



## A new combination in *Sagittaria* (Alismataceae)

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The new combination *Sagittaria spongiosa*, based on the basionym *S. calycina* var. *spongiosa*, is made here, allowing for its use at the specific rank in *Sagittaria*. The typification of the basionym is discussed.

Bogin (1955: 195–200) in the most recent monograph of the genus *Sagittaria* Linnaeus (1753: 993), recognized *S. montevidensis* Chamisso & Schlechtendal (1827: 156) in a broad sense with four subspecies. *Sagittaria montevidensis* subsp. *montevidensis* and subsp. *chilensis* (Chamisso & Schlechtendal 1827: 155) Bogin (1955: 196) are characterized by a purple spot at the base of the petals, usually lack a ring of stamens in the pistillate flowers, and are native to South America. In contrast, *S. montevidensis* subsp. *spongiosa* (Engelm. in Gray 1867: 493) Bogin (1955: 198) and subsp. *calycina* (Engelm. in Emory 1859: 212) Bogin (1955: 197) lack a purple spot at the base of the petals, usually possess a ring of stamens in the otherwise pistillate flowers, and are native to North America (Bogin 1955).

Keener (2005), based on a molecular analysis, found that *Sagittaria montevidensis* s.l. (although he did not sample subsp. *chilensis*) does not form a clade without the inclusion of *S. intermedia* Micheli in de Candolle & de Candolle (1881: 80) and a putative undescribed species. He also found that the three subspecies he sampled formed their own clades. Ito *et al.* (2020), based on an expanded molecular analysis, similarly found that *S. montevidensis* s.l. does not form a clade without the inclusion of *S. intermedia* and in some trees *S. sprucei* Micheli in de Candolle & de Candolle (1881: 80).

*Sagittaria montevidensis* subsp. *spongiosa* has glabrous filaments, 1–4 whorls of flowers per stem, usually lacks lobed leaf blades, and is restricted to fresh to brackish tidal marshes along the east coast of the United States and adjacent Canada. *Sagittaria montevidensis* subsp. *calycina* differs in having pubescent filaments, usually 3–12 whorls of flowers per stem, usually lobed leaf blades, and occurs inland in North America in alkaline to circumneutral non-tidal wetlands (Bogin 1955, Haynes & Hellquist 2000, Abbott 2017, Keener & Weakley 2023).

### Taxonomy and Nomenclature

Based on the molecular, morphological, ecological, and distribution details noted above and in agreement with Weakley *et al.* (2012), Abbott (2017), Knapp & Naczi (2021), and Keener & Weakley (2023), we opt to treat *Sagittaria montevidensis* subsp. *spongiosa* at the rank of species. However, the above mentioned authors use the name *S. spatulata* (Smith 1899: 149) Buchenau (1903: 40), which is based on *Lophotocarpus spatulatus* J.G. Sm., for this taxon but another epithet appears to have priority as discussed below.

The basionym of *Sagittaria montevidensis* subsp. *spongiosa* is *S. calycina* var. *spongiosa* Engelm. Smith elevated the variety to the specific rank as *Lophotocarpus spongiosus* (Engelm.) Smith (1899: 148), and in the same publication, he described another species, *L. spatulatus*. Many authors (Bogin 1955, Haynes & Hellquist 2000, Haines 2011, Abbott 2017, Werier 2017, Knapp & Naczi 2021, Keener & Weakley 2023) consider these heterotypic names to apply to the same taxon. When treated at the specific rank, the two epithets (i.e., *spatulatus* and *spongiosus*) have equal priority from 1899.

Regarding a choice between the specific epithets *spatulatus* and *spongiosus*, Art. 11.5 of the International Code of Nomenclature for algae, fungi, and plants (ICNafp; Turland *et al.* 2018) states, “When, for any taxon at the rank of family or below, a choice is possible between legitimate names of equal priority at the corresponding rank, or between available final epithets of names of equal priority at the corresponding rank, the first such choice to be effectively published (Art. 29–31) establishes the priority of the chosen name, and of any legitimate combination with the same type and final epithet at that rank, over the other competing name(s) ...” And Art. 11, Note 3 states, “A choice as provided for in Art. 11.5 is effected

by adopting one of the competing names, or its final epithet in the required combination, and simultaneously rejecting or relegating to synonymy the other(s) or their homotypic (nomenclatural) synonyms.” In this case, although Buchenau (1903: 40) recognized *Sagittaria spatulata*, based on *Lophotocarpus spatulatus*, at the specific rank, he placed *L. spongiosus* in synonymy of *S. calycina* Engelm. Therefore, Buchenau did not make the first choice, because he considered the two taxa to be distinct species (cf. Art. 11 Ex. 24 of the ICNafp (Turland *et al.* 2018)).

