

NOMENCLATURE ARTICLE

Typification of two aquatic plant names described by Linnaeus from highly heterogeneous original elements: *Sagittaria sagittifolia* (Alismataceae) and *Sparganium erectum* (Typhaceae)

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Abstract The original material of the Linnaean names *Sagittaria sagittifolia* and *Sparganium erectum* both represent more than one taxon. This had previously led to a reluctance to resolve the nomenclature of these two species, led some to consider the application of the names doubtful, and even led some to propose that *Sp. erectum* should be treated as a nomen ambiguum. Incorporating study of the Linnaean correspondence and several unpublished manuscripts, we discuss these names and typify them here. *Sagittaria sagittifolia* is lectotypified with a specimen from LINN. *Sparganium erectum* is lectotypified with an illustration of “Platanaria sive Butomon” published by Dodoëns in 1616. An epitype is also designated for *Sp. erectum* because the lectotype is demonstrably ambiguous and the name cannot be applied to a currently recognized taxon with certainty. The previously designated lectotype of *Sp. natans* is also discussed, as is the importance of previously unrecognized original material in the Johann Georg Gmelin Herbarium at LE.

Keywords Burser Herbarium; epitype; Gmelin Herbarium; handwriting; Johann Amman; lectotype; Linnaeus; nomenclature

Supporting Information may be found online in the Supporting Information section at the end of the article.

INTRODUCTION

Sagittaria L. (Alismataceae Vent.) is a genus with about 40 species distributed predominantly in Asia and Europe, as well as in North America (Bogin, 1955; Rataj, 1972; Wooten, 1973; Rogers, 1983; Haynes & Hellquist, 2000; Heywood & al., 2007; Wang & al., 2010; Ito & al., 2020). Some species are cultivated as ornamental pond plants, and many have edible roots, prized for millennia as a reliable source of starch and carbohydrates (Haynes & Holm-Nielsen, 1994, 1995; Haynes & al., 1998). Linnaeus (1753, 1759, 1775) published five names at the rank of species in *Sagittaria*. Effective typifications exist for four of these (*Sa. lancifolia* L., *Sa. obtusifolia* L., *Sa. pugioniformis* L., *Sa. trifolia* L.; Jarvis, 2007: 806), whereas, *Sa. sagittifolia* L. remains untypified. This is remarkable because *Sa. sagittifolia* is the generitype of *Sagittaria* (designated by Green in Sprague, 1929: 188).

Sparganium L. (Typhaceae Juss.) is a genus of monoeious perennial plants consisting of 14–19 species and mainly distributed in temperate and arctic regions of the Northern Hemisphere (Cook & Nicholls, 1986, 1987; Talavera, 1987;

Sun & Simpson, 2010; Sulman & al., 2013). The plants of this genus are used for medicinal purposes such as improving blood circulation, reducing menstrual irregularity, and as anti-cancer agents (Shirota & al., 1996; Tulin & al., 1999; Cho & al., 2006). Nomenclature of *Sp. erectum* L., the generitype of *Sparganium* (designated by Green in Sprague, 1929: 187), is complicated because some of the original material are identifiable as *Sp. emersum* Rehmman (see Jarvis, 2007), *Sp. natans* L. or *Sp. erectum* subsp. *neglectum* (Beeby) K.Richt. In addition, although some authors have rejected the name as a nomen ambiguum (see, e.g., Hylander, 1945: 64), others have continued to use it.

Although authors recognize numerous taxa at various ranks within *Sparganium* (e.g., Ostenfeld-Hansen, 1897; Graebner, 1900; Cook, 1980), many infraspecific taxa likely represent phenotypic variability of a single taxon (Cook & Nicholls, 1986, 1987; Kaul, 1997). In addition to this, hybridization between taxa is widely suspected to occur in the group (Harms, 1973; Cook & Nicholls, 1986, 1987; Les & Philbrick, 1993; Kaul, 1997). Linnaeus (1753: 971) recognized only two species, corresponding broadly to the two growth forms found

within the genus: *Sp. erectum* (plants emergent) and *Sp. natans* (plants floating). A specimen at LINN attributed to Johann Amman (Cook & Nicholls, 1986; Jarvis, 2007: 866) was designated by Cook (1985: 272) as the lectotype of *Sp. natans*. However, our research has shown that the history and origin of this specimen are more complex than previously recognized. In addition, *Sp. erectum* has not yet been typified (Jarvis, 2007).

Here we lectotypify *Sagittaria sagittifolia* and *Sparganium erectum*, and provide a detailed account of the origin of the already established lectotype of *Sp. natans*.

■ MATERIALS AND METHODS

Articles cited throughout the text follow the *Shenzhen Code* (Turland & al., 2018, hereafter *ICN*).

The designation of the types is based on the examination of Linnaeus's original material preserved at BM (John Clayton Herbarium), L (Adriaan van Royen Herbarium), LAPP (Herbarium Lapponicum; now BIF-LAPP) (see Fries, 1862; Alston, 1957; Stearn, 1957; Jarvis & Jonsell, 2003), LINN, and UPS (UPS-BURSER), and the analysis of the literature cited in the protologues. The Joachim Burser Herbarium at UPS (UPS-BURSER) was arranged and labelled according to Caspar Bauhin's *Pinax* (Juel, 1923; Savage, 1937; Jarvis, 2007) and was cited in the introduction to *Species plantarum* (Linnaeus, 1753). Adriaan van Royen's collection was consulted by Linnaeus for the preparation of Leiden's Hortus Botanicus during his stay in this city (period 1735–1738) before departing to Sweden in 1738 (Van Royen, 1740; Thijsse & Veldkamp, 1999; Jarvis, 2007: 153, 226).

For decrypting historical details of some specimens and their relationships to original material, the Linnaean correspondence and historical publications were used (e.g., Gmelin, 1751, 1752; Smith, 1821; Hartman, 1851; Plieninger, 1861; Fries, 1862; Litvinov, 1909; Hulth, 1916; Savage, 1945; Stearn, 1957; Lindberg, 1958; Sebald, 1983; Jäger, 2000; Jarvis, 2007). In addition, manuscripts were studied in the Archive of Russian Academy of Sciences, St. Petersburg Branch (SPbB ARAS). For the interpretation of the specimens examined by Linnaeus, the surviving specimens from the Johann Georg Gmelin Herbarium were sought and studied at LE.

■ RESULTS

Typification of *Sagittaria sagittifolia*. — This species is a glabrous aquatic plant widespread across most of Europe, and extending beyond the region into Siberia, the Caucasus, Turkey, and Kazakhstan, where it grows in deep, mesotrophic to eutrophic, slow flowing or standing rivers, canals or ditches (Dandy, 1980; Hroudová & al., 1988; Lansdown, 2014). It also has some economic importance because the corms formed in fall at the ends of axillary stolons are edible. Baked

tubers are eaten in the former U.S.S.R. and in western Europe (e.g., in France) (Yuzepchuk, 1934). In its current delimitation, *Sa. sagittifolia* is a monoecious plant, with underground corms at the end of the stolons, broadly to narrowly sagittate aerial leaves, floating leaves that are lanceolate to ovate when present, bracteate inflorescences that are racemose or paniculate, flowers that have white petals which are purple at the base, the female ones with staminodes, and achenes that are flattened and winged, with a short and erect apical beak (Yuzepchuk, 1934; Dandy, 1980; Keener, 2005; Talavera & Ortiz, 2010).

