



<https://doi.org/10.15407/ukrbotj77.02.073>

## *Solenogyne christensenii*, comb. nov. (*Asteraceae: Astereae*), a new combination for a New Zealand species

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de Lange P.J., Wang J., Barkla J.W., Marshall A. 2020. *Solenogyne christensenii*, comb. nov. (*Asteraceae: Astereae*), a new combination for a New Zealand species. *Ukrainian Botanical Journal*, 77(2): 73–80.

**Abstract.** The new combination *Solenogyne christensenii* (Petrie) de Lange, Jian Wang ter & Barkla comb. nov. is validated for a New Zealand species originally published as *Abrotanella christensenii* Petrie. The species is described, illustrated and differentiated from similar and related taxa. The species is seriously threatened, being known with certainty only from the South Island of New Zealand where there is one extant population in Otago, though the species was also known historically from the type locality, Hanmer Plain, North Canterbury.

**Keywords:** *Abrotanella*, *Asteraceae*, *Astereae*, flora, new combination, New Zealand, *Solenogyne*, *Solenogyne christensenii*, taxonomy

Submitted 22 April 2020. Published 29 April 2020

де Ланге П.Дж., Ван Цзянь, Баркла Дж.В., Маршалл Е. 2020. *Solenogyne christensenii*, comb. nov. (*Asteraceae: Astereae*), нова комбінація для виду з Нової Зеландії. *Український ботанічний журнал*, 77(2): 73–80.

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**Реферат.** Нова комбінація *Solenogyne christensenii* (Petrie) de Lange, Jian Wang ter & Barkla comb. nov. запропонована для виду з Нової Зеландії, який до того був описаний як *Abrotanella christensenii* Petrie. Подано опис та ілюстрації виду, вказані його відміни від подібних та споріднених видів. Цей вид перебуває під загрозою зникнення, оскільки він достовірно відомий лише з Південного острова Нової Зеландії, де збереглася лише одна популяція в регіоні Отаго, хоча раніше вид був також відомий з типового місцезнаходження на рівнині Хенмер у північній частині регіону Кентербері.

**Ключові слова:** *Abrotanella*, *Asteraceae*, *Astereae*, *Solenogyne*, *Solenogyne christensenii*, нова комбінація, Нова Зеландія, таксономія, флора

## Introduction

The genus of *Solenogyne* Cass. was established by Cassini (1828) for those plants that resemble *Lagenophora* Cass.; the latter is now recognized as a genus containing ca. 25 species occurring mainly in Australasia, South America, and southern and south-eastern Asia (Wang, Bean, 2019). Cassini (1816) initially published this as "*Lagenifera*", the spelling of which he later corrected to *Lagenophora* (Cassini, 1818), and that latter spelling was conserved (Art. 14.11 of the ICN: Turland et al., 2018) following the nomenclatural proposal by Nicolson (1996). Subsequently the two genera (*Solenogyne* and *Lagenophora*) were united by Hooker (1860) and Bentham (1867), and this was followed by Maiden and Betche (1916). It was Davis (1950) who revised and reinstated *Solenogyne* as a distinct genus. Her research was followed by Cabrera (1966) who further distinguished the two genera by differences in their achenes, e.g., those of *Solenogyne* are without a beak and glands.

As currently circumscribed, *Solenogyne* includes four species (Fig. 1, 2): three in Australia and one in Japan. At the time when the genus was erected, there was only one species recognised, *S. bellioides* Cass. described from near Port Jackson (modern Sydney area), New South Wales, Australia (Cassini, 1828). Exactly a century later, Koidzumi (1928) published *S. mikadoi* Koidz., the second species of the genus from Amamiyohsima [Amami Ōshima, Amami Islands of the Satsunan islands group, Kagoshima Prefecture], Japan. *Solenogyne gunnii* (Hook.f.) Cabrera from Tasmania and *S. dominii* L.G.Adams from Australian Capital Territory, as the third and fourth members of the genus, were published by Cabrera (1966) and Adams (1979), respectively. *Solenogyne mikadoi* is now often treated as *Lagenophora mikadoi* (Koidz.) Koidz. ex H.Koyama (cf. Plants of the World Online <http://powo.science.kew.org/taxon/249376-1>), although this is not confirmed by phylogenetic studies (Nakamura et al., 2012; Sancho et al., 2015), or followed in Australasia (Schönberger et al., 2019).

