

Notes on the genus *Callitriche* (Plantaginaceae) in South Africa

RICHARD V. LANSDOWN^{1,2}, RENE GLEN³ & GUSTAVO HASSEMER⁴

¹ Ardeola Environmental Services, 45 The Bridle, Stroud, Glos. GL5 4SQ, rlansdown@ardeola.demon.co.uk

² Honorary Research Associate, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE

³ 46 Park Crescent, Forest Hills, Kloof, Pinetown, 3624, South Africa, lissie1@telkomsa.net

⁴ Statens Naturhistoriske Museum, Københavns Universitet, Sølvgade 83 S, 1307 Copenhagen, Denmark, gustavonaha@gmail.com

Abstract

Historically there has been confusion over the status and identification of *Callitriche* species in South Africa. Review of herbarium specimens and fieldwork have enabled confirmation of the presence of *C. deflexa* as a naturalised species in this country and confirmed that *C. compressa* and specimens named as *C. bolusii* are conspecific. Field surveys showed that *C. compressa* still occurs in the areas from which most historic collections were made with no evidence of a decline, it is widespread but local in Kwa-Zulu Natal and Eastern Cape Provinces and extends into eastern Western Cape Province. However because it is known from only five widely scattered sites, it is classed as Vulnerable under the IUCN Red List. We also typify here the names *C. compressa* and *C. deflexa*.

Key words: *Callitriche bolusii*, *Callitriche compressa*, *Callitriche deflexa*, distribution, ecology, taxonomy

Introduction

Three *Callitriche* Linné (1753: 969) species have been reported from South Africa, *C. compressa* Brown (1912: 276) was described in 1912 based on material from Umbilo in what is now within the city limits of Durban in Kwa-Zulu Natal Province. Thirteen years later the name *C. bolusii* Schönland & Pax in Marloth (1925: 141) was given to plants from Transvaal, but without providing a diagnosis or description. More recently, *C. deflexa* A.Braun ex Hegelmaier (1864: 58) was reported as a non-native from a nursery near Pietermaritzburg (Cook 2004). There has been confusion over the identity and status of *Callitriche* species in South Africa since recording began and this is clearly evident from the classification of both *C. compressa* and *C. bolusii*, a name still in use in spite of its invalidity, as Data Deficient (SANBI 2007), while recently they have been considered to be conspecific (e.g. Cook 2004). In general, herbarium specimens may not be adequate to enable reliable taxonomic distinctions between terrestrial *Callitriche* species due to poor representation or preservation of reproductive parts. Therefore, as part of a global project reviewing the conservation requirements of *Callitriche* species, fieldwork was undertaken by the first two authors (RVL and RG) throughout Kwa-Zulu Natal and Eastern Cape Provinces to try to clarify the taxonomy and assess the conservation condition of any valid species recognised.

There are only two specimens identified as *Callitriche* species from South Africa which do not involve *C. compressa* or *C. deflexa*. One specimen cited by Cook (2004) from the Okavango Native Territory (De Winter & Marais 4876, PRE 47455 1721CC) is infertile and therefore could not be confirmed to genus. It shows reddish coloration which is otherwise unknown in the genus and is unlikely to be a *Callitriche*. The area from which it was collected has been searched but no *Callitriche* material found and there is no *Callitriche* material from the area in PSUB (F. Murray-Hudson, pers. comm.). The specimen is no longer with the *Callitriche* material in PRE and is likely to have been redetermined to another genus (A. Mothapu, pers. comm.). Unless more material or live populations are found, this material should not be considered to represent an additional record of a *Callitriche* species. The second specimen collected by Gretel van Rooyen at the Old Tierkloof Homestead, Goegap Nature Reserve, Namaqualand (G. van Rooyen private herbarium), appears to be an aquatic form of a *Callitriche* but is not fertile and it has therefore not been possible to identify it to species.

Materials and methods

A list of sites from which collections of *Callitriche* have been made was compiled from the literature and herbarium specimens. A route was then selected including all sites from which *Callitriche* material had been collected in Kwa-Zulu Natal and Eastern Cape Provinces, which could be visited within a ten day period, starting in Durban, heading north through Kwa-Zulu Natal to Golden Gate National Park and then south-west through Eastern Cape Province to Grahamstown and finally back to Durban. Most of the *Callitriche* collection sites in South Africa were visited and when populations were found descriptive details were collected. Measurements were made using Vernier callipers and descriptions are based on a combination of fresh and herbarium material as there was no measurable difference in the size of parts on drying. The nomenclature presented here follows the Melbourne Code (McNeill *et al.* 2012). All field photographs were taken by RVL. Specimens have been consulted from the following herbaria: G, GH, GRA, K, NMW, NSW, NY, PRE and STU. All specimens listed were seen by RVL. Under additional material studied, records for which no herbarium is cited as repository for a specimen, represent own records based on field observations without specimens.

