HOW FASTER TO MASTER THE *ASTER* DISASTER: A PRIMER ON THE CHANGING NOMENCLATURE OF MISSOURI ASTERS

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Modern plant systematists are botanical genealogists. Their work is often expressed as cladistic phylogenies (cladograms), which are branched diagrams that detail the relationships among taxonomic groups as lineages derived from hypothetical ancesters. The concept of a "natural" taxonomic group has come to mean a hypothesis that two or more taxa have a direct shared common ancestry. The tools used to develop these phylogenies are broad and often involve some combination of data from morphological, anatomical, cytological, phytochemical, and molecular studies.

Phylogenetic systematists tend to operate under a set of basic assumptions that may not be intuitive to those outside the field. The technical term for a phylogenetically "natural group" is "monophyletic," which means that a given lineage is discrete and ultimately can be traced back to a single originating branchpoint. A taxonomic group (such as a genus) that can be shown to have been derived directly as a specialized portion within some other lineage renders that lineage "paraphyletic" and should be reclassified as a subgroup of that lineage (or the whole thing should be split up into a series of discrete monophyletic groups). Taxonomic groups that include members of two or more distantly related lineages are categorized as "polyphyletic" and are not tolerated.

In large taxonomic groups, like the Asteraceae, the basic units (tribes, genera, and species) may be more or less recognizable morphologically based upon one or several unusual features. The relationships between these basic units has been a major focus of many recent systematic studies, and the number of tribes, genera, and species accepted in a classification often has been modified from traditional limits because new data have defined novel monophyletic groups.

In the Asteraceae, there has been a recent trend to split many of the larger traditional genera into series of smaller genera. This usually

has come about because phylogenetic studies have resulted in a different understanding of the relationships between groups of closely related species. In many cases in a given tribe, some species within Genus A may be more closely related to some species within Genus B than to other species within Genus A. For the larger genera having broad distributions on several continents, these relationships may not be evident if only the species in a regional flora are studied, but can become clearer when the entire genus across its whole provenance is analyzed for patterns of variation. Thus, in recent years, traditional genera of Asteraceae, such as *Cacalia, Senecio, Eupatorium, Gnaphalium, Solidago*, and *Aster*, have become dismembered by systematists into smaller putatively monophyletic units.

Perhaps none of these genera has received more taxonomic attention than *Aster*. When Steyermark's (1963) Flora of Missouri was published, most botanists considered it a taxonomically difficult genus of nearly 450 species distributed widely in temperate and montane regions of the world. Today, the situation is quite different, with all but 1 of the ca. 180 species remaining in the genus native to Europe and Asia. In the Flora of North America region, the native circumboreal *A. alpinus* L. (alpine aster) occurs from Alaska southward through the Rocky Mountains to Wyoming (and also in far northern Europe and Asia) and the non-native *A. tataricus* L. f. (Tatarian aster, a Eurasian native) escapes sporadically from cultivation in gardens. In advance of the second volume of the revised Steyermark's Flora of Missouri, the purpose of the present paper is to alert botanists in the state to the recent taxonomic disposition of the asters of Missouri.

The changes in generic delimitation of *Aster* have been developing for a long time. In the early 1970s, Bernard Boivin (1971–1972) of the University of Laval (Canada) was the first to recognize that the white upland aster (*A. ptarmicoides*) was more closely related to the species of the *Oligoneuron* group of goldenrods (*Solidago*) than to the other species of *Aster*. In the late 1970s, John Semple at the University of Waterloo (Canada) and his colleagues began developing new cytological and morphological data to support a narrower circumscription of the genus (see Semple et al. [2002] for a review). The revised classification began to stabilize with the thorough taxonomic and phylogenetic analysis of the group throughout its range by Guy Nesom (1994), then at the the University of Texas–Austin. More recent analyses by Nesom (reviewed in Nesom [2000]) and Semple (reviewed in Semple et al. [2002]) have have continued to support the hypothesis of a narrower generic concept of

Aster. Ongoing molecular phylogenetic research (Noyes and Rieseberg, 1999; Semple et al., 2002) also has supported this general reclassification of the *Aster* group while fine-tuning the numbers and limits of the various smaller genera.

It is beyond the scope of the present paper to detail the research supporting the current classification of the tribe Astereae. It is sufficient to note that Nesom (1994) and Noyes and Rieseberg (1999), using independent data sets, arrived at the conclusion that there was a basic phylogenetic branch toward the base of the group's evolutionary tree between Old World and New World lineages. As the generic name *Aster* originally was described based on Eurasian plants, if the New World group represents a different lineage it can no longer be be classified under the name *Aster*. Within the New World lineage of Asteraceae tribe Astereae subtribe Asterinae, Nesom (1994) and later authors have arrived at a classification that includes about 14 currently accepted genera, a few of which are still controversial in their circum-scription. The justifications for maintaining each of these genera are discussed in Nesom's (2000) excellent review of the North and Cen-tral American genera of the tribe Astereae.

For Missouri, the practical consequence of this generic revision is that the native species are distributed among four genera. The largest of these (and the largest segregate in North America) is *Symphyotrichum*, which includes the core species of Missouri asters. The other genera accomodate asters that were separted toward the beginning of the keys to species determination in all of the floristic literature used by students of the state's flora until the present time. Thus, learning the new system will not be a difficult chore for most Missouri botanists once they accept the sad fact of the dismemberment of a genus that traditionally has been readily recognizable in the field and herbarium.