New Zealand has three *Solenogyne* species, all treated as naturalised: *S. mikadoi*, *S. dominii*, and *S. gunnii* (Drury, 1974; Webb et al., 1988). Of these, *S. mikadoi* is extremely uncommon, while *S. dominii* is locally common, particularly around Christchurch and Banks Peninsula. *Solenogyne gunnii* is the most widespread species, often occurring as an urban weed in lawns and street side verges in the main centres of New Zealand.

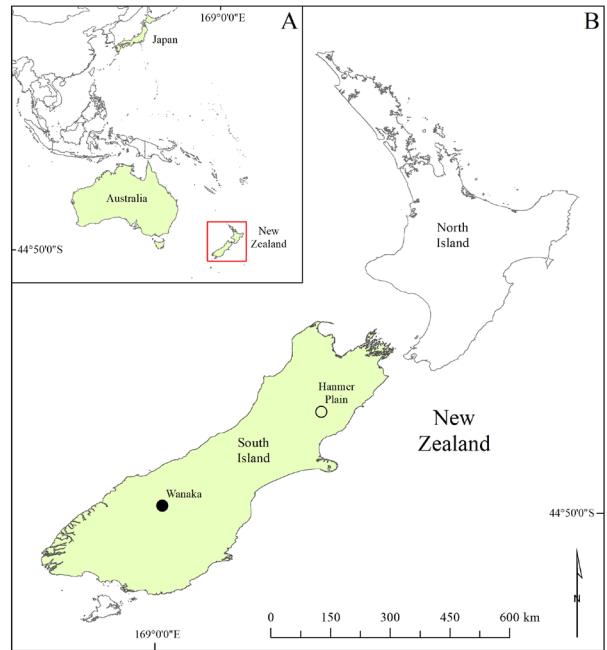


Figure 1. Distribution of the genus *Solenogyne* (A) and showing the two known locations for *S. christensenii* for the species in New Zealand (B), Hanmer Plain (the type locality, shown as an open circle because that population is now assumed to be extinct) and Wanaka, at the source of the Clutha River (black circle)

An enigmatic species of *Abrotanella* Cass., known only from the type collected by Charles E. Christensen from the Hanmer Plain, Amuri District, North Canterbury, was described by Petrie (1915) as *A. christensenii* Petrie. However, following critical examination of the type, this species was considered by Swenson (1993) to be conspecific with *Solenogyne gunnii*. There the matter of *Abrotanella christensenii* seemed to rest until an Asteraceous plant was discovered in a herbfield under kahikatoa (*Leptospermum scoparium* J.R.Forst. & G.Forst. s. l.) shrubland, near the outlet of Lake Wanaka, on the side of the Clutha River, Otago, by John Barkla in the early 2000s. That plant morphologically matched the type of *Abrotanella christensenii*; it was tentatively assigned to *Solenogyne gunnii* by Peter de Lange though it differed from that species with respect to its smaller overall stature, leaf colour, size and shape, and by having fewer disc florets. Specimens from this population were included in a phylogenetic study of *Lagenophora* (Sancho et al., 2015) where they were found to be sister to *Solenogyne gunnii*, thus further highlighting the possibility that these plants represented a fifth species of *Solenogyne*, the one endemic to New Zealand.