Keener (2005) attempted to designate LINN No. 1124.1 as the lectotype of *Sagittaria sagittifolia*. However, this was not effectively published because Keener's work was a dissertation that was distributed without an ISBN, the name of a printer or publisher or distributor, or a statement that it was intended to be effectively published under the *Code* (Art. 29.1 of the *ICN*). Thus the name remains untypified.

Linnaeus (1753: 993) described *Sagittaria sagittifolia* providing a short diagnosis (“SAGITTARIA foliis sagittatis acutis”) quoted directly from Linnaeus (1737: 344, 1745: no. 780 on p. 284), Van Royen (1740: 493), Gronovius (1739: 116), Haller (1742: 300), and Dalibard (1749: 297). The following six synonyms were also cited in the protologue: “Sagitta minor” from Dodoëns (1616: 587–588); “Sagitta aquatica minor latifolia” from Bauhin (1623: 194); “Sagitta aquatica minor angustifolia” from Bauhin (1623: 194) and marked with the symbol “β” as an unnamed variety; “Sagitta aquatica major” from Bauhin (1623: 194), marked with the symbol “γ” as an unnamed variety; “Sagitta aquatica foliis variis” from Loeselius (1703: 234, t. 74), marked with the symbol “δ” as an unnamed variety, and followed by the synonym “Gramen bulbosum aquaticum” cited from Bauhin (1620: 4). The provenance (“Habitat in Europae, Americae fluvii lacubus argillosis”) and a morphological comparison (“An sufficienter distincta SAGITTARIA foliis cordatis, quae a Moris. hist. 3. s. 15. t. 4. f. 6. delineata”, see Morison, 1699: 618) were also provided.

Dodoëns (1616: 588), Bauhin (1620: 4), and Loeselius (1703: 234, t. 74) provided illustrations that can be considered original material. Dodoëns's (1616: 588) drawing “Sagitta minor” illustrates a complete plant, with roots, leaves, and flowers. Bauhin's (1620: 4) illustration “Gramen bulbosum aquaticum” is of a vegetative plant, with a tuber at the end of the stolon, and linear submerged leaves. This latter illustration is not suitable to serve as the lectotype because the submerged leaves may not persist in mature flowering plants and they are therefore not used as diagnostic characters to identify and differentiate species of *Sagittaria* (see, e.g., Cook, 1980). Finally, Loeselius's (1703) drawing “Sagitta aquatica foliis variis” illustrates a complete plant, with roots, broadly sagittate aerial leaves and linear floating leaves, flowers, and fruits.

According to Jarvis (2007: 806), there are six extant specimens that are original material. One specimen is preserved at LINN (see also Bogin, 1955: 229), three are in the Burser

collection at UPS (linked to Bauhin's synonyms cited by Linnaeus, 1753: 993; see also Savage, 1937: 32), one is preserved at BM (John Clayton Herbarium), and one is in the Linnaean Iter Lapponicum Herbarium at BIF-LAPP.

The sheet at LINN (No. 1124.1) bears a leaf and a stem with flowers and fruits, and it is annotated in Linnaeus's hand "*I sagittifolia*", where "1" is the relevant species number from *Species plantarum* (image available at <https://linnean-online.org/11677>). This specimen is a good candidate to serve as lectotype because it shows diagnostic characters of the species (e.g., sagittate leaves with two long acute basal lobes, free lower bracts, and fruitlets with a short, erect, apical beak; Gorodkov, 1913; Yuzepchuk, 1934; Dandy, 1980; Talavera & Ortiz, 2010; Tison & al., 2014; Cirujano & al., 2020). This likely explains why Keener (2005) intended to select it as lectotype. Based on Linnaeus's annotation on the back of the sheet, "*Sagittaria foliis sagittatis* Gmel.", the specimen was obtained from J.G. Gmelin and originated from Russia.

The sheet Herb. Burser X: 133 (UPS-BURSER) bears a specimen with two leaves and a fragment of the inflorescence with several female flowers. It is annotated "*Sagitta aquatica major* Bauh. | [illegible] | Lipsiae | 133" (Fig. 1). The sheet Herb. Burser X: 134 (UPS-BURSER) bears a plant with leaves and an inflorescence with male flowers, and a separate leaf, and it is annotated "*Sagitta aquatica minor latifolia* Bauh. | in Lusatia | 134" (Fig. 2). This latter specimen has teratological flowers and therefore is not suitable to serve as lectotype. The sheet Herb. Burser X: 135 (UPS-BURSER) bears a plant with leaves and an inflorescence with female flowers, and a separate leaf, and is annotated "*Sagitta aquatica minor angustifolia* Bauh. | In Lusatia inferior | 135" (Fig. 3). This specimen, which is linked to the Bauhin citation in the protologue (see Jarvis, 2007), is eligible to serve as the lectotype. It is a good candidate because it shows some of the relevant diagnostic characters of the species (e.g., sagittate leaves with two long, acute basal lobes, free lower bracts, and fruits with a short apical beak).

The sheet at BM (Clayton Herbarium, Clayton 278; barcode BM000042232) consists of three leaves and a stem with flowers but no fruits. It is stamped "Virginia Clayton Ex Herb. Gronovia" and annotated "*Sagitta* with a white flower. D. Clayton Virginianum. 278 | *Sagittaria foliis sagittatis*. Linn. fl. Lapp. 344 | *Sagittaria foliis sagittatis obtusis*. Linn. Syst. gen. 946. n. 2 sp. pl. 2. p. 1410. n. 2" in the hand of Gronovius. Gronovius was in possession of an extensive collection made by John Clayton in the American colony of Virginia, which was the basis for his *Flora Virginica* (Gronovius, 1739). When Linnaeus was in the Netherlands from 1735 to 1738, he studied these collections. However, he acquired only a selection of duplicates for his own herbarium (Stearn, 1957: 108). Clayton's collections that were held by Gronovius were subsequently acquired by Banks in 1794 and are now held at BM (see Jarvis, 2007: 198–199, 208). The specimen at BM is original material of *Sa. sagittifolia*; however, as currently delimited, the species does not occur in North America (see, e.g., Haynes

& Hellquist, 2000; Keener, 2005). Indeed, the specimen represents *Sa. engelmanniana* J.G.Sm. (sensu Rataj, 1972; Wooten, 1973; Beal & al., 1982). Although not in direct conflict with the protologue, this specimen is not a suitable choice for lectotypification as it does not match the current delimitation of *Sa. sagittifolia* and was collected well outside the established range of the species.

The specimen in Linnaeus's Iter Lapponicum Herbarium (BIF-LAPP No. 344) consists of a plant with two leaves and one inflorescence including several flowers but no fruits. This sheet is annotated "344" in Linnaeus's hand and "*Sagittaria* [probably handwritten by Linnaeus] foliis sagittatis Fl. Lapp.



Fig. 1. Original material of *Sagittaria sagittifolia* L., Herb. Burser X: 133 (UPS-BURSER) (Image by courtesy of the herbarium UPS, reproduced with permission).

[p. 271 | *Sagittaria aquatica minor latifolia* | C.B.P. p. 199 [handwritten by Johannes Burman]”). It is known that while Linnaeus wrote the numbers of the *Flora Lapponica* on his sheets, he only rarely wrote the names as well and the polynomial synonymy was added to each sheet by Burman (Fries, 1862: 256; Alston, 1957: 103).

