

International Rock Gardener

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Another year and still the world is beset with Corona virus and the chaos it brings. As if there were not enough problems in our lives from day to day, the chances to enjoy our plants and gardens remain for many of us the extent of our interaction with nature. How lucky those of us with such retreats to escape to are! Some brave souls are beginning to venture further afield than their homes but many are still confined. Thank goodness for those people who do make an effort to share their plant experiences with others. Even as Covid has restricted world travel and regulations tighten around the exchange and sale of seed in so many countries, the passion of gardeners has seen no diminution for extending their knowledge and enjoying their plants.

'International Rock Gardener' is this month dedicated to new plant species.

Firstly the IRG features the publication of a new tulip species by J.J. de Groot & B.J.M. Zonneveld from the Kuh e Aladag in Iran's North Khorasan province. They have named this tulip for the plantlover and explorer who collected the seeds of this plant, [Marijn van den Brink](#).

We also have a new viola species from the tireless hands of John and Anita Watson in Chile. This is *Viola obituaria*, named in commemoration of a tragedy where 44 young conscripts and a sergeant froze to death. As John writes, "In this instance it is intended as a public written remembrance of a tragic incident on 12th May 2005 which befell a group of about four hundred young Chilean military conscripts on a night training march around the Antuco volcano."

Finally this month we have a paper from Julian M.H. Shaw, Bleddyn Wynn-Jones and T.Y. Aleck Yang of a new *Sarcococca* endemic to Taiwan.

[Julian Shaw](#) is a registrar with the Royal Horticultural Society: he recently confirmed the re-finding of *Oxalis brevis* in IRG 144. Bleddyn Wynn-Jones (with his wife, Sue) runs [Crûg Farm Plants](#), in Wales, known for so many fine plant introductions over more than ten years. [T.Y. Aleck Yang](#) works at the National Museum of Natural Science, Taiwan.



Cover image: Volcan Antuco, location of *Viola obituaria*. Photo John Watson.

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--- Species Description ---

Tulipa brinkii J.J. de Groot & B.J.M. Zonneveld, a new tulip from the Kuh e Aladag in Iran's North Khorasan province.

J.J. de Groot jacdegroot@casema.nl Beeklaan 9, 2191AA De Zilk, The Netherlands.

B.J.M Zonneveld ben.zonneveld@naturalis.nl Naturalis Biodiversity Center, Darwinweg 2, 2333C Leiden, The Netherlands. (PO box 9517, 2300RA Leiden).



1: *T. brinkii*

Abstract:

T. brinkii spec. nova is a tulip from the Kuh-e-Aladag in NE Iran. It is here described as a new species, based on its locality and different genome size and the article is provided with photos of cultivated plants. The differences with related species are discussed.

Keywords:

T. brinkii spec. nov., Iranian tulips, genome size, Kopet-Dag area.

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Introduction:

The genus *Tulipa* Lineus (1753:305) (Liliaceae) includes 87 species (Zonneveld 2009), 78 species (Christenhusz et al 2013), or 83 species (WCSP 2016 Kew). Today there are more than 150 species including the genus *Amana*. Several of them are included as a synonym of other species though the DNA value shows them as good species, others are newly described and a number are still waiting to be described.

T. brinkii is one of the several red flowering Iranian tulips with inner tepals that are smaller than the outer tepals, and these tulips mainly grow in the Zagros mountains of W. Iran. However, this newly described species grows in the Kuh-e-Aladag which is a mountain range in NE Iran, roughly between Sankhast in the SW and Bojnurd in the NE. It forms the eastern extension of the Alborz Mountains and include the SE corner of the Golestan National Park and the Salook National Park. These mountains consist largely of granite overlaid with chalkstone.

This newly described species is very variable, especial in the size of the plants, the colour of the pollen and the colour of the stems. In some forms there is an anthocyanin colouring on parts of the leaves in the springtime. The hairiness of the bulb tunic is also variable from plant to plant and from year to year. Together with 6) *T. micheliana* 46.3 pg, 3) *hoogiana* 47.7 pg, 2) *botschantsevae*, 4) *persica* Sweet 48.3 pg, (is *T. hoogiana* hort) and the species known in cultivation as 5) *T. eichleri* 48.6 pg, (which is not the *T. eichleri* Regel from the Caucasus), it forms an ancient, variable group of tulips, all with a relatively low amount of DNA and growing in the area around the Kopet-Dag mountains. Successors of this group of tulips migrated from this area in the distant past to Central Asia as well to Turkey and the Middle East.



Desert with *Papaver pavonicum* and the Kuh e Aladag in the distance. Photo K.J. van Zwienen.

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2: *T. botschantsevae*



3: *T. hoogiana*



4: *T. persica* (*T. hoogiana* of hort.)



5: *T. eichleri* (hort.)



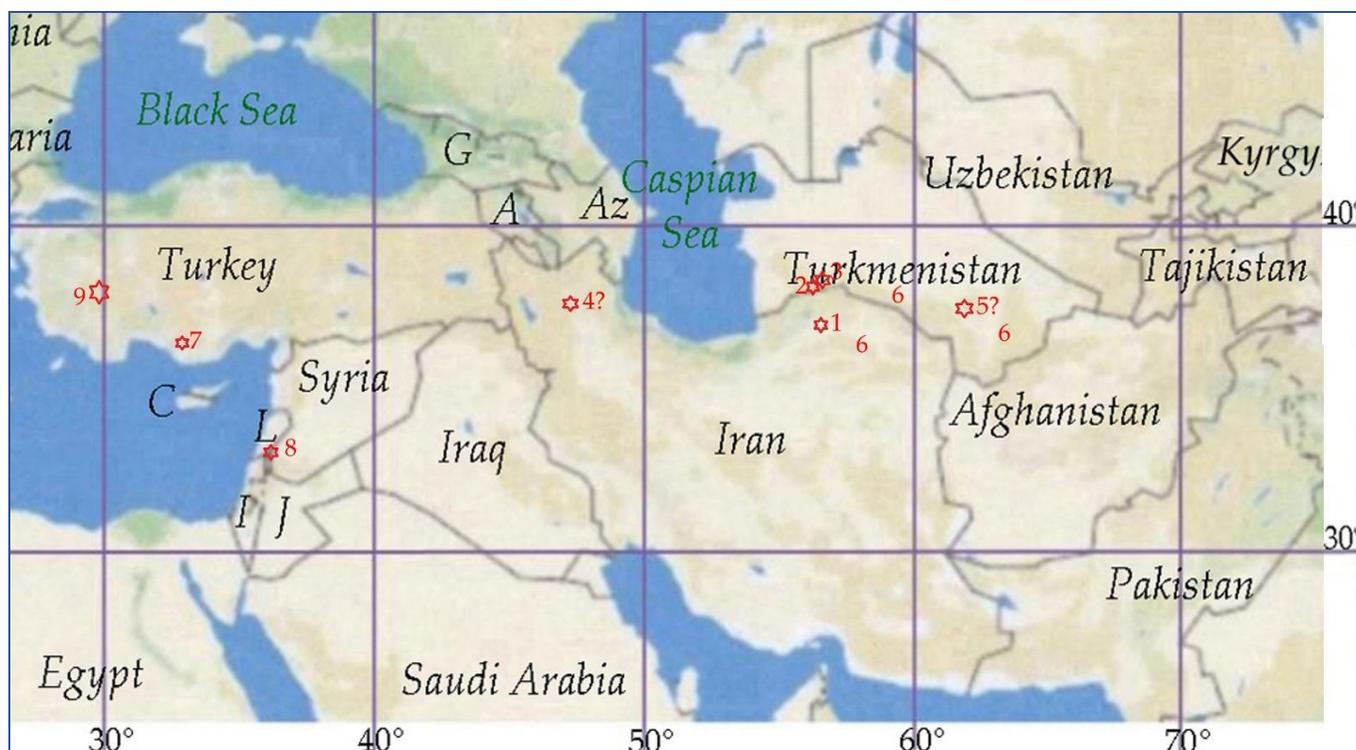
6: *T. micheliana*

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Material and methods:

Offspring are grown from wild collected seeds, which are growing in the collection of J.J. de Groot as nr. 09-25. This new tulip was found by M. v. d. Brink in 2009, in the spring. It was growing together with *Fritillaria gibbosa*, on the lower, south facing mountain slopes about 10 km NE of Sankhast, where the mountains meet the desert. It was already in seed there at that time. Some seeds were collected and taken to the Netherlands. They were sown in the autumn of 2009, and need up to nine years till they flower. An herbarium species is deposited in the Leiden herbarium (L) Naturalis Biodiversity Centre with the nr. L.4420634.

Flowcytometry was done by B.J.M. Zonneveld from Naturalis Biodiversity Centre. with propidium iodide and *Agave americana* 'Aureomarginata' with 15.9 pg, as standard (Zonneveld 2021).



Distribution map of the tulips mentioned herein.

1: *T. brinkii*

2: *T. botschantsevae*

3: *T. hoogiana*

4: *T. persica*

5: *T. eichleri*

6: *T. micheliana*

7: *T. harmoniana*

8: *T. agenensis*

9: *T. undulatifolia*

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Description:

The bulbs are up to 45 mm in diameter with a leathery brown tunic which is covered inside with hairs on the top and bottom. The hairless, green stem is 140 mm long, including the flower stem of 100 mm. The 4 (7) leaves are spear-shaped, green and keeled. The strongly waving margins are light reddish-brown with only some hairs near the tip of the leaves. The basal leaf is 192 x 75 mm, the second is 194 x 51 mm, the third is 187 x 41 mm and the fourth leaf is 145 x 29 mm. All the leaves are close together on the stem. The flower has outer tepals that are much bigger than the inner tepals. The spear-shaped outer tepals are 75 x 42 mm and dull pinkish red on the outside and straw coloured to the tip. They have outwards curved margins and a pale-yellow basal spot over 15%. The inside is bright red with a dark basal spot over 15% which is bordered with a yellow rim. The similarly coloured, oval inner tepals are 60 x 39 mm. The stamens are 25 mm long including filaments of 10 mm. The anthers are dark purple and the pollen is ochre-yellow. The triangular filaments are purple-black. The straight ovary is 24 mm long and pale green with some pale red stripes. The stigma with slightly protruding lobes is bright rose-red.