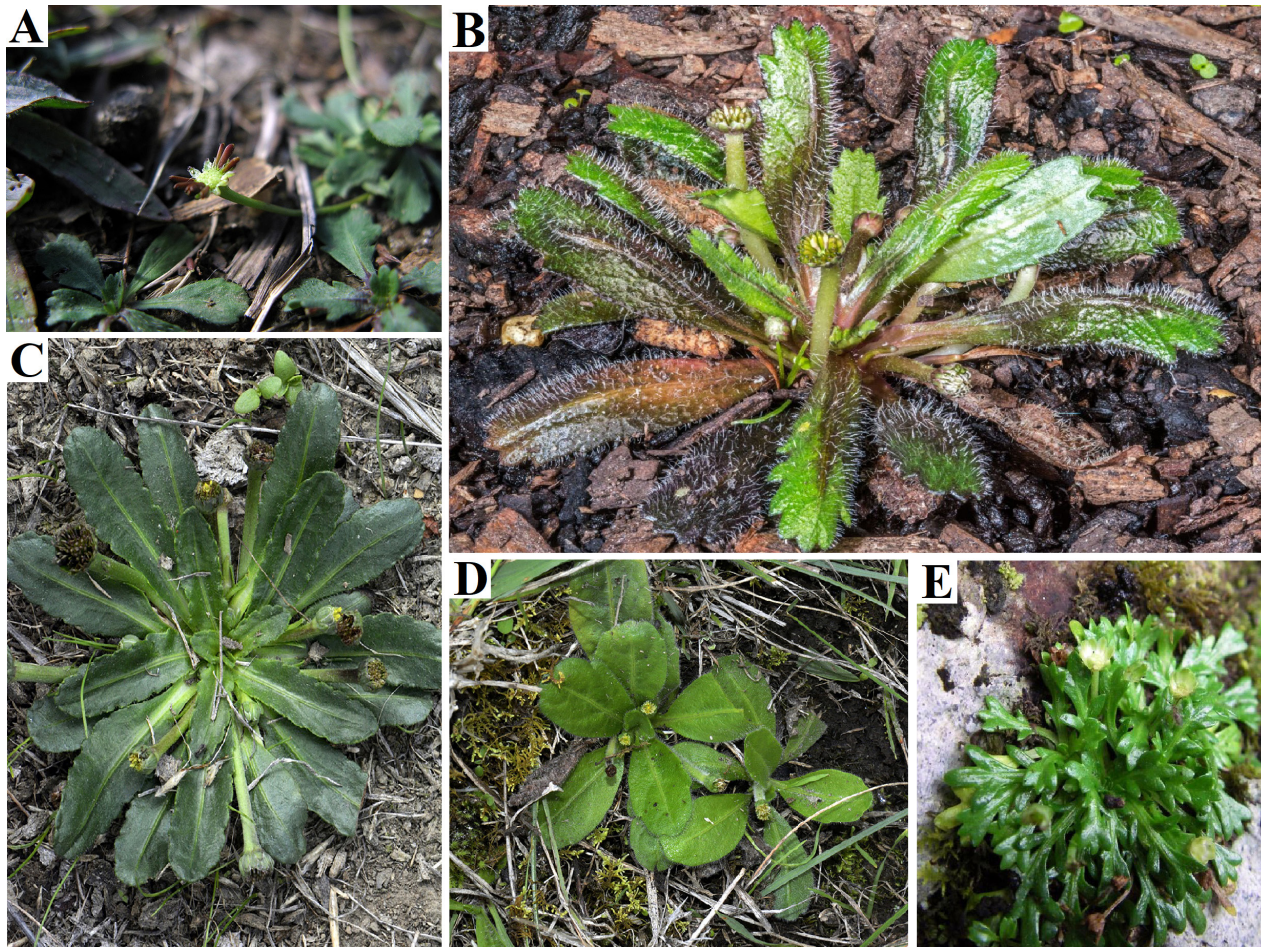


Figure 2. *Solenogyne* species. A: *S. bellioides*, Dungog, Australia (image: H. Rose). B: *S. christensenii*, cultivated plant, Stokes Valley, Lower Hutt, New Zealand (image: J.R. Rolfe). C: *S. dominii*, Cashmere Hills, Christchurch, New Zealand. D: *S. gunnii*, Cashmere Hills, Christchurch, New Zealand (images C, D: P. Enright). E: *S. mikadoi*, Kagoshima, Japan (image: Y. Uchiyama)

Following further examination of herbarium material and live plants, it is evident that *Abrotanella christensenii*, though allied to *Solenogyne gunnii* as Swenson (1993) thought, is a distinct species in its own right, and so a new nomenclatural combination in *Solenogyne* is made here.

