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Three new species of, and realignments in, *Rhododendron* sect. *Schistanthe* (Ericaceae)

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Abstract

Three new species are described, two from Sulawesi and one from New Guinea: *Rhododendron dissilistellatum* Craven, *R. gumineense* Craven and *R. torajaense* Craven. The circumscriptions of *R. seranicum* J.J.Sm. sensu Argent, *R. radians* J.J.Sm. sensu Argent & Sleumer, and *R. javanicum* (Blume) Benn. sensu Argent are considered to be excessively broad and the taxonomy of these three species is amended. One new name and six new combinations resulting from realignments in taxonomic status are proposed: *R. biappendiculatum* Craven, *R. cladotrichum* (Sleumer) Craven, *R. cockburnii* (Argent, A.Lamb & Phillipps) Craven, *R. extraneum* (Sleumer) Craven, *R. kinabaluense* (Argent, A.Lamb & Phillipps) Craven, *R. minahasae* (Sleumer) Craven, *R. palawanense* (Argent) Craven.

Keywords: *Rhododendron*, *Rhododendron* sect. *Schistanthe*, vireya rhododendrons, Ericaceae, new species, realignments, taxonomy, Malesia

Introduction

Fieldwork in support of the doctoral research of Gillian Brown (School of Botany, The University of Melbourne, and CSIRO Plant Industry, Canberra) into the morphological systematics of *Rhododendron* sect. *Schistanthe* Schltr. (at that time called sect. *Vireya* (C.B.Clarke) H.F.Copel.) was undertaken in Sulawesi, Indonesia, in 2002 (see also Brown 2004, 2006a, 2006b). During the fieldwork, several collections of non-fertile plants were made and living material (seed or cuttings) was obtained of these in order to grow them on to flowering, at which point the plants could then be identified. In several other cases, herbarium collections were identified to a preliminary point only and detailed investigations into their identity were not then made.

The identification of the Sulawesi collections has recently been revisited and I have concluded that the taxonomy of *R. radians* J.J.Sm. sensu Argent (2006) and Sleumer (1966), and of *R. javanicum* (Blume) Benn. sensu Argent (2006) is unsatisfactory. The differences between the several taxa included in these two species are as great as the differences between other taxa accepted as "good" species by these two authors. Accordingly, realignments in the taxonomy of these two species and of *R. seranicum* J.J.Sm. sensu Argent (2013) are proposed below. Notwithstanding any possible interpretation to the contrary, all the new species in the present contribution are accepted as species insofar as the provisions of the *International Code of Nomenclature* (McNeill et al. 2012) relating to acceptance of taxa by their authors are concerned.

Based upon studies of several DNA sequences conducted in the Benjamin D. Hall laboratory, Seattle, USA, Goetsch et al. (2011) published an inferred phylogeny of sect. *Schistanthe*. This research was used as the basis for proposing a new classification of *Schistanthe* (Craven et al. 2011). An important finding of the phylogenetic research was that there was no support for the formal recognition of subsections which are now known to be artificial assemblages of species with certain common morphological traits. In the newly proposed classification, the subsections are treated as informal groups. The advantage of this approach is that the informal groups, which can be keyed, are useful for identificatory purposes. In the text below, the names of the informal groups are given in Roman font.

It is worth noting in the context of taxon recognition in the present discussion that Sleumer (1966) apparently used the rank 'variety' when he was uncertain of the status of the entity involved (Argent 2006: 6). In other words, when Sleumer was uncertain as to whether or not an entity should be recognised at species rank or perhaps even not recognised at all, he ranked it as a variety. This led to his including taxa of uncertain acceptance within a "good" species, the expanded circumscription thus making that species itself of uncertain status. Argent (2006) has used the ranks of variety and subspecies in infraspecific taxonomies, but has not given a rationale for their application. In some cases he apparently has followed Sleumer in using the rank variety, e.g., for *R. radians* (see below).

† The author passed away on 11 July 2014, three weeks after submitting the final version of this paper. — Editor.

Taxonomy

1. On the Euvireya group in western Malesia and Sulawesi

1.1. *Rhododendron javanicum* sensu Argent (2006)

Argent (2006) adopted a very broad circumscription for *R. javanicum*, one that is difficult to justify and that was criticised by Craven (2007). One significant issue is that there is no character state or combination of character states that uniquely defines the species *R. javanicum* sensu Argent. In fact, if one accepts that the summed character states of *R. javanicum* sensu Argent circumscribe a species of sect. *Schistanthe* then at least several other species accepted by Argent as being distinct species of the section would have to be included within his concept of *R. javanicum*.

