far north as Maine, whereas the progenitor species have never been collected north of Massachusetts). On the basis of its distinctive morphology, ability to form viable fruit, and expanded geographic range, it is appropriate to consider this plant

as a species (rather than a hybrid). Its treatment as a variety (as *E. rotundifolium* var. *ovatum*) by Gleason and Cronquist (1991) is inappropriate. Naming it as a variety of *E. rotundifolium* implies that it is solely derived in phyletic fashion from *E. rotundifolium* (i.e., that it represents a diverging population of *E. rotundifolium* and that no other species are involved in its recent evolutionary history). However, *E. pubescens* is the product of two separate species. Therefore, it needs a separate name that does not imply incorrect evolutionary history. Figure 1 provides graphical explanation of this argument.

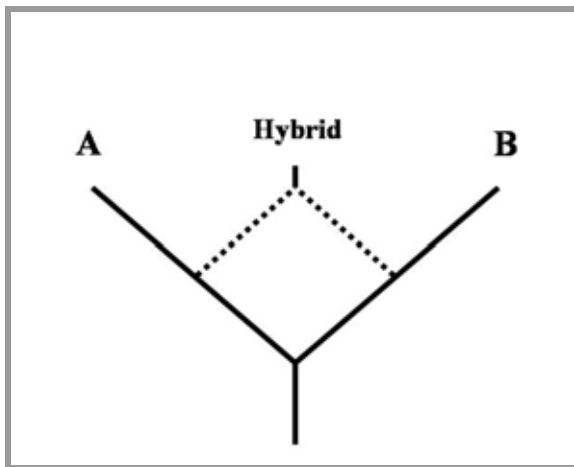


Figure 1. Hybrid phylogeny. The hypothetical hybrid shown in the above figure, derived from species A and species B, would require a name independent of those species. Naming it as a variety of A or B would be arbitrary. Which species would one choose to ally the hybrid with and on what basis?

*Eupatorium leucolepis* (DC.) Torr. & Gray var. *novae-angliae* Fern. is a rare coastal plain pond shore species endemic to New England (see Sorrie 1981 for a summary of populations). Two independent studies have similarly concluded that *E. leucolepis* var. *novae-angliae* is very likely a stabilized hybrid derivative (Sullivan 1992, Weifenbach 1993). As such, it is incorrect to refer to this species as a variety. The following new combination is made.

***Eupatorium novae-angliae* (Fern.) V. Sullivan ex A. Haines & Sorrie, comb. et stat. nov.**

Basionym: *Eupatorium leucolepis* (DC.) Torr. & Gray var. *novae-angliae* Fern.; *Rhodora* 39: 453. 1937.  
Holotype: United States. Massachusetts. Plymouth County. Lakeville, damp sandy shore of Loon Pond, 26 Aug 1913, Fernald & Long 10492 (GH).

*Eupatorium novae-angliae* is a rare coastal plain pond shore element of Massachusetts and Rhode Island (Elliman 2001; Figure 2). It was named as a variety of *E.*

*leucolepis* by Fernald (1937) based on superficial similarity to that species. Fernald chose not to consider this New England endemic a species because it did not possess corolla and cypselia morphology different from that of *E. leucolepis*. However, these features are generally not of taxonomic value for distinguishing species of *Eupatorium* and should not have been used as reasons for providing it an infraspecific rank (Weifenbach 1993).



Figure 2. Capitulescence of *Eupatorium novae-angliae*.

Sullivan (1992) was first to determine that *Eupatorium novae-angliae* existed as pollen-sterile polyploid populations (i.e., sexual diploid plants were unknown). Further, aspects of its morphology suggested hybrid origin. For example, *E. novae-angliae* has on average 6.62 flowers per capitulum, and capitula can be found with as many as 9 flowers (Arthur Haines, personal observation). Species of *Eupatorium* in eastern North America have either 5 flowers per capitulum or many more than 5 flowers (usually 9–23). The intermediate flower number of *E. novae-angliae* strongly suggests it is a hybrid between a species with 5 flowers per capitulum and a species with more than 5 flowers. Only three species of *Eupatorium* in eastern North America have capitula with more than 5 flowers—*E. perfoliatum* L., *E. resinsum* Torr., and *E. serotinum* Michx. Both *E. perfoliatum* and *E. serotinum* have obvious morphological traits that eliminate them from consideration as parental taxa of *E. novae-angliae* (connate-perfoliate leaves and elongate petioles, respectively). Therefore, Sullivan (1992) considered *E. resinsum* to be one of the parent species.