## Materials and methods

This article is based on the study of live plants cultivated in Dunedin, South Island, New Zealand, by John Barkla and the morphological examination of *Solenogyne* material at AK, BRI, CHR, MEL and WELT; herbarium acronyms follow Thiers (2020–continuously updated). All measurements are based on live plants, as well as dried material, except the dimensions of florets, in which material was reconstituted with boiling water.

## New combination

***Solenogyne christensenii* (Petrie) de Lange, Jian Wang ter & Barkla, comb. nov.**

**Basionym:** *Abrotanella christensenii* Petrie, Trans. & Proc. N.Z. Inst. 47: 51 (1915).

Type: New Zealand, South Island, Amuri, Hanmer Plains, March 1912, *C.E. Christensen* (holotype: WELT SP02098) (Fig. 3).

**Note:** Although Petrie (1915) did not specify a type, Cheeseman (1925) makes clear that there were only the two specimens held by Petrie, stating (p. 1005) "Only 2 specimens, which have been kindly lent [our emphasis] to me for examination by Petrie have been found", both specimens, are the same Christensen gathering that were forwarded by Leonard Cockayne (as became his practise when dealing with taxonomic matters: see Cockayne (1926), Thomson (1990), and de Lange (2019)

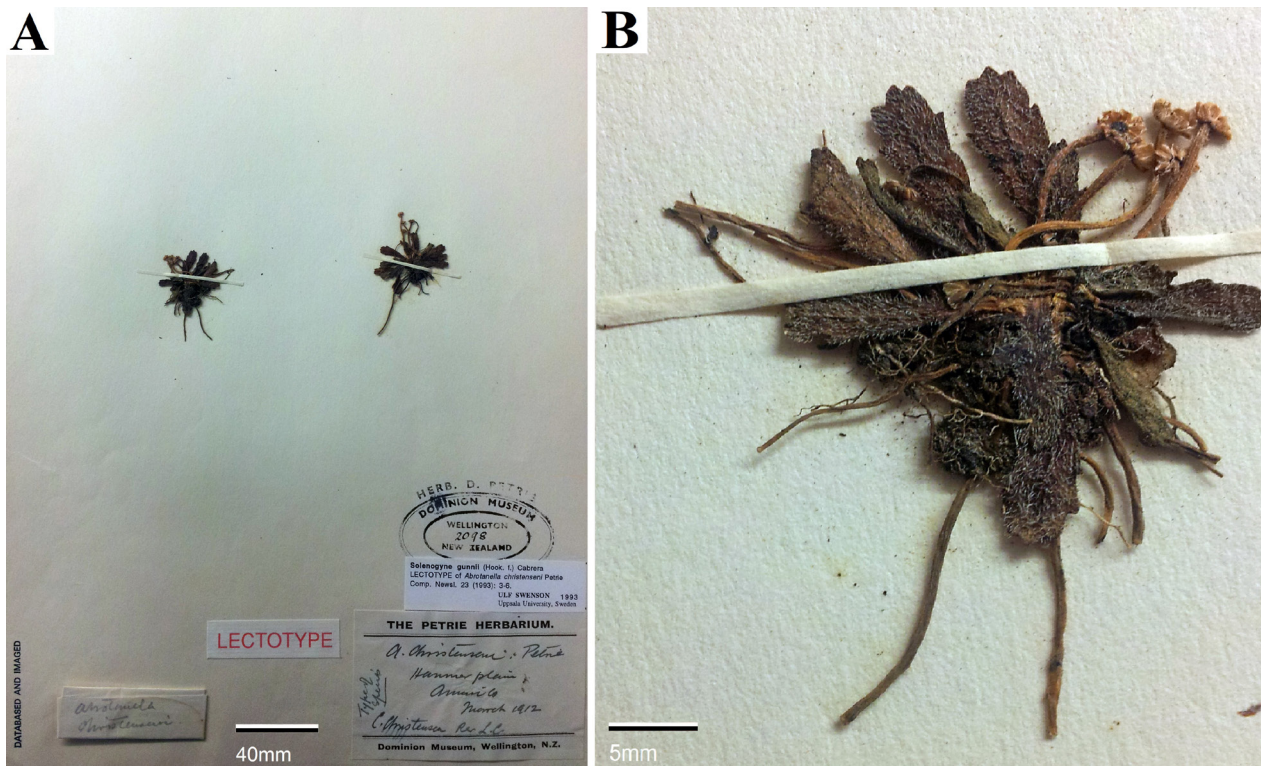


Figure 3. Holotype of *Abrotanella christensenii* Petrie, WELT SP02098. A: herbarium sheet. B: close up of one of the two plants mounted on the type sheet (image: P.J. de Lange)

for an account of Cockayne's stance on taxonomy) to Petrie. These are now mounted on the same sheet, WELT SP02098 (Fig. 3) held in the Petrie Herbarium, and labelled in Petrie's hand "Type Specm.". Therefore, Art. 9.1 of the ICN (Turland et al., 2018) applies, e.g., "A holotype of a name of a species or infraspecific taxon is **the one specimen or illustration** [bold type our emphasis here and thereafter] (but see Art. 40.4) either (a) **indicated by the author(s)** as the nomenclatural