The revised nomenclature of the Missouri asters is listed below. It should be noted that three species have been reported as new to the state since Steyermark's (1963) flora was published (these are indicated in the checklist). A few of the species are listed under different species epithets than in the older literature, following more recent species-level taxonomic investigations by asterologists. Synonymy in the checklist is mostly restricted to the names used by Steyermark (1963), but additional synonyms are listed where necessary for clarity. Infra-specific classification within the accepted species is beyond the scope of the present paper. Readers should consult the forthcoming second volume of the revised Steyermark's Flora of

Missouri for a detailed account of the varieties and subspecies of the Missouri species. Finally, within *Solidago*, only the single species transferred from *Aster* is listed.

THE CURRENT NOMENCLATURAL STATUS OF THE MISSOURI ASTERS

Aster L.—Ca. 180 species, North America (1 native taxon), Europe, Asia.

1. Aster tataricus L.f. (Tatarian aster). Reported for Missouri by Yatskievych and Summers (1993)

Doellingeria Nees—Three species, U.S., Canada.

2. Doellingeria umbellata (Mill.) Nees (flat-topped white aster). Reported for Missouri (as *Aster pubentior* Cronquist) by Gremaud (1988)

Aster umbellatus Mill.

Eurybia (Cass.) S.F. Gray—Ca. 28 species, U.S., Canada, Europe, Asia.

3. Eurybia furcata (E.S. Burgess) G.L. Nesom (forked aster)

Aster furcatus E.S. Burgess

4. Eurybia hemispherica (Alexander) G.L. Nesom (single-stemmed bog aster, southern prairie aster)

Aster paludosus Aiton ssp. *hemisphericus* (Alexander) Cronquist

5. Eurybia macrophylla (L.) Cass. (large-leaved aster). Reported for Missouri by Summers and Yatskievych (1990)

Aster macrophyllus L.

Ionactis Greene—Ca. 5 species, U.S., Canada.

6. Ionactis linariifolius (L.) Greene (stiff aster, stiff-leaved aster, flax-leaved aster)

Aster linariifolius L.

Solidago L.—Ca. 100 species, North America (23 in Missouri), South America, Europe, Asia.

7. Solidago ptarmicoides (Torr. & A. Gray) B. Boivin (white upland aster, sneezewort aster)

Aster ptarmicoides Torr. & A. Gray

Symphyotrichum Nees (aster)—Ca. 90 species, North America to South America.

8. Symphyotrichum anomalum (Engelm. ex Torr. & A. Gray) G.L. Nesom
Aster anomalus Engelm. ex Torr. & A. Gray

9. Symphyotrichum ciliatum (Ledeb.) G.L. Nesom (rayless alkali aster)
Aster brachyactis S.F. Blake

10. Symphyotrichum cordifolium (L.) G.L. Nesom (blue wood aster)
Aster cordifolius L.
Aster sagittifolius Wedem. ex Willd.

11. Symphyotrichum drummondii (Lindl. ex Hook.) G.L. Nesom (Drummond aster)
Aster drummondii Lindl. ex Hook.

12. Symphyotrichum dumosum (L.) G.L. Nesom
Aster dumosus L.

13. Symphyotrichum ericoides (L.) G.L. Nesom (wreath aster)
Aster ericoides L.

14. Symphyotrichum falcatum (Lindl.) G.L. Nesom (white prairie aster)
Aster commutatus (Torr. & A. Gray) A. Gray

15. Symphyotrichum laeve (L.) Á. Löve & D. Löve (smooth aster)
Aster laevis L.

16. Symphyotrichum lanceolatum (Willd.) G.L. Nesom (tall white aster, panicled aster)
*A*ster *simplex* Willd.

17. Symphyotrichum lateriflorum (L.) Á. Löve & D. Löve (white woodland aster)
Aster lateriflorus (L.) Britton

18. Symphyotrichum novae-angliae (L.) G.L. Nesom (New England aster)
Aster novae-angliae L.

19. Symphyotrichum oblongifolium (Nutt.) Nesom (aromatic aster, oblong-leaved aster)
Aster oblongifolius Nutt.

20. Symphyotrichum ontarione (Wiegand) G.L. Nesom (Ontario aster)
Aster ontarionis Wiegand

21. Symphyotrichum oolentangiense (Riddell) G.L. Nesom
(azure aster, blue devil)
Aster oolentangiensis Riddell
*A*ster *azureus* Lindl. ex Hook.

22. Symphyotrichum parviceps (Burgess) G.L. Nesom
(small white aster)
Aster parviceps (Burgess) Mack. & Bush

23. Symphyotrichum patens (Aiton) G.L. Nesom
(spreading aster, purple daisy)
Aster patens Aiton

24. Symphyotrichum pilosum (Willd.) G.L. Nesom
(white heath aster)
Aster pilosus Willd.

25. Symphyotrichum praealtum (Poir.) G.L. Nesom
(willow-leaved aster)
Aster praealtus Poir.

26. Symphyotrichum puniceum (L.) Á. Löve & D. Löve
(glossy-leaved aster)
Aster puniceus L.
Aster firmus Nees

27. Symphyotrichum racemosum (Elliott) G.L. Nesom
(small white aster, frost flower)
A. vimineus Lam., misapplied

28. Symphyotrichum sericeum (Vent.) G.L. Nesom
(silky aster)
Aster sericeus Vent.

29. Symphyotrichum subulatum (Michx.) G.L. Nesom
(inland saltmarsh aster, freeway aster)
Aster subulatus Michx.
Aster exilis Elliott

30. Symphyotrichum turbinellum (Lindl. ex Hook.)
G.L. Nesom (prairie aster)
Aster turbinellus Lindley

31. Symphyotrichum urophyllum (Lindl. ex DC.)
G.L. Nesom
Aster urophyllus Lindl. ex DC.
*A*ster *sagittifolius* Wedem. ex Willd., misapplied

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