

Notes on the water-starworts (*Callitriche*) recorded in Europe

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ABSTRACT

This article provides information on the nomenclature and taxonomy of some species of water-starwort (*Callitriche*) that have been reported from Europe. In addition, wherever possible names are typified. Two subspecies of *C. hermaphroditica* L. are recognised; the taxonomic status of *C. hamulata* Kütz. ex Koch and *C. brutia* Petagna is revised; and a new species, *C. brevistyla*, currently known only from a commercial greenhouse in Sweden, is described.

KEYWORDS: *Callitriche*, taxonomy, synonymy, typification.

INTRODUCTION

This article presents information on the taxonomy and nomenclature of water-starworts (*Callitriche*) recorded in Europe. Data were collected from herbarium material (**BM**, **CGE**, **K**, **L**, **LE**, **NMW**, **NY**, **P**, **SEV**), a total of 15 taxa grown in cultivation and from wild populations in France, Portugal, Spain and the UK (specimens deposited in **NMW**). The water-starworts are a poorly studied genus. The one monographic account of all known taxa was published in the 19th century (Hegelmaier 1864 *et seq.*). Since then a single thorough review of information available on the European members of the genus has been published (Schotsman 1967) and subsequently a certain amount of important information has been published in a wide variety of journals (e.g. Schotsman 1968 *et seq.*; Martinsson 1985 *et seq.*; Lansdown & Jarvis 2004).

For the sake of clarity, I have used few abbreviations; authors of plant names follow Brummitt & Powell (1992); the standard acronyms for herbaria of the world follow Holmgren & Holmgren (2005) and the symbol ! following details of a specimen indicates that I have personally verified its identification. For the purposes of this article the definition of Europe follows Tutin *et al.* (1993). Where possible, I have clarified

synonymy myself; where I have not been able to confirm details, I have in some cases accepted the synonymy established by others. In these cases, this is indicated by the term “*fide*” and with the source listed.

INDIGENOUS EUROPEAN TAXA

Callitriche hermaphroditica L., *Centuria I Plant*: 31 (Feb. 1755).

Lectotype (Lansdown & Jarvis 2004): Middle two specimens on sheet 13.1 (**LINN!**).

Synonymy:

C. palustris var. *bifida* L. *Sp. Pl.* 2: 969 (1 May 1753) (Lansdown & Jarvis 2004).

Lectotype not designated (Lansdown & Jarvis 2004).

C. autumnalis L., *Fl. Suecica* ed. 2: 2 (Oct. 1755). *Lectotype* (Lansdown & Jarvis 2004): Middle two specimens on sheet 13.1 (**LINN!**).

C. angustifolia Gilib. *Exerc. Phyc.*: 421 (1792). Illegitimate superfluous name. *Lectotype* (Lansdown & Jarvis 2004): Middle two specimens on sheet 13.1 (**LINN!**) designated here.

C. sessilis var. δ DC. in Lam. & DC. (1805). *Fl. Franc.*, éd. 3, 4: 414–415. Illegitimate superfluous name. *Lectotype* (Lansdown & Jarvis 2004): Middle two specimens on sheet 13.1 (**LINN!**) designated here.

C. bifida (L.) Morong, *Mem. Torrey Bot. Club* 5: 215 (1894); basionym: *C. palustris* var. *bifida* L. *Sp. Pl.* 2: 969 1 May 1753.

C. aquatica subsp. *autumnalis* (L.) Bonnier *Fl. Comp. Fr.* 4 : 35 (1921). *Basionym*: *C. autumnalis* L., *Fl. Suecica* ed. 2: 2 (Oct. 1755).

C. hermaphroditica L. var. *bicarpellaris* (Fenley) Mason in H. Mason, *Fl. Calif.*: 557 (1957) *Holotype*: Mason, H.L. 4445 3 May 1928; USA. San Joaquin County, four miles north of Clementes. (**GH** No: 110063974.48919); *Basionym*: *C. autumnalis* L. var. *bicarpellaris* Fenley 1936 in *Jeps. Fl. Calif.* 2: 436.

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Gilibert (1792) described two taxa, *C. angustifolia*, citing *C. autumnalis* L. as a synonym and *C. latifolia* citing *C. verna* L. as a synonym, but linking neither name to specimens. The names must therefore be based on the types of Linnaeus' names. I have designated here the lectotype of *C. hermaphroditica* L. as the type of *C. angustifolia* Gilib. and that of *C. palustris* L. as the type of *C. latifolia* Gilib. Similarly, De Candolle (in Lamarck & De Candolle 1805) separated all *Callitriche* into two species: *C. sessilis* with four varieties and *C. pedunculata*. He listed *C. verna* L. as a synonym of his var. α and *C. autumnalis* as a synonym of his var. δ with his other varieties synonymised to other non-Linnaean taxa. These two varieties must therefore be based on the types of Linnaeus' names. I have designated here the lectotype of *C. hermaphroditica* L. as the type of *C. sessilis* var. δ DC. and that of *C. palustris* L. as the type of *C. sessilis* var. α DC.

Previous authors have noted that the species described by Linnaeus as *C. hermaphroditica* shows strong variation in fruit size (Hegelmaier 1867; Schotsman 1958, 1967; Martinsson 1991) and that it probably represents more than one taxonomic entity. Martinsson (1991a) noted three forms of fruits: a large-fruited form, a small-fruited form and a form lacking lignification in the wing which she termed 'aberrant'. There are two clearly distinct taxonomic entities which vary principally in the size of the fruits but also in gross morphology. The differences are consistent between populations. When fruits are dried, the sizes of the two forms scarcely overlap, but there is greater overlap in fresh fruits. The plant with larger fruits was formally recognised as forma *macrocarpa* by Hegelmaier (1867) under *C. autumnalis* L. The plants with fruits lacking lignified cells described by Martinsson (1991a) appear to fall within one or other of the two groups separated on fruit size and I consider that they represent variation within the species as a whole.

C. hermaphroditica L. subsp. *macrocarpa* (Hegelmaier) Lansdown, **comb. nov.**

Basionym: *C. autumnalis* forma *macrocarpa* Hegelm., *Verh. Bot. Ver. Brandenburg* 9: 35 (1867).

Holotype: "*Callitriche autumnalis*, Anglesea, Anglia from Charles Babington" (MEL).

Var. *macrocarpa* can be separated from var. *hermaphroditica* by measurement of the dried fruits which are $(1.5-1.6-2.4) \times (1.6-1.7-2.8$

$-3)$ mm with the wing $0.2-0.7 (-0.8)$ mm, whereas those of var. *hermaphroditica* are $1.2-1.6 (-1.7) \times 1.2-1.7$ mm with the wing $0.1-0.4$ mm wide.

The type material was described by Hegelmaier (1867: 35) as "Frucht sehr gross, sehr breit geflügelt [Fruit very large, very broadly winged]" and cited as "Insel Anglesea (Babingt. In Hb. Sond.)"; it is in Sonder's herbarium in MEL, and has fruit up to 2.3 mm wide and 2.2 mm long (N. Walsh pers. comm.). In addition to the label by Babington, it has a hand-written note in German by Hegelmaier. C.C. Babington apparently made three collecting trips to Anglesey (Babington 1897) and his herbarium in CGE includes three specimens of *C. hermaphroditica* subsp. *macrocarpa*, one of which has two labels; "Llanfailog, Anglesey Aug. 1830, W. Wilson" and "Llyn Maelog, Anglesea Aug. 1835 Ex. herb. C. C. Babington". Wilson collected a lot of specimens for Babington (G. Murrell pers. comm.) and it is likely that the material was collected by Wilson for Babington, who then passed a part to Hegelmaier. It is likely, therefore, that this represents an isotype of the material cited by Hegelmaier in Sonder's herbarium; however the latter has no information by which to confirm this.

Callitriche truncata Guss., *Pl. Rar.*: 4, t. 2, f. 2 (1826)

No type has been designated, however it is possible that one could be located through further work.