Among the original material outlined above, Herb. Burser X: 134 in UPS and the specimen at BM are clearly not suitable to serve as lectotype. The specimens in BIF-LAPP, LINN and both Herb. Burser X: 133 and X: 135 in UPS are all good candidates for lectotypification. We designate the specimen at LINN as the lectotype because is the best-preserved, most

complete and most informative material. As has already been outlined above, this specimen is also consistent with the traditional concept of the species and the current use of the name.

***Sagittaria sagittifolia* L., Sp. Pl.: 993. 1753 – Lectotype (designated here):** Herb. Linnaeus No. 1124.1 (LINN [digital image!]); isolectotype: Iset Province, *Gmelin s.n.* (LE barcode LE 01020765!) [see below].

For an image of the lectotype, see <https://linnean-online.org/11677/>; for an image of the isolectotype, see Fig. 4.



Fig. 2. Original material of *Sagittaria sagittifolia* L., Herb. Burser X: 134 (UPS-BURSER) (Image by courtesy of the herbarium UPS, reproduced with permission).



Fig. 3. Original material of *Sagittaria sagittifolia* L., Herb. Burser X: 135 (UPS-BURSER) (Image by courtesy of the herbarium UPS, reproduced with permission).

Origin of the lectotype of Sagittaria sagittifolia. – The reference to Gmelin on LINN No. 1124.1 provides important context for the specimen. After a long Siberian journey (1733–1743), as a member of Vitus Jonassen Bering's Second Kamchatka Expedition, Gmelin began to prepare his *Flora Sibirica* and started correspondence with Linnaeus on Siberian plants (Gmelin, 1747, 1752; Plieninger, 1861; Litvinov, 1909; Stearn, 1957; Jarvis, 2007). “*Sagittaria foliis sagittatis*” is not mentioned in the surviving part of their correspondence. However, in a letter to Gmelin dated 13 August 1748 (Plieninger, 1861: 79), Linnaeus quoted an unpublished polynomial of a different species “*Sagittaria foliis ovatis oblongis integerrimis aut obiter [sagittatis Gmel.]*”, with the commentary “*Certe sola varietas vulgaris!*” (i.e., “consider it as a variety of the common *Sagittaria [sagittifolia]*”). Consequently, it is reasonable to suppose that the lectotype of *Sa. sagittifolia* was sent by Gmelin to Linnaeus together with a second ambiguous one, the latter of which probably belonged to *Sa. natans* Pall. and was not preserved in the Linnaean herbarium.



Fig. 4. Putative isolectotype of *Sagittaria sagittifolia* L. from J.G. Gmelin's herbarium, LE 01020765 (Image by courtesy of the herbarium LE, reproduced with permission).

The outcome of this discussion was not published by Gmelin during his lifetime. After his death, the last two volumes of *Flora Sibirica* were edited by his nephew, Samuel Gottlieb Gmelin (“Gmelin Jr.”; Gmelin, 1769). Apparently, the interpretation of J.G. Gmelin's concept of *Sagittaria* should be attributed to S.G. Gmelin. The last volume of *Flora Sibirica* (Gmelin, 1769: 207), includes only one species of *Sagittaria*, “56. *SAGITTARIA* foliis sagittatis acutis, ROY. Lugd. 493. HALL. *Helv.* 300. LIN. *Sp. pl.* I[II]. p. 1410. *Cum syn.*”, which is identified as *Sa. sagittifolia* with the comment “*Ab. Irty fluvio In Camtschatcam usque frequenter nascitur.*” Citation of the Linnaean name refers to the second edition of *Species plantarum* where the name was mentioned (Linnaeus, 1763: 1410).

The use of the name by Gmelin is odd as *Sagittaria sagittifolia* does not occur in Kamchatka and is generally absent in the entire Russian Far East (Gorodkov, 1913; Yuzepchuk, 1934). On the other hand, two species occur in the area of the Irtysh River in western Siberia, *Sa. sagittifolia* and *Sa. natans*. In 1734, J.G. Gmelin had the opportunity to observe these species while travelling along the Irtysh River (Gmelin, 1751; Litvinov, 1909). However, Gmelin saw only one *Sagittaria* in 1734 and did not collect any material of it from the Irtysh area. This is based on the manuscript, “*Catalogus plantarum aestate anni 1734 plurimam partem ad Irty fluvium observatarum*”, stored in the St. Petersburg Branch of the Archive of the Russian Academy of Sciences (SPbB ARAS). The manuscript explicitly states that species collected were marked with a line, and the text reads “*Omnes plantae, quarum nomenclaturis — linea — | in hoc Catalogo praefixa est, numero 216 una cum hoc | Catalogo, siccae transmittuntur in 142 distinctis fo- | liis Chartae albae filo lineo assutae*” (Gmelin, 1734: SPbB ARAS R. I Op. 104 D. 8 L. 15ob.). The entry for “*Sagitta J. B. passim in aquis stagnantibus ad Irty fl.*” mentioned by Gmelin on sheet 6ob. (*ibid.*) is not marked as having been collected. Hence it seems that Gmelin did not collect the type material at the time and location where this was most likely to have occurred during Bering's expedition.

Fortunately, in addition to a copy handwritten by S.G. Gmelin, the Archive of the Russian Academy of Sciences holds draft manuscripts of the fourth volume of *Flora Sibirica* (Gmelin, s.d. [1748–before 1753]), which belonged to J.G. Gmelin himself and were handwritten partly by Gmelin's assistant (likely Joseph Gottlieb Kölreuter). A draft titled “*Flora Sibirica III[–IV]*” (SPbB ARAS R. I Op. 105 D. 11; see Fig. 5A,B herein) contains two fragments that refer to *Sagittaria*. There are also fragments of another manuscript in a mixed folder (SPbB ARAS R. I Op. 104 D. 28; see Fig. 5C herein) identified by one of us (AVG) as parts of a second draft of the fourth volume of *Flora Sibirica* that includes fragments of a sheet that refers to *Sagittaria*.

Compared to the published version (Gmelin, 1769: 207), J.G. Gmelin's initial concept of *Sagittaria* was close to the actual one, as he applied two different polynomials to two different species, which are now known as *Sa. sagittifolia* and

