Taxonomic and nomenclatural rearrangements in *Artemisia* subgen. *Tridentatae*, including a redefinition of *Sphaeromeria* (Asteraceae, Anthemideae)

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**Authors**
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TAXONOMIC AND NOMENCLURAL REARRANGEMENTS IN 
ARTEMISIA SUBGEN. TRIDENTATAE, INCLUDING A REDEFINITION 
OF SPHAEROEROMA (ASTERACEAE, ANTHEMIDEAE)

Sònia Garcia1,5, Teresa Garnatje1, E. Durant McArthur2, Jaume Pellicer3, 
Stewart C. Sanderson2 and Joan Vallès4

ABSTRACT.—A recent molecular phylogenetic study of all members of Artemisia subgenus Tridentatae, as well as most of the other New World endemic Artemisia and the allied genera Sphaeromeria and Picrothamnus, raised the necessity of revising the taxonomic framework of the North American endemic Artemisia. Composition of the subgenus Tridentatae is enlarged to accommodate other North American endemics and is organized into 3 sections: Tridentatae, Nebulosae, and Filifoliae. This paper deals with the combination of one section, the amendment of 2 more sections, and the combination in or the reversion to Artemisia of some Sphaeromeria and Picrothamnus species. The new names given for previous Sphaeromeria species are Artemisia macarthurii (for S. argentea), A. albicans (for S. cana), A. constricta (for S. conpacta), and A. inaequifolia (for S. diversifolia). The other Sphaeromeria we studied (S. capitata, S. potentilloides, S. ruthiae, and S. simplex) had been formerly considered Artemisia (respectively, A. capitata, A. potentilloides, A. ruthiae, and A. simplex), and their previous nomenclature is therefore recommended.

RESUMEN.—Un estudio reciente sobre la filogenia molecular de todos los miembros del subgénero Tridentatae de Artemisia, así como de la mayoría de las otras especies de Artemisia endémicas del Nuevo Mundo y los géneros afines Sphaeromeria y Picrothamnus, hizo ver la necesidad de revisar el marco taxonómico de las especies de Artemisia endémicas a Norteamérica. La composición del subgénero Tridentatae se ha ampliado para dar cabida a las otras especies endémicas de Norteamérica, y está organizado en 3 secciones: Tridentatae, Nebulosae y Filifoliae. El presente artículo trata sobre la combinación de una sección y la enmienda de 2 más, y propone la incorporación o reversión a Artemisia de algunas especies de Sphaeromeria y Picrothamnus. Los nuevos nombres de las especies previamente asignadas a Sphaeromeria son Artemisia macarthurii (para S. argentea), A. albicans (para S. cana), A. constricta (para S. conpacta) y A. inaequifolia (para S. diversifolia). Las otras especies de Sphaeromeria estudiadas (S. capitata, S. potentilloides, S. ruthiae y S. simplex) habían sido previamente consideradas como miembros de Artemisia (A. capitata, A. potentilloides, A. ruthiae y A. simplex, respectivamente), por lo que se recomienda utilizar su nomenclatura anterior.

Artemisia L. is the largest genus of tribe Anthemideae Cass. (Asteraceae Martynov), comprising around 500 species (Vallès and McArthur 2001, Vallès and Garnatje 2005, and references therein), many of them ecologically and economically relevant. Artemisia has a very large distribution in the Northern Hemisphere but a limited number of species (around 10) in the Southern Hemisphere. The genus Artemisia has classically been structured in 5 large groups treated as sections or subgenera. In the latter case, the infrageneric names are Artemisia, Absinthium (Miller) Less. (these 2 are merged into a single entity, Artemisia, by some authors, e.g., Shultz 2006a, 2009), Dracunculus Besser, Seriphidium (Besser) Poljakov, and Tridentatae (Ryd.) McArthur. These subgenera are further divided into sections and/or series. Recent molecular studies (Watson et al. 2002, Vallès et al. 2003, Sanz et al. 2008, Tkach et al. 2008, Garcia et al. 2011) only partially support the traditional, mostly morphology-based classifications; none of the classical subgenera are monophyletic in a strict sense, especially upon increased taxon sampling. Apart from infrageneric structuring problems, several genera have been established from species segregated from Artemisia. These genera, which are small (with the exception of Seriphidium) and often monotypic, are in general not supported as independent by the molecular phylogenies, in which they appear perfectly embedded in a monophyletic genus Artemisia (Sanz et al. 2008 and references therein). Some of these genera (such as Seriphidium) are considered by most authors as members of

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Artemisia, but others are usually regarded as independent (Oberprieler et al. 2009 and references therein). The objective of the present work is to provide the taxonomic and nomenclatural arrangements necessary to reflect the phylogenetic results revealed by molecular analyses in these endemic North American species.