Synonymy:

C. cruciata Lebel, *Mém. Soc. Imp. Sc. Nat. de Cherbourg* 9: 43 (1863) *nom. nud. fide* Schotsman (1967).

C. amblycarpa Scheidw. (1866) in sched. (BRLU, WU) not effectively published, *fide* Hegelmaier (1864).

C. graminea Link in Spreng., *Jahrb. Gew.* 3: 31 (1818-1820); in sched. (Hb. Berol.) *nom. nud. fide* Schotsman (1967).

Callitriche autumnalis L. subsp. *truncata* (Guss.) Arcangeli *Comp. Fl. Ital.*: 613 (1882); *Basionym*: *C. truncata* Guss., *Pl. Rar.*: 4, t. 2, f. 2 (1826).

C. aquatica subsp. *truncata* (Guss.) Bonnier *Fl. Comp. Fr.* 4: 35 (1921). *Basionym*: *C. truncata* Guss., *Pl. Rar.*: 4, t. 2, f. 2 (1826).

Callitriche palustris L. var. *truncata* (Guss.) Fiori *Nouv. Fl. Anal. Ital.* 2: 192 (1926); *Basionym*: *C. truncata* Guss., *Pl. Rar.*: 4, t. 2, f. 2 (1826).

C. hermaphroditica subsp. *truncata* (Le Gall) Jahandiez & Maire Catal. *Pl. Maroc*. 2: 470 (1932). Basionym: *C. truncata* Guss., *Pl. Rar.*: 4, t. 2, f. 2 (1826).

C. truncata has been separated from other taxa by the combination of uniform, single-veined leaves; translucent, unornamented pollen; lack of stem and leaf scales; and the width of the fruit being greater than its height. It has also been separated on the basis of exclusively submerged reproduction, although terrestrial plants have recently been shown to produce mature fruit (Lansdown 1999). Schotsman (1967) reviewed herbarium material from throughout Europe and western Asia and separated material with these features into three subspecies: subsp. *truncata* in which the fruits are clearly winged; subsp. *occidentalis* (Rouy) Schotsm., in which the fruits lack a wing; and subsp. *fimbriata* Schotsm., in which the fruits are winged, but the wing is reduced to a fringe of whitish 'hairs'. Subsequently the latter was elevated to species rank as *C. fimbriata* Tzvelev (1975).

The 'hairs' described as fringing the ripe fruits of var. *fimbriata* by Schotsman are actually the fibrils (see Schotsman 1967 Plate F). On many taxa, the outer wall of the wing cells breaks down after the fruits have fallen from the plant, leaving the fibrils resembling a fringe of hairs. However, *C. truncata* subsp. *fimbriata* Schotsm. appears to be the only *Callitriche* in which this occurs before fruits fall. Before degradation of the cell walls, the fruits of this taxon strongly resemble those of *C. truncata* subsp. *truncata*. In fact, the differences between *C. truncata* subsp. *truncata* and subsp. *occidentalis* are greater than those between *C. truncata* subsp. *truncata* and *C. truncata* subsp. *fimbriata*. Accordingly this taxon is returned here to subspecific status within *C. truncata* and all three subspecies are recognised.

Callitriche truncata subsp. *fimbriata* Schotsm., *Les Callitriches: Esp. Fr. et nouv.*: 39 (1967).

Holotype: Sarepta (USSR), 1894. Becker. (P!).

Synonymy:

C. fimbriata (Schotsm.) Tzvelev, *Nov. Syst. Pl. Vasc.* 12: 237 (1975).

Callitriche truncata subsp. *occidentalis* (Rouy) Schotsm., *Les Callitriches: Esp. Fr. et nouv.*: 39 (1967).

Lectotype: Schultz, herb. norm. 658. Vallée de

la Taute à Carentan (Manche), 31-5-1863. Lebel. P (not seen).

Synonymy:

C. truncata proles *occidentalis* Rouy 1910. *Fl. Fr.*, 12: 186 (1910); *Basionym*: *C. truncata* subsp. *occidentalis* (Rouy) Schotsm., *Les Callitriches: Esp. Fr. et nouv.*: 39 (1967).

C. truncata race *occidentalis* (Rouy) Br.-Bl. *Bull. Soc. Linn. Lyon, nouv. sér.*, 75: 17 (1929); *Basionym*: *C. truncata* subsp. *occidentalis* (Rouy) Schotsm., *Les Callitriches: Esp. Fr. et nouv.*: 39 (1967).

Callitriche lusitanica Schotsm. *Bol. Soc. Brot.* 35: 95–127, figs. 1, 2, and 3 (1961).

Holotype: Castelo Branco, rib. Ponsul, VI-1881. A.R. Da Cunha s. n. (LISU).

Synonymy:

C. clausonis Hegelm. in sched. based on: Herb. E. Cosson 18; Bou Ismaël, près Koléah, prov. D'Alger, Clauson (P!).

C. hermaphroditica L. subsp. *clausonis* Maire ex Quézel & Santa, *Nouv. Fl. Algérie* 2: 608 (1963) *nom. inval.* without latin description.

In the herbarium of the Muséum National d'Histoire Naturelle, Paris there is a specimen from the herbarium of E. Cosson (details above) which bears a handwritten label by F. Hegelmaier. The label is difficult to read and my transcription does not agree entirely with that of Schotsman (1977: 14). My transcription is as follows: "Plantula maxime insignis, a me huc usque non visa ideoque, ut videtur rarissima, *C. autumnali* L. et *C. truncata* Guss. affinis, sed ab utraque diversissima et haud dubia, nisi forte cum *C. capillaris* Parlat. (quam nondum vidi) convenit nova speciei nomma *C. clausoni* salutanda". This can be translated as "An extremely remarkable little plant, not seen hitherto and therefore, as it seems, very rare, akin to *C. autumnalis* L. (= *C. hermaphroditica* L.) and *C. truncata* Guss. but very different from either and, unless perhaps it agrees with *C. capillaris* Parlat. (= *C. brutia* Petagna) (which I have not yet seen), no doubt to be recognised with the name of a new species, *C. clausoni*." (translated by P. Oswald).

Schotsman (1977) stated that the name *C. clausoni* appeared only on the herbarium label and so was not effectively published. She considered that the size of the fruits and width of the wing, combined with the lack of lignification of wing cells were such that she

could not determine the specimen as *C. lusitanica* with absolute confidence. Schotsman annotated the herbarium sheet with the following: "1 mm breed, 0.6 mm hoog, 0.9 mm hoog, breed 1-1.2 mm" [which I take to mean: 1 mm wide, 0.6 mm high, 0.9 mm high, width 1-1.2 mm]. This presumably refers to measurement of two fruits and would give a range of 1-1.2 mm wide × 0.6-0.9 mm high. Measurement of 53 fresh fruits on specimens of *C. lusitanica* from Spain and Portugal gives a range of 1.2-1.9 mm wide × 1-1.4 mm high. As noted by Schotsman, the Bou Ismaël material is sparse and composed of only a few shoots bearing flowers and a few fruits which are largely unripe. Even the ripest fruits do not appear fully mature, which may explain the lack of lignification (this becomes apparent only as fruits ripen). This, together with the fact that *Callitriche* fruits shrink on drying, suggests that, although smaller than the fresh fruits measured, these measurements cannot be regarded as significantly different. I do not consider that the differences are sufficient to justify treating this material as a different taxonomic entity from *C. lusitanica* Schotsman. Apart from discussion of this specimen by Schotsman (1967, 1977) the only other reference that I have found to the name *C. clausonis* is that in Quézel & Santa (1963), who gave only a French description which did not validate the name.

Callitriche stagnalis Scop. *Fl. Carniolica.*, ed. 2: 251, n. 1202 (1772).

Neotype: Aberleri Fields, Borth, Cards 22/61209160, 20 July 1998, Chater, A. O. (NMW); designated here.

Synonymy:

C. stagnalis Scop. α and β *vulgaris* Kütz. in Reichenb., *Ic. Plant. Crit.* cent. 9: 36 (1831). *Holotype*: Germany, Schleusingen rec. 1865, W. F. R. Suringar, (L! Sheet No: 91017286 L0486887).

C. palustris subsp. *stagnalis*: (Scop.) Schinz & Thell. *Fl. Schweiz*, ed. 2, 1: 322 (1905). *Basionym*: *C. stagnalis* Scop. *Fl. Carniolica.*, ed. 2: 251, n. 1202 (1772).