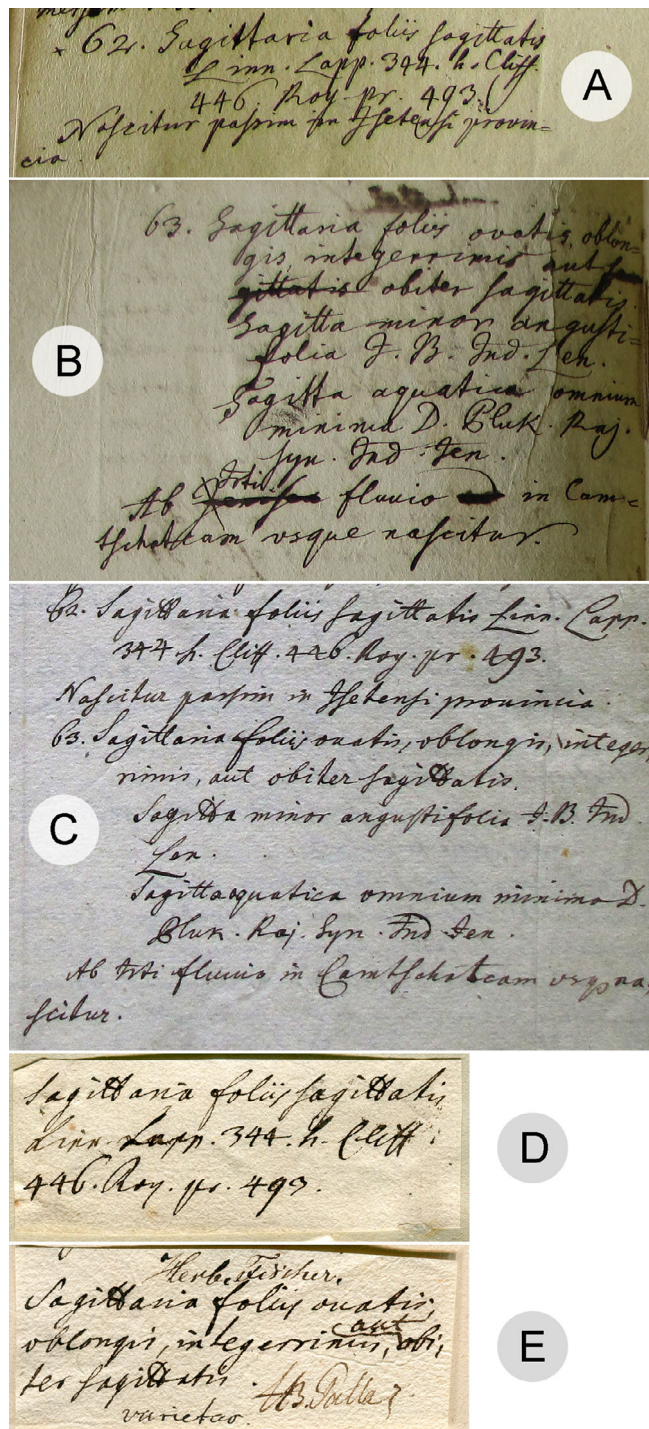


Fig. 5. Fragments of draft manuscripts of the *Flora Sibirica* IV (Gmelin, s.d. [1748–before 1753]), containing a preliminary concept of J.G. Gmelin of the genus *Sagittaria* (A–C); (A & B, SPbB ARAS R. I Op. 105 D. 11 L. 95–95ob.; C, SPbB ARAS R. I Op. 104 D. 28 L 113ob.); and herbarium labels prepared by Gmelin assistants in accordance with the manuscripts for corresponding specimens of *Sa. sagittifolia* L. (D) and *Sa. natans* (E) stored with specimens at LE. The later notes on the original label (about the specimen's ownership) “Hb. Pallas” (E: at the bottom) and “Herb. Fischer” (E: at the top) were added in the first half of the 19th century. Photos by Alexey V Grebenjuk; St. Petersburg Branch of the Archive of the Russian Academy of Sciences (SPbB ARAS), reproduced with permission.

Sa. natans: “62. [= *Sa. sagittifolia*] *Sagittaria foliis sagittatis* | Linn. Lapp. 344. h. Cliff. | 446. Roy. pr. 493. | Nascitur passim | in Isetensi provin- | cia” (SPbB ARAS R. I Op. 105 D. 11 L. 95) (Fig. 5A) and “63. [= *Sa. natans*] *Sagittaria foliis ovatis, oblon- | gis, integerrimis aut sa | gittatis obiter sagittatis. | Sagitta minor angusti- | folia J. B. Ind[ex]. Len[ensis]. | Sagitta aquatica omnium | minima D. Pluk. Raj. | syn. Ind[ex]. Jen [iseensis]. | Ab Jenisea Irтин fluvio ad in Cam- | tschatcam usque nascitur” (SPbB ARAS R. I Op. 105 D. 11 L. 95ob.) (Fig. 5B). The distribution given for each species clarifies that evidently the specimen J.G. Gmelin sent to Linnaeus came from the former Iset Province in the southern Trans-Urals, specifically the area of the Iset River, a left tributary of the Tobol River which flows through western Siberia from the eastern side of the Ural Mountains. Gmelin travelled there in 1741–1742, during his return to St. Petersburg (Gmelin, 1752; Litvinov, 1909; Sebald, 1983). *Sagittaria sagittifolia* currently occurs in this region (e.g., Borisova & al., 2016).*

Duplicate material of the lectotype of *Sagittaria sagittifolia*. – Gmelin’s personal specimen of *Sagittaria sagittifolia*, labelled in accordance with the early manuscripts of the *Flora Sibirica* (Fig. 5A,C,D) is extant and deposited at LE (barcode LE 01020765; Fig. 4 herein). The label (Figs. 4, 5D) was handwritten by J.G. Gmelin’s assistant (likely Kölreuter; Fig. 5A–C). The same handwriting is found on many other specimens associated with Gmelin at LINN and other herbaria (suppl. Fig. S1). Some documents related to the Second Kamchatka Expedition are also written in the same hand (e.g., Jäger, 2000: 327, 332 top, 334 top). This handwriting was erroneously depicted by Jarvis (2007: 226 at the top) as exemplary of Adriaan van Royen.

On LE 01020765 (Fig. 4), there is a pencil note (“*S. sagittifolia* L. | f. *typica* Klinge | [acronym:] ♂Γ [in Russian; = bG]”) handwritten by B.N. Gorodkov as an identification for published review (Gorodkov, 1913), and a printed label added by K. Rataj in 1968. However, apparently none of the workers who saw this specimen interpreted it as belonging to the Gmelin collection. The sheet contains the whole plant with roots, leaves, and inflorescences with flowers and fruits. The specimen is in perfect condition, and the plant is very similar to the lectotype of *Sagittaria sagittifolia*, apparently being its more complete duplicate. This specimen is clearly a duplicate of the specimen in LINN and hence an isolectotype.

It should also be noted, that after returning from Siberia, Gmelin also saw plants of *Sagittaria sagittifolia* in St. Petersburg (the species still occurs today in this region; e.g., Uotila, 2009). His handwritten diary, “Catalogus plantarum quas 1743 florentes vidi” (Gmelin, 1743–1747), includes an entry “956. *Sagittaria foliis sagittatis* Linn. flor. 344. | Est major J. B[auhini].”, and an indication “In Tschorna reka ins. Basilij d. 6. Jul. [1744 o.s.] multum defloruit” (SPbB ARAS R. I Op. 13 D. 20 L. 90ob.). The presence of flowers on the specimen at LE contradicts Gmelin’s observation that the plants lacked flowers. Moreover, at the end of July/early August 1744, this species was mentioned by A.W. Martini as “201.

Sagittaria foliis sagittatis Linn. flor. | 344” from Duderhof (now the area in southwestern St. Petersburg, Krasnoselsky District), where he studied the flora on behalf of Gmelin (Martini, 1744, “Catalogus plantarum circa Duderhoff in fine Julii et initio Augusti 1744 observatarum”: SPbB ARAS R. I Op. 14 D. 16 L. 13). Nothing is known about the collection of this species from Duderhof and the plants from St. Petersburg were not mentioned in the manuscripts of *Flora Sibirica*. Given the above, and the labelling of LE 01020765, we assert that the type of *Sa. sagittifolia* originated in Iset Province rather than the St. Petersburg area.

Typification of *Sparganium erectum*. — Cook (1985: 271) and Cook & Nicholls (1987) accepted a Lobelius (1591: 80) plate “Sparganium, & Butomos Theophrasti lib. I. cap. 8. L. 41. A 40. T. 112” as the type of *Sparganium erectum*. Unfortunately, the plate was not cited in the protologue and cannot be considered original material (Jarvis, 2007; see also below). Another excellent illustration of this species was published by Pietro Andrea Matthioli (1674: 702), with two details of the female head and one fruit. However, although Linnaeus cited Matthioli’s work elsewhere in *Species plantarum*, the drawing “Sparganium” was not cited by Linnaeus in the protologue of *Sp. erectum*.

