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## *Trithuria brevistyla* (*Hydatellaceae*), a new combination for the New Zealand endemic species from the South Island

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**Abstract.** A new combination, *Trithuria brevistyla* (K.A.Ford) de Lange & Mosyakin, is proposed for the recently described New Zealand, South Island endemic taxon originally published as *T. inconspicua* subsp. *brevistyla* K.A.Ford. Species rank for that taxon is advocated on the basis of morphological and reproductive distinctions between that species and the closely related North Island, New Zealand endemic *T. inconspicua* Cheeseman sensu stricto. Some general considerations on optional species versus subspecies ranks for plant taxa in need of conservation are provided.

**Keywords:** conservation, endemic species, *Hydatellaceae*, new combination, New Zealand, nomenclature, taxonomy, *Trithuria*

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**Резюме.** Нова комбінація *Trithuria brevistyla* (K.A.Ford) de Lange & Mosyakin запропонована для шойно описаного з Південного острова Нової Зеландії ендемічного таксона, що був опублікований як *T. inconspicua* subsp. *brevistyla* K.A.Ford. Видовий ранг для цього таксона обґрунтований на основі його морфологічних та репродуктивних відмінностей від близько спорідненого виду *T. inconspicua* Cheeseman sensu stricto, який є ендеміком Північного острова Нової Зеландії. Обговорені деякі загальні міркування щодо можливості визнання видового або підвидового рангу таксонів рослин, що потребують охорони.

**Ключові слова:** *Hydatellaceae*, *Trithuria*, ендемічний вид, Нова Зеландія, нова комбінація, номенклатура, охорона, систематика

### Introduction

*Trithuria* Hook. f. (*Hydatellaceae* U.Hamann) is a genus of ca. 12 currently recognized species, or probably 15 or more species, as new data on cryptic taxa suggest (Sokoloff et al., 2019). At least eleven (or more) of these occur in Australasia, with one species, *T. konkanensis* S.R.Yadav & Janarth., being endemic to India (Yadav & Janarthanam, 1994, 1995; Sokoloff et al., 2008, 2011; Iles et al., 2012). *Trithuria* species are mostly annual, small plants, whose reproductive biology, reproductive unit and fruit morphology are considered important

taxonomic characters (Sokoloff et al., 2008, 2011; Iles et al., 2012). *Trithuria filamentosa* Rodway (= *Hydatella filamentosa* (Rodway) W.M.Curtis) from Tasmania and *T. inconspicua* Cheeseman (= *Hydatella inconspicua* (Cheeseman) Cheeseman) from New Zealand seem to be the only perennial species in the genus.

Earlier the members of *Hydatellaceae* were treated in the genera *Trithuria* sensu stricto and *Hydatella* Diels (now included in *Trithuria*; see Sokoloff et al., 2008, 2011; Iles et al., 2012; etc.). In almost all recent phylogenetic systems of angiosperms (e.g. Cronquist, 1981; Dahlgren et al., 1985; Takhtajan, 1987, 1997, 2009; Hamann, 1998; APG, 1998; APG II, 2003) the family

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was usually placed in or near commelinoid monocots (!); however, the unusual characters and uncertain phylogeny of that group were also acknowledged (for example, by Dahlgren et al., 1985; see an overview in Sokoloff et al., 2011).

The surprising discovery (Saarela et al., 2007) of the real phylogenetic position of *Hydatellaceae* close to or within *Nymphaeales* Salisb. ex Bercht. & J.Presl, among the early-branching lineages of angiosperms, stimulated much interest of researchers and resulted in numerous important publications on morphology, anatomy, genetics, phylogeny, evolution, biogeography, and other aspects of these plants (see overviews and relevant references in Sokoloff et al., 2011, 2019; Smissen et al., 2019; etc.). A new infrageneric system of *Trithuria* (incl. *Hydatella*) was proposed, in which the New Zealand species *T. inconspicua* was placed in *Trithuria* sect. *Hydatella* (Diels) D.D.Sokoloff, Iles, Rudall & S.W.Graham (Iles et al., 2012), together with Tasmanian *T. filamentosa* and Australian mainland taxa *T. australis* (Diels) D.D.Sokoloff, Remizowa, T.D.Macfarl. & Rudall (sensu lato, see below) and *T. austinensis* D.D.Sokoloff, Remizowa, T.D.Macfarl. & Rudall. Despite the initial reluctance of some researchers to accept the new phylogenetic placement of *Hydatellaceae* (e.g. Tillich et al., 2007), now the position of the family in *Nymphaeales*, together with *Nymphaeaceae* Salisb. and *Cabombaceae* Rich. ex A.Rich., is firmly established (APG III, 2009; APG IV, 2016).