type or (b) **used by the author(s) when no type was indicated**. As long as the holotype is extant, it fixes the application of the name concerned (but see Art. 9.15)". With respect to the number of specimens, Art. 8.2 applies ("for the purpose of typification a specimen.....may consist of a single organism, **parts of one or several organisms, or of multiple small organisms**") because the two specimens mounted on WELT SP02098 are part of the same gathering used by the naming author to describe *Abrotanella christensenii*. Nevertheless, Swenson (1993, p. 3) was under the impression that the two specimens referred to by Cheeseman (1925) were different collections held by different herbaria, perhaps misunderstanding Cheeseman's statement that Petrie "lent" him the specimens to study, stating "...that

no more collections than the two cited by Cheeseman (1925) exist, i.e. the type specimens: C. Christensen, March 1912 (lectotype WELT). However, I have only been able to locate one of these sheets, the one deposited in Wellington (WELT), the second was presumably deposited in Auckland (AK) by Dr Petrie, but no type is held according to the herbarium". Thus he cautiously referred to WELT SP02098 as "Lectotype" presumably following the type statement of Allan (1961, p. 695) ("Type: W[ELT], C.E. Christensen") in the belief that two specimens had existed, and that one of those was now missing. However, Cheeseman on examining Petrie's two specimens (in fact, two plants) returned them to Petrie, and they now reside on the same herbarium sheet in his herbarium. Therefore, the type statements by Allan (1961) and Swenson (1993) can be taken as lectotype designations, but only if two or more syntypes or other original elements exist (or definitely existed). Since there are good reasons to believe that Petrie used only the two plants now mounted on the same sheet in WELT, that specimen in fact constitutes the holotype for his species name.