Linnaeus (1753: 971) described *Sparganium erectum* providing the short diagnosis “SPARGANIUM foliis erectis triquetris”, taken directly from Linnaeus (1737: 271 [species no. 345], 1738: 439; 1745: 280–281 [species no. 770]), Van Royen (1740: 73), Gronovius (1739: 114), and Gmelin (1747: 133). Three synonyms were also cited: (1) “Sparganium ramosum” from Bauhin (1623: 15; 1658: 228), (2) “Platanaria s[ive]. Butomon” from Dodoëns (1616: 601) (Fig. 6), and “Sparganium non ramosum” from Bauhin (1623: 15; 1658: 231), the latter marked with the symbol “β” as an unnamed variety. The provenance was also given as “Habitat in Zonaë frigidaë septentrionalis aquis.”

Dodoëns (1616: 601) provided an illustration of his “Platanaria sive Butomon” (which is the same one that was published by Lobelius, 1591: 80, “Sparganium, & Butomos Theophrasti lib. I. cap. 8. L. 41. A 40. T. 112”) that is original material of *Sparganium erectum*, and it is identifiable with the species based on erect leaves and bracts that are triangular in transverse section (“foliis erectis triquetris” in Linnaeus’s protologue), and branched inflorescence bearing male capitula on lateral branches and borne above female capitula (Graebner, 1900: 13 sub *Sp. ramosum* Huds. nom. illeg.; Cook, 1961, 1962, 1980; Medina, 2007; Pišová & Fér, 2020) (Fig. 6). This illustration matches the traditional concept and current use of *Sp. erectum*.

Bauhin (1658: 228, 231) also provided illustrations that are original elements of *Sparganium erectum*, although these were not cited by Jarvis (2007: 866). Bauhin’s illustration given as “Sparganium ramosum” (Bauhin, 1658: 228) can be identified as belonging to *Sp. erectum* based on leaves (erect) and male inflorescences (with lateral branches borne above female capitula). However, the illustration published

as “II Sparganium non ramosum” (Bauhin, 1658: 231) is identifiable as *Sp. emersum* based on the simple, unbranched, inflorescence with more than three male capitula (Cook, 1980; Medina, 2007; Pišová & Fér, 2020).

According to Jarvis (2007), there are three extant specimens that are also original material. One in LINN, one in the Clifford Herbarium at BM, and one in BIF-LAPP (Elodie Delcambre-Maillard, pers. comm.). We located two more specimens that constitute original material, one each in L and LINN.

The specimen in BIF-LAPP (Herb. Linnaeus No. 345) has leaves and flowers. It was annotated “345” by Linnaeus, and “Sparganium foliis | natantibus, plano con- | vexis Fl. Lapp. p. 271” by Johannes Burman. According to Alston (1957: 103) “when the collection came into Burman’s hands he entered the synonymy fully on each sheet but not always correctly”. Nevertheless, in this case, the plant identified with the number “345” matches the species described in *Flora Lapponica* (Linnaeus, 1737: 271–272) with the number “*345” as a “Flo-tagræs”, and therefore Burman’s identification was correct (see also Fries, 1862: 267). Thus, the specimen is accompanied by a polynomial name, which was cited by Linnaeus (1753: 971)

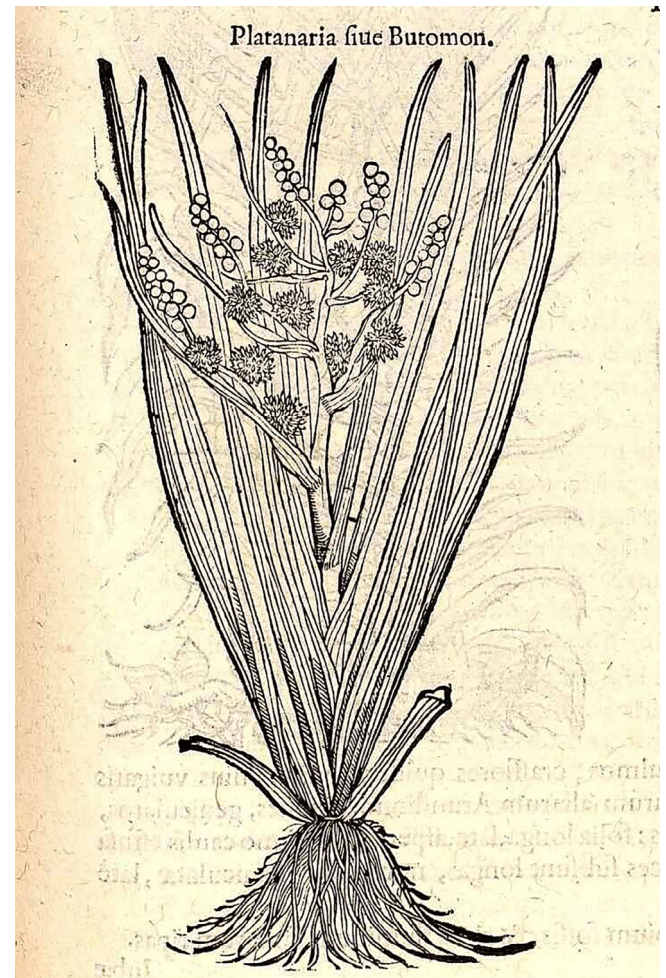


Fig. 6. Lectotype of *Sparganium erectum* L. subsp. *erectum*, “Platanaria sive Butomon” in Dodoëns (1616: 601).

as a synonym of *Sparganium natans*. In *Species plantarum*, Linnaeus (1753) did not distinguish between the numbers “345” and “345*”. Therefore, both *Sp. erectum* and *Sp. natans* have the same number but different polynomials taken from *Flora Lapponica*. Hence, contrary to Jarvis (2007: 866), the specimen in BIF-LAPP “*Sparganium foliis natantibus, plano convexis* Fl. Lapp. p. 271” is original material for *Sp. natans*, but not for *Sp. erectum*. This specimen can be identified as belonging to *Sp. natans* based on the thin perianth-segments, flat leaves, four female capitula (three sessile, the lowermost pedunculate), leaf-like bract subtending the lowermost capitulum less than 10 cm long and not exceeding the whole inflorescence, and ovoid fruit (see, e.g., Cook, 1980 sub *Sp. minimum* Wallr. [= *Sp. natans* according to POWO, 2022]).

Another specimen from the *Flora Lapponica*, marked by Linnaeus as “*345”, is kept in the Linnaean herbarium at LINN. The sheet (LINN No. 1095.3) bears a plant with leaves and flowers, and is annotated “345*” and [on verso] “Sparg[anium] non ramosum minus Dill. Giss. 130 app 58” handwritten by Linnaeus, and “simplex vix natans | Specimen described in Flo. Lapp.” handwritten by James Edward Smith (image available at <https://linnean-online.org/11460>). There is no citation of a specific polynomial from the *Flora Lapponica* (Linnaeus, 1737: 271). Unlike the specimen in BIF-LAPP, LINN No. 1095.3 matches the description of the species under number “345” in the *Flora Lapponica* (“SPARGANIUM foliis adsurgentibus triangularibus”), but not “*345” (the latter refers to another species in Linnaeus’s *Flora Lapponica*, “SPARGANIUM foliis natantibus planoconvexis”). Although this specimen is undoubtedly original material of *Sparganium erectum* and is not in conflict with the protologue, it represents *Sp. emersum* based on the leaf shape (triangular in transverse section near the base) and inflorescence (simple and including more than three male capitula) (Cook, 1980). Therefore, it does not correspond to the current use of *Sp. erectum*, which has a paniculate inflorescence with the lowest branch axillary and bearing male and female heads (Cook, 1980). Selection of this specimen as lectotype would clearly not contribute to nomenclatural stability.