### ***Trithuria* in New Zealand: one species or two?**

Smissen et al. (2019) recognized a new subspecies of the New Zealand endemic *Trithuria inconspicua*, subsp. *brevistyla* K.A.Ford. This western South Island subspecies they distinguished from the western Northland, North Island *T. inconspicua* subsp. *inconspicua* on the basis of its shorter stature, carpels covered in short stigmatic hairs forming a knobby "capitate head", ovoid to globose fruits, and scapes which do not elongate at maturity. Subspecies rank was chosen because North Island and South Island populations are allopatric, forming two distinct genetic clusters with a "closer relationship" to each other than to the also allopatric Tasmanian endemic *T. filamentosa*, and exhibiting predominantly selfing or asexual reproduction (Smissen et al., 2019). Notably, *Trithuria inconspicua* subsp. *brevistyla* was considered to be apomictic because as yet no male reproductive units have been seen. This rank decision was followed by the

statement that "given these factors, choice of rank is inevitably somewhat arbitrary" (Smissen et al., 2019: 8).

A taxonomic survey of other *Trithuria* taxa notes the highly conserved morphological nature of the genus, with many species distinguished from each other only by minor floral and fruit characters; however, the reproductive biology and sex expression of the species are also important (Sokoloff et al., 2008, 2011; etc.). On those considerations alone, *T. inconspicua* subsp. *brevistyla* merits elevation to species rank. The view that *T. inconspicua* subsp. *brevistyla* has a closer genetic relationship to subsp. *inconspicua* than to the geographically distant (ca. 2400 km separation) Tasmanian endemic *T. filamentosa* is wholly expected, considering the geographic separation between both countries, their different geological histories and tectonic states, as well as the generally younger age of many components of the New Zealand flora, and the widespread hybridization within it, often resulting in very close relationships amongst its plant species (Heenan et al., 2017; McGlone, 1985; McGlone et al., 2007; Meudt et al., 2009; Mildenhall, 1980; Miller et al., 2017; etc.). The decision to cite genetic distance as a basis in deciding taxonomic rank needs to be taken in that context, as it is hardly unique; after all, there are other morphologically distinct New Zealand species exhibiting similar patterns of genetic variation, which are more closely allied to each other than they are to their Australian congeneric species. Consider New Zealand *Lepidium* (de Lange et al., 2013) and *Myosotis* (Meudt et al., 2014; Meudt, Prebble, 2018) as comparable examples. If genetic distance between Australian – New Zealand congeners was to be taken as a key deciding factor for their taxonomic ranks, then many widely accepted and morphologically discrete New Zealand allopatric species should perhaps also be reduced to subspecies because of their close relationship to each other and genetic distance from allied species in Australia or South America for that matter?

The argument of allopatry as a factor in defining subspecific rank for populations of species exhibiting minor fixed morphological differences is popular in New Zealand (Edgar, 1996; Connor, 1998; de Lange, Murray, 1998; de Lange et al., 1999; de Lange, 2012). However, it is usually applied for allopatric populations exhibiting very minor but consistent differences, such as larger leaves or smaller fruits. This is not the case for New Zealand *Trithuria*. Furthermore, the claim of allopatry needs further study as Smissen et al. (2019) acknowledge there are other South Island populations

of *Trithuria* that they did not study, some because they lacked herbarium specimens or because they could no longer find plants at those sites. They, rightly then, leave those populations out of their treatment of *T. inconspicua* subsp. *brevistyla*. What is not stated though is the possibility that at least some of those populations might belong to *T. inconspicua* subsp. *inconspicua*. Only thorough survey of these locations will be able to tell us otherwise, since South Island *Trithuria*, as its late date of discovery (1993) shows, is notoriously difficult to find even in well-known and apparently well-surveyed locations.