**Taxonomic Considerations on Subgenus Tridentatae and Allied Taxa**

Tridentatae were first considered, without specifying any rank, within subgenus Seriphidium (Rydberg 1916). McArthur et al. (1981) raised Tridentatae to the rank of subgenus and explained the similarity with Seriphidium as a result of convergent evolution. This observation is supported by chemical data (Jeffrey 1995) and by recent molecular phylogenetic studies of the genus (Watson et al. 2002, Vallès et al. 2003, Sanz et al. 2008, Garcia et al. 2011).

As for classification below the subgeneric level (see Table 1 for comparison of previous arrangements with the classification proposed herein), 2 groups without taxonomic recognition (the A. cana and the A. tridentata lineages) were put forth by several authors with different research emphases (Ward 1953, Beetle 1960, Shultz 1983). Shultz (2009), in her recent monograph of the Tridentatae, advocates an extended concept of the subgenus and recognizes 2 sections: Tridentatae and Nebulosae. L.M. Shultz, the latter created to include some other North American endemic Artemisia species on the basis of molecular studies (Watson et al. 2002, Riggins 2008). Molecular cytogenetics and genome size data (Garcia et al. 2007, 2008, 2009) have also shed light in particular cases and supported a more restrictive concept of the section Tridentatae, the “Tridentatae core” or true sagebrushes, which may be partly equivalent to section Tridentatae sensu Shultz (2009). Additionally, 2 North American endemic genera, the monotypic Picrothamnus Nutt. (Shultz 2006b) and Sphaeromeria Nutt. (9 species; Holmgren et al. 1976, Lowrey and Shultz 2006), have also appeared embedded in the North American endemic Artemisia clade (Watson et al. 2002, Vallès et al. 2003, Riggins 2008, Sanz et al. 2008, Garcia et al. 2011). In addition to several similar morphological characters (the most outstanding being the discoid and homogamous capitula) and ecological features (e.g., dry habitat), they share the presence of interxylary cork (Holmgren et al. 1976), which is typical of Tridentatae species (Moss 1940).

Our recent and comprehensive molecular phylogenetic research (Garcia et al. 2011), concerning all members of Artemisia subgenus Tridentatae, as well as most of the other New World endemic Artemisia and the allied genera Sphaeromeria and Picrothamnus, has raised the necessity of emending the current taxonomic framework of endemic North American Artemisia. The constitution of subgenus Tridentatae is enlarged to accommodate other North American endemics and is organized, partially following Shultz (2009), into 3 sections: Tridentatae, Nebulosae, and Filifoliae, the last 2 hosting species and other genera that have been considered closely related to the core sagebrushes in undefined ways. This has taxonomic-nomenclatural consequences, since the genera Sphaeromeria and Picrothamnus should be best treated as Artemisia species, and new nomenclatural combinations must be proposed.

**Rearrangements in the Subgenus Tridentatae and the Genera Picrothamnus and Sphaeromeria, Including Nomenclatural Novelties**