C. tholeyreanum Gandoger, in sched. (BC, G) *fide* Schotsman (1967).

Schotsman (1967) stated that "malheureusement l'herbier de Haller (P) ne contient pas de *Callitriche* portant l'indication "Stellaria foliis omnibus subrotundis" et, parmi les échantillons présents, on n'y trouve aucune plante qui montre nettement les caractères de *C. stagnalis*" [unfortunately the Haller herbarium (P) does not contain *Callitriche* labelled "Stellaria foliis omnibus subrotundis"

and the samples present do not include plants which clearly show the characters of *C. stagnalis*]. She concluded that Scopoli did base his diagnosis on the taxon that we call *C. stagnalis* but that there is no type specimen for *C. stagnalis* Scop. and that it was not yet possible to prove that material studied by Scopoli existed in collections. A neotype is therefore designated above.

Callitriche obtusangula Le Gall, *Fl. Morb.*: 202 (1852).

Neotype: Le Palais, Belle Ile en mer, Morbihan, 19 Aug. 1958, Raynal, J., Raynal, A. (P!); designated here.

Synonymy:

C. aquatica Hudson subsp. *obtusangula* (Le Gall) Bonnier *Fl. Comp. Fr.* 4: 35 (1921).

Basionym: *C. obtusangula* Le Gall, *Fl. Morb.*: 202 (1852).

C. palustris subsp. *obtusangula* (Le Gall) Jahandiez & Maire *Catal. Pl. Maroc.* 2: 470 (192). *Basionym*: *C. obtusangula* Le Gall, *Fl. Morb.*: 202 (1852).

There is apparently no designated type for *C. obtusangula* Le Gall. Le Gall did not cite one and it has not been possible to trace any of his specimens. The name is based on the statement "Je crois avoir vu dans le Morbihan un Callitric (sic) que j'ai souvent recueilli dans le département d'Ille-et-Vilaine. Il a les feuilles, les bractées et les stigmates du *C. des étangs*; (= *C. stagnalis* Scop.), mais il en diffère par le fruit dont les loges ne sont point en carène ailée, mais présentent un dos très obtus. *C. obtusangula* N. C'est au moins une var. fort remarquable du Callitric des étangs" [I believe that I have seen a *Callitriche* in the Morbihan that I have often collected in the Department of Ille-et-Vilaine. Its leaves, bracts and stigmas resemble those of the lake water-starwort (= *C. stagnalis* Scop.), but it differs in the fruits of which the edges are at most slightly winged and show a very blunt back. *C. obtusangula* N. It is at least a particularly remarkable variety of the lake water-starwort]. As noted by Schotsman (1967: 55) the description fits the species we now call *C. obtusangula*. Neither she nor I have been able to locate any specimens of this taxon determined by Le Gall. Schotsman (1967: 14) concluded that it was not yet possible to prove that material studied by Le Gall existed in collections. A neotype is therefore designated above.

Callitriche cophocarpa Sendtn., *Veg. Südbayerns*: 773 (March 1854).

Holotype: Wendelstein gegen die Spitzingalpe, 20-VIII-1851. Sendtner. M (isotype K!).

Synonymy:

- C. platycarpa* b *major* Kütz. *Linnaea* 7: 185 (1832). *Holotype*: Germany, Schleusingen (L! Sheet No: 91017284 L0486872).
- C. platycarpa* a *minor* Kütz., *Linnaea* 7: 185 (1832). *Holotype*: Germany, Schleusingen (L! Sheet No: 91017282 L0486873).
- C. polymorpha* Lönnr., *Observationes Crit. Plant. Suec.* (Diss. Uppsala) 19 (May 1854) (Schotsman 1967: 61) *Holotype*: “a.o. ex. Herb. Svanlund, (G)” *fide* Schotsman (1954)
- C. transsilvanica* Schur, *Enum. plant. trans:* 217 (1866) *Syntypes*: “no. 134 (?) 85” (P and BP) *fide* Schotsman (1967).
- C. longistyla* Norman, *Fl. Arct. Norv. Sp:* 28 (1893) *fide* Schotsman (1967).
- C. palustris* subsp. *polymorpha* (Lönnr.) Emberger & Maire *Catal. Pl. Maroc*, 4: 1066 (1941). *Basionym*: Lönnr., *Observationes Crit. Plant. Suec.* (1854).

Callitriche lenisulca Clav., *Actes Soc. Linn. Bordeaux*, 5è. sér., 4: 43 (1890).
Holotype: La Martière-en-Oléron (Char.-Inf.), Réau sheet No. 2847 (P!).

Synonymy:

- C. stagnalis* Kütz. forma *acroptera* Clavaud, *Bull. Soc. Rochel.*, 12: 45 (1890) *Lectotype*: La Martière-en-Oléron (Char.-Inf.) Réau. 2847 (P!); material annotated by me as *C. lenisulca*, designated here (see notes below).
- C. acroptera* (Clavaud) Rouy, *Fl. France* 12: 184 (1910).

C. lenisulca was initially described on the 16th April 1890 by Armand Clavaud in a presentation to the Linnaean Society of Bordeaux; an extract of which was published, including a description but no specimens (Clavaud 1890a) (Schotsman & Andreas 1974 Fig. 1–2). Clavaud died shortly after this presentation and never published a full account of *C. lenisulca* (Schotsman & Andreas 1974). The only other references to the name *C. lenisulca* are in an extract from a letter by Clavaud published in a catalogue of plants in the Bulletin of the Rochelaise Botanical Society (1890) (cited in Index Kewensis Add. Suppl. I 1906), under the account of *C. acroptera* Rouy (1910: 184) (see below) and in work by H. D. Schotsman (Schotsman 1967; Schotsman & Andreas 1974). Schotsman (1967) initially considered the plant described

by Clavaud to be *C. cophocarpa* Sendtn. However, a few years later she located live material of *C. lenisulca* and, revisiting Clavaud’s herbarium material and illustrations, was able to confirm that his represented an otherwise undescribed species (Schotsman & Andreas 1974). She confirmed that that the account in Clavaud (1890a) constitutes valid publication of the name.

The catalogue of plants includes reference to two specimens (Schotsman & Andreas 1974: 14): 2847 La Martière-en-Oléron (Char.-Inf.) Réau and 2848 *C. lenisulca* Clavaud. St. Georges-d’ Oléron (Char.-Inf.) Réau. Specimen No. 2847 is in the Herbarium of the Muséum National d’Histoire Naturelle, Paris (P). It comprises an intimate mixture of *C. lenisulca* Clav. and *C. stagnalis* Scop. According to Schotsman & Andreas (1974), No. 2848 is not *C. lenisulca* Clav., but *C. obtusangula* Le Gall.

Rouy (1910: 184) raised *C. stagnalis* forma *acroptera* Clavaud in *Bull. Soc. Rochel.*, 12 (1890: 45) to specific rank as *C. acroptera* Rouy, citing specimen No. 2847, following Clavaud in suggesting that it may be a hybrid between *C. lenisulca* (which Rouy called *C. verna*) and *C. stagnalis* Scop. His description is largely derived from the account of *C. lenisulca* in Clavaud (1890): “Fruits inégaux, souvent très petits, fréquemment mal venus; aile des loges sensiblement plus large au sommet que dans le reste de son étendue; pollen petit et très inégal, mêlé de grains complètement avortés” [fruits unequal, often very small, frequently poorly developed; wing often wider at the apex than on the remainder; pollen small and very unequal mixed with completely aborted grains]. The impression of unequal fruits is probably due to the combination of *C. stagnalis* Scop. and *C. lenisulca* on the same sheet.

Callitriche platycarpa Kütz. in Reichenb., *Ic. Plant. Crit.* cent. ix: 38 (1831).

Lectotype: Magdeburg, Germany, rec. 1865, W. F. R. Suringar (L Sheet No: 91017293).

Synonymy:

- C. platycarpa* b *latifolia* Kütz. in Reichenb., *Ic. Plant. Crit.* cent. 9: 41 (1831); *Holotype*: Germany, Schleusingen (L! Sheet No: 91017271 L0486879).
- C. platycarpa* γ *undulata* Kütz. in Reichenb., *Ic. Plant. Crit.* cent. 9: 39 (1831); *Holotype*: Germany, Schleusingen (L! Sheet No: 91017270(L0486880)).