In their new article Sokoloff et al. (2019) reported the existence of cryptic species among self-pollinating members of *Trithuria* sect. *Trithuria* and sect. *Hydatella*. In particular, they demonstrated, using evidence from microsatellite data (SSRs), an expanded molecular phylogenetic analysis, and fruit micromorphology, that Western Australian plants currently classified as *T. australis* sensu lato (sect. *Hydatella*) in fact belong to at least four species; of those four newly detected entities, one was formally described as a new species, *T. fitzgeraldii* D.D.Sokoloff, I.Marques, T.D.Macfarl., Rudall & S.W.Graham. Finally, Sokoloff et al. (2019) concluded that species diversity in *Hydatellaceae* is strongly underestimated. These findings are well in line with our proposed treatment of the South Island *Trithuria* as a distinct species.

Irrespective of the allopatric argument (see above), it is the fact that *Trithuria inconspicua* subsp. *brevistyla* is a smaller statured, most probably apomictic plant, with morphologically distinctive female reproductive units, and ovoid to globose (rather than ellipsoid to ovoid) fruits; because of these differences we think that this taxon merits species rank. On this basis, acknowledging that Smissen et al. (2019) regard that "choice of rank is inevitably somewhat arbitrary", then to be consistent with other global treatments of *Trithuria*, a combination at species rank is here made.

### New combination

*Trithuria brevistyla* (K.A.Ford) de Lange & Mosyakin, comb. nov.

**Basionym:** *Trithuria inconspicua* Cheeseman subsp. *brevistyla* K.A.Ford in Smissen et al., Austral. Syst. Bot. 32(1): 9. 2019.

**Informal name** (provisionally used in de Lange et al., 2018: 34): "*Trithuria* aff. *inconspicua* (CHR 502359; South Island)".

**Type:** New Zealand: South Island, Southland, Lake Hauroko, Mary Bay, east side, 12 Mar. 2015, K.A. Ford KF448 & R.D. Smissen (holotype: CHR 638456; isotype: AK: see Smissen et al., 2019: 9).

### Species versus subspecies: some conservation-related considerations

The problem of taxonomy's impact on efficient conservation of species and/or infraspecific taxa was discussed in many publications (e.g. Ryder, 1986; Ryder et al., 1988; Mosyakin, 2000; Isaac et al., 2004; Haig et al., 2006; Padial, De la Riva, 2006; Garnett, Christidis, 2007; Mallet, 2007, 2013; Morrison III et al., 2009; Sangster, 2009; Casacci et al., 2014, and references therein). The term "taxonomic inflation" was even coined for cases when "known subspecies are raised to species as a result in a change in species concept, rather than to new discoveries" (Isaac et al., 2004: 464), especially when it is done to avert the concern that conservation management priorities should be set at "species" rank rather than encompassing all named ranks (Joseph et al., 2008; cf. de Lange et al., 2010). In our opinion, this is not the case with *Trithuria brevistyla* as discussed above.

Garnett and Christidis (2007: 189), who emphasized the cases of conservation of birds, concluded that "Curiously the bureaucratic activity that attends shifting taxa from subspecies to species actually influences very little with respect to the implementation of conservation legislation". Similarly, Morrison III et al. (2009: 3201) "found no evidence of a **consistent** effect of taxonomic change on conservation, **although splitting taxa may tend to increase protection...**" [emphasis added – P.dL. & S.M.].

Mallet (2013: 47) concluded that "Today's conservationists are reducing emphasis on species conservation, and are becoming increasingly aware of biodiversity at all the levels of the hierarchy of life, including well-marked subspecies. Thus, the legislative need for differentiating local races as species may ultimately become less important provided that future legislation falls more into line with the prevailing biological thought".