Another sheet (LINN No. 1095.1) is also original material of *Sparganium erectum*. It was annotated “erectum” by C. Linnaeus filius (image available at <https://linnean-online.org/11458>). According to some authors (e.g., Savage, 1945: 167; Lindberg, 1958: 110; Jarvis, 2007: 866), this sheet lacks the relevant Linnaean *Species plantarum* number (in this case “1”) and would therefore be a post-1753 addition to the Linnaean collection that is not original material (e.g., Stearn, 1957; Jarvis, 2007). However, the number “1” was handwritten by Linnaeus on the sheet, it is just barely noticeable at the bottom and presumably added by Linnaeus with a pencil during the preliminary numbering, between the letters of the epithet “c” and “t” (together with the hand of Linnaeus’s son now as “erectum”). The same provisional number, written by Linnaeus with a pencil, can also be found on LINN No. 1124.1 of *Sagittaria sagittifolia* and on many others sheets. This material can be identified as belonging to *Sparganium emersum*

(with simple, unbranched, inflorescence with more than three male capitula).

According to Savage (1945: 167), handwritten notes on the label of LINN No. 1095.1 belong to Johann Amman, but this is an error. The label “*Sparganium foliis assurgentibus | triangularibus* Flor. Lap. 345 | N°. 30” was written by Alexander Wilhelm Martini. Beginning in 1740, Martini was a companion of J.G. Gmelin on the Siberian journey during the Second Kamchatka Expedition from 1733 to 1743. He was also Gmelin’s copyist and assistant who later helped to prepare the *Flora Sibirica* (Gmelin, 1752; Litvinov, 1909: 54; Sebal, 1983). This numbered specimen was sent to Linnaeus from St. Petersburg and accompanied Gmelin’s letter to Linnaeus dated 16 April 1745. Linnaeus answered Gmelin in a letter dated 5 July 1745 with comments on the specimens requested by Gmelin (see also Plieninger, 1861: 43–47). In this case, Linnaeus confirmed Gmelin’s determination by adding a phrase to the polynomial number 30 “Omnino! Haec immense variat magnitudine” (= “All in all! This varies immensely”). Thus, LINN No. 1095.1 was obtained by Linnaeus in 1745 and Gmelin’s specimen is part of the original material for *Sparganium erectum*.

In LE there are four specimens that were mounted at the end of the 19th century on two sheets (barcodes LE 01044140 and LE 01044141) and are accompanied by an identical Linnaean polynomial from *Flora Lapponica* (Fig. 7, suppl. Fig. S2). These specimens from the Gmelin Herbarium belong to the same gathering as LINN No. 1095.1. In particular, the complete plant on the left of LE 01044141 (Fig. 7; see also suppl. Fig. S2 right) is very similar to the specimen in LINN. Unfortunately, this material also belongs to *Sparganium emersum* (the plant mounted on the left half of the sheet shows a simple, unbranched, inflorescence with more than three male capitula, and the inflorescence mounted on the right half of the sheet is an unbranched inflorescence) and is therefore undesirable for lectotypification.

In the Clifford Herbarium at BM there are two specimens that are also original material: Herb. Clifford no. 439, *Sparganium* 1αA (barcode BM000647364) bears a specimen with leaves and flowers while Herb. Clifford no. 439, *Sparganium* 1αB (barcode BM000647365) bears a complete plant, with leaves and flowers. As has been previously reported by Jarvis (2007), both specimens are identifiable as *Sp. emersum* as they have leaves that are triangular in transverse section near the base and simple, unbranched inflorescences with more than three male capitula.

In the Adriaan van Royen Herbarium at L there is a sheet linked to the reference cited by Linnaeus (1753: 971) in the protologue (Van Royen, 1740: 73). The sheet No. 908.247-527 (barcode L 0052633) bears an inflorescence with bracts and flowers, and is annotated at the bottom “*Sparganium foliis adsurgentibus, triangularibus*. Linn. flor. p. 271. (erectum) | *Sparganium ramosum*. Bauh. pin 15 / Rudb. elys. 1. p. 120. f. 1. Boerh. lugdb. 4. p. 168 | Herb. van Royen”. This specimen is original material of *Sparganium erectum* because Linnaeus worked with A. van Royen and consulted his

herbarium for the preparation of Leiden's Hortus Botanicus during his stay in this city before departing to Sweden in 1738 (Jarvis, 2007: 153). Unfortunately, this specimen appears to be *Sp. erectum* subsp. *neglectum* (Beeby) K.Richt. based on the branched inflorescence bearing male capitula on lateral branches and borne above female capitula, although the ripe fruit necessary for unambiguous identification is not present (Cook, 1980; Medina, 2007; Pířová & Fér, 2020).



Fig. 7. Specimen of *Sparganium emersum* Rehmman from J.G. Gmelin's Herbarium, LE 01044141, accompanied by Linnaean polynomial from *Flora Lapponica*. This material probably has a common origin with the original material at LINN 1095.1, for the name *Sparganium erectum* L. (see also suppl. Fig. S2). The original label is annotated with polynomial names “*Sparganium culmo erecto foliis | triquetris* Hall. Helv. 259. | *Sparganium foliis adsurgentibus | triangularibus* Linn. Lapp. n. 345” handwritten by J.G. Gmelin, and “*Sparganium alterum* Lob. | n. 80. J. B. II. p. 541. | *Sparganium non ramosum*. | C. B. Theatr. 231.” handwritten by A.W. Martini. The later note on Gmelin's label (at the top) “*Kraschen[innikow]. et Gmel.*”, handwritten by F.J. Ruprecht, is not quite correct (since 1839, F.J. Ruprecht is a curator of the Herbarium (Botanical Museum) of the Russian Academy of Sciences in St. Petersburg). The additional label with a pencil note “*Sp. simplex* Huds” was added by W. Rothert as an identification, in the early 20th century (Image by courtesy of the herbarium LE, reproduced with permission).

To summarize, all the extant specimens that constitute original material are not suitable for lectotypification because they do not represent *Sparganium erectum* s.str., and instead represent *Sp. emersum*, *Sp. erectum* subsp. *neglectum* or *Sp. natans*. We were not able to locate any further original material in any Linnaean and Linnaean-linked herbaria including UPS that would be linked to the synonyms of Bauhin (1623, 1658) “*Sparganium ramosum*” and “*Sparganium non ramosum*” cited by Linnaeus in the protologue. Instead of typifying the name with an element that does not correspond to *Sp. erectum* s.str. in its current sense, we select the illustration published Dodoëns (1616: 601) as lectotype.