Figure 4. Cultivated plant of *Solenogyne christensenii* showing (A) growth habit, inflorescences, flowering and fruiting capitula (B, C) (images: J.R. Rolfe)

**Description** (Fig. 3, 4): Small perennial rhizomatous tufted herb up to 30 mm tall and 50 mm across; roots and rhizomes fibrous; stem very short (leaves in basal rosette); leaves and scapes firmly attached to stem and/or rootstock. Leaves 15–25, oblanceolate, obdeltoid to cuneate, 10–20(–25) × 5–8 mm (10–5× longer than wide), with a winged petiole-like base 8–10 mm long; leaf apex tridentate; leaf margins serrated (rarely repand-sinuate), usually with 4–6 teeth either side, each lobe 0.5–1.0 mm long; adaxial leaf surface glossy, initially green, maturing bronze-green or brown mottled, or maroon-brown; adaxial surface pilose, hairs patent eglandular, 0.3–1.8 mm long, 3–8 per mm<sup>2</sup>; abaxial leaf surface pale glossy green, ± glabrescent; hairs present on young leaves, unevenly shedding with leaf maturation, eglandular, pubescent, ± appressed, 0.4–0.8 mm long, 0–2 per mm<sup>2</sup>, hairs; both leaf surfaces papillate, papillae c. 0.01 mm long, more or less evenly distributed; leaf margins pilose, hairs eglandular patent 3–4 per mm<sup>2</sup>, 0.2–1.0 mm long; lateral veins slightly raised and usually visible adaxially, obscure abaxially. Scapes terete and smooth on fresh specimens, channelled on dry ones, 4–8 per tuft, each 5–20 mm long at anthesis, 10–30 mm long at fruiting stage, 1.5–2.5 mm diameter throughout;

scape bracts 0, or occasionally furnished with 1, ovate to orbicular, chartaceous c.1.5 × 0.4 mm bract; scape indumentum including eglandular hairs 0.3–1.0 mm long, patent, spreading or mixed weakly appressed / retrorse; 1–6 hairs per mm<sup>2</sup>; and papillae to c.0.01 mm long, scattered throughout the scape. Capitula 1.8–2.2 mm long, 2.8–3.0 mm diameter; involucre bracts 18–22 in 2 rows, glabrous or occasionally papillate along midrib on outer surface, ovate to broadly oblong, apex obtuse to rounded, margins pink, ciliate in upper distal ½–¾; outer bracts 1.2–1.6 × 1.0–1.6 mm, inner bracts 1.1–1.2 × 0.9–1.0 mm. Receptacle flat to slightly convex, 0.8–1.2 mm diameter. Ray florets tubular, creamy to pale pink, 18–20 in 2–3 rows; tube 0.4–0.7 mm long, 0.1–0.12 mm wide; style 0.5–0.8; stigma 2-branched c.0.02 mm long. Disc florets 0–3; corolla pale yellow, tubular, c.1 mm long, outer surface glabrous; corolla lobes 5, deltate, c.0.1 × 0.1 mm; stamens 5, to c.0.4 mm long; style c.0.6 mm long; sterile ovary c.0.3 mm long. Achenes glabrous, more or less flattened, narrowly obovoid, straight or slightly curved, 0.9–1.1 mm long by 0.3–0.5 mm wide excluding beak, uniformly yellow green, darkening to brown at maturity; achene edges smooth; achene beak