Callitriche compressa Brown (1912: 276)

Lectotype (designated here):—SOUTH AFRICA. EASTERN CAPE PROVINCE: In mud in stagnant pool, Umbilo, 10 ft. altitude, 28 October 1912 [correctly it should read: 1911], *M. Franks s.n.*, Wood, J.M. 11943, [protologue from Kew Bull. attached] [annotated Ex Herbario Natalensi *Callitriche compressa* N.E. Brown “fl. green”. (K000350084); isoelectotypes: (NH0013002-0, PRE0508515-0, PRE0263581-0).

= *Callitriche bolusiana* Schönland & Pax in Engler (1921: 169), *nom. nud.*

= *Callitriche bolusii* Schönland & Pax in Marloth (1925: 141), *nom. nud.*

Description:—Plant apparently always terrestrial (but see discussion). Stems with a groove running along each of two opposite faces, creeping and rooting at lower nodes. Stem, leaf and axillary scales present. Leaves elliptic or spatulate, 3.0–10.0 × 1.0–3.5 mm: petioles ≤2 mm, 3-veined, 1 central vein and 2 secondary veins originating near the base of the blade. Normally a male and female flower in one axil opposed by a solitary female, less often a male and female in each of a pair of axils and occasionally a solitary female flower in each of a pair of axils. Bracts lacking. Styles persistent, reflexed <0.5 mm. Filaments erect, ≤0.2 mm long. Anther reniform, 0.3–0.6 mm wide. Pollen yellow. Fruits on peduncles 0.1–0.2 mm long, somewhat wider than high and tapering toward the base, brown or blackish when mature, 0.6–7.5 (–8.0) mm × 0.6–0.7 mm, unwinged.

Ecology and distribution:—*Callitriche compressa* has been recorded from the coastal Provinces of Kwa-Zulu Natal, Eastern Cape and Western Cape in southern and eastern South Africa. It occurs on wet mud or sand on the margins of permanent rivers, such as a broad alluvial fan deposited by a stream as it entered a reservoir, a sand bank at the downstream end of a plunge pool formed by a waterfall and on thin soil over bedrock in a shaded forest river, or in seasonally inundated habitats such as a drying oxbow and on clay in a pond probably dug to provide material for road construction. 0–1200 m elevation.

Additional material studied:—KwaZulu-Natal: mud on streamlet bank, Dhlinda forest, Eshowe, 21 January 1963, *R.G. Strey 4579* (K, PRE 741740); dense mat on forest floor in forest, on banks of Mshwati River, Karkloof forest near farm ‘Twinstreams’, Natal, 29° 17’ S, 30° 23’ E, 14 June 1989, *J.O. Wirminghaus 908* (NU) material not flowering but probably this; ‘chord’ [streambank in forest], on mud of river bank, Mshwati River Valley, Karkloof forest, Natal, 2 October 1989, *J.O. Wirminghaus 1049* (NU); growing on a thin layer of soil on bedrock in the Mshwati River channel, damp but not under water, with dense forest on both sides of the channel, L’Abri, Karkloof, 29° 17’ 24.38” S, 30° 23’ 07.29” E, 4 October 2016, *R.V. Lansdown and E. Nel*; one terrestrial plant, exposed firm sand bar, downstream end of plunge-pool, Umbilo River, Paradise Valley Nature Reserve, 29° 50’ 06.19” S, 30° 53’ 41.15” E, 28 October 2016, *R.V. Lansdown and R. Glen*. Eastern Cape: under bushes in Featherstone’s Kloof near Grahamstown, 1700 ft or 1800 ft, 2 November 1890, *H. Bolus 6688* (BOL); Damp places, Grahamstown, Nov. ’90, *S. Schönland s.n.* (GRA); “growing in a swampy place, Kloof between Featherstone’s Kloof and bottom of Woest Hill, near G.T. (Grahamstown), Albany District”, 1350 ft., October 1892, *S. Schönland 348* (BOL, GRA [8 sheets], NH0005435-0, PRE0030227-0, STU); Perie Forest, King Williams Town, April 1893, *H.G. Flanagan 1769* (BOL, PRE 263579); stony /rocky soil, Grahamstown, November 1893, *S. Schönland s.n.* (annotated PRE 46783, PRE 263578); along streams, near Komgha, King Williams Town District, 1200ft. elev., February 1894, *H.G. Flanagan 2220* (GRA, PRE 30215); on sand, Ntafufu, Port St. Johns, 29 August 1969, *R.G. Strey 8972* (PRE 652239); rooted in drying mud at edge

