

Nomenclatural notes on southern African *Oxalis* species

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Background: The correct author citation of *Oxalis sonderiana* (Kuntze) J.F.Macbr. and the validity and identity of the species *Oxalis beneprotecta* R.Knuth, *Oxalis bullulata* T.M.Salter and *Oxalis pulchella* Jacq. var. *beneprotecta* (R.Knuth) T.M.Salter are unclear.

Objectives: To resolve the nomenclatural and taxonomic confusion surrounding these four taxa.

Method: We studied relevant herbarium records (especially type material) of all the taxa, and paired this with scrutiny of all publications that bear reference to the nomenclature and taxonomy of these species.

Results: The correct author citation for *Oxalis sonderiana* has been determined; *Oxalis bullulata* is confirmed as a distinct species, and the continued recognition of *Oxalis beneprotecta* as a variety of *Oxalis pulchella* is suggested. It is further ascertained that the name '*Oxalis nidulans* Turcz.' is not a later homonym, but a reference to a misapplication of *Oxalis nidulans* Eckl. & Zeyh. to the type specimen of *Oxalis sonderiana*.

Conclusion: These results clarify the current confusion surrounding these taxa in global herbaria and in national and international databases.

Correct author citation for *Oxalis sonderiana*

In 1860, Sonder described the species *Oxalis minima* Sond. based on the specimen *Zeyher 237* (Sonder 1860:312). This was an illegitimate later homonym, as the combination was already published for three other species of *Oxalis*, namely by Steudel (1821:579), by Don (1831:760) and by Ecklon and Zeyher (1835:92). Kuntze (1891:91) moved several *Oxalis* species to the genus *Acetosella* Kuntze. As the epithet '*minima*' had already been assigned to one of the older species [*Acetosella minima* (Eckl. & Zeyh.) Kuntze = *O. minima* Eckl. & Zeyh.], Kuntze (1891:91) published a *nomen novum* for *O. minima* Sond., namely *Acetosella sonderiana* Kuntze. Knuth (1930:355) again treated all species under the genus *Oxalis* and lists this taxon as *O. minima* Sond. Macbride (1934:8) recognised that *O. minima* Sond. was an illegitimate superfluous name and corrected the name for the South African species while dealing with the South American *O. minima* G.Don. In doing this, Macbride (1934:8) unfortunately used an orthographical variant of the epithet and proposed the name *Oxalis sonderana* (Kuntze) J.F.Macbr. instead of '*sonderiana*'. Two years later, Salter (1936:155) described a variety of this taxon as *Oxalis minima* Sond. var. *alba* T.M.Salter. Salter (1944) later revised the southern African members of *Oxalis*, including the taxon based on the *Zeyher 237* type specimen. At some point between 1936 and the revision, he became aware that the original species epithet was preoccupied, and in Salter (1944:196), he thus superfluously proposed the name *Oxalis sonderiana* (Kuntze) T.M.Salter (an isonym) for this species. He appears to have been unaware of the publication by Macbride (1934), as he does not refer to it in his section entitled 'Previous Systematic Work' (Salter 1944:9).

The work of Salter (1944) has been widely accepted. For this reason, most South African databases [including those of the South African National Biodiversity Institute (SANBI), namely the Botanical Database of Southern Africa (BODATSA; www.newposa.sanbi.org) and the Red List of South African Plants (www.redlist.sanbi.org)], as well as the international database Tropicos (www.tropicos.org), list (or had listed, see below) this species with Salter as final author. In contrast, the International Plant Names Index (IPNI; www.ipni.org) recognises the publication by Macbride (1934:8) and thus correctly lists the species as *Oxalis sonderiana* (Kuntze) J.F.Macbr. This confusion is further exacerbated by notes to the effect that Macbride (1934:8) should be the author rather than Salter (1944:196) on the type specimen in Kew and yet it is listed as *O. sonderiana* (Kuntze) T.M.Salter in the Kew herbarium catalogue. In addition, an accession listed as *Oxalis minima* Sond. (collection *Schlechter 7931*, barcode K000419342!) on the same herbarium sheet is not this species, but is still

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listed as an accession of *O. sonderiana* (Kuntze) T.M.Salter. Salter (1944:198) identified the two plants (top right hand side on the sheet) comprising the *Schlechter* 7931 collection as *Oxalis luteola* Jacq., an identification with which we agree based on the visible bulb and sepal characters (<http://apps.kew.org/herbcat/getImage.do?imageBarcode=K0004193442> – accessed 07 June 2017).

Article 61.4 of the International Code of Nomenclature for Algae, Fungi and Plants (ICN; McNeill et al. 2012) states that:

The orthographical variants of a name are to be corrected to the validly published form of that name. Whenever such a variant appears in a publication, it is to be treated as if it appeared in its corrected form. (p. 122)

This means that the orthographical variant published by Macbride (1934:8) is to be treated as an error to be automatically corrected and, therefore, the publication by Macbride (1934:8) should be accepted as the first valid publication of the combination, given that it predates that of Salter (1944:196). The correct author citation for the species is thus *Oxalis sonderiana* (Kuntze) J.F.Macbr., as listed in IPNI and recently corrected in BODATSA.