It seems the taxa mentioned with respect to the discussion of *R. javanicum* sensu Argent (2006) are probably closely related; in Goetsch et al. (2011), clade 4 consists of western Malesian species that include several of the treated or mentioned taxa. It is pertinent also to note that within clade 4, *R. brookeanum* H.Low ex Lindl. and *R. javanicum* are in different, strongly supported clades, thus supporting Sleumer (1966) who maintained these two as distinct species.

Very little is known about the extent of sympatry within this group of species, which is unfortunate, as biotic sympatry can be a powerful indicator of genetic distinctness. Sleumer (1966) indicates that *R. teysmannii* Miq. and *R. javanicum* rarely occur in biotic sympatry, which is evidence they are reproductively isolated.

Several characters that are diagnostic for the western Malesian sect. *Schistanthe* species included by Argent (2006) in *R. javanicum* are listed in Table 1, with the relevant states indicated for each taxon as far as the states can be determined. The character states predominantly have been taken from Argent (2006) and Sleumer (1966), supplemented with data from Callard (2014), protologues and personal observations. Where a state was not given by Argent (2006) or Sleumer (1966) for one of the infraspecific taxa they treated, but those authors indicated that the infraspecific taxon was morphologically the same as the autonymic, infra-specific taxon except for particular, designated features, the applicable state of a character has been determined by inference. Typically branchlets of taxa within the complex are scaly and lack hairs, but when Sleumer (1966) and/or Argent (2006) state that an organ is glabrous it is interpreted as there being neither scales nor hairs. Characters that I consider to be valuable for characterising species include leaf arrangement, leaf lamina anatomy, outer perulae shape, corolla form, ovary surface and the ovary-style interface.

The leaves of *Rhododendron* species are spirally arranged on each seasonal growth flush, either pseudo-whorled or dispersed, and the possession of one or other of these two latter states is diagnostic. Occasionally, a species, in which the pseudowhorled condition is the usual state, may have dispersed leaves on a particularly vigorous growth or "water shoot" but this axis reverts to the pseudowhorled condition once the abnormally vigorous growth has slowed. Taxa which always possess the dispersed state are *R. kinabaluense* (Argent, A.Lamb & Phillipps) Craven, *R. palawanense* (Argent) Craven and *R. schadenbergii* Warb., the remainder have pseudowhorled leaves, with the exception of *R. moultonii* Ridl., in which the leaves are in an intermediate pseudowhorled-dispersed state.

Leaf lamina anatomy is an especially interesting feature. In *R. javanicum*, the leaves of fresh material are relatively thin and the primary (the major lateral) veins are distinct; the leaves appear "dryish" when snapped. In some other taxa, such as *R. brookeanum* and *R. kinabaluense*, the leaves are thickened and the primary veins are obscured, apparently by being more or less immerged within the lamina; the leaves of fresh material appear "subfleshy" when snapped. The "subfleshy" leaves apparently are, to one extent or another, sunken between the primary veins and can perhaps be best described as "puckered". The "dryish" leaves are flat between the primary veins. The subfleshy, puckered leaf type is well shown in photographs in Argent (2006: 246, *R. brookeanum*, & 247, *R. cockburnii*). The dryish leaf type is depicted well in Callard (2014: Species Gallery, as *Rhododendron javanicum* subsp. *javanicum*).

Anatomical studies underway at the Erik Nilsen laboratory at Virginia Tech, Blacksburg, will demonstrate the structural differences between the two leaf types and provide answers as to whether or not distribution of these leaf anatomies within Euvireya are congruent with the phylogenetic clades recovered by Goetsch et al. (2011) (E. Nilsen, personal communication). As it is of particular interest to those interested in physiological adaptations and as many sect. *Schistanthe* species are epiphytic, one hopes the Nilsen lab will also consider the potential significance of the subfleshy leaf anatomy to such aspects as water management. My impression is that these leaf features reflect major genetic differences, possibly indicating separate evolutionary paths, and therefore should be acknowledged in classification by distinct, specific-level, taxonomic recognition as opposed to uncritical "lumping".

The shape of the outer perulae (inflorescence bud scales) and the nature of any indumentum also are valuable in species delimitation. Unfortunately, because of their essential ephemeral nature these usually are not available on herbarium specimens and data are only directly available for *R. brookeanum* and *R. javanicum* — collectors usually only collect rhododendrons when they are in flower, by which time the perulae have largely fallen, and non-insightful collectors usually do not collect buds. The corolla of all taxa is funnel-shaped, with the exception of *R. cockburnii*, in which the corolla is tubular-funnel-shaped with a constriction in the tube. Surface features of the ovary, whether scaly, hairy or

Table 1. Character states of eleven western Malesian *Rhododendron* species in the Euvireya group. See text for discussion of characters/states. Character states in 'Roman' font have been taken from Argent (2006), Sleumer (1966), Callard (2014) or are personal observations. Character states in '*italics*' are derived by inference from Argent (2006) and/or Sleumer (1966).