of dam, Besters Hoek, Somerset East, 25 Oct 1980, *O.M. Hilliard & B.L. Burt* 13250 (NU); broad expanse of mud exposed alongside the inflow stream to a small reservoir, Boschberg Municipal Nature Reserve, Somerset East, 32° 42' 06.66" S, 25° 33' 15.13" E, 9 October 2016, *R.V. Lansdown* 2016/3, *A. & A. Hobson* (GRA); long, shallow pond probably created through extraction of gravel for road, mostly dry at the time of survey, Braystone's Farm, Southwell, Bathurst District, 33° 26' 06.81" S, 26° 36' 49.50" E, 18 October 2016, *R.V. Lansdown and R. Glen*; Shallow to deep oxbow in riparian woodland, generally dry or containing damp mud, but with standing water in one area, at the bottom of the hill below Pirie Mission, near King Williams Town, 32° 48' 50.22" S, 27° 13' 53.12" E, 14 October 2016, *R.V. Lansdown, R., H. and M. Glen*. Western Cape: In umbros. ad Silver River, 4000 ft. elev., 6 November 1894, *F.R.R. Schlechter* 5873(G, K, GRA, NSW, PRE 263580).

Discussion

The material of *C. compressa* at Kew (K000350084) is annotated with the name *C. compressa* in N.E. Brown's hand and obviously is part of the original gathering if not the holotype. The handwritten label indicates it as having been collected on 28 October 1912, but has an accession stamp "25 MAR 1912". It is likely that the handwritten label has been copied in early 1912 prior to shipping the material to K hence the confusion of years. The "Diagnoses Africanae" series was commenced in 1894 (Thiselton-Dyer 1894) for species discovered as new during the preparation of the "Flora of Tropical Africa" and naming of new accessions at Kew herbarium, hence the types for all species should be at K unless stated otherwise. Due to the lack of explicit mentioning of the repository of the type directly in the protologue and the existence of duplicates of the original gathering a lectotypification appears necessary here nonetheless (McNeill 2014).

The name *C. bolusiana* was first mentioned by Engler (1921) who cites gatherings from Grahamstown and the Silver River ("welche bei Grahamstown im östlichen Kapland und am Silver River im westlichen Kapland vorkommt"). Nevertheless, this name was not validly published, since it lacks a description or diagnosis (Art. 38.1). Agreeing with Henderson (1958) the line drawings under *C. bolusii* in Marloth (1925) make it possible to identify the plant without doubt as identical with the taxon represented by the material cited in Engler (1921). Further confirming Henderson (1958), the reference to this taxon occurring in Transvaal in Marloth (1925) obviously was erroneous. In contrast to Henderson (1958), we agree with Cook (2004), who considered the name *C. bolusii* not validly published being based on an illustration with analysis only since it was published after 1 January 1908 (Art. 38.8).

In October 2016, RVL and RG surveyed rivers, marshes (vlei) and farm ponds in all the areas from which *C. compressa* has been recorded apart from near Komgha, King Williams Town District (Flanagan 2220), Faure, Stellenbosch Division (Parker 4915), Ntafufu, Port St. Johns (Strey 8972) and the Silver River (Schlechter 5873). Populations of *C. compressa* were found within a few kilometres of each former collection site except in Dhlinza Forest, Eshowe although suitable habitat remains in the area and there is no reason to expect that it will have disappeared. These results, although they still amount to only a handful of records suggest that the species has persisted in most of these areas for 100 years. Although most populations found were small, the area and period of search were minimal and so to have found such a large proportion of historic populations at all is quite remarkable. It seems reasonable to interpret these results as indicating that the overall population is stable and that *C. compressa* occurs in three Provinces of South Africa. However, it has been recorded from very few sites and confirmed from only five very widely separated sites (near Karkloof and Umbilo, KwaZulu-Natal Province; Somerset East, Southwell (near Grahamstown) and below Pirie Mission in Eastern Cape Province) in recent years, therefore although there are no known significant threats to populations, it is classed as Vulnerable D2 under the IUCN criteria (IUCN 2012) because the loss of any one population would significantly reduce the known global population of this species.

All herbarium material seen was terrestrial except one (South Africa. Eastern Cape Province: "growing in a swampy place, Kloof between Featherstone's Kloof and bottom of Woest Hill, near G.T. (Grahamstown), Albany District", 1350 ft., October 1892, *S. Schönland* 348 (BOL, GRA [8 sheets], PRE-30227, STU) which showed variation in leaf size suggesting that it may have grown supported by water, with larger leaves. One plant of hundreds found near Pirie Mission in 2016 showed similar leaf shape variation and it is possible that *C. compressa* can grow as an aquatic.

Callitriche compressa is unique in the genus *Callitriche* as it is the only species known to have a distinctly grooved stem. It differs from other native *Callitriche* species in sub-Saharan Africa in the small size of its fruit. It is also unusual within the genus having unwinged fruits which are narrower at the base than the apex.



FIGURE 1. *Callitriche compressa*, dry part of oxbow, Pirie Mission, Eastern Cape Province, 14 October 2016.