While the lectotype is unambiguously referable to *Sparganium erectum*, Dodoëns did not illustrate the fruits, which are essential to distinguish among the five recognized subspecies of that species (Cook, 1980; Cook & Nicholls, 1987; Pířová & Fér, 2020). Hence the lectotype is demonstrably ambiguous and cannot be assigned to *Sp. erectum* subsp. *erectum* with certainty. The five subspecies of *Sp. erectum* are subsp. *erectum*, subsp. *oocarpum* (Čelak.) Domin, subsp. *neglectum* (Beeby) K.Richt., subsp. *microcarpum* (Neumann) Domin, and subsp. *stoloniferum* (Graebn.) H.Hara. Of these, subsp. *oocarpum* is of ancient hybrid origin, derived from the crossing of subsp. *erectum* and subsp. *neglectum* (Pířová & Fér, 2020). Furthermore, three other hybrids have been detected in nature, suggesting recent hybridization: subsp. *erectum* × subsp. *microcarpum*, subsp. *microcarpum* × subsp. *neglectum*, and subsp. *erectum* × subsp. *oocarpum* (Pířová & Fér, 2020). All of this complicates taxonomy within the species and the unambiguous assignment of the lectotype to an infraspecific taxon.

Among the infraspecific taxa within *Sparganium erectum*, the important distinguishing characters are style length, fruit shape (e.g., ovoid, obpyramidal, fusiform), and various subsets of fruit width and length. The length of the upper part of the fruit and constriction in the middle part of the fruit identify subsp. *erectum*, the ratio between the lengths of the upper and lower part of the fruit together with fruit width identifies subsp. *oocarpum*, the ratio between style length and fruit width together with the ratio of fruit length to fruit width identifies subsp. *microcarpum*, and length of the upper part of the fruit and style length identify subsp. *neglectum* (Belavskaya, 1984; Pířová & Fér, 2020). Therefore, we select an epitype (Art. 9.9 of the ICN, Turland & al., 2018) to fix the application of the name to a specimen that unambiguously represents *Sp. erectum* subsp. *erectum*. The epitype is a complete specimen, has well-developed fruits, has published molecular data and was used and cited by Pířová & Fér (2020) to distinguish *Sp. erectum* subsp. *erectum* from the other taxa. This material clearly represents the traditional concept (e.g., Linnaeus, 1753) and current application of *Sp. erectum* subsp. *erectum* (e.g., Cook, 1980; Talavera, 1987; Medina, 2007; Pířová & Fér, 2020).

Sparganium erectum* L., Sp. Pl.: 971. 1753 subsp. *erectum* – Lectotype (designated here): [illustration] “*Platanaria

sive Butomon” in Dodoëns, *Stirp. Hist. Pempt.*, ed. 2: 601. 1616 – **Epitype (designated here)**: Czech Republic, Central Bohemia, fire reservoir in the town Libice and Cidlina, 50.12883 N, 15.17883 E, 190 m a.s.l., 25 Aug 2007, *S. Pišová s.n.* (PRC [on 3 sheets] barcodes PRC 456022!, PRC 456023!, PRC 456024!; isopitype: PRC [on 3 sheets] barcodes PRC 456019!, PRC 456020!, PRC 456021).

For an image of the lectotype, see Fig. 6; for an image of the epitype, see Fig. 8.

Notes on the lectotype of *Sparganium natans*. — Linnaeus (1753: 971) also described *Sparganium natans*. This name was typified by Cook (1985: 272) based on LINN No. 1095.2 and the lectotypification is accepted by most authors (Cook & Nicholls, 1986; Kaul, 1997; Medina, 2007; Sun & Simpson, 2010). However, Cook (1985) did not discuss the origin of the lectotype or the handwriting on the label. Savage (1945: 167) appears to be the first to have identified Johann Amman as the individual who wrote on the label “*Sparganium foliis complanatis, natan- | tibis, spicis paucissimis. Hall. | Stirp. Helv. 260. | N°. 31*”. Despite the fact that Albrecht von Haller’s *Enumeratio methodica stirpium Helvetiae indigenarum* cited on the label

(Haller, 1742) was published the year after Amman’s death, this interpretation is still accepted today (Jarvis, 2007: 866). That Amman died on 15 December 1741 (NS) in St. Petersburg was established early on (e.g., Smith, 1821: 191; Litvinov, 1909: 4). It was even mentioned in Gmelin’s letter dated 5 June [25 May OS] 1744 to Linnaeus: “B[ea-tus] Ammanus d. 4 December. St. vet. 1741 mane hora tertia mania cum vehementibus epilepticis insultibus decessit” (B[ea-tus] Ammanus d. 4 December St. vet. 1741 in the morning at the third hour of mania with violent attacks of epileptics).

In fact, the label was handwritten by A.W. Martini as was the case for many labels in Gmelin’s collection. The specimen was sent to Linnaeus from St. Petersburg and accompanied Gmelin’s letter to Linnaeus dated 16 April 1745 (NS). In the letter, after identifying this specimen with the polynomial name from Haller (1742: 260), Gmelin noted that his plant was slightly different: “Parvitate ab Halleriana planta differt. Aquae immersum aut folia natantia nunquam vidi” (It differs in size from the Halleriana plant. I’ve never seen leaves immersed in water or swimming).

Linnaeus answered Gmelin on 5 July 1745 (Plieninger, 1861: 43–47), and rather than confirming Gmelin’s determination added a note to the specimen “*Sparganium foliis*



Fig. 8. Portion of the epitype of *Sparganium erectum* L. subsp. *erectum*, PRC 456022 (left) and PRC 456023 (right) (Images by courtesy of the herbarium PRC, reproduced with permission).

complanatis natantibus, spicis paucissimis, Hall[eri]. Non est, sed omnino varietas prioris ex paludibus turfosis” (Sparganium with floating and flattened leaves, with very few spikes, Hall[eri]. There is not, but at all the variety of the former from the muddy marshes). Accordingly, the specimen with No. 31 is a variety of the species with the previous number “30. Sparganium foliis assurgentibus triangularibus Fl. Lapp.” (i.e., LINN No. 1095.1 [*Sparganium emersum*]; see above), which was shipped with it. However, the authority of Linnaeus influenced Gmelin, and his initial concept of several separate species (Gmelin, 1739) was changed to a single broadly delimited one (Gmelin, 1747). Following Linnaeus’s opinion, Gmelin considered *Sp. natans* to be a variety (“ α . Varietas minima foliis planiusculis. | Varietas vix palmaris STAEBELINI | HALL. *Helv.* p. 260”) of the single species he recognized (“69. SPARGANIUM foliis adsurgentibus triangularibus LINN. Lapp. 345”) in *Flora Sibirica* (Gmelin, 1747: 133).

We located a single sheet with two plants of *Sparganium natans* in LE (barcode LE 01044142; Fig. 9 herein) and an original label handwritten by Gmelin in accordance with his *Flora Sibirica* and with Linnaeus’s indication in the protologue. At least one of the two plants, likely the one mounted on the left of the sheet, is an isoelectotype of *Sp. natans*. According to Gmelin (1747: 133), the variety “ α ” was found in three areas: “ad ripas lacuum in vicinia *Ieniseae* [1] fluvii | copiosissime, in *Isetensi* [2] etiam provincia passim ad lacus na- | scitur, quin et *Petropoli* [3] non infrequens est, scilicet palu- | dibus muscosis fere propria”. Thus, the type material of *Sp. natans* could have originated from [1] the Yenisei River basin; [2] the former province Iset in southern Trans-Urals; or [3] from St. Petersburg.

