

A nomenclatural revision of *Littorella* (Plantaginaceae: Plantagineae)

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Abstract *Littorella* is a small genus of three herbaceous aquatic species distributed in Europe, northeastern North America and southern South America. Here we provide a complete nomenclatural revision for this genus, where lectotypes are designated for the names of its three accepted species, including the Linnaean name *Plantago uniflora*, which is the basionym of *L. uniflora*.

Keywords lectotypification; Linnaeus; nomenclature

■ INTRODUCTION

Littorella P.J.Bergius (Plantaginaceae Juss., tribe Plantagineae Dumort.) is a small genus of three herbaceous aquatic species distributed in Europe, northeastern North America and southern South America (Pilger, 1937; Hoggard & al., 2003). The most widely distributed species is the European *L. uniflora* (L.) Asch. (Pilger, 1937; Grigoriev, 1958; Moore & al., 1976; Pignatti, 1982; Hoggard & al., 2003; Pedrol, 2009; Kolář, 2014), while the North American *L. americana* Fernald and the South American *L. australis* Griseb. ex Benth. & Hook.f. are much more restricted ecologically and geographically (Pilger, 1937; Bassett, 1973; Rahn, 1995; Hoggard & al., 2003).

It should be noted that *Littorella* is sometimes subsumed within *Plantago* (e.g., Linnaeus, 1753; Rahn, 1996). Nevertheless, the inclusion of *Littorella* within *Plantago* is not accepted by the vast majority of botanists (e.g., Linnaeus, 1771; Pilger, 1937; Grigoriev, 1958; Moore & al., 1976; Pignatti, 1982; Hoggard & al., 2003; Pedrol, 2009; Kolář, 2014; Hassemer & al., 2018a, b). *Littorella* can be distinguished from *Plantago* by the unisexual monoecious flowers, the fruits containing a single anatropous ovule, and by the plants being capable of reproducing vegetatively by means of stolons (Robe & Griffiths, 1998; Hoggard & al., 2003).

There has been considerable nomenclatural and taxonomic confusion regarding the number of *Littorella* species and their authorship. In terms of taxonomy, *L. americana* was often either considered synonymous with *L. uniflora* (Kartesz, 1994) or a variety of that taxon (Gleason, 1952). However, subsequent molecular phylogenetic studies supported the recognition of this taxon at the species level (Hoggard & al., 2003). In terms of nomenclature, there has been confusion as to where *L. australis* was published. Furthermore, the European species of *Littorella* was described three separate times, twice by Linnaeus himself. This evidently caused much confusion until Ascherson (1864) recognised *Plantago uniflora* L. as the oldest name for the taxon and transferred the epithet to the genus *Littorella*. To complicate things further, there are two legitimate names, *L. flexuosa* Raf.

and *L. spicata* Rojas Acosta, whose taxonomic identities remain unresolved and thus are potentially nomenclaturally disruptive (Hassemer & al., 2018a, b).

Here we provide a complete nomenclatural revision of *Littorella*, where lectotypes are designated for the names of its three accepted species, including the Linnaean name *Plantago uniflora*, which is the basionym of *L. uniflora*.

■ MATERIALS AND METHODS

Specimens of *Littorella* kept at C, CTES, EFC, FI, FLOR, FT, FURB, GB, HBR, ICN, K, MA, MBM, MVFA, MVJB, MVM, P, PI, SGO, SI, UPCB and UPS, and images of specimens kept at GH, GOET, LINN, MO, NEBC, NY and US were studied. *Littorella* is here accepted as distinct from *Plantago*, as per Pilger (1937) and Hoggard & al. (2003). The nomenclatural articles quoted in the text follow the *Shenzhen Code* (Turland & al., 2018).

■ TAXONOMIC TREATMENT

Littorella P.J.Bergius, Kongl. Vetensk. Acad. Handl. 29: 341. 1768 – Type: *L. juncea* P.J.Bergius, nom. superfl. et illeg. (≡ *L. uniflora* (L.) Asch.)