In the young stage, it is a stoloniferous species with very small young bulbs at the end of hairlike stolons. That is very similar to the young stages of the Middle Eastern *T. agenensis*.



Plant parts of *Tulipa brinkii*.

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Etymology:

T. brinkii is named after Marijn van den Brink who collected the seeds of this species. He visited the countries where the tulips grow in the wild several times. There is a nice photo gallery online (<https://photos.v-d-brink.eu>).

Discussion:

#1 *T. brinkii* 47.8 pg, is morphologically similar to the somewhat larger #7 *T. harmonia* 49.0 pg, from the western Taurus mountains in Turkey, a species described in 1892 by Sprenger (Cat. (1893)5. – Gartenflora 42-1893) but lumped into #9 *T. undulatifolia* 57.1 pg, by Baker.

However, the growing distance from one species to the other is more than 2200 km in a straight line.

The similarity of this new species from north east Iran with the tulips growing in western Iran, the Middle East and Turkey is a strong argument to describe this species, as its morphological characters indicate a direct link to these western species.

Table:

	<i>T. harmonia</i>	<i>T. brinkii</i>	<i>T. agenensis</i>
Covering on the inside of the bulb tunic	short hairs, mostly on the nose and bottom	long hairs, mostly on the nose and bottom	a layer of woolly hairs
Length of the stem	up to 30 cm	up to 17 cm	up to 20 cm
Covering of the leaves	sparsely short hairs on the margins	few short hairs, only near the leaf tip	short hairs on the whole margins
Filaments	triangular, 12 x 3,5 mm	triangular, 10 x 4 mm	triangular, 13 x 3 mm
pollen	yellow or light greyish-purple	ochre or light greyish-brown	variable, from yellow to black
Ovary	straight	straight	bottle shaped
DNA value	49.0 pg	47.8 pg	56.2 pg

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1 *Tulipa brinkii*

7 *Tulipa harmonia*



#8: *T. agenensis* in the Judean hills.

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Flowcytometry is a valuable way to discriminate species when the visible marks give no decisive answer. In the case of *T. brinkii*, it pointed out that that the average DNA mass/weight in the cell nucleus of this species with 47.8 picograms, is 1.2 pg, lower than the DNA mass of *T. harmonia* from Turkey which has 49.0 pg.

Zonneveld (2021) selected perennial plants to provide convenient standards for the determination of genome size with flowcytometry.

#9: *T. undulatifolia*



Photos are by J.J. de Groot unless otherwise stated.

References:

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Fetschenko B. 1910. Gardiners cronicle 48, *T. hoogiana*.

Hall A.D. 1940, The Genus Tulipa.

Hoog 1902, The Gardeners Chronicle pag. 350-351, *T. micheliana*.

Lindley, 1828, Edwards Botanical Register vol. 14, pag 1143, *T. oculis solis* var. *persica*.

Sprenger - Garten flora 42- pag. 732 – 1893, *T. harmonia*.

Zonneveld, B.J.M., 2009, The systematic value of nuclear genome size for 'all' species of Tulipa L. Plant Systematics and Evolution 281: 217- 245.

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Marijn van den Brink in the Kuh e Aladag. Photo K.J. van Zwienen.

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--- Species description ---

Volcán Antuco, the site of a tragedy recalled by the Latin specific name of this new *Viola* (Violaceae)

Anita (Ana Rosa Flores) and John Watson

Casilla 161, Los Andes, Provincia de Aconcagua, Región de Valparaíso, Chile.

E-mail: john.anita.watson@gmail.com.

Abstract

Presented here is *Viola obituaria*, a hitherto undescribed sempervivoid Andean rosulate taxon from a National Park in southern Chile, where its small single-site population is exceptionally rare and was critically threatened when last seen by ourselves in 2009. We provide a diagnosis and description as well as detailing its habitat, floral community, conservation status and systematic placing. Its unusual specific epithet is also explained.

Resumen

Se presenta *Viola obituaria*, un taxón rosulado sempervívode andino, que no ha sido descrito hasta ahora, de un Parque Nacional en el sur de Chile. Su pequeña población de un solo sitio es excepcionalmente rara y fue críticamente amenazada cuando fue visto para nosotros por la última vez en 2009. Brindamos un diagnóstico y descripción, además de detallar su hábitat, comunidad floral, estado de conservación y ubicación sistemática. También se explica su inusual epíteto específico.

1: Map of the regions of Chile with Bío Bío Region, where *Viola obituaria* is endemic, outlined and arrowed red.

Keywords: Bío Bío Region, Chile, corolla spur, extinction threat, *Lepus europaeus*, military accident, national park, rare, section *Sempervivum*, subgenus *Neoandinium*, *Viola*, volcanic scoria.

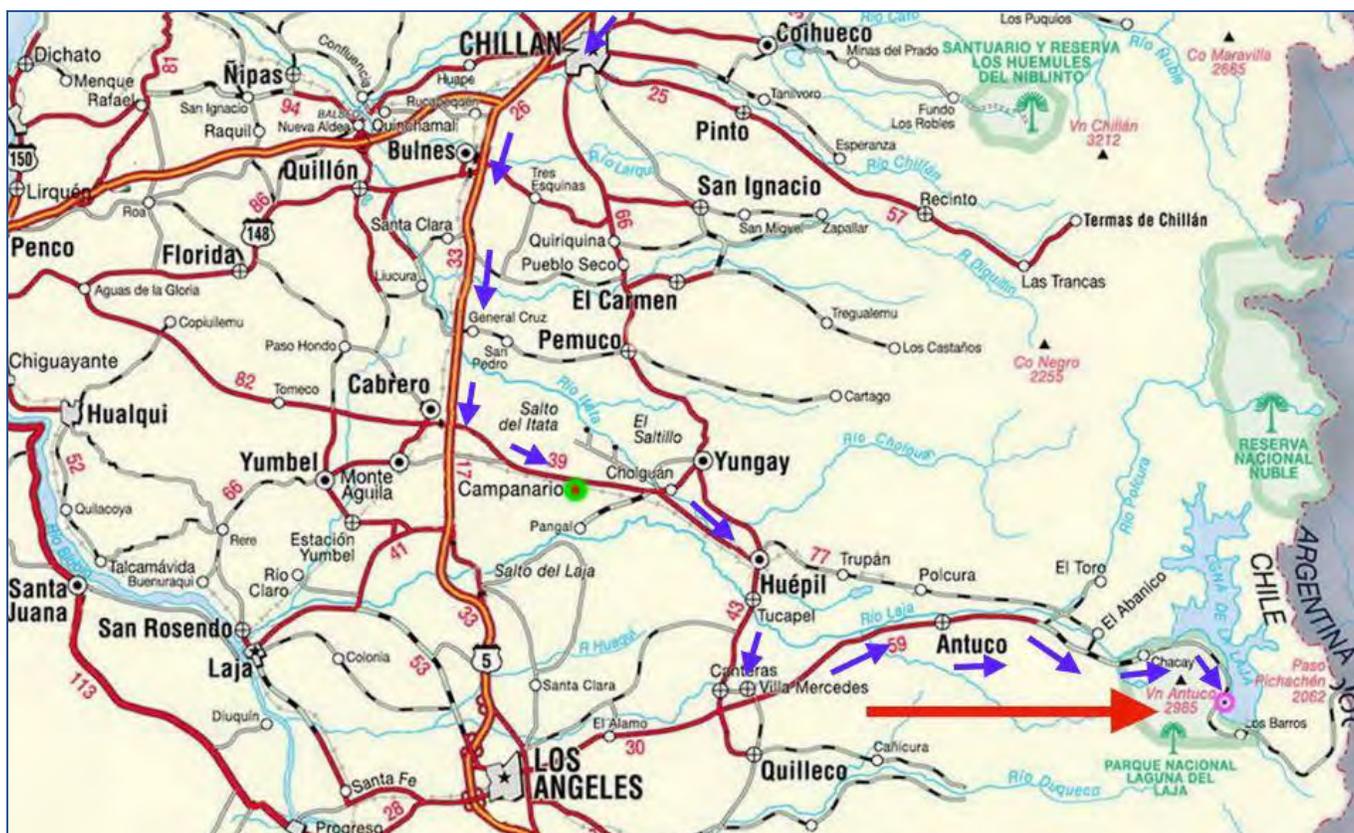
Introduction

Beginning in 1987 with the Pern and Watson project and continuing up to 2019, we have made 23 explorations of varying durations up to four months in southern Chile and Argentinian Patagonia as far down as Punta Arenas (53°10'S).



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These included leading floral tours for the Alpine Garden Society. But the northern sector of Río Negro and Neuquén provinces in Argentina, together with Bío Bío and Maule regions in Chile [figs. 1, 2], proved so productive, particularly in taxa previously undescribed for science, that from 2000 on we no longer continued southwards. The 870 km long northern area in question has yielded 19 new species, including the one described here, as compared with just three in the 1850 km further south.



2: Bío Bío Region, Chile, Type site of *Viola obituaris* as violet circle indicated by red arrow. Green, red-centred circle, home of Anita's brother. (Map by courtesy of Turistel)

The route to the location of the present species took us past the home of Anita's brother [fig.2], where we were able both to stay and explore for the rich immediate flora. This included *Mutisia araucana* Phil. [fig.3], which we thought at first might be a new pink subspecies of well-known red *M. subulata*. Growing in abundance all around it were large colonies of *Phycella chilensis* (L'Hér.) Grau ex Nic. Garcia in all its wide range of colours between pale creamy yellow [fig.4] and shades of pink or red [fig.5]. From there to Antuco, a distance of 77 km, an abundance of assorted ground orchids lined the roadside at intervals. They included well-known *Chloraea magellanica* Hook. f. [fig.6], *Gavilea odoratissima* Poepp. [fig.7] and *G. glandulifera* (Poepp.) N.M. Correa [fig.8].