- C. platycarpa* δ *sterilis* Kütz. in Reichenb., *Ic. Plant. Crit. cent.* 9: 40 (1831); *Holotype*: Germany, Schleusingen (L! Sheet No: 91017291 L0486881).
- C. platycarpa* β *rigidula* Kütz. in Reichenb., *Ic. Plant. Crit. cent.* 9: 39 (1831); *Holotype*: Germany, Schleusingen (L! Sheet No: 91017272 L0486882).
- C. platycarpa* α *elongata* Kütz. in Reichenb., *Ic. Plant. Crit. cent.* 9: 41 (1831); *Holotype*: Germany, Schleusingen (L! Sheet No: 91017276 L0486883).
- C. aquatica* Hudson subsp. *platycarpa* (Kütz.) Bonnier & Layens *Fl. Fr.*: 106 (1894). *Basionym*: *C. platycarpa* Kütz. in Reichenb., *Ic. Plant. Crit. cent.* ix: 38 (1831)
- C. font-queri* Allorge, V. & Allorge, P. 1941. *Bull. Soc. Bot. France* 88: 242 *Holotype*: Spain, "In fossis turfaceis lente fluentibus infra lacu « Lago de Ausente » dicot, prope S. Isidro, regn. Legionensi, alt. Ca. 1,680 m." (P).
- In describing *C. font-queri* Allorge & Allorge (1941) cited differences between this, *C. verna* L. (= *C. palustris* L.) and *C. polymorpha* Lönnr. (= *C. cophocarpa* Sendtn.). Schotsman (1967: 70) reviewed the holotype and another specimen collected in the same locality by Lainz in 1961. She concluded that the plants were impoverished specimens of either *C. platycarpa* Kütz. or *C. cophocarpa* Sendtn. and noted that Lainz had collected a specimen of *C. platycarpa* from the Province de Santander in 1962, which she was able to confirm and which is to date the only confirmed specimen of this species from Spain. *C. cophocarpa* has not been confirmed as occurring nearer to Spain than north-western Italy. It therefore seems best to consider *C. font-queri* Allorge & Allorge as a synonym of *C. platycarpa* Kütz.
- Callitriche palustris* L., *Sp. Pl.* 2: 969 (1753)**
Lectotype (Lansdown & Jarvis 2004): Herb. Linnaeus, Sheet No. 13.1, lowermost three specimens (LINN!).
- Synonymy*:
- C. palustris* var. *minima* L., *Sp. Pl.* 2: 969 (1753). *Lectotype* (Lansdown & Jarvis 2004): 3 lower specimens on sheet 13.1 (LINN!).
- C. palustris* var. *natans* L., *Sp. Pl.* 2: 969 (1753). *Neotype* (Lansdown & Jarvis 2004): *C. verna* L. α *genuina* Kütz.; Germany, Schleusingen (L! Sheet No: 91017287 L0486889).
- C. androgyna* L., *Centuria I Pl.*: 31 (Feb. 1755). *Lectotype* (Lansdown & Jarvis 2004): 3 lower specimens on sheet 13.1 (LINN!).
- C. verna* L., *Fl. Suecica*, ed. 2: 2 (Oct. 1755). *Lectotype* (Lansdown & Jarvis 2004): Herb. Linn. 13. 2 (LINN!).
- C. fontana* Scop. *Fl. Carn.* ed. II. 2: 251, illegitimate superfluous name; *Lectotype*: 3 lower specimens on sheet 13.1 (LINN!) designated here.
- C. aquatica* Hudson, *Fl. Ang.* 2:439–440 (1778), illegitimate superfluous name; *Lectotype*: 3 lower specimens on sheet 13.1 (LINN!) designated here.
- C. latifolia* Gilib. *Exerc. Phyc.*: 421 (1792), illegitimate superfluous name. *Lectotype*: 3 lower specimens on sheet 13.1 (LINN!) designated here.
- C. sessilis* var. α DC. in Lam. & DC. *Fl. Franc.*, éd. 3, 4: 414–415 (1805), illegitimate superfluous name. *Lectotype*: 3 lower specimens on sheet 13.1 (LINN!) designated here.
- C. verna* L. α *fontana* Kütz. in Reichenb., *Ic. Plant. Crit. cent.* 9: 33 (1831); *Holotype*: Germany, Schleusingen (L! Sheet No: 91017287 L0486889).
- C. verna* L. β *stellata* Kütz. in Reichenb., *Ic. Plant. Crit. cent.* 9: 33 (1831) *Holotype* the same as *C. verna* L. α *fontana* Kütz.
- C. verna* L. δ *latifolia* Kütz., *Linnaea* 7: 178 (1832); *Holotype* the same as *C. verna* L. α *fontana* Kütz.
- C. caespitosa* Schultz *Prodr. Fl. Starg.* (1819); illegitimate superfluous name. *Lectotype*: 3 lower specimens on sheet 13.1 (LINN!) designated here.
- C. aquatica* δ *caespitosa* Willd. *Enum. Pl.* (1809). *Basionym*: *C. caespitosa* Schultz *Prodr. Fl. Starg.* (1819).
- C. pallens* Gray *Nat. Arr. Brit. Pl.* (1821); illegitimate superfluous name. *Lectotype*: 3 lower specimens on sheet 13.1 (LINN!) designated here.
- C. euverna* Syme *Engl. Bot.* ed. 3(8): 122 (1863), error on Figure label.
- C. verna* L. α *genuina* Kütz., (in sched. and litt.); *Holotype* the same as *C. verna* L. α *fontana* Kütz.
- Scopoli (1772) separated all *Callitriche* into two taxa: *C. fontana* and *C. stagnalis*, but without linking the names to specimens. As a synonym of *C. fontana*, he cited *Callitriche* (1) LINN. Syst. Nat. p. 52. In his *Systema naturae*, Linnaeus (1770) lists two taxa, *C. verna*

numbered 1 and *C. autumnalis*, numbered 2. *C. fontana* Scop. must therefore be based on *C. verna* L. (= *C. palustris* L.), with the same type. Hudson (1778) described *C. aquatica*, citing both *C. verna* L. and *C. autumnalis* L. as synonyms, citing *Species Plantarum* 6 but not linking the name to any specimens. The name must therefore be based on the type of one of Linnaeus' two taxa and I have therefore designated that of *C. palustris* L. (= *C. verna*) as the lectotype. The name *C. euverna* Syme is listed by The International Plant Names Index (2004, accessed 2006), however Syme (1963) describes the name as erroneously applied to the illustration on Plate MCCLXXI which should have been labelled *C. verna* L.

Callitriche brutia Petagna, *Institutiones Bot.*, 2: 10 (1787).

Lectotype: Calabria. Ex herb. Petagna (FI) (chosen by Schotsman 1967).

C. brutia and *C. hamulata* have a complex taxonomic history. They were first recognised as different from other taxa by Petagna in 1787. Subsequently the latter was recognised as distinct from *C. brutia* by Kützing (1831) as *C. autumnalis* L. σ *callophylla*. However, various authors have considered them as subspecies (e.g. Syme 1863), varieties (e.g. Babington 1862) or forms (Wahlenberg 1824–1826) of the same species.