Littorella americana

When describing *L. americana*, Fernald (1918) provided a morphological description, in addition to a detailed comparison with the similar species *L. uniflora*. Though he listed a number of collections of the species, Fernald explicitly indicated one collection (“abundant, but local, at Spectacle Pond, Wallingford, July 7 and September 4, 1898, *W. W. Eggleston & E. C. Kent*”) as “TYPE in Gray Herb.”, and therefore all the other collections he listed are paratypes (Art. 9.7). Because Fernald indicated specimens collected on two different dates (7 July and

4 September 1898) as “type”, a single gathering (see Art. 8.2) was not indicated, and thus a holotype was not designated; the specimens collected on these two different dates are syntypes instead (Art. 9.6).

We were able to locate three elements that are syntypes of *L. americana*: GH barcodes 00106960 and 00729411 (both collected on 7 July 1898) and 00664245 (collected on 4 September 1898). All specimens under these three barcodes were collected in the same place (Spectacle Pond [now referred to as Wallingford Pond], Wallingford, Rutland County, Vermont, U.S.A.) and are both in agreement with the description provided by Fernald (1918) and the current application of the name (Pilger, 1937; Bassett, 1973; Hoggard & al., 2003). Specifically, all the specimens have sessile or subsessile pistillate and staminate flowers on separate peduncles, slender peduncles that are up to 4 cm long, and leaves that are markedly compressed. We designate GH barcode 00106960 (Fig. 1) as lectotype, because it contains the best and more complete specimens among the options available for lectotypification.

Littorella americana is distributed in eastern Canada and the northeastern U.S.A., and grows in muddy, sandy or gravelly shorelines of lakes, ponds and slow-moving rivers (Pilger, 1937; Bassett, 1973; Hoggard & al., 2003).



Fig. 1. Lectotype of *Littorella americana* (W.W. Eggleston & E.C. Kent s.n., GH barcode 00106960). Copyright: Harvard University.

Gleason (1952) published the new combination *L. uniflora* var. *americana* (Fernald) Gleason without explanation. This is not accepted here because molecular phylogenetic and biogeographic evidence (Hoggard & al., 2003) support the recognition of *L. americana*. In terms of phylogeny, *L. americana* was found to form a clade with *L. australis*, having *L. uniflora* sister to this clade (Hoggard & al., 2003), meaning that, contrary to what would be expected based on morphology, the North American *L. americana* is phylogenetically closer to the South American *L. australis* than to the European *L. uniflora*. It is important to note that the intended new combination “*Plantago americana* (Fernald) Rahn” was not validly published, because Rahn (1996: 197) failed to give a direct reference to the place of valid publication (Art. 41.5) of the basionym *L. americana*. Also, Bassett (1973) incorrectly cited the collection “Shore of Lake Champlain, Alburgh, Vermont, Sept. 2, 1879, C.G. Pringle (GH!)” as “holotype” of *L. americana*. This is incorrect because Fernald (1918) explicitly cited different material as “type”.

Littorella americana Fernald in *Rhodora* 20: 62. 1918 ≡ *L. uniflora* var. *americana* (Fernald) Gleason in *Phytologia* 4: 24. 1952 – **Lectotype (designated here)**: U.S.A. Vermont: Rutland County: Spectacle Pond, Wallingford, alt. 2257 ft., 7 Jul 1898, W.W. Eggleston & E.C. Kent s.n. (GH barcode 00106960!; isolectotype: GH barcode 00729411!). – “*Plantago americana* (Fernald) Rahn” in *Bot. J. Linn. Soc.* 120: 197. 1996, not validly published.

Littorella australis

The protologue of *L. australis* is often cited as “Berberid. Amer. Austral.: 53. 1857” (e.g., Rahn, 1996, and also IPNI), but this name was not validly published in this work (Lechler, 1857) because no description or diagnosis were provided (Art. 38.1). The protologue of *L. australis* (Bentham & Hooker, 1876: 1225) provided a short morphological description of flowers and fruits, but no information was given regarding original material, except the implicit indication that the name *L. australis* was coined by Heinrich August Rudolf Grisebach, who wrote morphological descriptions of the species in labels left on herbarium specimens collected by Willibald Lechler in southern Chile. Thus, Grisebach’s *L. australis* was an unpublished herbarium name when it was taken up by Bentham and Hooker.