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3: *Mutisia araucana*. (JMW)



4: *Phycella chilensis*, pale yellow form. (JMW)



5: *Phycella chilensis*, pinky red form. (JMW)



6: *Chloraea magellanica*. (JMW)

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7: *Gavilea odoratissima*. (ARF)



8: *Gavilea glandulifera*. (JMW)



9) Volcan Antuco, location of *Viola obituaria*, looking the scenic, tranquil antithesis of the killer it can be. (JMW)

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Anthesis of the new *Viola* had long passed at the time of our first visit in 2008 to Volcán Antuco [fig.9] by the side of the Laguna del Laja [figs.10, 11, 49] (often erroneously spelt [figs.2, 34]!), and we were only able to find material with vacant capsules. At that point we could already see that half of its population had been seriously bitten down by some animal [fig.12], a few individuals having been reduced to no more than identifiable dead remnants. Of course, we had no idea it was new to science at that point but did know that three species of the same *Viola* subgen. *Neoandinium* (W. Becker) Marcussen (Watson et. al. 2021) had been recorded from the volcano and its immediate surrounds, all of them more to the north. On foliar characteristics two of these, *Viola farkasiana* J.M. Watson & A.R. Flores [fig.13] and *Viola rosulata* Poepp. & Endl. [fig.14], clearly did not belong in the sempervivoid alliance, i.e. *V.* subgen. *Neoandinium* sect. *Sempervivum* J.M. Watson & A.R. Flores (Watson et al, 2021), as did the sterile plant. However *Viola aizoon* Reiche [fig.15], the third species, did, and until a more detailed study revealed otherwise, we assumed we had probably found a more imbricate form of that taxon with wider laminae.



10: Looking across the Laguna del Laja to Argentina from the *Viola obituaria* type site on Volcán Antuco. A car is passing on the road. (JMW)

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11: Inlet of the Laguna del Laja to the immediate south of the *Viola obituaris* location. (JMW)



12: Devastating hare damage to this critically threatened species. 4 plants recently killed, were included on our 40+ global total count. (JMW)



13: *Viola farkasiana*. (JMW)



14: *Viola rosulata*. (ARF)



15: *Viola aizoon*. (ARF)



16: *Viola rossowiana*. (ARF)

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On subsequent visits we encountered the species in flower, observed it had a significantly long lower petal spur, which is only otherwise possessed by *Viola rossowiana* J.M. Watson & A.R. Flores [figs. 16, 39, 41, 43], *Viola santiagonensis* W. Becker and *Viola sempervivum* Gay of the alliance, all with significantly discrete geographical distributions. Comparing with our specimen and the other three revealed all four to be distinct.



17: *Berberis empetrifolia*, a dominant shrublet where *Viola obituaria* was found. (JMW)

Surprisingly, it was discovered not far from a minor international unsurfaced road between Argentina and Chile, Furthermore, the accessible Laguna del Laja National Park where it occurs receives many visitors the year round, and was presumed to have been thoroughly explored botanically, starting with the renowned German naturalist Eduard Poeppig in the first half of the nineteenth century. But the area of no more than a few hundred square metres where the type and only known population occurs is so extremely confined that it is hardly surprising that this novelty has been overlooked until now. A description and other formal details follow below.

Research and Preparation

Based on 30 years experience of specialising in the investigation of subgen. *Neoandinium*, we determined its only close relatives as three other taxa of the subgenus with equally long lower petal spurs. The type specimens of two, *V. rossowiana* and *V. sempervivum*, were compared.

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The only material ever collected of the third, *V. santiagonensis*, was destroyed at B during the Second World War by an allied bomb (Hiepko 1987, Haagemann & Zepernick 1993) and the taxon has not been re-encountered in situ since. As a result we referred to its protologue (Becker 1925a) as well as those of the other two published long-spurred species (Gay 1846, Watson & Flores 2013b) and found them to be critically distinct morphologically from the viola described below.



18: A close-up of *Berberis empetrifolia*. (JMW)



19: And here is *Viola obituaria* in habitat. The rosettes we found the first time are now almost hidden under inflorescences. (JMW)



20: A close view of the same first *Viola obituaris* we found. (JMW)

Taxonomy

Viola obituaris J.M. Watson & A.R. Flores, sp. nov. [Figs.19-21, 35-38, 40, 42, 44-46]

Type: CHILE. Bío Bío Region, Bío Bío Province, Volcán Antuco, open SE exposure, 37°20'S 71°19'W, ca. 1750 m, 1 December 2009, A.R. Flores & J.M. Watson, F.& W. 11904 (holotype CONC; isotype herb. Flores & Watson).

Diagnosis: The markedly long lower petal spur of the new species distinguishes it from all but three other taxa in sect. *Sempervivum* (Watson et al. 2021) of subgen. *Neoandinium*. *Viola sempervivum*, one of those three, differs in its smallish yellow, as opposed to larger white corollas, while the stamens of *Viola santiagonensis* are hirsute rather than glabrous. Inter alia, the lateral style crest lobes of the last of the three comparative taxa, *Viola rossowiana*, are patent and acute, whereas those of *V. obituaris* are reflexed and rounded.

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Description: *Life form* perennial, rosulate, glabrous, subcaulous, evergreen hemicryptophyte, forming 2-11 close-set rosettes as seen, rarely solitary. *Rootstock* axial, 12-40 cm or more long × 5-6.5 mm dia. at junction with caudex, vertical, subligneous, solitary above, branching into several multiple feeder roots near subterranean apex. *Caudex* ca. 5-7 cm × 6-7 mm, simple or more slender-branched, cylindrical, enveloped densely above in short leaves and below in remains of dead foliage. *Rosette* to ca. 3-4 cm dia. × 7 cm high, tightly imbricate on face, less so below, columnar as seen, green, shallowly depressed towards centre of face. *Leaves* spatulate, ca. 8-9 mm when mature, arranged in distinct spirals; *pseudopetiole* 8-11 mm, flat, thickish, strongly suborbicular-widened at the base, including with membranous margins where attached to the stem, estipulate; *lamina* 4-8 × 4-9 mm, entire, orbicular, briefly cuneate to pseudopetiole, leathery-succulent, rigid, somewhat glaucous green or occasionally cryptic coloured, margin 0.3 mm wide, translucent-cartilaginous, apex minutely apiculate. *Anthesis* synchronous. *Flowers* axial, solitary, forming continuous or intermittent outwards and upwards facing ring of up to ca. 10 individual blooms around, and integral with, outer-upper circumference of rosette; *Peduncles* 1.7 cm long × 1.5-2 mm dia., somewhat shorter than leaves; *bracteoles* 6.5 × 1.5 mm, basal, narrowly triangular with acute-subulate apex, hyaline. *Calyx* ca. 7.5 mm, sepals free; *superior sepal* 4-4.5 × 1.5-2 mm, narrowly acute-triangular; *lateral sepals* 6 × 1 mm, linear-subulate; *inferior sepals* 5 × 1.5 mm, narrowly acute-triangular. *Corolla* 1.2-1.7 cm high × 1-1.5 cm wide, glabrous, white, central base of inferior petal with yellow oblong blotch back to throat of spur; *superior petals* 7 × 4-4.5 mm, rounded-obovate, cuneate to narrow base; *lateral petals* 8 × 5-5.5 mm, orbicular, cuneate to narrow base; *inferior petal* 8-8.5 × 6-6.5 mm, broadly ovate-depressed, shallowly long-retuse with rounded lateral lobes, cuneate leading to canaliculate base connecting with spur: *spur* 6.5-7 × 1.2-1.5 mm, downcurved, cylindrical, apex retuse. *Androecium* and *gynoecium* contained within throat but readily visible; *anthers* ca. 1.5 mm, lower pair with 2.5 mm filiform, curved nectar spurs; *connectives* 1-1.2 mm, orange, enclosing stamens; *ovary* 1.5-2 mm; *style* 1-1.3 mm, subgeniculate, clavate; *stigma* as frontal opening. *Style crest* 2 short, broad, stout recurved lateral lobes rounded at apex. *Fruit* 3.5-4 mm orbicular capsule; *capsule* 5 mm long × 4.5 mm dia., spherical, three valved, apex pointed; *seeds* 3 × 2 mm, lacrimiform with strongly flattened broad base, dark brown.

Other specimens examined or recorded: CHILE. Bío Bío Region, Bío Bío Province, Volcán Antuco, SE exposure, 37°20'S 71°19'W, ca. 1750 m, 24 January 2008, leg. A.R. Flores & J.M. Watson, F.& W. 11610 (herb, Watson & Flores!). Ibid. 2 December 2009, A.R. Flores & J.M. Watson, F.& W. 11906 (as digital photographs only).



21: One of the few untouched *Viola obituaris* individuals, protected from hares by spiny *Berberis empetrifolia* and the prostrate cactus *Maihuenia*. (ARF)

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Etymology: The specific epithet *obituaría* is a New Medieval Latin word deriving from the original Latin *obitus* (Merriam-Webster 2021). An obituary memorialises deceased people who are recalled positively. In this instance it is intended as a public written remembrance of a tragic incident on 12th May 2005 which befell a group of about four hundred young Chilean military conscripts on a night training march around the Antuco volcano [fig.9]. Inadequately dressed, one group was caught in a bitterly cold, blinding snowstorm when too far into the route to turn back, and a significant number froze to death along the way (Wikipedia 2021). The unfortunate officer on the spot in charge was made the scapegoat for failure by the relevant army authorities to provide obligatory institutional protective clothing as always needed for mountain operations [fig.48], where the weather can be unpredictable at any time (pers. obs.), let alone deep into autumn. Had the snowstorm not materialized, but he had cancelled the march, he would in all likelihood have been court-martialled for disobeying orders, while his superiors, who held the ultimate responsibility, had sat comfortably in the warmth of the nearest town. One of us (John) has done obligatory military service and experienced such injustices.

This human disaster is singularly relevant for *V. obituaría* due to several remarkable coincidences. The species grows on the same volcano and within sight of the very course they took. Furthermore, its white corollas echo the freezing snow they all endured, and which killed forty-four conscripts and a sergeant. Perhaps most bizarre of all is this numerical aspect. Our prolonged and meticulous count of all the individuals of *V. obituaría* at the location amounted to just over forty, those being in danger of extinction due also to lack of protection. Nothing could be more appropriate therefore than to name this species as a permanent scientific reminder to augment the inscribed stone plaques where each body was found along the route [fig.49] and the army monument recording the event [fig.50].