Sonder (1860:20*, in a list of Addenda and Corrigenda) seems to be the first to cite the name '*O. nidulans*, Turcz. Bull. Mosc. 1858. No. 2, p. 436' as a synonym of *O. minima*. McBride (1934:8) and Salter (1944:196) both list this name in synonymy, probably merely following Sonder (1860) and not referring to the original publication, as the Russian journal in which the article by Turczaninow (1858) was published would likely not have been easily available to them. Because of these publications, it is generally accepted, and also listed as such on IPNI, that the name '*O. nidulans* Turcz.' is a later homonym. However, Turczaninow did not publish a new name, but specifically accredits the name to Ecklon & Zeyher. He lists *Zeyher 237* as being representative and mentions the following about the specimens in his herbarium:

Descriptio satis quadrat, praeter tuberculum in speciminibus meis deficientem [Compares well enough with the description, except for the lack of a tubercle (we interpret this to mean bulb) in my specimens]. (p. 436)

The lack of bulb material on *Zeyher 237* undoubtedly contributed to the confusion, as the bulbs of *O. nidulans* and *O. sonderiana* differ markedly. We therefore believe that Turczaninow (1858:436) did not publish a new name, but merely misapplied the name *O. nidulans* Eckl. & Zeyh. to *Zeyher 237*, which was later chosen as the type of *O. minima* by Sonder (1860:336). The mere mention of *Zeyher 237* by Turczaninow (1858) does not constitute typification of *O. nidulans* Eckl. & Zeyh. with this specimen, because he does not use the term 'type' or equivalent, nor does he provide explanation in this article that the specimens mentioned should be treated as types (Art. 7.10, McNeill et al. 2012). As Ecklon and Zeyher (1835:92) earlier cited a single collection from 'Pampoenkraal' in the protologue, this specimen (Ecklon & Zeyher 724) is the holotype of *O. nidulans*.

Oxalis sonderiana (Kuntze) J.F.Macbr. in *Candollea* 6: 8 (1934), as '*sonderana*'; *Acetosella sonderiana* Kuntze in *Revis. Gen. Pl.* 1: 91 (1891); *Oxalis nidulans* auct. sensu Turcz. in *Bull. Soc. Imp. Nat. Mosc.* 31,2: 436 (1858), non Eckl. & Zeyh. (1836); *Oxalis minima* Sond. in *Fl. Cap.* 1: 336 (1860), *nom. illegit.* non Steud. (1821), nec G.Don (1831), nec Eckl. & Zeyh. (1835); [*O. sonderiana* (Kuntze) T.M.Salter' in *J. S. Afr. Bot.*, Suppl. vol. 1: 196 (1944), *nom. superfl.*]. Type: [South Africa, Namaqualand], Grootriet, *Zeyher 237* (S11-2967, lecto. here designated; GRA0001610-1!, GRA0001610-2!, K000419345!, P00390732!, PRE0456167-1, SAM0030412!, W0009104!, isolecto.).

Note: Salter (1944:198) specifically states that the type of *O. sonderiana* (*Zeyher 237*) is in the Sonder Herbarium. The first set of the South African collections made by Ecklon & Zeyher was acquired by Sonder. After Sonder's death, his herbarium was sold in several parts, the most important of which are currently housed at S and MEL. S houses the South African set of Ecklon & Zeyher specimens (Stafleu & Cowan 1985). A note on the sheet of *Zeyher 237* at S indicates that it came from the Sonder Herbarium. We therefore choose this sheet as lectotype. Our choice is further supported by the fact that this specimen is well preserved and includes many flowering individuals. Unfortunately, this specimen does not contain bulb material, but it still represents the best material available as lectotype, with copies available in various international herbaria, including SAM.

Identity of *Oxalis beneprotecta* and *Oxalis bullulata*

A further taxonomic issue regarding southern African *Oxalis* taxa involves the identity and validity of *O. beneprotecta* Dinter ex R.Knuth and *O. bullulata* T.M.Salter. *Oxalis beneprotecta* is based on the type specimen *Dinter 5182* from Namibia. Salter (1944:151) demoted this taxon to a variety of the widespread and variable *O. pulchella* Jacq., as *O. pulchella* var. *beneprotecta* (Dinter ex R.Knuth) T.M.Salter. It shares the typical *O. pulchella* characters of a large bulb (3 cm – 6 cm in length), well-developed papery bracts on the sturdy rhizome and hairy petioles, and appears to intergrade smoothly into the other varieties of *O. pulchella*. It differs from all other varieties of *O. pulchella* in being a smaller plant with a much larger number of leaves arranged in a rosulate basal tuft. Salter saw at least the type of *O. beneprotecta* (*Dinter 5182*) and also made several of his own collections of what he interpreted to be this taxon (Salter 1944:151). Regarding his own collections, Salter (1944) mentioned that:

Dinter's specimens are less hairy and have far fewer leaves than those from Louwspoor and Kamieskroon [Salter's Namaqualand collections], which were growing in rock crevices and had large distorted bulbs, but the two forms are evidently not separable. (p. 151)

Salter possibly considered his own collections as morphological intermediates to the Namibian forms, although it must be acknowledged that this is our interpretation.