Taxon	Leaf arrangement	Leaf lamina	Branchlet surface	Leaf surface	Pedicel surface	Outer perulae shape	Corolla form	Anther length (mm)	Ovary surface	Ovary-style interface
R. brookeanum	pseudowhorled	apparently thickened but primary veins possibly not fully obscured	laxly scaly	scaly, not hairy	scaly, rarely hairy	ovate subacuminate, glabrous	funnel-shaped	(4–) 4.5–5 (–7)	scaly and hairy	ovary ± abruptly tapering to style
R. cladotrichum	pseudowhorled		*scaly* and hairy	*scaly*, hairy	+/- glabrous	*ovate subacuminate, glabrous*	*funnel-shaped*	(4–) 4.5–5 (–7)	*scaly and hairy*	*ovary ± abruptly tapering to style*
R. cockburnii	pseudowhorled	thickened and primary veins obscured		*scaly*, [?hairy or not]			tubular-funnel-shaped, tube with a constriction	5	glabrous	
R. extraneum	pseudowhorled		branchlets laxly scaly, not hairy	*scaly, not hairy*	scaly, not hairy	*ovate subacuminate, glabrous*	funnel-shaped	(4–) 4.5–5 (–7)	*scaly and hairy*	*ovary ± abruptly tapering to style*
R. gracile	pseudowhorled, tightly to loosely so	apparently not thickened and obscuring primary veins	scaly, hairy or not	*scaly, not hairy*	scaly, hairy or not	*ovate subacuminate, glabrous*	funnel-shaped	c. 4	*scaly* and hairy	*ovary ± abruptly tapering to style*
R. javanicum	pseudowhorled	not thickened and obscuring primary veins	laxly scaly	scaly	laxly scaly, not hairy	broadly ovate, shortly subulate-mucronate, glabrous	funnel-shaped	(2.5–) 3–3.5 (–4)	glabrous or very sparsely scaly	ovary tapering to style
R. kinabaluense	dispersed	thickened and primary veins obscured	scaly				funnel-shaped		hairy	
R. moultonii	intermediate pseudowhorled dispersed	thickened and primary veins obscured	laxly scaly	scaly	laxly scaly		funnel-shaped	5–6	glabrous	ovary abruptly tapering to style
R. palawanense	dispersed	perhaps thickened and primary veins possibly not fully obscured (needs confirmation)			glabrous or laxly scaly		funnel-shaped	5	glabrous or variably hairy and scaly	
R. schadenbergii	dispersed	perhaps thickened and primary veins possibly not fully obscured (needs confirmation)	scaly	*scaly*	*laxly scaly, not hairy*	*broadly ovate, shortly subulate-mucronate, glabrous*	*funnel-shaped*	5–6 (–7)	*glabrous or very sparsely scaly*	*ovary tapering to style*
R. teysmannii	pseudowhorled	not thickened and obscuring primary veins		*scaly*	nearly always hairy	*broadly ovate, shortly subulate-mucronate, glabrous*	*funnel-shaped*	*(2.5–) 3–3.5 (–4)*	densely hairy, *scaly*	*ovary tapering to style*

glabrous, are useful and easily scored. Generally, the particular states are consistent within a taxon, but in *R. gracile* and *R. teysmannii* hairs may be present or absent and in *R. palawanense* the ovary may be glabrous or scaly. Another useful feature involving the style is the ovary/style interface. The ovary may taper gradually to the style or may taper abruptly and apparently this is a difference between *R. javanicum*, in which the ovary tapers to the style, and *R. brookeanum*, in which it more or less abruptly tapers to the style.

There are other characters, the states of which have diagnostic value, such as flower orientation (erect, semi-erect, spreading, semipendulous, etc.), inflorescence shape (domed or flat), anther colour (yellowish or dark reddish/purple) and pollen colour (at least grey or cream), that could be used for circumscribing the species, but data are not available for sufficient taxa to include them in Table 1. Assessment of inflorescence shape is difficult when a plant is not flowering to the maximum of its potential; reduced nourishment, reduced vigour, etc., can result in the production of flat inflorescences instead of the usual domed inflorescences that that genotype may produce when in a state of optimal vigour.