Schotsman (1967) provided a detailed description of the morphology of both *C. brutia* Petagna and *C. hamulata* Kütz. ex Koch and carried out an extensive review of their known distribution. She concluded that they were distinct taxa, but that it was not possible to be certain that they were distinct species. "Il résulte de ce résumé que *C. brutia* est sans doute un taxon apparenté à *C. hamulata*. On pourrait se demander s'il agit ici de deux sous-espèces ou de deux espèces. Cependant, selon notre opinion, les différences sont telles que nous préférons considérer *C. brutia* et *C. hamulata* comme des espèces bien séparées." [*C. brutia* is undoubtedly closely related to *C. hamulata* and it is not clear whether they represent two species or two subspecies. In our opinion, the differences are such that we prefer to consider them as two clearly separate species] (Schotsman 1967). She treated them as separate species throughout her subsequent publications (Schotsman 1967 *et seq.*). However, she noted that "pour l'instant, il reste toujours des exemplaires de *C. brutia* et de *C. hamulata* difficiles ou impossibles à séparer, parce qu'à certaines phases

de leur développement, les deux espèces se ressemblent d'une façon telle, que la culture ou le comptage des chromosomes seulement pourrait nous procurer la solution." [there are still examples of *C. brutia* and *C. hamulata* that are difficult or impossible to separate. At certain stages of their development, the two species are so similar that they can only be separated through cultivation or chromosome counts] (Schotsman 1967). In a later publication (Duvigneaud & Schotsman 1977), she notes "la distinction entre certaines formes de *C. hamulata* et de *C. brutia* sera souvent impossible." [the distinction between certain forms of *C. hamulata* and *C. brutia* is often impossible] and "Un problème important reste à résoudre: celui de préciser la distinction entre *C. hamulata* et *C. brutia*. Très souvent en effet, sur du matériel d'herbier provenant de nos régions, il est impossible de distinguer avec certitude ces deux taxons" [the distinction between *C. hamulata* and *C. brutia* remains a problem that it is important to resolve. Very often material of the two taxa from our regions cannot be separated]. Schotsman gave the following identification features for these two taxa:

C. hamulata Kütz ex Koch. Material studied from Austria, Belgium, Czech Republic, Denmark, France, Germany, Hungary, Luxembourg, Poland, Sweden, Switzerland and United Kingdom.

Plant in general robust, often in running or fairly deep water. Linear leaves expanded toward the apex, with a deep notch in the form of an arc. Peltate scales in a circular disk of about 15 cells. Axillary scales have 5–8 longer cells. Fruits orbicular when viewed from the side. Mericarp narrowly winged. Structure of wing (see pl. XIV: IV 2). Fruits (of terrestrial form) sessile (Schotsman, 1967). Fruits suborbicular 1.2–1.5 mm long \times 1.4 mm wide (Duvigneaud & Schotsman 1977).

C. brutia Petagna. Material studied from Belgium, Italy, Norway, Portugal, Sardinia, Spain and United Kingdom.

Plant delicate, in shallow, still water. Lower leaves very narrow, often slightly rigid. Notch irregular, more or less deep. Peltate scales often in an asymmetrical disk of 10–15 cells. Axillary scales with 4–5 fairly short cells. The shape of the fruits of *C. brutia* is less constant than that of the fruits of *C. hamulata*, varying from elliptic to circular (from the side). Mericarps often more broadly winged than those of *C. hamulata*. Structure of wing (compare with pl. XIII: IV 1 b). Fruits (of terrestrial form) clearly pedunculate

(Schotsman 1967). Fruits elliptic or sub-orbicular 1–1.4 mm long \times 1–1.2 mm wide (Duvigneaud & Schotsman, 1977).

I collected and described material from 119 populations of the two taxa. As the aim of the work was to question and clarify identification features, I had to rely on unambiguous characters to identify material. The only apparently unambiguous characters for these two taxa are the long-pedunculate fruits of *C. brutia* and the chromosome numbers. Chromosome counts were not available for many populations and so the presence of long-pedunculate fruits was used to determine 55 populations from France, Ireland, Norway, Spain, Sweden, The Netherlands and the UK identifiable as *C. brutia*, leaving 64 populations that could not be attributed to *C. brutia*. Material of *C. brutia* was described in detail, including but not limited to those features described by Schotsman (1967 *et seq.*). The following features of particular note were recorded: number of peltate scale cells average 13.51 (7–20) [N = 106]; number of axillary scale cells average 6.24 (4–9) [N = 84]; fruit biometrics: width average 1.27 (0.74–1.62) mm [N = 84]; height average 1.23 (0.71–1.83) mm [N = 84]; wing width: side of fruits average 0.1 (0–0.8) mm [N = 146]; top of fruits average 0.13 (0.04–0.23) mm [N = 84].

This clearly shows that on plants that could be unambiguously identified as *C. brutia*, the ranges of all quantifiable parameters included values attributed by Schotsman to both *C. hamulata* and *C. brutia*. Other features are not quantified and the situation is further complicated by the fact that *C. brutia* tends to produce pedunculate fruits only when growing in a terrestrial form. In cultivation, the relative delicacy of plants was found to vary in relation to conditions, particularly water depth; it is therefore similarly too vague a feature on which to base taxonomic separation. The depth and shape of the notch and associated expanded leaf-apices is inconsistent; when terrestrial plants of *C. brutia* were submerged, leaf apices varied from narrowly to broadly expanded, but never produced the 'classic' apices considered typical of *C. hamulata*. However, these are only occasionally present on the latter, generally in fast-flowing water. The peltate scales of *Callitriche* are generally uniform, with a circular disk of few cells when young, gradually developing variation in shape as they mature. No consistency was found in the shape of the peltate scales of confirmed *C. brutia* or the length of axillary scale cells. Comparison of

the width and height of individual fruits showed that they varied from higher than wide to wider than high and, therefore, the relative proportions cannot be useful. Similarly, the features of the fibrils in the wing cells illustrated by Schotsman (1967) were found to vary not just between plants, but occasionally on the same fruit. In conclusion, none of the gross morphological features cited by Schotsman (1967 *et seq.*) for separation of *C. brutia* and *C. hamulata* are reliable. Even the long-pedunculate fruits are of uncertain value as *C. hamulata* is described as occasionally having pedunculate fruits (Schotsman 1967), while most plants of *C. brutia* with long-pedunculate fruits will have some that are sessile.

During the study outlined above, isozymes were analysed from material from a number of the same populations by B. Demars at the University of Leicester. No difference was found between the isozymes of the two taxa, although those of all other British taxa were clearly different (Demars & Gornall 2003: 391), while Philbrick & Les (2000) found no molecular (*rbcL*) apomorphies that would distinguish the two taxa. Thus, the only consistent, unambiguous difference that can be confirmed between the two taxa is the difference in chromosome number ($2n = 28$ for *C. brutia* and $2n = 38$ for *C. hamulata* (Schotsman 1967 *inter alia*). There is no obvious way in which plants with $2n = 28$ and $2n = 38$ could evolve one from the other directly (C.A. Stace pers. comm.). However there are at least two plausible explanations as to how these could arise. A common base number in *Callitriche* is 5; it is possible that *C. brutia* is a hypohexaploid and *C. hamulata* a hypooctoploid, where the numbers are derived through chromosome multiplication, followed by a loss of two chromosomes in each case. Alternatively, it is possible that the numbers evolved through hybridisation, which, although rare, is known to occur in *Callitriche* (Martinsson 1991), with subsequent backcrossing. Following this hypothesis, *C. brutia* has an allopolyploid origin from two parental species, one with $2n = 8$ and the other with $2n = 10$ chromosomes, with chromosome number doubling which restores fertility: $2n = 18$. Backcrossing with the parent with $2n = 10$, again with chromosome doubling achieves $2n = 28$. *C. hamulata* could then be produced if $2n = 28$ backcrossed again with a species with $2n = 10$, again involving chromosome doubling to derive $2n = 38$. Neither of these hypotheses can

be considered very likely and the true situation could only be explained through detailed cytological analysis. The isozyme evidence strongly suggests that *C. brutia* and *C. hamulata* share an identical chloroplast genome (R. J. Gornall, pers. comm.).

The two taxa are undoubtedly extremely close, and not reliably distinguishable in the field or herbarium except under particular environmental conditions, when *C. brutia* produces long-pedunculate fruits. Given the different chromosome numbers and the fact that only some plants appear to produce long-pedunculate fruits when they become terrestrial, it is not reasonable to combine the two taxa as one subspecies. Therefore, they are retained here as varieties of a single species. Schotsman (1967) showed that a plant described by Petagna (*Institutiones Botanicae* II, 9) in 1787 as *C. brutia*, and supported by good specimens, was clearly of this species and concluded that, if they were considered synonymous, *C. brutia* had priority over *C. hamulata* at species rank. Therefore the two taxa are considered here as varieties of *C. brutia* Petagna.