Distribution: As known, *V. obituaría* is an extremely rare single site endemic of Bío Bío Region in Chile, being situated in the southern sector of temperate South America [fig.1]. It inhabits the lower eastern footslopes of Volcán Antuco shortly beyond and above the Laguna del Laja [figs.10, 11, 34]. This is the type site and only known location, where it covers an estimated limited area of ca. 300 m horizontally with an elevation range of 100 m. The exposure is SE, that is tending towards the Southern Hemisphere polar region [fig.19].

Phenology: The new viola was seen in flower initially on the first day of December, when anthesis was already well advanced, but no fruits had formed. On a later visit towards the end of January the majority of healthy plants contained capsules, some of which had dispersed their seeds.

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Habitat and local floral community: This lower open and sharply to gently inclining section near the foot of the volcano consists of fine greyish volcanic ash and coarser scoria with some solid outcrops. The flora there varies from sparse where *V. obituaria* grows, but with some denser local colonies of shrublets including dominant *Berberis empetrifolia* Lamarck [figs.17, 18], to a more close-set and diverse general community on more level areas facing east and north. The latter includes *Maihuenia poeppigii* (Otto ex Pfeiffer) F.A.C. Weber [figs.21, 22], *Ephedra chilensis* C. Presl [fig.23], *Azorella prolifera* (Cav.) G.M. Plunkett & A.N. Nicolas [fig.24], *Pozoa volcanica* Mathias & Constance [fig.25], *Mutisia oligodon* Poepp. & Endl. [fig.26], *Nassauvia revoluta* D. Don [fig.27], *Oxalis valdiviensis* Barnéoud [fig.28], *Erythranthe naiandina* (J.M. Watson & C. Bohlen) G.L. Nesom [fig.29], *Orites myrtoideus* (Poepp. & Endl.) Engler, *Ourisia microphylla* Poepp. & Endl. [fig.30], *Anemone multifida* Poir. [fig.31] and *Acaena argentea* Ruiz & Pav. [fig.32] (Rondanelli et al. 2000, Watson & Flores pers. obs.).



22: *Maihuenia poeppigii*, a spiny southern temperate cactus grew together with *Viola obituaria*, affording the colony some protection in 2009. (ARF)



23: *Ephedra chilensis*. (Michail Belov)



24: *Azorella prolifera*. (JMW)



25: *Pozoa volcanica*. (ARF)

Proposed conservation status: The situation regarding the vulnerability of *V. obituararia* could hardly be simpler to explain, and only discovery of further populations somewhere can change it.

As noted, it exists well within the bounds of a National Park, this being an element of a more extensive Biosphere Reserve, which would seem to offer an unsurpassable conservation option. However, the known world count amounted to ca. 40 adjacent live individuals when last observed by the present authors in 2009, and approximately half of those had their rosette or rosettes bitten off to the caudex or below [fig.12] by the introduced European hare, *Lepus europaeus*, which clearly exists in considerable numbers, as noted from the quantities of its excreta on the volcanic ash [fig.33]. In fact, the animal has reached plague proportions in various sectors of southern South America and is even hunted at night with searchlights and automatic weapons in some parts of Patagonia, where enough are killed to be used for commercial purposes (pers. obs.).



26: *Mutisia oligodon*. (JMW)

In theory the park staff of CONAF (Ministeria de Agricultura 2021) should be able to control the pest, as happens on agricultural land, for example. However, 'no hunting' signs are prominently displayed, including not far from the site of the new species, and no living animal is killed. Obviously, this measure is intended to protect the native wild fauna, and it is a gross irony that

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as a consequence this endemic rarity is threatened with extinction in its totality, if not already made extinct during the twelve years that have elapsed since we last saw it. Even a thriving colony of this minimal size within such a confined range would undoubtedly qualify as CR (critically endangered) according to IUCN ranking criteria (IUCN 2012); and if all have indeed been destroyed meanwhile then the classification requirement would be EX (extinct).



27: *Nassauvia revoluta*. (ARF)



28: *Oxalis valdiviensis*. (JMW)

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29: *Erythranthe
naiandina*. (JMW)



30: *Ourisia microphylla*. (JMW)

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31: *Anemone multifida*. (ARF)



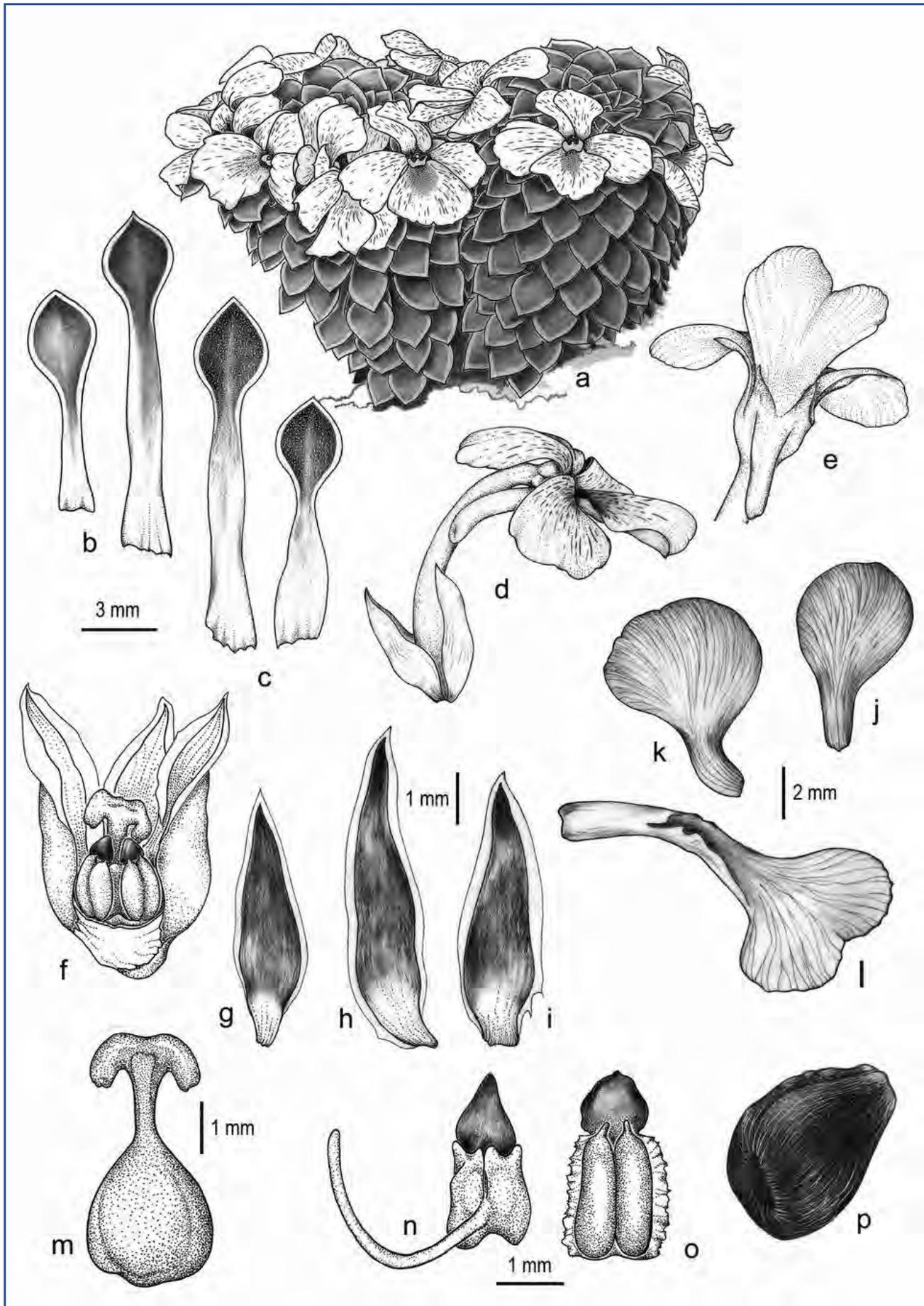
32: *Acaena argentea*. (Michail Belov)



33: Faeces of the introduced common hare, *Lepus europaeus*, were scattered closely all over the volcanic ash in vegetated sectors. (JMW)



34: The purple, orange-centred circle marks the type and only known location of *Viola obituaris* on the east facing aspect of the Antuco volcano.



35: *Viola obituaris* details. (Maria Cecilia Scoones)

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36: *Viola obituaris* laminas showing hyaline margins and apiculate tips. (JMW)



37: Measurements of *Viola obituaris* laminas with semi-amplexicaul bases. (ARF)



38: A side view which illustrates the rosette face and columnar habit of *Viola obituaria*. (JMW)



39) The other long-spurred species as presently known, *Viola rossowiana*, for comparison. (ARF)