FIGURE 2. *Callitriche compressa*, reservoir margin, Somerset East, Eastern Cape Province, 9 October 2016.



FIGURE 3. *Callitriche deflexa* growing in ornamental beds, Botanical Garden, Durban, Kwa-Zulu Natal Province, 18 October 2016.



FIGURE 4. *Callitriche deflexa* growing in a car park, Umlalazi, Kwa-Zulu Natal Province, 7 October 2016.

***Callitriche deflexa* A.Braun ex Hegelmaier (1864: 58)**

Lectotype (designated here):—BRAZIL. RIO DE JANEIRO: 1859, *F. Rudio s.n.* (STU; isoelectotypes G, GH [3 sheets: 110020570.48927, 110073465.48928 and 110076391.48929], K-000470002, NY, STU).

Note: Hegelmaier (1864) cited three further syntypes (Arkansas, *Engelmann s.n.* 1835; Pennsylvania, in udis ad M. Conolstown, *s.n.*, herb. Vindob.; Philadelphia, ad ripas fl. Lecha, *Moser* 1832, *pro parte*), but considered the Brazilian material to represent the typical form. Consequently a duplicate of the Brazilian collection investigated by him is here designated as the lectotype.

Description:—Plant always terrestrial. Stems terete, creeping and rooting at the nodes. Leaves (1.0–)2.0–4.0 × 0.8–2.3(–3.0) mm, elliptic; petiole 2.07–3.25 mm × 1.04–1.39 mm; petiole 0.58–1.40 mm, 3 veined, 1 central vein and 2 secondary veins originating near the base of the blade. Generally one male and one female flower together in most or all leaf axils; occasionally a solitary male in one of a pair of axils. Bracts lacking. Styles persistent, 0.4–1.6(–1.8) mm, recurved. Filaments erect, ≤ 0.5 mm. Anthers reniform, 0.19–0.35 mm wide. Pollen yellow, subspherical. Fruits wider than long, sessile or on peduncles up to 6.6 mm (Bacigalupo 1979); ripe fruits black, 0.7–1.0 mm wide × 0.56–0.80 mm long, winged throughout.

Ecology and distribution:—This is a species of the coastal region of south-eastern Brazil, Uruguay and north-eastern Argentina (Bacigalupo 1979). It occurs as a non-native in Australia, Mauritius, Morocco, Portugal, Reunion, Taiwan and Tanzania (Schotsman 1977, Cook 2004, Lansdown 2006a, Lansdown 2006b, Bean 2007). In South Africa it has been recorded from various localities in Gauteng, Kwa-Zulu Natal and Mpumalanga Provinces, including the Botanical Garden, Durban, a coastal area at the Raphia Palm Monument, Mtunzini, nurseries at Pietermaritzburg and just outside Amsterdam. In its native range, this species occurs in low-lying, humid areas such as sandy beaches and dry river beds, outside its native range it occurs in a wide range of seasonally or permanently moist conditions such as irrigated areas of nurseries, ornamental beds and greenhouses in botanical gardens, low lying disturbed soil in areas such as un-metalled parking areas and on roadsides.

Additional material studied:—Gauteng: Disturbed clay soil over sandstone in runoff from shade houses, Rosslyn. Malanseuns Nursery, Pretoria District, 10 September 1992, *H.F. Glen* 3051 (PRE 782504). Kwa-Zulu Natal: On damp soil forming dense mat, Carters Nursery, Pietermaritzburg, 20 Oct 1969, *K.D. Gordon-Gray* 6258 (NU); abundant along path sides and on ornamental beds, Durban Botanical Garden, 29° 50' 50.79" E, 31° 00' 29.16" S, 18 October 2016, *R.V. Lansdown & R. Glen*; on the margin of an unmetalled car park, Raphia Palm Monument, Eshowe, 28° 57' 27.37" E, 31° 45' 40.61" S, 7 October 2016, *R.V. Lansdown, M. H.F., & R. Glen*. Mpumalanga: Nugro Seedlings, just outside Amsterdam on the road to Paulpietersburg, Mpumalanga, 2001, *C.D.K. Cook s.n.* (NMW), Western Cape: weed of flowerpots, Somerset West, Stellenbosch Division, 13 September 1953, *R.N. Parker s.n.* (BOL 4908; K) Schotsman (1977); weed of wet ground, Faure, Stellenbosch Division, 27 September 1953, *R.N. Parker* 4915 (BOL, K).

Key to the identification of *Callitriche* species in South Africa

1. Fruits longer than wide, sessile or on peduncle <1 mm, unwinged, stem grooved.....*C. compressa* N.E.Br.
- Fruits wider than long, most or all of them on peduncles >1 mm, narrowly winged throughout, stem terete.....*C. deflexa* A.Braun ex Hegelm.

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