According to the International Code, Article 35.4 “if only one infraspecific rank is admitted, it is considered to be that of variety”. However, Kützing (1831 *et seq.*) recognised four ranks below that of species but did not designate any of them as being at varietal rank. There is therefore no established name for this taxon at varietal level and I have applied the name *C. brutia* var. *hamulata*, with *C. hamulata* Kütz. ex Koch as the basionym. Schotsman (1967: 92) designated a specimen which is now in the Leiden herbarium: labelled “*C. autumnalis* L. ♂ *callophylla* Kütz.; Germany, Schleusingen (L! Sheet No: 91017266 L0015953), as the lectotype of the name *C. hamulata* Kütz. ex Koch.

C. brutia* Petagna var. *brutia

Synonymy:

- C. pedunculata* DC. In Lam. & DC., *Fl. Fr.*, éd. 3, 4: 415 (1805). *Holotype*: “3656. Pedunculata. Fructibus pedunculatis. In aquilegis Fontisbleaudi” (possible isotype P! see note below).
- C. hamulata* subsp. *pedunculata* (DC.) Syme *Engl. Bot.* Ed. 3B (1863). *Basionym*: *C. pedunculata* DC. In Lam. & DC., *Fl. Fr.*, éd. 3, 4: 415 (1805).
- C. capillaris* Parl., *Fl. It.* 4: 42 (1867) *Holotype*: “*Callitriche tenuifolia* (Fries ex

auctoris folio); – *hamulata* (*Fl. Sard?*); – *capillaris* Parl. (*Fl. It.*); Maddalena. Maggio 1861. (N. Genn.)” with another label saying “Da Gennari in Ott. 1861” (FI).

- C. aquatica* subsp. *pedunculata* (DC.) Bonnier *Fl. Comp. Fr.* 4 : 35 (1921). *Basionym*: *C. pedunculata* DC. In Lam. & DC., *Fl. Fr.*, éd. 3, 4: 415 (1805).
- C. palustris* subsp. *pedunculata* (DC.) Jahandiez & Maire *Catal. Pl. Maroc.* 2: 470 (1932). *Basionym*: *C. pedunculata* DC. In Lam. & DC., *Fl. Fr.*, éd. 3, 4: 415 (1805).

There is a specimen in the herbarium of the Muséum National d’Histoire Naturelle, Paris donated by A. P. De Candolle in 1822, on which the original label simply says “*Callitriche pedunculata* DC. Fontainebleau”. It was annotated “serait-ce le type? ou un cotype?” [is this the type? or a cotype?] by H. D. Schotsman in 1967. Prof. G. G. Aymonin of the Museum suggests that the type is likely to be in Geneva (pers. comm. 2002), however, this material could represent an isotype. I was unable to locate the material cited by Schotsman (1967: 84).

C. brutia* var. *hamulata* (Kütz. ex W. D. J. Koch) Lansdown, **comb. nov.*

Basionym: *C. hamulata* Kütz. ex W. D. J. Koch 1837 *Syn. Fl. Germ.* ed. 1: 246.

Lectotype: Germany, Schleusingen (L!) Sheet No: 91017266 (L0015953) designated here.

Synonymy:

- C. intermedia* Hoffm. *Fl. Germ.* Ed. 1:2 (1791); *type*: Schkuhr *Taschenbuch f.d. Erlangen*, t. 1, fig. e (1791) *Epitype*: River Wye, nr. Llangurig, 22/908797, 8 August 1995 (NMW); designated here.
- C. autumnalis* L. ♂ *goldbachii* Kütz. in Reichenb., *Ic. Plant. Crit.* cent. 9: 43 (1831) *Holotype*: Germany, Schleusingen (L! Sheet No: 91017260 L0486908).
- C. autumnalis* L. ♂ *brutia* Kütz. in Reichenb., *Ic. Plant. Crit.* cent. 9: 45 (1831); *Holotype*: Germany, Schleusingen (L! Sheet No: 91017251 L0486892).
- C. autumnalis* L. d. *minuta*, Forma b. *halleri* Kütz. in Reichenb., *Ic. Plant. Crit.* cent. 9: 44 (1831); *Holotype*: Germany, Schleusingen (L! Sheet No: 91017267 L0486893).
- C. autumnalis* L. τ *callophylla* Kütz. in Reichenb., *Ic. Plant. Crit.* cent. 9: 44 (1831); *Holotype*: Germany, Schleusingen (L! Sheet No: 91017266 L0015953).

- C. autumnalis* L. α *lacustris* Kütz. in Reichenb., *Ic. Plant. Crit.* cent. 9: 44 (1831); *Holotype*: Germany, Schleusingen (L! Sheet No: 91017266 L0015953).
- C. autumnalis* L. α *heterophylla* Kütz., *Linnaea* 7: 191 (1832) *Holotype*: Germany, Schleusingen (L! Sheet No: 91017265 L0486909).
- C. autumnalis* L. ξ *platyphylla* Kütz., *Linnaea* 7: 191 (1832) *Holotype*: Germany, Schleusingen (L! Sheet No: 91017264 L0486899).
- C. hamulata* Kütz. ex W. D. J. Koch 1837 *Syn. Fl. Germ.* ed. 1: 246. *Lectotype*: Germany, Schleusingen (L!) Sheet No: 91017266 (L0015953) designated here.
- C. aquatica* Hudson subsp. *hamulata* (Koch) Bonnier & Layens *Fl. Fr.*: 106 (1894). *Basionym*: *C. hamulata* Kütz. ex W. D. J. Koch 1837 *Syn. Fl. Germ.* ed. 1: 246

C. naftolskyi Warb. & Eig., *Rep. Spec. Nov. Regni Veg.* 26: 84 (1929)
Lectotype: Sharon Plain, NE of Tel Aviv, 23.4.1927. Naftolsky (HUJ 01853).

C. naftolskyi Warb. & Eig. (1929: 84) was described as a new species, based on material from Israel. It differs from all European and Mediterranean taxa, except *C. brutia* Petagn., in its combination of more or less isodiametric fruits borne on long pedicels and heterophylly. According to the authors, it differs from *C. brutia* Petagn. by the larger fruits with a broader wing and its persistent stigma. In addition they suggested that the fruits of *C. naftolskyi* penetrate the soil vertically which they considered to be unlike *C. brutia* Petagn. and to resemble *C. deflexa* A. Br. ex Hegelm. more closely (Schotsman 1967: 97–98). However, this does not seem to me to be a very reliable difference. Warburg & Eig (1929: 84) stated that mature fruits are 1.33–1.5 mm wide \times 1.25–1.5 mm high. My own biometric data show that the fruits of *C. brutia* (including var. *brutia* and var. *hamulata* (Petagna) Lansdown) are (0.7–)1–1.5(–1.6) wide \times (0.7)1–1.5(–1.8) high, thus *C. naftolskyi* fruits fall within this range. Warburg & Eig described the wing of *C. naftolskyi* as narrow, without providing measurements. They describe the style as persistent in open air, presumably as opposed to when buried in the substrate; part of the style of *C. brutia* is persistent, but generally only the lower quarter.

Schotsman (1967: 97–98 and 1977: 248–249) reviewed material collected by the authors. She noted another potential difference: the veins on the leaves of *C. naftolskyi* are sinuous, rather than straight or curved. However, a specimen determined as *C. brutia* Petagn. in SEV (no details retained) has similarly sinuous veins, highlighted in a handwritten note by Schotsman. I have also found material of *C. brutia* var. *hamulata* in the UK with sinuous veins and suspect that this may be a response to environmental conditions, rather than a genetic factor. Schotsman also found material from Sardinia (“Marais sales près Villacerde (Sard. Merid.) III 1854. Huet de Pavillon” P) (1967: 98; pl. X: IV3b) and Portugal (with no locational details (Schotsman 1967: 89 under *C. brutia*); this may be the SEV specimen), that she considered could belong to *C. naftolskyi*. However, she later concluded that material from Syria (no details) and Israel should be assigned to *C. naftolskyi* and other populations to *C. brutia* (Schotsman 1977).