We were able to locate five elements that constitute original material of *L. australis*: GOET009479 (*W. Lechler* 178, collected in Arique in January 1851) and GOET008756, GOET009478, P03531642 and P03531643 (*W. Lechler* 1397, collected in Panguipulli in February 1854). All these specimens were collected in Valdivia Province, southern Chile, and are in agreement with the short description provided by Bentham & Hooker (1876), specifically “flores ♀ sat numerosi in spicam”, and the current application of the name (Pilger, 1937; Rahn, 1995; Hoggard & al., 2003), specifically: inflorescences with 4–8 pistillate flowers and 1 staminate flower at the apex; distributed in southern South America and the Falklands. We designate GOET008756 (Fig. 2) as lectotype, because this sheet includes a handwritten morphological description and



Fig. 2. Lectotype of *Littorella australis* (W. Lechler 1397, GOET barcode GOET008756). Copyright: Universität Göttingen.

illustrations of the species by Grisebach, which certainly is the reason why both Lechler (1857) and Bentham & Hooker (1876) attributed authorship of *L. australis* to him.

Littorella australis is distributed in southern Chile, southern Argentina and the Falkland Islands, where it grows on the margins of freshwater lagoons (Pilger, 1937; Rahn, 1995; Hoggard & al., 2003).

Rahn (1996: 197) published the replacement name *Plantago araucana* for *L. australis*, because the name *P. australis* Lam. already existed so a new combination was not possible.

Littorella australis Griseb. ex Benth. & Hook.f., Gen. Pl. 2: 1225. 1876 ≡ *Plantago araucana* Rahn in Bot. J. Linn. Soc. 120: 197. 1996 – **Lectotype (designated here):** CHILE. Am sandigen Ufer der Laguna von Panguepoulli [Panguipulli], Feb 1854, W. Lechler 1397 (GOET barcode GOET008756!; isolectotypes: GOET barcode GOET009478!, P barcodes P03531642! & P03531643!).

Littorella uniflora

Littorella uniflora was published as a new combination for the Linnaean basionym *Plantago uniflora* by Ascherson (1864: 544). Linnaeus (1753: 115) described *P. uniflora* with the diagnostic phrase name “PLANTAGO scapo unifloro”, making reference to the name used for the species in Linnaeus’s

treatments in *Flora Lapponica* (“*Fl. lapp.* 64”) (Linnaeus, 1737: 35–36) and *Flora Suecica* (*Fl. suec.* 128) (Linnaeus, 1745: 45), and also to Dalibard’s (1749: 51) *Floræ Parisiensis prodromus* (“*Dalib. paris.* 50”). The provenance of the species was indicated as “*Habitat ad Europæ littora lacuum*”. Two polynomial synonyms were also cited. The first, “*Plantago floribus semineis sessilibus ad exortum scapi uniflori maris*”, cited the following two references: “*Juss. act.* 1742. p. 131. t. 7” (Jussieu, 1745) and “*Guett. stamp.* 2. p. 26” (Guettard, 1747). The second, “*Gramen junceum, capitulis quatuor longissimis filamentis donatis*”, cited the following two references: “*Pluk. alm.* 180. t. 35. f. 2” (Plukenet, 1691, 1696) and “*Morison. hist.* 3. f. 8. t. 9. f. 30” (Morison, 1699). The following illustrations also are original material: (1) t. 35(2) in Plukenet (1691); (2) t. 8(9, 30) in Morison (1699); and (3) t. 7 in Jussieu (1745).