Robinson & Fernald (1908: 83) appear to have been the first to consider *Lophotocarpus spatulatus* and *L. spongiosus* to represent the same taxon, and they chose *L. spongiosus* as the accepted name. Therefore, when these two taxa are treated as conspecific and recognized at the specific rank, as our preferred taxonomy does, the epithet *spongiosus* has priority over the epithet *spatulatus*. To allow for the use of the epithet *spongiosus* at the specific rank in *Sagittaria* a new combination is required and is made here.

***Sagittaria spongiosa*** (Engelm.) Werier *comb. nov.* Basionym: *Sagittaria calycina* var. *spongiosa* Engelm. 1867, p. 493 in Manual of the botany of the northern United States, Fifth Edition, by A. Gray. Type:—UNITED STATES. “occurs eastward.” Lectotype (designated by Smith (1899: 148)):—Del[aware]: Wilmington, July 1860, *E. Tatnall s.n.* (MO! BC: MO- 104310).

Homotypic synonyms: *Lophotocarpus calycinus* var. *spongiosus* (Engelm.) Fassett (1922: 73); *L. spongiosus* (Engelm.) Smith (1899: 148); *Sagittaria montevidensis* var. *spongiosa* (Engelm.) Boivin (1967: 527).

Heterotypic synonyms: *Lophotocarpus spatulatus* Smith (1899: 149); *Sagittaria spatulata* (J.G. Sm.) Buchenau (1903: 40).

### Typification of *Sagittaria spongiosa*

In the protologue of *Sagittaria calycina* var. *spongiosa*, Engelmann (1867), except for mentioning a general distributional range of this taxon, did not cite a precise locality or mention specimens that he studied to describe this taxon, and there was no illustration. Since Engelmann’s herbarium was at the Missouri Botanical Garden (MO), a search was made of their online database. There are at least two sheets of this taxon at MO that were originally part of Engelmann’s herbarium. These are 1) USA. Maine: Kennebunk, 1859, [*C.W.*] *Swan s.n.*, (MO! BC:MO-2206239); and 2) USA. Del[aware]: Wilmington, July 1860, *Edw. Tatnall s.n.*, (MO! BC:MO-104310). The Tatnall specimen at MO has been annotated as the holotype by C. Bogin in 1952 and B.R. Keener in 2004 but both the Tatnall and Swan specimens noted above can be considered original material and therefore there is no holotype (Art. 9.1 of the ICNafp (Turland *et al.* 2018)). For *S. calycina* var. *spongiosa*, Smith (1899: 148) wrote “type collected by Edward Tatnall, Wilmington, Del., July, 1860, in Engelmann Herbarium”. The specimen noted by Smith appears to be the Tatnall specimen at MO. Therefore, based on Art. 9.10 of the ICNafp (Turland *et al.* 2018), Smith’s usage of the term “type” is corrected to lectotype.

Two specimens, 1) USA. Del[aware]: Wilmington, 1860, *E. Tatnall s.n.*, (GH! 22717); and 2) USA. Delaware: Wilmington, 1860, *Edward Tatnall s.n.*, (GH! 22718) might appear to be duplicates of the lectotype. The GH 22717 specimen was annotated by Smith as “co-type” with an unknown person writing “isotype” below. This specimen was also annotated by C. Bogin as an isotype. As there was no holotype, the GH 22717 specimen is not an isotype. Letters written by Tatnall (1860) to Engelmann indicate that Tatnall sent his initial collections of this taxon to Engelmann (these now at MO) and then specimens he collected on a later day to Gray (these now at GH). Although Engelmann might have studied the GH specimens for his treatment of the genus *Sagittaria*, it is evident from Tatnall’s letters that *E. Tatnall s.n.* (GH! 22717) and *E. Tatnall s.n.* (GH! 22718) are not duplicates of *E. Tatnall s.n.* (MO! BC:MO-104310) and therefore are not isolectotypes.