Schotsman considered that, without further research, it would not be possible to establish whether *C. naftolskyi* is a separate species, or simply a representation of regional variation within the *C. brutia* complex. My own data suggest that the cited differences are less important than was considered by prior authors; certainly I would not consider them sufficient to justify description of a new species. However, it is clear that there is insufficient information on this taxon. Not only is it not possible to decide whether it should be considered a separate species, subspecies or variety, or even simply an indication of regional variation, but it is not possible to establish conclusively whether or not it occurs in Europe.

AMERICAN TAXA REPORTED FROM EUROPE

Three terrestrial *Callitriche* taxa native to America have been reported from Europe. Of these, *C. deflexa* A. Braun ex Hegelm. occurs on São Miguel in the Azores, *C. terrestris* Raf. has been reported once from central France and *C. peploides* Nutt. once from the Pyrenees (Schotsman 1967). Records of terrestrial *Callitriche* taxa are increasing, both naturalised outside Europe and associated with cultivated plants in Europe. There is an increasing risk that they will occur in the wild and for this reason they are discussed here.

C. deflexa A. Braun ex Hegelm. 1864. *Mon. Gatt. Call.*: 58, t. 3.

Type: Brazil. Rio de Janeiro 1859–1860, F. Rudio (ex herb. A. Braun) (**MO**, **CM** and **GH** Nos: 110020570.48927; 110073465.48928; and 110076391.48929 *vide* Fassett 1951), it is not however clear whether one of these can be recognised as a nomenclatural type.

Material collected in 2001 from the Azores (Ponta Delgada, São Miguel harbour, Azores, Portugal. September 2001, Rumsey, F.J. (**NMW!**) differs from published biometrics on the species in only very minor ways and I have determined this material as *C. deflexa* Braun ex Hegelm., therefore agreeing with Schotsman's conclusion that the material from the Azores constitutes an occurrence of this species in Europe. The population of this species growing in the Botanic Garden at Coimbra, Portugal (Schotsman 1961: 124) appears to have died out and I have been unable to locate specimens, therefore this material cannot be compared with material from other populations.

C. terrestris Raf. 1808. *Med. Reposit.* (New York) 5: 358.

Holotype: USA, Pennsylvania, Adripus fluvii Lecha prope Philadelphiam, August 1832, Moser, C. J.; (**NY!** No. 248730), Ex Herb. Meisner.

Synonymy:

C. austinii Engelm. in A. Gray, *Mon. Bot. Ed.* 5, 428 (1867); *Holotype*: USA, New Jersey, on damp soil in open woods, fields and roads, 1864, Austin C. F. (**MO**).

C. deflexa var. *austinii* (Engelm.) Hegelm., *Verh. Bot. Vereins Prov. Brandenburg*: 15 (1867).

C. pedunculata A. Gray (non DC) *Man.* (taken to indicate Gray's Manual neither volume nor date specified *vide* Hegelmaier (1864).

C. terrestris subsp. *subsessilis* (Fassett) N. M. Bacig. *Darwiniana* 22(1): 392 (1979).

Holotype: Norte de Santander, Valley of Rio Chitaga, southwest of Pamplona, Colombia, 6500 ft. alt., 13 October 1944, Fassett, N. C. 25932 (**GH** No: 110076392.48930) (isotypes **MO**, **CM**, **GH**, **US**, **NY!**, **WIS**).

Synonymy:

C. deflexa var. *subsessilis* Fassett, *Rhodora* 53: 150 (1951).

C. terrestris subsp. *turfosa* (Bert.) Bacig. *Darwiniana* 22(1–3): 393 (1979).

Holotype: *C. turfosa* Bert. ex. Hegelm. in Andibus Ecuadorensibus, Ecuador, 1857–1859, Spruce, R. No. 5053 (**GH** No: 110003851.48938).

Synonymy:

C. turfosa Bert., *Amer. J. Sci.* 19: 308 (1831) *nom. nud.*

It appears likely that the specimen reported from France (Herb. M. Weill (**P**) 11.6.1930 Clairefontaine [Seine-et-Oise], "Forêt des Yvelines, dans des mares asséchées à proximité du Carrefour des marais" [in dried-out marshes close to the Carrefour des marais]; determined by Schotsman 1967 p: 99) was of subspecies *turfosa*. Prof. G. G. Aymonin (pers. comm.) has suggested that it is likely that this specimen is now in Geneva but I have been unable to trace it.

C. peplodes Nutt., *Trans. Amer. Philos. Soc. nov. ser.* 5: 141 (1835).

Lectotype: Nuttall, T. [undated]; USA, Arkansas; Fertile (**NY!** designated here) No. 248737: Ex herbarium Torrey. Three collections are mounted on sheet NY bar-codes 248738 and 248739 are other taxa not determined.

C. peplodes occurs naturally in coastal southern North America, south to Costa Rica, where it often occurs as a weed in damp areas of arable fields and around floodplain pools, mainly at low altitude (T. Philbrick pers. comm.). It has been reported once from Europe, in 1948 in a peat bog called Despax-Estibière, near Lac d'Orédon in the Pyrenees (Kapp, M. "dans la tourbière Despax-Estibière, près du lac d'Orédon, près de la localité de Fabian dans les Hautes-Pyrénées" 1948 herb. pers. M. Kapp) (Schotsman 1967: 100). The bog is at 2600 m altitude and very isolated. In spite of an extensive search in 2001, no *Callitriche* was found at the site, although *C. palustris* was found nearby. At the time of the record, there was no road to the site, although one was under construction. The degree of isolation of the site, together with its altitude, raise doubts over the record. A specimen in the herbarium of the Muséum National d'Histoire Naturelle (Estibière, nr. Col d'Aumar, 1918–1919, Chouard, P. (**P!**), shows that *C. palustris* occurred at the site well before the record.

Comparison of the descriptions and illustrations provided for type material of *C. peploides* by Fassett (1951) with those of the material from Despax-Estibièrre (Schotsman 1962, 1967) does not support the identification and, in fact, the illustration in Schotsman (1967, pl. VIII V₂) more closely resembles *C. palustris* L. The original material must be compared with confirmed material of *C. peploides* var. *semialata* and var. *media* before the record can be considered valid.

C. brevistyla Lansdown sp. nov. (Fig. 1).

Holotype: Sösdala stn., Skåne, Sweden, 08 February 2001, Karlsson, T. (NMW!).

Planta terrestris, in limo udo. Folia 2.5–6.2 × 1.6–3.0 mm, elliptica vel elongatoelliptica, integra, ad apicem incisura parva vel nulla praedita, omnia nervos tres (unum primarium medium, duo secundarios), aliquot venas additas anastomosantes a nervis secundariis inter has et folii marginem exorientes ferentia. Bracteolae 0.3–0.4 mm, in axillis omnibus flores continentibus effectae, translucidae, exalbidae ut videntur, falcatae, persistentes. Utraque axilla geminata paene semper (93%) florem unum masculum unumque feminium, paris una rarius feminium solitarium vel rarissime masculum solitarium continens. Filamentum cum floris femini pedunculo exoriens. Pollinis granum 20–30 × 20–30 µm, ovoideoellipsoideum vel sphaericum, luteum, ornamentis valde (sed mihi ignote) notatum. Stylus brevissimus, 0.17–0.29(–0.32) mm, erectus. Fructus 0.65–0.84 × 0.86–1.12 mm, aliquantum latior quam altior, ad basin paulo attenuatus, sessilis, mericarpiis 1–4, parallelis; fructus maturus niger, mericarpiis ad basin quam ad apicem valde crassioribus; testae cellulae in annulis ordinatae, crystallae (ex conjectura calcii oxalatis) continentes. Ala 0.04–0.08(–0.16) mm in latere, 0.05–0.14(–0.16) mm in apice, ad apicem latior. Fibrillae validae, simplices vel non tortuose dendroideae, solum in alarum cellulis effectae.