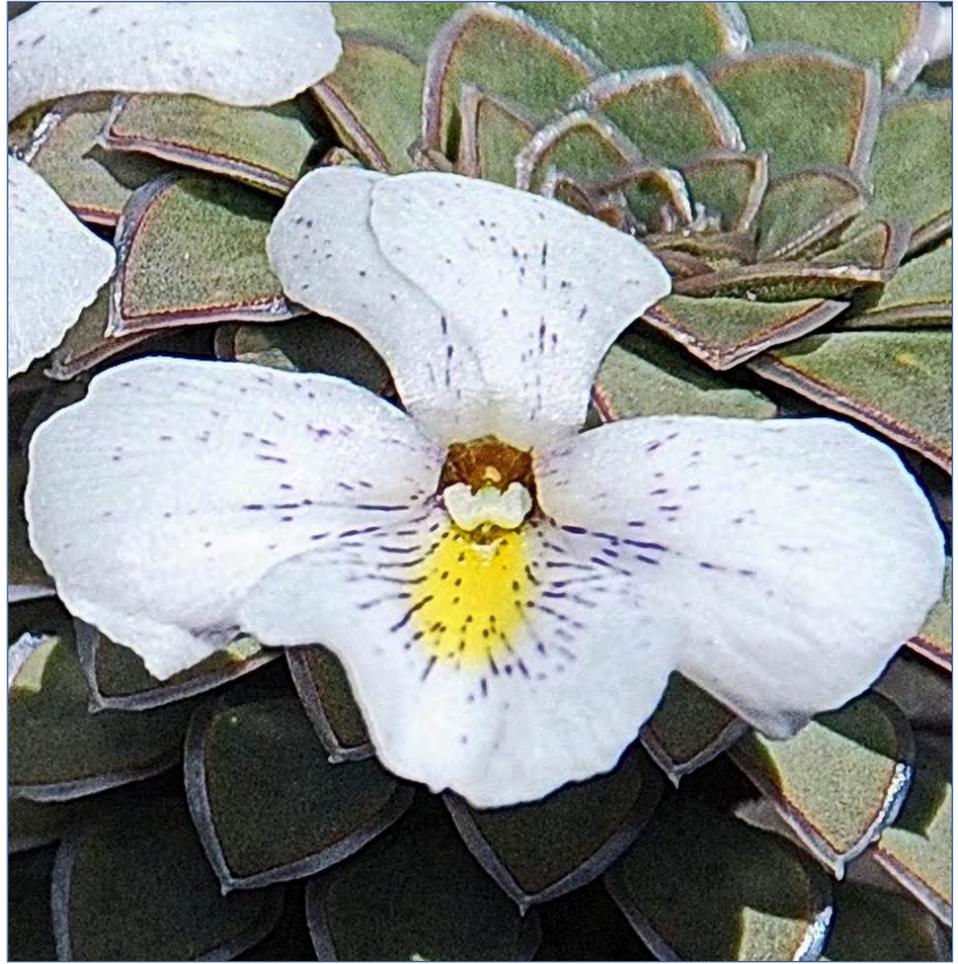
40: The *Viola obituaris* corolla spur in relation to the flower and peduncle. (ARF)



41: The similarly long spur of *Viola rossowiana*. (ARF))

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42: *Viola obituaris* flower.
(JMW)



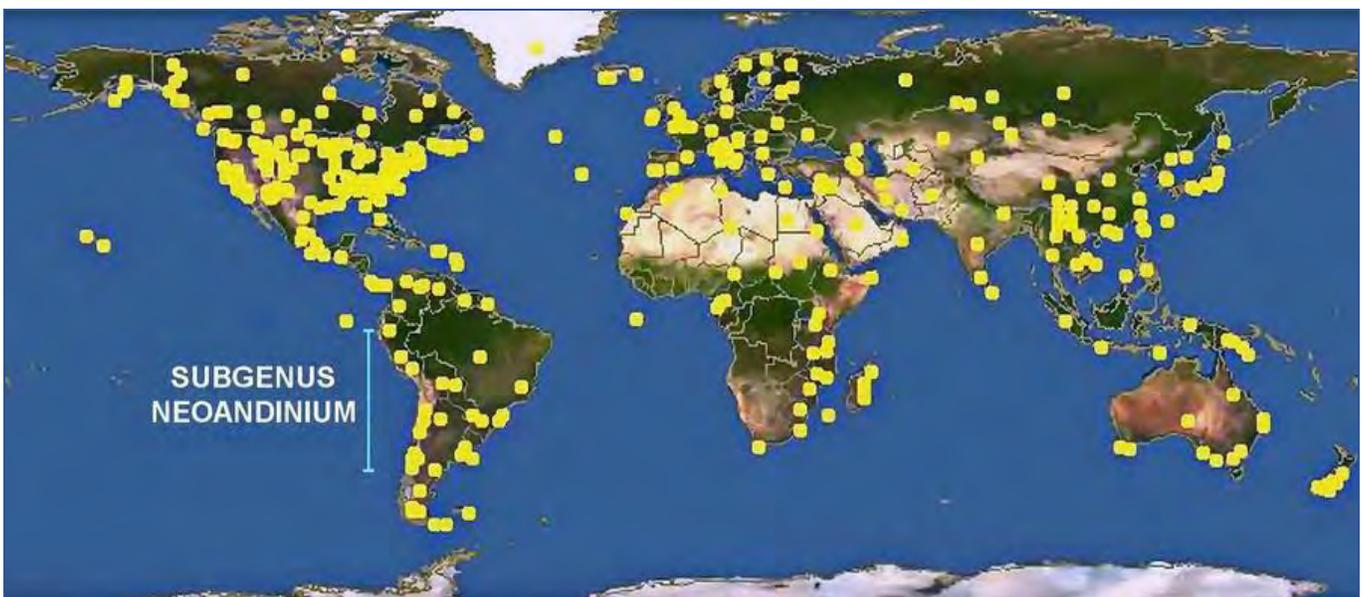
43: *Viola rossowiana* flower for
comparison. (ARF)

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44: *V. obituaris* sexual organs with all but two sepals removed - connectives (lowest) - anthers (dark) - style crest (top). (ARF)

45: *V. obituaris* stamen with nectar secreting spur. (Botanical painting - Cecila Scoones)



47) World distribution of the genus *Viola* showing the range of subgen. *Neoandinium* and its sempervivoid alliance, to which *V. obituaris* belongs.

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Background.

***Viola* and its subgenus *Neoandinium* (W. Becker) Marcussen**

Cosmopolitan *Viola* has a mainly temperate and high tropical mountain distribution [fig. 47]. With ca. 620-630 known and accepted species (Marcussen et al. ined.) it is the largest genus of the Violaceae family, and consists of 30 sections, mostly in the Northern Hemisphere (Wahlert et al. 2014, Marcussen et al. ined.). *Viola* evolved ca. 35 Ma years ago in what is now the southern end of temperate South America (Clausen 1929, Ballard et al. 1999, Marcussen et al. 2012, Marcussen et al. 2015). This early branching from the rest of the family has led to the conclusion that species of the most direct ancestral origin exist in the subcontinent in its subgen. *Neoandinium*, while four sections of the other subgenus, *Viola* L, are also present there (Marcussen et al. ined.).

Viola subgen. *Neoandinium* with 111 published taxa (IPNI 2021, Watson et al. 2021) in 11 sections, as accepted herein, is one of three groups of the genus endemic to South America. Together with the present species and others recorded but waiting to be described or collected, its individuals are known colloquially as the Andean rosulate violas. With a longitudinal distribution from the equator to southern Patagonia, their complement of published and known but as yet undescribed species as currently recognised by the present authors amounts to 151 (Watson & Flores ined.).

Apart from two regional floras, *V.* subgen. *Neoandinium* was ignored botanically until the mid-1990s following the death in 1928 of its historical authority Wilhelm Becker of Berlin-Dahlem. Indeed, it became rather better known to horticulture thanks to Sampson Clay (1937), despite some rather wild inaccuracies by him, and in particular as a result of his publishing B & W photos taken by Harold Comber during his explorations in Patagonia. The latter in fact constituted our own first awareness in 1965 of these remarkable violas and provided the initial attraction and impetus which drew us to the subgenus.

Taking this prolonged academic 'vacuum' into account, together with the inaccessible habitats and solitary or few known populations of many taxa (Watson & Flores 2014), the fact that it is still relatively poorly understood is hardly surprising. Furthermore, at least 25 of its species are currently unknown in the wild (Watson et al. 2021), which serves to exacerbate the problems, as does destruction of several important specimens and the difficulty of distinguishing between some taxa (Watson & Flores 2020).

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Nevertheless, Marcussen et al. (2015) have been able to calculate that the subgenus split from the rest of *Viola* as early as 29 Ma. This revelation, together with specialised adaptation to regional geological and geoclimatic conditions, explains why so many of its taxa are uniquely unlike the familiar violets and pansies of *V.* subgen. *Viola* (Watson & Flores 2012, 2013a, 2013c).

Anyone who has studied subgen. *Neoandinium* seriously could hardly fail to notice that, with the exception of a few unique individuals with no close morphological affinities, its species sort into a number of mainly very distinct natural alliances, these recently published as eleven sections (Watson et al 2021). Our vision of how the subgenus evolved and split into these groups has also been laid out informally (Watson & Flores 2012, 2013a, 2013c).

Two of the sections are particularly numerous, one being the very distinctive *V.* subgen. *Neoandinium* sect. *Sempervivum* under consideration here. Its 32 known species occupy the total range of the entire section. That is from Ecuador by the equator down via Peru, Bolivia, Chile and Argentina to approximately 49°S, some 5500 km when following the line of the Andes [fig.47]. We hypothesise that due to its initial position at the point of evolution of the section, its distinctive morphology, and range of habitats, this particular alliance evolved early to take advantage of vacant habitats resulting from ongoing vulcanism and rapid orogenous uplift in the southern Andes (Watson & Flores 2013a).

The scientific history of the sempervivoid alliance

Sixteen years after the earliest encountered of all the *V.* subgen. *Neoandinium* taxa was made known to science another, *Viola cotyledon* Ging., was the first of these particular species to actually be described (IPNI 2021). It took another couple of decades for the second to be published, those two being the only previous ones known by Gay (1846), as included in the *Viola* entry of his comprehensive multi-volume Flora de Chile. This was next followed by a monograph of the genus *Viola* in Chile (Reiche 1893). Another four of these particular sempervivoid violas had been located meanwhile, and were added to the group Reiche called perennial rosulates (*Rosulatae Perennes*).

After a decade of no further advance, the all-time authoritative giant of the genus, Wilhelm Becker, came on the scene and began to turn his attention to the South Americans. He was the first to publish a review of *V.* subgen. *Neoandinium* as a whole (Becker 1925b), defining it in this work as a section based on Reiche's illegal name *Rosulatae*. From 1922 to his untimely death in

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1928 he described no fewer than seven new species of *V.* subgen. *Neoandinium* sect. *Sempervivum* as collected by various others (Watson et al. 2021). These were augmented during the same period by three more from southern Patagonia discovered and published by the Swedish botanist and explorer Carl Skottsberg (1916).

Almost unbelievably, there was no significant study of the subgenus following Becker until 1994, when it was adopted by the present authors. Just one Peruvian and one Argentinian species were added during those 66 years! Our revitalising concentration on subgen. *Neoandinium* has yielded another nine taxa, including this one, to the sempervivoid alliance since. Another is under progress towards publication at the time of writing.