Despite these optimistic opinions, government officials, general public, and even botanists and conservationists, at least in some countries, tend to pay less attention to conservation of infraspecific taxa, or to ignore them (Mosyakin, 2000).

Garnett and Christidis (2007: 189) commented that "for the most part, the people drafting international agreements or national legislation have carefully avoided defining "species" in any way that takes sides in the scientific debate... <...> None of the conventions or laws [of those mentioned in the article] <...> state definitively that taxa below the level of species are to be ignored...".

Indeed, in most international conventions and national official documents no clear distinction is made intentionally between species *versus* subspecies and other infraspecific entities in terms of their conservation needs.

For example, rather paradoxically from a traditional taxonomic viewpoint but quite reasonably for conservation purposes, Article 1(a) of the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES: [www.cites.org](http://www.cites.org)) defines the term "species" (for the purposes of CITES) as "any species, subspecies, or geographically separate population thereof".

The *IUCN Red List Categories and Criteria* manual (IUCN Species Survival Commission, 2012) does not include the word "subspecies", while the word "species" is mentioned many times. It is stated, although, that the IUCN "criteria can be applied to **any** taxonomic unit at or below the species level. In the following information, definitions and criteria the term 'taxon' is used for convenience, and may represent species or lower taxonomic levels, including forms that are not yet formally described" (IUCN Species Survival Commission, 2012: 4). It may be concluded from that that both species and subspecies ranks (as well as any other infraspecific entities) are equally suitable for conservation purposes as outlined by IUCN.

However, another IUCN document, the *Guidelines for Using the IUCN Red List Categories and Criteria* (IUCN Standards and Petitions Subcommittee, 2017: 4), states that "taxa below the rank of variety (e.g. forma, morph, cultivar), are NOT included on the IUCN Red List, with the exception of assessments of subpopulations. Before assessments of taxa below the species level (subspecies, variety or subpopulation) can be included on the IUCN Red List, an assessment of the full species is also required".

Moreover, the reasons for a transfer between IUCN categories include changes in taxonomy ("The new category is different from the previous owing to a taxonomic change adopted during the period since the previous assessment") and must be documented

as one of the following: "Such changes include: *newly split* (the taxon is newly elevated to species level), *newly described* (the taxon is newly described as a species), *newly lumped* (the taxon is recognized following lumping of two previously recognized taxa) and *no longer valid/recognized* (either the taxon is no longer valid e.g. because it is now considered to be a hybrid or variant, form or **subspecies** [emphasis added – P.dL. & S.M.] of another species, or the previously recognized taxon differs from a currently recognized one as a result of a split or lump)" (IUCN Standards and Petitions Subcommittee, 2017: 12). It looks as, if we follow *verbatim* the above guidelines, a species can be potentially excluded (delisted) from the IUCN Red List just because of its nomenclatural transfer from the species to subspecies rank.

Interestingly, the Summary Statistics page (<https://www.iucnredlist.org/resources/summary-statistics>, accessed 15 April 2019) of the IUCN Red List website states that "All of the statistics presented in the summary tables are **for species only** (i.e. they **do not include subspecies**, varieties or geographically isolated subpopulations or stocks)" [emphasis added – P.dL. & S.M.]. Consequently, despite the widely declared equality of species and subspecies for conservation purposes (including legal ones), subspecies often receive less attention in conservation as compared to recognized species.

Thus, considering the above arguments, we think it advisable, in cases when species and subspecies ranks are considered as equally (or almost equally) acceptable options and when there are no strictly scientific (taxonomic, evolutionary, genetic, etc.) obstacles against using either of these ranks, to prefer the species status for plant taxa in need of conservation, especially those of the high-risk categories. That is, in our opinion, the case with *Trithuria brevistyla*, for which Smissen et al. (2019) proposed a conservation status of *Nationally Endangered A (3/1)*, and which merits species-rank recognition for both taxonomic and conservational reasons.

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