Plant terrestrial, on wet mud. Leaves 2.5–6.2 × 1.6–3.0 mm, elliptic to elongate-elliptic, entire and with little or no notch at apex, all with three veins (a primary midrib and two secondary veins) and a few with additional anastomosing veins arising from the secondary veins between these and the leaf margin. Bracts 0.3–0.4 mm, in all axils containing flowers, translucent, appearing whitish, falcate, per-

sistent. Each of a pair of axils almost always (93%) containing one staminate and one carpellate flower, less often one of a pair containing a solitary carpellate flower or very occasionally a solitary staminate flower. Filament arising with pedicel of carpellate flower. Pollen grain 20–30 × 20–30 µm, ovoid-ellipsoid to spherical, yellow, strongly ornamented. Style very short, 0.17–0.29(–0.32) mm, erect. Fruits 0.65–0.84 × 0.86–1.12 mm, somewhat wider than high, tapering slightly to base, sessile, with 1–4 parallel mericarps; mature fruits black, with mericarps distinctly thicker at base than at apex; testa cells in rings, containing crystals (presumably of calcium oxalate). Wing 0.04–0.08(–0.09) mm on side, 0.05–0.14(–0.16) mm at apex, wider at apex. Fibrils strong, simple to mildly dendroid, only developed in wing cells.

In 1992 a terrestrial *Callitriche* was found growing as a weed in a commercial greenhouse in Sweden and identified as *C. deflexa* A.Br. ex Hegelm. (Martinsson 1994). I obtained live material from the population and cultivated it for a year, to prepare a botanical description. Morphological characters showed that it could not be *C. deflexa* A.Br. ex Hegelm. and, in fact, did not conform to any described taxon. It is therefore described here as a new species, named *C. brevistyla* Lansdown because of its strikingly short style.

The plant belongs to the group of strictly terrestrial *Callitriche* taxa as, when inundated, it does not produce flaccid submerged leaves lacking stomata and does not form rosettes at the water surface. It also bears crystals within the cells of the fruits, a feature peculiar to terrestrial members of the genus (Fassett 1951, Schotsman 1967). The diagnostic features of *C. brevistyla* Lansdown are the large, persistent bracts, which appear whitish and are clearly visible to the naked eye, and the extremely short style. Although information on the terrestrial members of the genus is at best poor, *C. brevistyla* Lansdown appears to be most closely related to the terrestrial taxa occurring naturally in Australasia (*C. aucklandica* Mason, *C. brachycarpa* Hegelm., *C. capricorni* Mason and *C. sonderi* Hegelm.) which are unusual among terrestrial *Callitriche* taxa in bearing bracts.

In all but seven of the described *Callitriche* taxa for which data are available the fully developed style exceeds 1 mm. Of the seven in which the style is equal to or less than 0.5 mm,

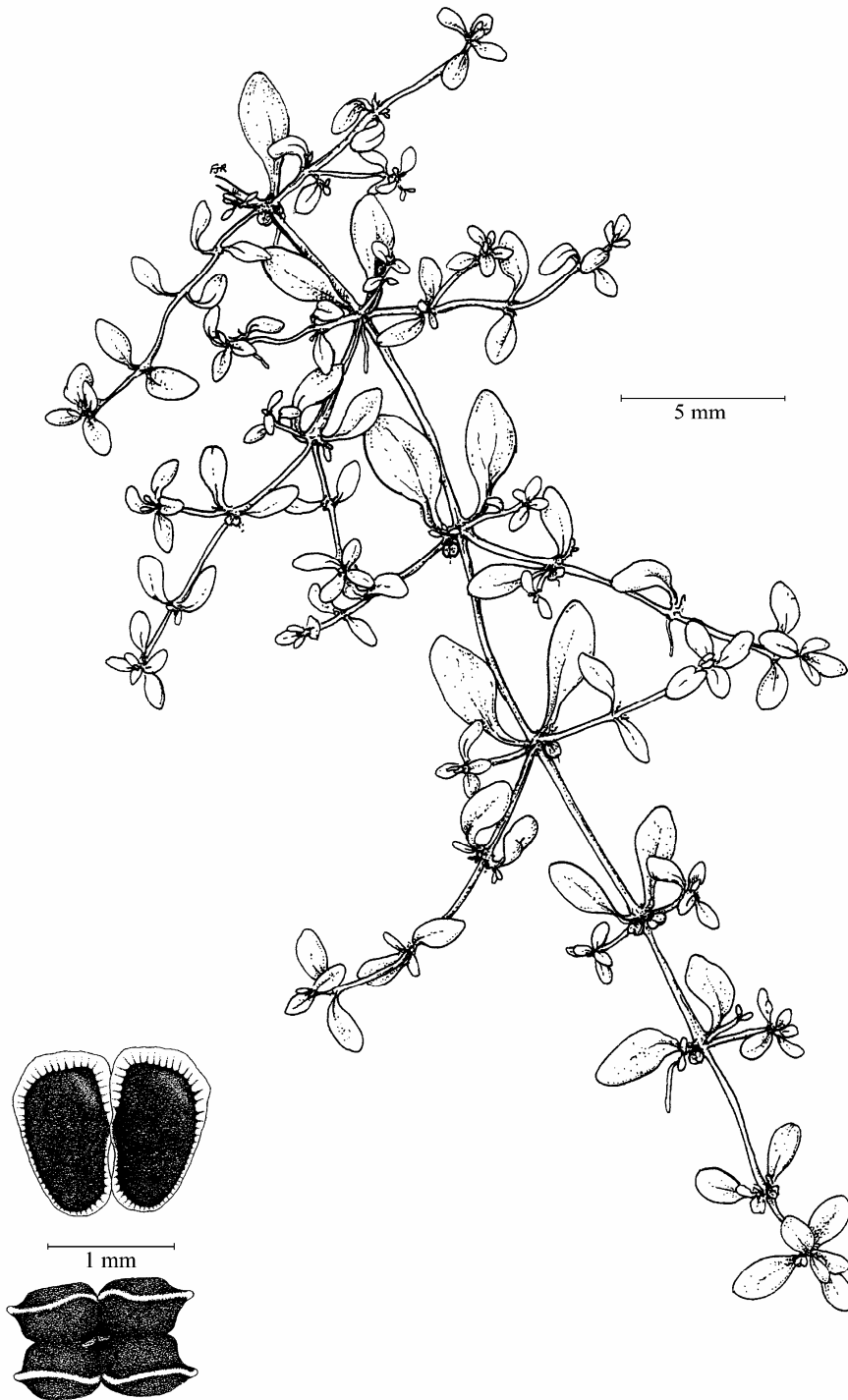


FIGURE 1. *Callitriche brevistyla* showing growth form and details of ripe fruits.

the filament of *C. capricorni*, *C. cycloptera* Schotsm. and *C. sonderi* arises from the pedicel of the carpellate flower (Schotsman 1985); *C. deflexa* Br., *C. peploides* Nutt. and *C. japonica* Hegelm. lack bracts; the fruit of *C. deflexa* is long-pedunculate; that of *C. peploides* is winged only at the apex or unwinged (Fassett 1951); in *C. japonica*, ripe fruits are widest at the apex, tapering toward the base and *C. compressa* N. Brown is amphibious; the plant described here as *C. brevistyla* clearly does not belong to any of these taxa. Of the taxa for which no data on style length are available, all except *C. lechleri* Fassett are amphibious; *C. lechleri* has fruits 1–1.2 mm × 1–1.4 mm and significantly larger than those of *C. brevistyla*.

All known material of *C. brevistyla* derives from a population found in a glasshouse near Sösdal in Skåne, Sweden (Martinsson 1994). It was growing on wet soil under pot-shelves and had probably arrived with plant material from abroad. The glasshouse was empty at the time, but had at times been used for the cultivation of *Pelargonium* and *Impatiens* imported from Denmark, as well as azaleas imported from Belgium. The population was still growing in 2001 when Thomas Karlsson sent me material and I have successfully germinated abundant plants from seed stored for over a year in soil. I am not aware of any immediate cause for concern regarding the future of the species, but it is very important to try to locate wild populations. Review of herbarium specimens has shown that many terrestrial *Callitriche* plants are recorded as *C. deflexa*, almost by default. A first step toward location of natural populations of *C. brevistyla* would be to carry out a comprehensive review of material of terrestrial *Callitriche* in herbaria.

NEW TAXA AND COMBINATIONS

C. hermaphroditica L. subsp. *macrocarpa* (Hegelmaier) Lansdown, **comb. nov.**; *C. brutia* Petagna var. *hamulata* (Kütz. ex W. D. J. Koch) Lansdown, **comb. nov.**; *C. brevistyla* Lansdown, **sp. nov.**

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