Defining characters of the sempervivoid alliance: Plant one annual, otherwise perennial, dwarf, subcaulous herbs, evergreen, glabrous, forming distinct, more or less tightly imbricated and spirally foliate rosettes. Rootstock axial, often notably stout, branched or not below. Rosette face depressed towards centre. Leaf pseudopetiolate, estipulate. Lamina broadly oblanceolate to wider than long, rigidly carnosose-coriaceous, entire, eglandular, smooth on both faces. Margin usually cartilaginous, usually glabrous, at times minutely ciliate or denticulate basally. Apex acute, obtuse or subtruncate, mucronulate with the rare exception of five taxa, and another facultatively so. Flowers never exceeding foliage, disposed around circumference or on face of rosette. Corolla glabrous or bearded, small to large. Style crest usually lateral, less commonly lateral and apical; apical in two taxa only.

Key to distinguish *Viola obituaris* from all others of sect. *Sempervivum*, as found exclusively in South America between Ecuador and Patagonia

1. Plants annual or perennial; rosulate or not; subcaulous, cauline, rhizomatous, ericoid or short lignose-branched; imbricate or not, glabrous or usually with distinct indumentum on at least some foliar parts; often with crenate margins to leaf blade, this flexible. Rosette when present never columnar. (Peru to S Patagonia) ... *V.* subgen. *Viola* and *V.* subgen. *Neoandinium* sections other than sect *Sempervivum*.

- Plants perennial and one annual; rosulate; subcaulous, columnar or depressed; always more or less densely imbricate; glabrous or occasionally minutely ciliate on lower leaf blade margin. Leaf blade entire or minutely serrate at base, subsucculent and rigid. Rosette columnar or not: *V.* subgen *Neoandinium* sect. *Sempervivum* (Ecuador to S Patagonia) ... 2.

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2. Spur not exceeding 4 mm length, usually less ... *VV. abbreviata* J.M. Watson & A.R. Flores, *aizoon*, *atropurpurea* Leyb., *auricolor* Skotts., *bangii* Rusby, *beckeriana* J.M. Watson & A.R. Flores, *blaxlandiae* J.M. Watson & A.R. Flores, *columnaris* Skotts., *comberi* W. Becker, *coronifera* W. Becker, *cotyledon*, *dasyphylla* W. Becker, *hieronymi* W. Becker, *leyboldiana* Phil., *lologensis* (W. Becker) J.M. Watson, *micranthella* Wedd., *nobilis* W. Becker, *pachysoma* M. Shearer, J.M. Watson & A.R. Flores, *petraea* W. Becker, *polycephala* H.E. Ballard & P. Jørg., *portulacea* Leyb., *pusillima* Wedd., *pygmaea* Juss. ex Poir., *regina* J.M. Watson & A.R. Flores, *sacculus* Skotts., *skottsbergiana* W. Becker, *turritella* J.M. Watson & A.R. Flores, *xzwienerii* J.M. Watson & A.R. Flores.

- Spur 6 mm or more long ... 3.

3. Corolla small, yellow (Andes of Santiago, central Chile) *V. sempervivum*

- Corolla larger, white ... 4.

4. Stamens hirsute (Andes of Santiago, central Chile) *V. santiagonensis*

- Stamens glabrous ... 5.

5. Rosette cryptic brown, corolla violet veined, petals discrete, style crest directed forwards, lobes patent. (Andes of Neuquén Province, N Patagonia, Argentina) *V. rossowiana*

- Rosette green, corolla without veining, petals broad, contiguous, style crest lobes recurved. (Andes of Bío Bío Region, S Chile) *V. obituaría*



48: An effectively clothed and equipped Andean military route march in a snowstorm. (Photo courtesy of tvu.cl)



49: Memorial plaques mark where, by terrible numerical irony, 44 young conscripts and a sergeant froze to death in May 2005. (JMW)

Acknowledgements

We much appreciate that Anita's brother Miguel, who works in forestry and lives at Campanario ca. 180 km NNW of Volcán Antuco, kindly put us up for a few days and at times accompanied us to the *V. obituaría* location with his family. They were just one of the many people, often friends, who afforded us nights' lodgings and sometimes gave us meals during our explorations in Patagonia and southern Chile.

The botanical artwork of our colleague Cecilia Scoones from just across the Andes in Mendoza, Argentina, has added immeasurably to the quality of this presentation.

As ever, we must not forget either the constant debt we owe to the Internet for being able to access various of its invaluable services, including the Word text and ACDSsee visual digital programmes, Wikipedia (above all for its account of the Antuco tragedy), and IPNI, among many others.



50: Military statue as permanent memorial of the tragedy and homage to those who perished.
(JMW)

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--- Species description ---

A *Sarcococca* endemic to Taiwan.

Julian M.H. Shaw¹, Bleddyn Wynn-Jones² & T.Y. Aleck Yang³

¹ Horticultural Taxonomy, Royal Horticultural Society, Wisley, Woking, Surrey, GU23 6QB.
julianshaw@rhs.org.uk

² Crûg Farm Plants, Caernarfon, Gwynedd, Wales, LL55 1TU.

³ National Museum of Natural Science, No.1, Guanqian Road, North District, Taichung City, Taiwan.

Sarcococca (Buxaceae) is a genus of some 11 to 15 species of small monoecious shrubs much appreciated in gardens for the strong perfume of their winter flowers. In the wild they are distributed eastwards across Asia from Afghanistan to China, Taiwan, the Philippine island of Luzon, and southwards as far as Sri Lanka, Thailand, Indochina, Java and Sumatra. The hardy species are widely grown as ornamental shrubs for their early scented flowers and evergreen foliage (Armitage *et al.*, 2014; McKean, 1997). The genus was last reviewed by Sealy (1986), although there has been at least one new taxon described since then (Shaw, 2011), along with new regional floristic accounts including the Flora of China (Min & Brückner, 2008) and Flora of Taiwan (Yang & Lu, 1993).

Sarcococca is distinguished from *Buxus* by alternate leaves, predominately bicarpellate female flowers in the basal part of the inflorescence and a berry fruit, rather than opposite leaves, and a 3-celled, capsular fruit, developing from a solitary terminal female flower. Recently *Buxus sirindhorniana* was described from Thailand that displayed characters of both genera, combining a bicarpellate ovary with opposite leaves, and a single terminal flower in each inflorescence (Soh *et al.*, 2014). However, molecular studies using nuclear ITS and plastid sequences have demonstrated the monophyly of both *Buxus* and *Sarcococca* and confirmed the generic placement of aberrant species such as *Buxus sirindhorniana* and the central American *Buxus conzattii* (Balthazar *et al.*, 2000; Soh *et al.*, 2014). Previous treatment of atypical *Buxus* as species of *Sarcococca*, such as *B. conzattii* as *Sarcococca conzattii* on account of its alternate leaves, bicarpellate flowers and berry-like fruit, but with a solitary terminal female flower in the inflorescence (Standley & Steyermark, 1949) is presumably the basis for ascribing one species of *Sarcococca* to Central and North America as in Flora of China (Min & Brückner, 2008), and probably the source of higher estimates, up to 20, of the number of species. *Buxus* with about 100 species is most species rich in Cuba where there may be as many as 40 species (González Gutiérrez *et al.*, 2013), whereas *Sarcococca* is largely south-east Asian. A generic synopsis of Buxaceae is provided by Byng (2014) who provides an

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estimate of c. 10 species for *Sarcococca* and notes that molecular investigation indicates *Haptanthus* also belongs within Buxaceae.

On the island of Taiwan, *Sarcococca* is very rare and has only been collected from two montane localities. One locality is Hualien Hsien, Hsiulin, Hsiang (121° 26' 12" E, 24° 07' 26" N) between 2771-3013 m altitude. The other larger colony in Kaohsiung province, Taouan Hsiang, Kuanshan mountain trail (120° 55' 01" E, 23° 15' 32" N) at around 2424 m altitude, where it was recollected in 2007 by B. Wynn-Jones in an area adjacent to the Southern Cross-Island Highway, a locality also visited by American plant collector Dan Hinkley (Hinkley, 2009).

***Sarcococca pruniformis* LINDL. var. *dioica* HAYATA n.v.** Frutex, ramis gracilibus fuscentibus, minute pubescentibus, vel subglabris, teretibus. Folia alterna, exsiccatō fusco-rubrescentia, lanceolata, pinnivena, breve petiolata, 8 cm. longa 2 cm. lata, utrinque acuminata, vel apice acuminata, basi attenuata ad petiolum brevem 1- $\frac{1}{2}$ cm. longum abeuntia, coriacea, margine integra, recurvata, costis supra impressis vel elevatis, supra glabra, subtus sub microscopio minute lepidota, rubroferruginea vel pallidissima, venis primariis lateralibus utrinque inconspicuis primum rectis, prope marginem abrupte flexuosis recurvis ascendentibus venam superiorem attingentibus. Flores ♀ spicato-racemosi, racemis brevibus 1-2 cm. longis, cum pedicellis 9 mm. longi, pedicellis 6 mm. longis, 1-bracteati, bracteis lanceolatis, 8-bracteolati, bracteolis oppositis, 4-seriatim imbricatimque dispositis, obovatis breve cuspidatis in forma sepalum sub-aquantibus gradatim ad sepalum abeuntibus. Sepala 4, obovata breve obtuseque cuspidata 3 mm. longa 1 $\frac{1}{2}$ mm. lata, margine ciliolata. Ovarium 2-carpellare, glabrum cum stigmatibus 3 mm. longum, stigma plus minus recurvatum. Fructus ignotus.

HAB. Montibus Centralibus, leg. U. MORI April., 1910.

Near *S. pruniformis* LINDL. (FORBES et HEMSL. In. Fl. Sin. II. p. 418) = *S. trinervia* WIGHT, Ic. t. 1877; but differs from the type by the much longer pedicels of female flowers and by the lanceolate leaves.

Original description of *S. pruniformis* var. *dioica* by Hayata, 1912.