*Eupatorium novae-angliae* has distinctive involucre bracts. The bracts are acuminate at the apex and prominently white-scarious along the distal margins (Figure 3). Only two other extant species of *Eupatorium* in eastern North America have this trait—*E. album* L. (Figure 4) and to some extent *E. leucolepis* (the white

border is not as prominent in most collections as it is in *E. album*). *Eupatorium resinosum* has involucre bracts more similar to other species of eastern North American *Eupatorium* in that they are acute to obtuse at the apex and lack a prominent white-scarious apical border (Figure 3). Based on these observations, Sullivan (1992) considered *E. novae-angliae* to be the hybrid derivative of *E. album* and *E. resinosum* and suggested that *E. novae-angliae* be renamed to accurately reflect it did not arise as a divergent population of *E. leucolepis* (but a new combination was not made).



Figure 3. Involucral bracts of *Eupatorium novae-angliae*.



Figure 4. Involucral bracts of *Eupatorium album*.



Figure 5. Involucral bracts (and remnant disk flower) of *Eupatorium resinosum*.

Weifenbach (1993) followed up the studies of Sullivan by examining DNA sequence data from several species of *Eupatorium*. Using chloroplast DNA (cpDNA) and nuclear ribosomal DNA (nrDNA), Weifenbach compared genetic divergence among various species of *Eupatorium* to determine their possible role as a progenitor to *E. novae-angliae*. She found that *E. novae-angliae* and *E. resinosum* were the least divergent and shared 99.5% and 100% complementary sequences for the portions of cpDNA and nrDNA sampled, respectively. These results strongly implicated *E. resinosum* in the evolutionary history of *E. novae-angliae*. However, *E. album* was not supported as a likely progenitor species as the sequence divergence values were greatest between *E. album* and *E. novae-angliae*. Weifenbach concluded that *E. novae-angliae* may have been the result of hybridization between *E. resinosum* and an extinct species that possessed acuminate and white-scarious-tipped involucre bracts (but a new combination was not made).

Regarding the probable parentage of *Eupatorium novae-angliae*, there are other morphological features that must be considered. First, the involucre bracts of *E. novae-angliae* are conspicuously pubescent on the abaxial surface (Figure 3). Those of *E. album* are glabrous (Figure 4). If *E. album* were a parent, *E. novae-angliae* would be expected to show a reduced amount of involucre bract pubescence relative to *E. resinosum*, but this is not the case. Second, *E. resinosum* has pinnately-veined leaf blades, whereas *E. novae-angliae* has +/- triple-nerved leaf blades. Therefore, the other parent of *E. novae-angliae* likely has triple-nerved leaf blades. These facts suggest that the unknown parent of *E. novae-angliae* would appear morphologically similar to *E. leucolepis* in many features.

## Representative Specimens

MASSACHUSETTS. Plymouth County. Kingston, Muddy Pond (Lake Providence), common around much of eastern half of pond, sandy-cobbly to peaty shores, 3 Sep 1980, *Sorrie 715* (NEBC). Lakeville, Loon Pd., moist sandy shore at NW corner of pond, branch of 1 plant, only 7 plants found, 10 Sep 1979, *Sorrie 249* (NEBC). Lakeville, sphagnum grassy place, Loon Pond, 10 Sep 1930, *Blake 11287* (GH). Plymouth, 6 plants on gravelly upper beach of King Pond, 30 Aug 1928, *Fernald 1076* (NEBC). Plymouth, muddy pond margin, 13 Sep 1925, *Smith s.n.* (NEBC). Plymouth, Little Widgeon Pd., dry sandy shelf on W shore, most plants very robust, 2 Sep 1979, *Sorrie 243* (NEBC). Plymouth, Great South Pond, cove E of Pickerel Cove, emergent in 10 cm of water, 2 Sep 1979, *Sorrie 239* (NEBC). Plymouth, Triangle Pond north of Rte. 44, 17 Jul 1980, *Hellquist 14630* (NEBC). Plymouth, Triangle Pond near Rtes 44 and 80, moist sandy margin of SW lobe, 2 flowering stalks from same fibrous root, 1 Sep 1979, *Sorrie 237a & 237b* (NEBC). Plymouth, Harlow Pd., emergent near shore of N cove, 2 Sep 1979, *Sorrie 245* (NEBC). Plymouth, Little Micajah Pd., peaty-sandy margin of NW cove, 2 Sep 1979, *Sorrie 242* (NEBC). Plymouth, edge of Triangle Pond, 26 Aug 1928, *Griscom 12706* (NEBC).

RHODE ISLAND. Washington County. South Kingston, granitic gravel and sand about small pond east of Long Pond, 5 Sep 1914, *Collins s.n.* (BRU, GH, NEBC, NHA). South Kingston, sandy and peaty shore, southern end of Long Pond, 5 Sep 1914, *Collins 11444* (GH, NEBC). South Kingston, Kingston, shore of Smelt Pond, 30 Aug 1908, *Rich s.n.* (GH).

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