No herbarium specimens were listed as original material for *P. uniflora* by Jarvis (2007). However, a sheet (Herb. Linn. No. 1107.2) linked to the Linnaean basionym is conserved at LINN, as was cited in Savage’s (1945: 170) analytical catalogue of the Linnaean herbarium. The specimen was annotated “14 *uniflora*” by Linnaeus (“14” being the species number for *Plantago uniflora* in *Species plantarum*), clearly indicating that this sheet is original material for *P. uniflora*. Another *Littorella* sheet at LINN (Herb. Linn. No. 1107.1), lacks any reference or number linking to the *Species plantarum*, or any reference to the specific epithet “*uniflora*”, and is annotated with the later genus name (“*Littorella* Berg.”). This suggests that, despite unequivocally belonging to *L. uniflora*, the latter sheet is most probably not original material for *P. uniflora*.



Fig. 3. Lectotype of *Plantago uniflora*, the basionym of *Littorella uniflora* (LINN No. 1107.2). Copyright: Linnean Society of London.

All the elements of the original material for *P. uniflora* (i.e., the specimen LINN 1107.2 and the three illustrations) are in agreement with the current application of the name (Pilger, 1937; Grigoriev, 1958; Moore & al., 1976; Pignatti, 1982; Hoggard & al., 2003; Pedrol, 2009; Kolář, 2014). Specifically, all the elements have sessile or subsessile pistillate and staminate flowers on separate peduncles, slender peduncles that are up to 4 cm long, and cylindrical leaves that are, only slightly compressed. All things considered, we designate LINN 1107.2 (Fig. 3), the only extant specimen which is original material, as the lectotype of *P. uniflora*.

The names *L. juncea* P.J.Bergius and *L. lacustris* L. were validly published by Bergius (1768: 341–344) and Linnaeus (1771: 295) respectively. However, in both cases, the legitimate name *P. uniflora* was cited as a synonym; therefore, both names are superfluous and illegitimate (Art. 52).

Littorella uniflora is distributed in Europe, including Iceland and the Azores, and it grows along the margins and in shallow water (down to circa 4 m below water-line) of freshwater lagoons, lakes and ponds, and also temporarily inundated depressions (Pilger, 1937; Grigoriev, 1958; Moore & al., 1976; Pignatti, 1982; Hoggard & al., 2003; Pedrol, 2009; Kolář, 2014). This species is much less frequent in Mediterranean areas than in colder and more humid regions to the north (Hoggard & al., 2003; also G. Hassemer, pers. obs.).

Littorella uniflora (L.) Asch., Fl. Brandenburg 1: 544. 1864 ≡ *Plantago uniflora* L., Sp. Pl.: 115. 1753 ≡ *L. juncea* P.J.Bergius in Kongl. Vetensk. Acad. Handl. 29: 341. 1768, nom. superfl. et illeg. (Art. 52) ≡ *L. lacustris* L., Mant. Pl.: 295. 1771, nom. superfl. et illeg. (Art. 52) – **Lectotype (designated here):** Herb. Linnaeus No. 1107.2 (LINN!).

Excluded names

The species names *L. flexuosa* and *L. spicata* are very problematic, due to the scant morphological information provided in their protologues (Rafinesque 1838: 12–13 and Rojas 1897: 175, respectively) and the lack of original material. Both names probably refer not to *Littorella* species, but rather to *Plantago* (Hassemer & al., 2018a, b). Also very problematic and potentially disruptive is the infrageneric name *Littorella* subg. *Xamotris* Raf., which has *L. flexuosa* as its type. Because of the uncertainties involving these three names and their potential to replace well-established names in *Plantago*, thus causing disadvantageous nomenclatural changes, these names were proposed for rejection (Hassemer & al., 2018a, b).

■ AUTHOR CONTRIBUTIONS

GH idealised the study and wrote the manuscript with the help of PM and NOL. All authors contributed to the nomenclatural discussions and the search for specimens and literature. — ORCID: GH, <https://orcid.org/0000-0003-4365-6934>; PM, <https://orcid.org/0000-0001-5306-476X>; NOL, <https://orcid.org/0000-0001-7414-3416>

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