Sarcococca plants from this locality were first described by Bunzō Hayata (1912) as *Sarcococca pruniformis* Lindl. var. *dioica*, based on a collection by Japanese botanist, Mori made in 1910. Li (1963) included it in the Himalayan *S. saligna* and was followed subsequently by the *Flora of Taiwan* (Yang & Lu, 1993) and *Flora of China* (Min & Brückner, 2008). Treatment of the Taiwanese plant as part of *S. saligna* as by Li (1963), which ranges from Afghanistan to Nepal would represent a rather disjunct and unlikely range extension. Perhaps partly in view of this disjunction it was recently treated as *Sarcococca longipetiolata* M. Cheng var. *dioica* (Hayata)

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F.Y. Lu *et al.* (2006). While *S. longipetiolata* is present on nearby mainland China, in Guangdong and Hunan, and also in Hong Kong (Hu, 2008), as its name implies it is not known for its short petioles. The leaves are also larger and more ovate, a dull green and the fruit is red. Red fruit has only been observed on *S. ruscifolia* (or *S. confusa* before maturing black). A colour image of live material from Hong Kong is available in Hu, (2008) and also online at the Hong Kong Herbarium website.

Moreover this nomenclatural combination is invalid because the name *S. longipetiolata* M. Cheng was not validly published under the provisions of the ICN since two different collections were cited as types. The name *S. longipetiolata* has since been validated (Yu & Li, 2014).

S. philippinensis also has very long narrow leaves but differs in the densely imbricate bracts subtending female flowers. There is a very detailed drawing of it published in *Hooker's Icones Plantarum* 35: t.3471 (1947).

Sealy (1986) did not see any Taiwanese material, but based on the description and published illustration by Hayata (1912), summarised the situation by concluding the Taiwanese plant is referable to the *S. coriacea* group, by reason of its glabrous branches, and bicarpellate female flowers, while noting that the Taiwanese taxon was distinct in that group by reason of small narrow leaves and notably shorter petioles. Because he did not have a specimen to examine, he refrained from naming it as a distinct species. Thus, the Taiwanese plant has been treated variably.

We were able to examine the extensive collection of live plants at Crûg Farm Plants, North Wales, UK, and also herbarium material, and we conclude that the Taiwanese plants are deserving of specific rank, completing the work of Sealy (1986). Consequently the following new name is provided.

Sarcococca taiwaniana J.M.H.Shaw, B.Wynn-Jones & A.Yang nom. et stat. nov. Replaced synonym: *Sarcococca pruniformis* Lindl. var. *dioica* Hayata, Icon. Pl. Formosan. 2: 130. 1912.

Type held at the Herbarium, Taiwan Forestry Research Institute.

Holotype: *Ushinosuke Mori s.n.*, 15 Apr 1910. TAI 15086.

Synonym: *Sarcococca longipetiolata* M.Cheng var. *dioica* (Hayata) F.Y.Lu, C.H.Ou, Y.T.Chen, Y.S.Chi, K.C.Lu & Y.H.Tseng, *Trees Taiwan* 2: 45. 2006. Nom. inval.

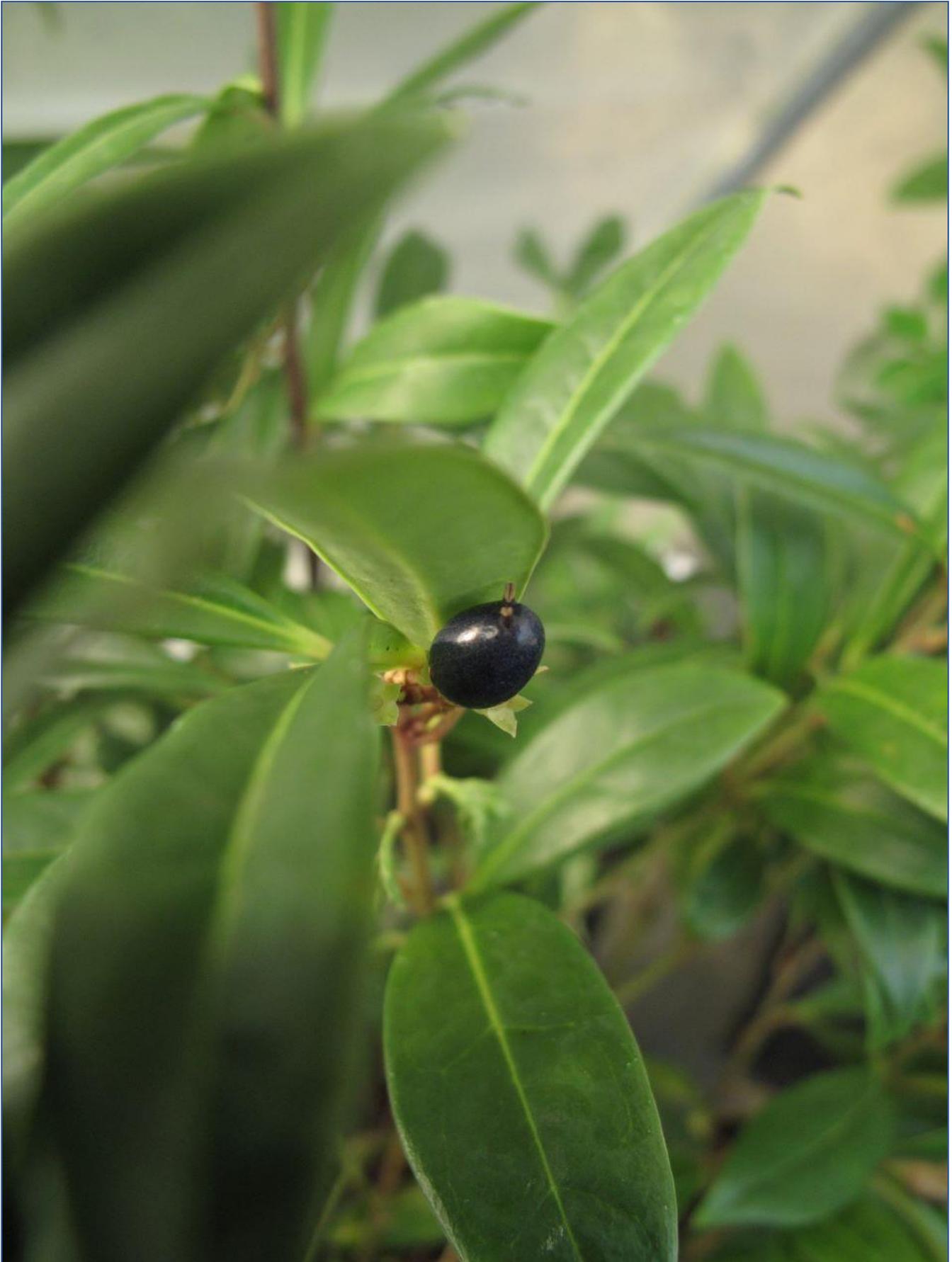
Description: Evergreen many-branched shrub, 30 cm to 1.2 m tall. Stems reddish-brown, c. 2 mm diameter, young twigs appearing smooth but finely hairy under magnification, stems with numerous longitudinal red striae on a light grey bark with small, transparent linear trichomes,

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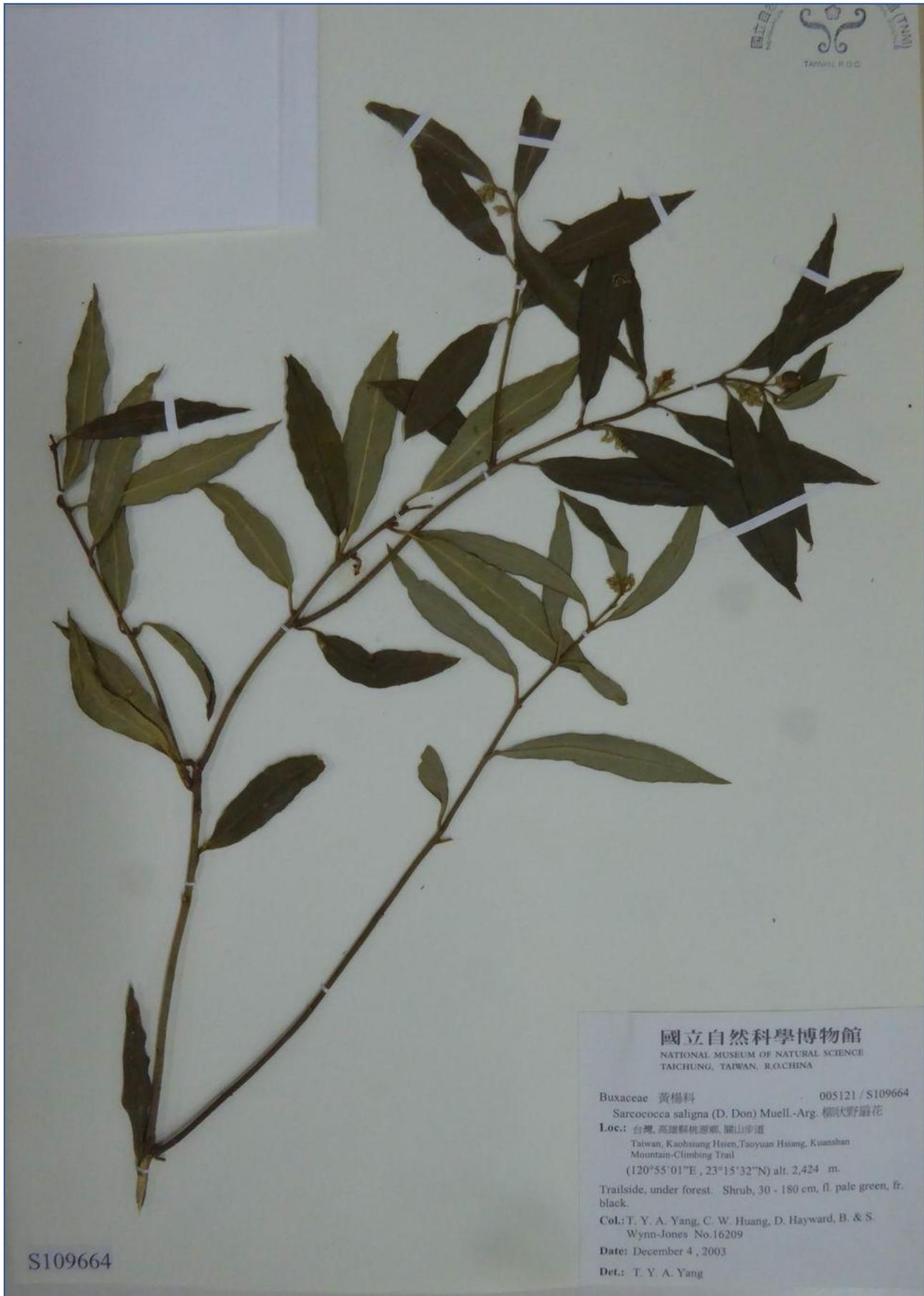
c. 0.1 mm long. Petioles 4-10 mm, minutely hairy. Leaves narrowly lanceolate, 50-104 mm long x 8-19 mm wide, apex acuminate, margin entire, thickened, slightly recurved forming a rough ridge; adaxial surface dark green, waxy, midrib slightly impressed, lateral veins indistinct, 7-11 per side, abaxial surface light green with numerous stoma appearing as light green dots, midrib raised, minutely hairy towards petiole. Inflorescences appearing in axils of upper leaves, (2-)3-4 female and 2 male flowers per inflorescence in uppermost few axils, and 1-2(-4) male flowers in leaf axils below. Peduncle with green, scale-like, triangular, 2 mm bracts with finely fimbriate margins. Female flowers with 2 bracts and 8 green tepals, styles 2, rarely 3. Male flowers with white, sometimes blushed pink, apiculate tepals with fimbriate margins. Stamens 4, strongly exerted, filaments white, 5.5 mm long, anthers 1-1.5 mm long, apex recurved, dark maroon, pollen creamy-white. Fruit subtended by 4 sepals slightly enlarging in fruit, margins fimbriate. Fruit solitary or up to 4 on a stalk, a blue-black shiny berry when ripe, 9-10 x 5-7 mm, ellipsoid, with 2, rarely 3, stigmas 1-1.5 mm long at the apex.