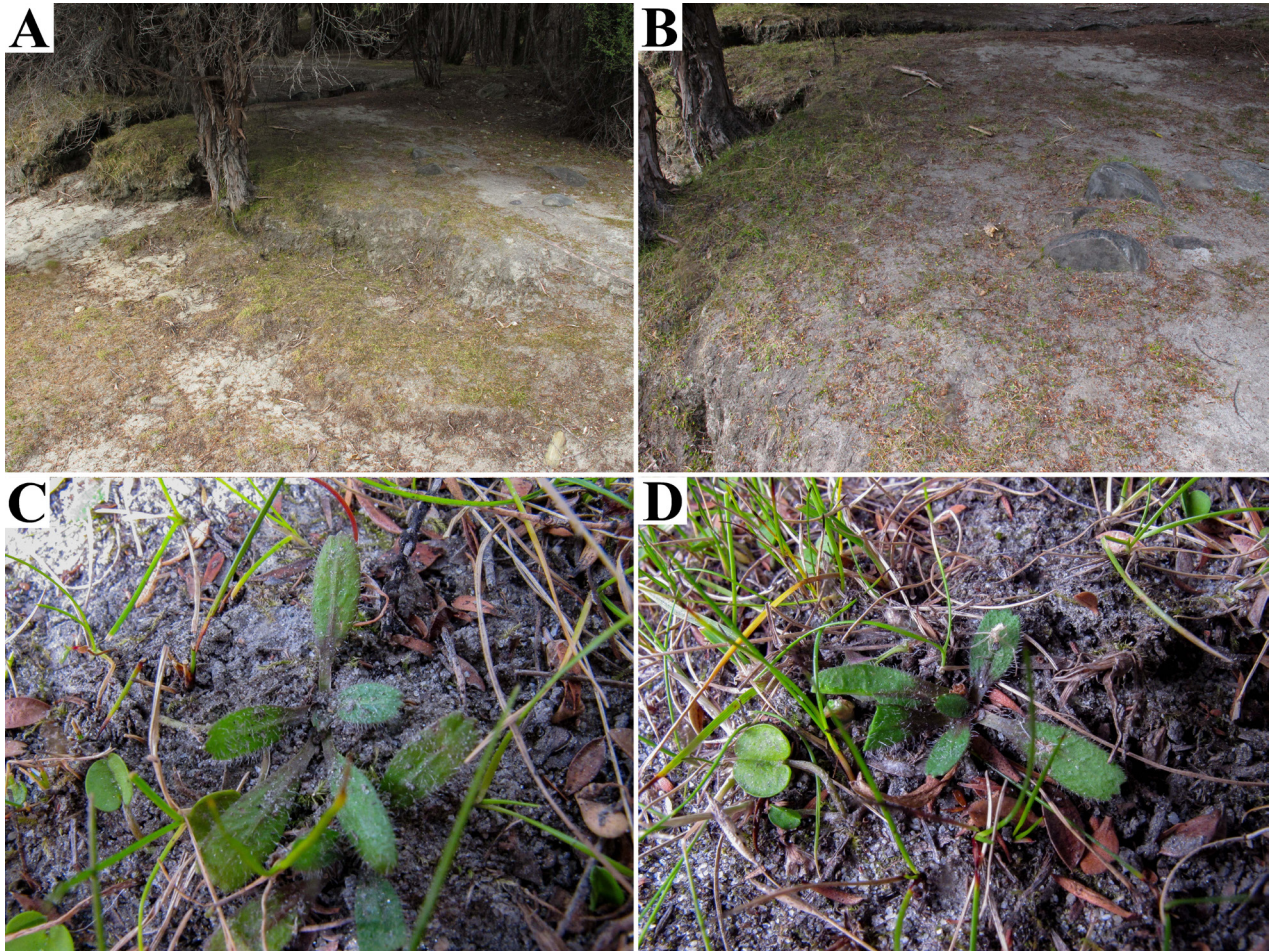


Figure 5. The habitat of *Solenogyne christensenii* on the side of the Clutha River, near Lake Wanaka, Otago, New Zealand. A: habitat on side of river bank adjacent a small walking track. B: close up of the habitat showing open herbfield in which the species grows. C, D: sterile young plants of *Solenogyne christensenii* (images: J.W. Barkla)

0.1–0.2 mm long, without obvious annular collar at its apex, c. 0.1 mm diameter.

**Additional specimens examined.** New Zealand. Ex Cultivated, South Island, Otago, Clutha River, J.W. Barkla s.n., Mar. 2009, CHR 605697.

**Etymology:** Petrie (1915) named this species after Charles E. Christensen (1876–1938) who was the first person to collect this species, as *Abrotanella christensenii*, during his botanical exploration of the vegetation of Hanmer Plain, Amuri District, North Canterbury, New Zealand (Godley, 1994).