Structuring of Artemisia

Subgenus Tridentatae


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<td>Section Pygmaeae</td>
<td>A. tridentata lineage&lt;sup&gt;a&lt;/sup&gt;</td>
<td>A. tridentata lineage</td>
<td>A. tridentata lineage</td>
<td>A. arbuscula</td>
<td>Section Tridentatae</td>
<td>A. pygmaea</td>
<td>Sphaeromeria</td>
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<td>A. arbuscula</td>
<td>A. bigelovii</td>
<td>A. bigelovii</td>
<td>A. arbuscula</td>
<td>A. argilosa</td>
<td>South American taxa</td>
<td>S. potentilloides</td>
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<td>Section Rigidae</td>
<td>A. arbuscula ssp. longiflora</td>
<td>A. longiflora</td>
<td>A. longiflora</td>
<td>A. pygmaea</td>
<td>S. capitata (A. capitata)</td>
<td>A. echegarayi</td>
<td>Circumboreal taxa</td>
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<td>A. rigida</td>
<td>A. tridentata</td>
<td>A. californica</td>
<td>A. californica</td>
<td>A. cana</td>
<td>S. completa (A. completa)</td>
<td>A. mendoncana var. mendoncana</td>
<td>A. conata</td>
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<td>Section Tridentatae</td>
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<td>A. nova</td>
<td>A. nova</td>
<td>A. tridentata</td>
<td>S. diversifolia (A. diversifolia)</td>
<td>A. spinescens</td>
<td>A. echegarayi</td>
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<td>A. cana</td>
<td>A. tridentata</td>
<td>A. rigida</td>
<td>A. rigida</td>
<td>A. tridentata</td>
<td>S. inflata (A. inflata)</td>
<td>A. mendozana — var. mendozana</td>
<td>A. flavus</td>
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<td>A. pygmaea</td>
<td>A. rigida</td>
<td>A. spiciformis</td>
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<td>S. martirensis (A. martirensis)</td>
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<td>A. furcata</td>
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<td>A. spiciformis</td>
<td>A. spiciformis</td>
<td>A. rothrockii</td>
<td>S. ruthiae (A. ruthiae)</td>
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<td>A. hyberborea</td>
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<td>A. rigida</td>
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<td>Section Nebulosae</td>
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<td>A. californica</td>
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<td>A. californica</td>
<td>A. cana</td>
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<tr>
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<td>A. cana</td>
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<td>A. cana</td>
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<td>A. bigelovii</td>
<td>A. californica</td>
<td>A. californica</td>
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<td>A. californica</td>
<td>A. californica</td>
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<tr>
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<td>A. californica</td>
<td>A. californica</td>
<td>A. californica</td>
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<td>A. californica</td>
<td>A. californica</td>
</tr>
</tbody>
</table>

<sup>a</sup> Includes questionable placement of A. palmeri.<br>
<sup>b</sup> Includes questionable placement of A. tridentata.<br>
<sup>c</sup> Includes questionable placement of A. pygmaea and A. rigida.
Artemisia ser. Filifoliae (Rydb.) Y.R. Ling in Hind, Jeffrey & Pope, Advan. Comp. Syst.: 272, 1995). The type species is A. filifolia. This section also hosts A. bigelovii, (excluded from the subgenus in previous treatments; Rydberg 1916, Ward 1953, Shultz 1983), A. rigida, (a species of unclear taxonomic position within the core sagebrushes; Shultz 1983), and most collateral members of subgenus Tridentatae, including the former genera Picrothamnus (its only species) and Sphaeromeria (most of its species).

Section Nebulosae L.M. Shultz emend. S. Garcia, Garnatje, McArthur, Pelllicer, S.C. Sand. & Vallès-Xirau. This section is limited to A. californica Less. and A. nesiotica P. H. Raven, excluding A. filifolia, which is the type of the section Filifoliae.

Unranked species at the sectional level, albeit members of subgenus Tridentatae, are A. argilosa, A. pygmaea, Sphaeromeria cana (D.C. Eaton) A. Heller, and S. diversifolia (D.C. Eaton) Rydb.

Rearrangements of the Former Genera Picrothamnus and Sphaeromeria

The only species of the genus Picrothamnus must be returned to Artemisia, thus restoring the previously applied name Artemisia spinescens D.C. Eaton. The genus Sphaeromeria must also be merged into Artemisia. To do so, some taxa need only be returned to the genus in which they were first described, while others have to be combined. In the latter case, since some of the Sphaeromeria specific epithets are already used in Artemisia, new names must be proposed. The names of the Sphaeromeria species in Artemisia are as follows:

Artemisia macarthuri S. Garcia, Garnatje, Pelllicer, S.C. Sand. & Valles-Xirau, nom. nov. Basionym: Sphaeromeria argentea Nutt., Trans. Amer. Philos. Soc. ser. 2, 7:402. 1841. Synonym: Tanacetum nuttallii Torr. & A.Gray. A new name is necessary, since the specific epithet was already used in Artemisia: A. argentea L’Hér. The new name is given in honor of botanist and geneticist E. Durant McArthur, who fruitfully devoted a large part of his scientific career to the study of sagebrushes. We have adopted the form macarthuri instead of mcarthuri for the specific epithet following the recommendation 60C.5(a) of the International Code of Botanical Nomenclature (McNeill et al. 2006).


We are not proposing to transfer the species Sphaeromeria martirensis (Wiggins) A.H. Holmgren, L.M. Shultz & Lowrey (originally described as Tanacetum martirensense Wiggins) to Artemisia until its phylogenetic position has been assessed by molecular techniques similar to those employed on the other Sphaeromeria species (Garcia et al. 2011), as our DNA sample failed to amplify. The same applies for the variety Sphaeromeria potentilloides var. nitrophila (Cronquist) A.H. Holmgren, L.M. Shultz & Lowrey (described as Tanacetum potentilloides var. nitrophilum Cronquist), of which we could not obtain material.

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