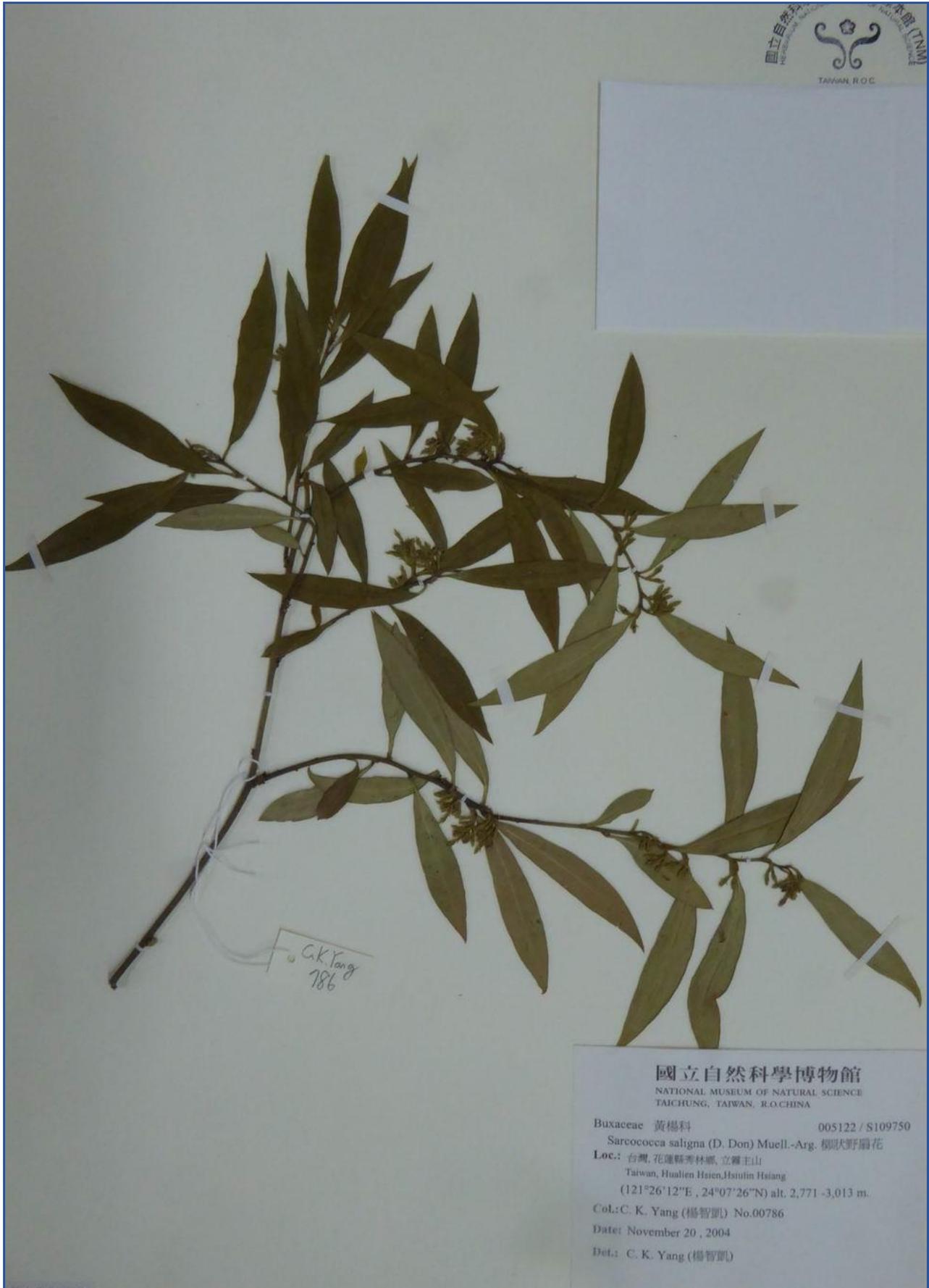
Flowering shoot of *Sarcococca taiwaniana* in cultivation.



Sarcococca taiwaniana fruit. Photo Bleddyn Wynn-Jones.



Herbarium specimen of the original collection of *S. taiwaniana* from Kaohsiung province, Taouan Hsiang, Kuanshan mountain trail, 2424m, Taiwan.



Herbarium specimen of *S. taiwaniana* from the other population at Hualien Hsien, Hsiulin, between 2771-3013 m, Taiwan. This confirms only one species is present in Taiwan.

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Bleddyn Wynn-Jones and colleagues have made several visits to the Taiwanese locality, and provided the following field notes.

RWJ 9999. Date of collection: 4 December 2003. Altitude: 2645m. Location: South Cross Highway no. 20. Running from east to west, on descent on western side. Kuanshan Trail on south side of road, starting at 2450m. Very steep trail only climbed as far as 2750m. *Sarcococca* starting at 2550m increasing in numbers till 2680m, ending at 2715m. A poorly colonising suckering shrub, with wiry stiff stems to 1.2m tall, sparsely branched above, stems purple especially in the upper elevation. Leaves dark green, glossy, narrowly elliptic to 9cm long by 1.8cm wide on petioles 1cm+ long, young branches pubescent. Flowering spikes few flowered, small, axillary on new growth. Fruit ellipsoid, glossy bluish-black, 7-8mm long with 2 or 3 styles. Less than 10 fruit were collected, so a few small plants were taken. The lack of fruit was due weakened plants caused by a heavy infestation of by a sap-sucking woolly scale insect, which had infected the entire colony and was apparently undescribed and possibly specific to *Sarcococca*. Plants were cultivated at the National Museum and eventually cleaned up from the insect infestation. When eventually imported to the UK sometime later they flowered and fruited freely. The resultant seedlings are the basis of the stock now in cultivation.

Growing under dense canopy of tall conifers, *Chamaecyparis formosensis* with sparse understorey, dark and relatively dry. Lower elevation with more diversity, including *Fatsia polycarpa* (narrow lobed forms), *Sinopanax formosana*, *Viburnum taitoense* (coming into flower), *Tricyrtis lasiocarpa*, *Disporum nantouense*, *Daphniphyllum pentandrum*, *Stachyurus sigeyosii* and *Viburnum propinquum*. Upper area opening out to large groves, *Ophiopogon sp.*, *Viburnum foetidum* var. *rectangulatum*, *Daphne morrisonensis* (linear leafed form), *Schefflera taiwaniana*, along with the following pteridophytes: *Arachniodes rhomboides*, *Dryopteris formosana*, *Polystichum falcipinnum*, *P. hancockii*, *P. parvipinnulum*, *Monachosorum henryi*, *Pteris nervosa*, *P. wallichiana* and *Plagiogyria euphlebia*.

RWJ was used for a joint collecting trip in which BW-J worked with Dick Hayward, of Rickard's Ferns, and Aleck Yang.

CWJ 12391. Date of collection: 22 November 2007. Altitude: 2700m. Just one miserable seed found from top, after searching all day. CWJ was used for a joint expedition in which BW-J worked with Finlay Colley and Aleck Yang.

Additional specimens examined at TNM: *T. Y. A. Yang, C. W. Huang, D. Hayward, B. & S. Wynn-Jones 16209*. 4 Dec 2003, Kaohsiung City, Taoyuan District, Taiwan Prov., No. 20 Hwy (also called South Cross Highway), Kuanshan trail, alt. 2424m. (flowers and fruit); *S. C. Liu & C. L. Chen et al., 150*. 7 Mar 2004, Taiwan Prov., no. 20 Hwy, Bridge Chingchinchiao to Kuanshan,

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2500-2700m. (leaves only); *C.K. Yang* 786, 20 Nov 2004, Huanlien County, Hsiulin Township, on the way of Mount Liwuchushan, alt. 2771-3000m. (flower buds).

The Kuanshan area is noted as an important centre of endemic biodiversity. Chung and Peng (2002) listed the following taxa, as either endemic or as only known from Kuanshan, as in the case of *Sarcococca taiwaniana* (listed as *Sarcococca saligna* (D. Don) Muell.-Arg.); *Epilobium nankotaizanese* Yamam.; *Listera kuanshanensis* H.J. Su; *Parasenecio monantha* (Diels) C.-I Peng & S.W. Chung; *Parasenecio nokoensis* (Masam. & Suzuki) C.-I Peng & S.W. Chung; *Polystichum xiphophyllum* (Baker) Diels; *Ponerochis tominagai* (Hayata) H.J. Su & J.C. Chen; *Senecio taitungensis* S. S. Ying; *Saussurea kanzanensis* Kitam.; *Senecio kuanshanensis* Chung & Peng; *Woodsia okamotoi* Tagawa.

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