The only Yenisei River specimen labelled by Gmelin as “[257.] An Sparganium | non ramosum, mi- | nus C. G.? | Ind. Jen.” in 1739, is LE 01044144 (Fig. S3). This specimen was collected by Gmelin for the manuscript work *Index plantarum anno 1739 ad Jeniseam fluvium* or *Index Jeniseensis*, where the plant was described as follows “Ad omnem Jeniseam ad ripas lacuum vicinorum frequens occurit” (Gmelin, 1739: SPbB ARAS R. I Op. 105 D. 1 L. 16ob., see Fig. S4). It is not known how many specimens were collected by Gmelin, however, LE01044144 belongs to *Sparganium hyperboreum* Laest. ex Beurl. having a stem with four internodes, flat leaves, two female capitula (the lower long pedunculate, the upper sessile), thin perianth-segments, and ovoid fruit (Cook, 1980).

As has been discussed previously, Gmelin travelled in the area of the Iset River in 1741–1742 during his return to St. Petersburg (Gmelin, 1752; Litvinov, 1909; Sebald, 1983). However, no specimens of *Sparganium natans* collected by Gmelin from this region have been found. After 1743, Gmelin mentioned a *Sparganium* (No. 459, as “Sparganium foliis complanatis natantibus, spicis paucissimis Hall. Alp. 260”) in an unpublished handwritten work (Gmelin, 1743–1747, “Catalogus plantarum quas 1743 florentes vidi”: SPbB ARAS R. I Op. 13 D. 20 L. 46ob.), but he did not indicate whether a

collection was made. LE contains a specimen of *Sp. natans* collected by J. Amman from St. Petersburg (“In | paludosis secus viam Insula Basili Ostrow [= Vasilyevsky Island] quae mare versus itur Junio mense”) annotated with the polynomial name from Bauhin’s *Pinax* “Sparganium non ramosum CBP [= Cape Bon Spei]” for his manuscript catalogue (Amman, 1735–1736, “Catalogus plantarum circa Petropolim sponte nascentium”: SPbB ARAS R. I Op. 14 D. 14 L. 6; Fig. 10 herein). The little-known Amman collection, referred to in the St. Petersburg flora, contains specimens of 117 taxa and was kept separately from the associated manuscript catalogue (for example specimen from a published list of Amman’s collection (Anonymous, 1745: 519) and is known as “Herbarium Ammanianum” see Fig. S5).



Fig. 9. Putative isoelectotype of *Sparganium natans* L. from J.G. Gmelin’s Herbarium, LE 01044142. The label “Sparganium foliis adsurgentibus, triangularibus Linn. Lapp. | 345. | j. Varietas vix palmaris Staehelini Hall. Helv. 260.” was handwritten by Gmelin. The later note on the original label (at the bottom) “S. simplex et natans [in pencil] Krasch[eninnikow]” was incorrectly handwritten by F.J. Ruprecht after 1839 (about Ruprecht, see caption to Fig. 7). The additional label with a pencil note “Sp. minimum Fr.” was added by W. Rothert as an identification, in the early 20th century (Image by courtesy of the herbarium LE, reproduced with permission).

In conclusion, the identification of handwriting on the original samples of Russian origin in the Linnaean herbarium, undertaken by Savage (1945) was not entirely correct. It is known that Amman sent Linnaeus only 31 specimens, which were accompanied by his last letter to the latter on 29 [18 OS] November 1740 (Smith, 1821: 200–203; Hulth, 1916: 61–64). More than half of the specimens Amman is known to have sent can now be identified among those at LINN.

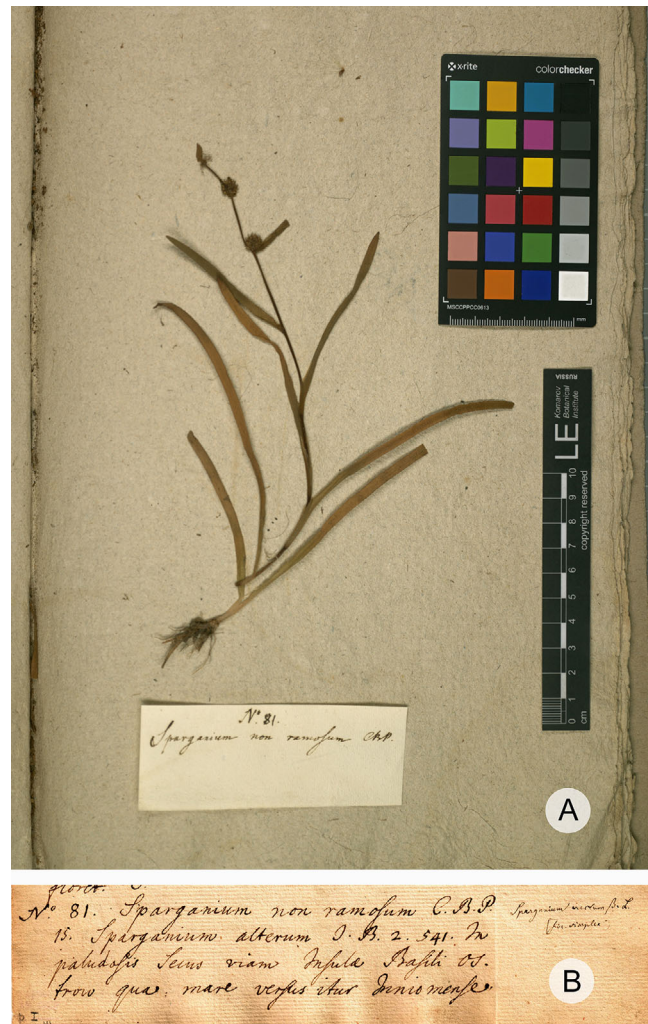


Fig. 10. Specimen of *Sparganium natans* L. collected and labelled by Johann Amman from St. Petersburg (preserved at LE) (A). The fragment unpublished work, “Catalogus plantarum circa Petropolim sponte nascentium” (Amman, 1735–1736: SPbB ARAS R. I Op. 14 D. 14 L. 6), handwritten by Amman, with the mention of a plant that corresponds to a specimen of *S. natans* under No. 81 (B). The later side note “*Sparganium erectum* β. L. | sive simplex” was handwritten by F.J. Ruprecht after 1839 (about Ruprecht, see caption to Fig. 7). Ruprecht’s determination is erroneous, and he made it in the Amman manuscript without examining the specimen, comparing the polynomials (the corresponding specimens were preserved separately from the manuscript catalogue). Photo by Alexey V Grebenjuk; St. Petersburg Branch of the Archive of the Russian Academy of Sciences (SPbB ARAS), reproduced with permission.

Finally, as can be seen, none of these specimens have additional labels and genuine Amman autographs. The label published by Jarvis (2007: 189) as an example of Amman handwriting is actually in Martini’s hand, and the information on at least 70 specimens from Amman that are in LINN is erroneous and based on an incorrect attribution of materials actually related to Gmelin.

■ AUTHOR CONTRIBUTIONS

PPFG, design and writing; PPG & AVG, analysis of the origin of Russian specimens and their interpretation, handwriting examination, literature and text additions; AVG, DI, MI & ST, literature and text review. — PPGF, <https://orcid.org/0000-0001-7595-9302>; AVG, <https://orcid.org/0000-0002-4067-040X>; DI, <http://orcid.org/0000-0001-5491-7568>; MI, <https://orcid.org/0000-0002-2771-2935>; ST, <https://orcid.org/0000-0002-6173-6754>

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