Quite separately, Salter (1936:49) described the species *Oxalis bullulata* T.M.Salter based on the type specimen *Salter 5552*

and synonymised the manuscript name '*O. parvicormus* Dinter' based on *Dinter* 6372 (Dinter 1931:167) under it. He viewed it as a distinct species primarily because of the very different bulb – *Oxalis bullulata* has a small bulb (half to a third the length of the bulb of *O. pulchella*) with a characteristic puckered appearance to the tunics (to which the epithet '*bullulata*' refers). Both *O. pulchella* var. *beneprotecta* and *O. bullulata* were maintained in the Salter (1944:151, 164) monograph on *Oxalis*, and there is no question that he considered these entirely separate entities.

Schreiber (1966:5; 1967:296) revised the Namibian species of *Oxalis* and rejected the taxonomic placements by Salter (1936:49). She accepted *O. beneprotecta* as a good taxon at species level and synonymised *O. bullulata* and *O. parvicormus* under this species. Having examined three isotypes of *O. bullulata*, Schreiber (1966:5) further stated her certainty that *O. bullulata* is identical to *O. beneprotecta* and therefore synonymised the former under the latter, despite the demonstrable morphological differences. Despite acknowledging that she had never seen Salter's Namaqualand specimens of *O. bullulata*, and stating that they may not belong to *O. beneprotecta*, Schreiber (1967:296) nevertheless still listed them under *O. beneprotecta*. These taxonomic changes were accepted in the *List of Species of Southern African Plants* by Gibbs Russel et al. (1987:99), from where they were propagated to many databases, both in South Africa (BODATSA and the Red List of South African Plants) and internationally (e.g. Tropicos).

We here wish to clarify the taxonomic confusion surrounding these taxa by accepting the circumscriptions of Salter (1936:49; 1941:167; 1944:151, 164). The morphological differences between the two taxa as described above are clear from the type specimens (digital versions available at http://ww2.bgbm.org/herbarium/images/B/10/01/59/92/b_10_0159928.jpg and http://plants.jstor.org/stable/10.5555/al.ap.specimen.bol136446?searchUri=filter%3Dname%26so%3Dps_group_by_genus_species%2Basc%26Query%3Doxalis%2Bbullulata). Our morphological assessment based on other herbarium collections in the STEU, NBG, SAM and BOL herbaria, and many field samples, has confirmed the separate identities of *O. beneprotecta* and *O. bullulata* beyond reasonable doubt. *Oxalis bullulata* is, morphologically at least, a good species worthy of recognition, and the manuscript name '*O. parvicormus*' (based on *Dinter* 6372) is a synonym thereof. We are less certain of the taxonomic level at which to recognise *Oxalis beneprotecta* – it might very well be a species separate from *O. pulchella*, although it has many morphological similarities with this species. The precise species boundaries here require greater sampling as well as the acceptance of a coherent species concept for this morphologically variable genus. Until such data are available, we prefer to retain *O. beneprotecta* as a variety of *O. pulchella*, as *O. pulchella* var. *beneprotecta* (R.Knuth) T.M.Salter.

***Oxalis bullulata* T.M.Salter** in *J. S. Afr. Bot.* 2: 49 (1936). Type: South Africa, Namaqualand, 10 miles north-west of Steinkopf, *Salter* 5552 (BOL136446!, holo.; K000417359!, NBG0107089-0!, iso.).

['*O. parvicormus* Dinter' in *Repert. Spec. Nov. Regni Veg.* 29: 167, 168 (1931), *nom. nud.* as for: Südwestafrika [Namibia], Buchuberge, Küstengebiet, *Dinter* 6372 (M0172240!); Buchuberg, S.W. Africa, *Dinter* 6472 (SAM0072757!)]

***Oxalis pulchella* Jacq. var. *beneprotecta* (R.Knuth) T.M.Salter** in *J. S. Afr. Bot.*, Suppl. vol. 1: 151 (1944); *O. beneprotecta* Dinter ex R.Knuth in *Pflanzenr.* (Engler) *Oxalidac.*: 355 (1930). Type: [Namibia], Vahldorn, *Dinter* 5182 (B 10 0159928!, holo.; AMD.82867!, BOL136447!, HBG509416!, HBG509417!, M0108543!, PRE0454873-1!, PRE0454873-2!, PRE0454873-3!, PRE0454873-4!, SAM0072763-0!, iso.).

Note: The sheet of the holotype at B has been wrongly encoded on www.plants.jstor.org as *Dinter* 5162. The sheet at SAM has been wrongly encoded as *Dinter* 5782.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

L.L.D. and K.C.O. studied and compared the plant material of all relevant specimens. R.R.K. provided the impetus for the paper by initially querying the correct author citation of *O. sonderiana* and assisted considerably with the more complex aspects of the nomenclature. L.L.D. wrote the manuscript, and both co-authors commented on two drafts thereof.

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