**Distribution and habitat:** Endemic to New Zealand where it is restricted to montane shrubland at approximately 280 m above sea level in the upper Clutha Valley of Otago (Fig. 1). At its only extant site (Fig. 5) it grows in tiny patches within a 25m<sup>2</sup> herbfield on silty riverbank under dappled shade provided by 2–4 m tall

kahikatoa. Common associated native forbs include *Dichondra brevifolia* Buchanan, *Galium perpusillum* (Hook.f.) Allan, *Colobanthus strictus* Cheeseman, *Centella uniflora* (Colenso) Nannf., *Leptinella* sp., *Pseudognaphalium luteo-album* (L.) Hilliard & B.L.Burt (sensu lato), *Ranunculus foliosus* Kirk, *Epilobium komarovianum* H.Lév., *Carex breviculmis* R.Br., *Carex resectans* Cheeseman, and *Isolepis* sp. Common associated naturalized forbs and grasses include *Prunella vulgaris* L., *Pilosella officinarum* Vaill., *Centaureum erythraea* Rafn subsp. *erythraea*, and *Agrostis capillaris* L. (plant names are given mainly as accepted in de Lange & Rolfe, 2010, and Schönberger et al., 2019).

In the past it has also been recorded from "bare spots in dry fescue [*Festuca novae-zelandiae* (Hack.) Cockayne] tussock steppe" from the Hanmer Plains (Petrie, 1915).

**Phenology:** In the wild both flowers and fruits were observed mid-April. In cultivation, plants have been observed beginning to flower in January, with fruits evident a month later, with fruiting extending at least through to May.

**Affinities:** *Solenogyne christensenii* (Fig. 4) is of similar appearance to *S. gunnii* (Fig. 2, D), but differs by: the leaf size (usually 10–20 × 5–8 mm for *S. christensenii*; usually 20–100 × 5–20 mm for *S. gunnii*) and leaf shape (usually oblanceolate, obdeltoid to cuneate for *S. christensenii*; narrowly obovate and obtuse for *S. gunnii*); the obtusely serrate leaf margins (sinuate to undulate for *S. gunnii*); the short and hirsute scape to 30 mm long in fruit (up to 100 mm long in fruit and woolly for *S. gunnii*); the fewer and shorter disc florets (0–3 and c.1 mm long for *S. christensenii*; usually 7–9 and c.2 mm long for *S. gunnii*); the smaller achene size (0.9–1.1 mm long for *S. christensenii*; 2.0–2.5 mm long for *S. gunnii*); and the flattened achene edges (achene edges more or less thickened for *S. gunnii*).

*Solenogyne christensenii* also resembles *S. dominii* (Fig. 2, C), from which it differs by: the pilose leaves (glabrate for *S. dominii*); smaller leaf size (usually 30–50 × 7–12 mm for *S. dominii*); the shorter scape (up to 70 mm long in fruit for *S. dominii*); the fewer and shorter ray flowers (18–20 and 0.4–0.7 mm long for *S. christensenii*; usually 35–60 and 0.8–1.2 mm long for *S. dominii*); the fewer and shorter disc flowers (usually 10–14 and 2.0–2.5 mm long for *S. dominii*); the smaller achene size (2.0–2.5 mm long for *S. dominii*).

**Conservation status:** *Solenogyne christensenii* is an extremely uncommon species only known with certainty from one small population comprising less than 100 plants. Under the New Zealand Threat Classification System (Townsend et al., 2008), its conservation status, as *Abrotanella christensenii*, is listed as Nationally Critical qualified ‘DP’ [Data Poor] and ‘EF’ [Extreme Fluctuations] by de Lange et al. (2018).

## Acknowledgements

Dr. Sergei Mosyakin provided encouragement and some advice on the preparation of this manuscript, and also facilitated the translation of the authors' names, addresses, abstract and keywords into Ukrainian. We thank Jeremy Rolfe for use of his images and the auspices of iNaturalist ([www.inaturalist.org](http://www.inaturalist.org)) and the contributors therein for permission to use their images of other *Solenogyne* species. The authors are appreciative of the comments made on the submitted manuscript by Dr. Filip Verloove, Meise Botanic Garden, Belgium.

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Recommended for publication by S.L. Mosyakin