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## References

- Abbott, R.J. (2017) Alismataceae. In: Naczi, R.F.C., Abbott, R.J. & Collaborators (eds.) *New manual of vascular plants of northeastern United States and adjacent Canada, digital version*. NYBG Press, Bronx, NY, USA, pp. 1–16.
- Bogin, C. (1955) Revision of the genus *Sagittaria* (Alismataceae). *Memoirs of the New York Botanical Garden* 9: 179–233.
- Boivin, B. (1967) Énumération des plantes du Canada. VI—monopsides, (2ème partie). *Le Naturaliste Canadien* 94: 471–528.
- Buchenau, F.G. (1903) *Sagittaria* L. *Das Pflanzenreich* 16 (IV.15): 37–59.
- de Candolle, A. & de Candolle, C. (eds.) (1881) *Monographiae phanerogamarum*. G. Masson, Paris, France, 1020 pp.
- Chamisso, L.K.A. von & Schlechtendal, D.F.L. von (1827) De plantis in expeditione speculatoria Romanzoffiana observatis disserere pergunt. *Linnaea: Ein Journal für die Botanik in ihrem ganzen Umfange* 2: 1–738.
- Emory, W.H. (1859) *Report on the United States and Mexican boundary survey made under the direction of the secretary of the Interior. Vol. 2. Part I*. C. Wendell, printer, Washington D.C., USA, 270 pp.
- Engelmann, G. (1867) *Sagittaria*, L. In: Gray, A. (ed.) *Manual of the botany of the northern United States. 5th ed.* Ivison, Phinney, Blakeman, & Co., New York, NY, USA, pp. 492–494.
- Fassett, N.C. (1922) *Lophotocarpus* on the north-eastern river-estuaries. *Rhodora* 24: 71–73, plate 137.
- Gray, A. (1867) *Manual of the botany of the northern United States. 5th ed.* Ivison, Phinney, Blakeman, & Co., New York, NY, USA, 756 pp.
- Haines, A. (2011) *Flora Novae Angliae. A manual for the identification of native and naturalized higher vascular plants of New England*. Yale University Press, New Haven, CT, USA, 973 pp.
- Haynes, R.R. & Hellquist, C.B. (2000) Alismataceae Ventenat. In: Flora of North America Editorial Committee (ed.) *Flora of North America north of Mexico, volume 22, Magnoliophyta: Alismatidae, Arecidae, Commelinidae (in part), and Zingiberidae*. Oxford University Press, New York, NY, USA, pp. 7–25.
- Ito, Y., Tanaka, N., Keener, B.R. & Lehtonen, S. (2020) Phylogeny and biogeography of *Sagittaria* (Alismataceae) revisited: evidence for cryptic diversity and colonization out of South America. *Journal of Plant Research* 133: 827–839.  
<https://doi.org/10.1007/s10265-020-01229-5>
- Keener, B.R. (2005) *Molecular systematics and revision of the aquatic monocot genus Sagittaria (Alismataceae)*. PhD thesis. The University of Alabama, Tuscaloosa, AL, USA, 168 pp.
- Keener, B.R. & Weakley, A.S. (2023) *Sagittaria* L. In: Weakley, A.S. & Southeastern Flora Team (eds.) *Flora of the southeastern United States*. University of North Carolina at Chapel Hill Herbarium, North Carolina Botanical Garden, Chapel Hill, NC, USA, pp. 198–202.
- Knapp, W.M. & Naczi, R.F.C. (2021) Vascular plants of Maryland, USA. A comprehensive account of the state's botanical diversity. *Smithsonian Contributions to Botany* 113: i–viii, 1–151.
- Linnaeus, C. von (1753) *Species plantarum. Vol. 2. 1st ed.* Impensis Laurentii Salvii, Stockholm, Sweden, 640 pp.  
<https://doi.org/10.5962/bhl.title.669>
- Robinson, B.L. & Fernald, M.L. (1908) *Gray's new manual of botany, 7th ed.* American Book Company, New York, NY, USA, 926 pp.
- Smith, J.G. (1899) Revision of the species of *Lophotocarpus* of the United States: and descriptions of a new species of *Sagittaria*. *Report (Annual) of the Missouri Botanical Garden* 11: 145–151, plates: 53–58.
- Tatnall, E. (1860) *Letters from Edward Tatnall to George Engelmann. 5 July, 9 July, & 28 July 1860. Correspondence: Tatnall (Edward) and Engelmann (George)*. Biodiversity Heritage Library. Washington D.C., USA. Available from: <https://www.biodiversitylibrary.org/bibliography/79991> (accessed: 30 June 2023).
- Turland, N.J., Wiersema, J.H., Barrie, F.R., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Kusber, W.-H., Li, D.-Z., Marhold, K., May, T.W., McNeill, J., Monro, A.M., Prado, J., Price, M.J. & Smith, G.F. (eds.) (2018) *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. Regnum Vegetabile 159*. Glashütten: Koeltz Botanical Books.  
<https://doi.org/10.12705/Code.2018>
- Weakley, A.S., Ludwig, J.C. & Townsend, J.F. (2012) *Flora of Virginia*. Botanical Research Institute of Texas Press, Fort Worth, TX, USA, 1554 pp.
- Wierier, D. (2017) Catalogue of the vascular plants of New York State. *Memoirs of the Torrey Botanical Society* 27: 1–543.