The name *R. brookeanum* var. *extraneum* Sleumer is not mentioned by Argent (2006), neither in the index nor in the text dealing with the *R. javanicum* complex. This is not just an isolated instance of a name either not appearing in Argent's book or not being satisfactorily accounted for; it happens quite frequently. Surprisingly, Argent has not even included some of his own names, such as *R. brookeanum* subsp. *brookeanum* var. *kinabaluense* (Argent, A.Lamb & Phillipps) Argent, *R. brookeanum* subsp. *gracile* (Lindl.) Argent, and several others relevant to the present discussion as far as their taxonomic and/or nomenclatural status is concerned.

Having considered the variation recorded for the taxa listed in Table 1 together with variation in other organs such as leaf lamina shape and size, etc., I believe the taxonomy of this complex is best resolved with all the taxa being accepted at species rank, as listed below. The species can be identified using the keys in Argent (2006: 234–237), with the exception of *R. extraneum* (see below).

Additional synonyms are given under the relevant taxa in Argent (2006) and Sleumer (1966).

***R. brookeanum* H.Low ex Lindl.**

J. Hort. Soc. London 3: 823 (1848). — *R. javanicum* subsp. *brookeanum* (H.Low ex Lindl.) Argent & Phillipps, Bot. J. Linn. Soc. 85: 15 (1982).

Notes. *Rhododendron brookeanum* may be distinguished from *R. javanicum* sensu stricto by the puckered leaf lamina; the ovate subacuminate, glabrous outer perulae; and the ovary more or less abruptly tapering to the style. In *R. javanicum* the leaf lamina is flat; the outer perulae are broadly ovate, shortly subulate-mucronate, glabrous; and the ovary tapers to the style.

R. cladotrichum* (Sleumer) Craven, *comb. et stat. nov.

Basionym: *R. brookeanum* var. *cladotrichum* Sleumer, Reinwardtia 5: 224 (1960). — *R. javanicum* subsp. *cladotrichum* (Sleumer) Argent, Rhododendrons of subgenus Vireya 247 (2006).

Notes. Sleumer (1966) separated *R. cladotrichum* (as var. *cladotrichum*) from *R. brookeanum* (as var. *brookeanum*) by the branchlets being hairy and the leaf lamina midrib being densely short-hairy on both surfaces in *R. cladotrichum* and the branchlets and leaf lamina being glabrous in *R. brookeanum*.

R. cockburnii* (Argent, A.Lamb & Phillipps) Craven, *comb. et stat. nov.

Basionym: *R. javanicum* subsp. *cockburnii* Argent, A.Lamb & Phillipps, Notes Roy. Bot. Gard. Edinburgh, 42: 113 (1984). — *R. brookeanum* subsp. *cockburnii* (Argent, A.Lamb & Phillipps) Argent, Edinburgh J. Bot. 52: 364 (1995).

Notes. The pseudowhorled leaves, the subfleshy and puckered leaf lamina and the corolla with its constricted tube are diagnostic for the species. The corolla is depicted in Argent (2006: 247, as *R. javanicum* subsp. *cockburnii*).

R. extraneum* (Sleumer) Craven, *comb. et stat. nov.

Basionym: *R. brookeanum* var. *extraneum* Sleumer, Reinwardtia 5: 225 (1960).

Notes. *Rhododendron extraneum* was treated by Sleumer (1966) as a variety within *R. brookeanum*. *Rhododendron extraneum* occurs on Sumatra whereas the other three of the four infraspecific taxa of *R. brookeanum* sensu Sleumer (1966) are from Borneo. It may well be that the present taxon fell into Sleumer's "uncertain status" category, discussed above, and he placed it as a variety within *R. brookeanum*. The two specimens of *R. extraneum* in L, *Meyer 4582* (the type) and *Meyer 5390*, cannot be keyed to a taxon in Argent's key to sect. *Euvireya* sensu Argent (F. Adema, personal communication) and this supports its status as a distinct species.

Sleumer (1966) separated this taxon from *R. gracile* (as var. *gracile*) on the basis of the leaf lamina being narrowly ovate and the corolla being 5 (–6) cm long in *R. gracile* and the leaf lamina being narrowly ovate-oblong and the corolla being 4 (–5) cm long in *R. extraneum.*

***R. gracile* H.Low ex Lindl.**

J. Hort. Soc. London 3: 84, fig. (1848). — *R. brookeanum* var. *gracile* (H.Low ex Lindl.) Henslow, J. Roy. Hort. Soc. 13: 261, f. 42 (fol.), 43a (fl.) (1891). — *R. javanicum* subsp. *gracile* (H.Low ex Lindl.) Argent, A.Lamb & Phillipps, Notes Roy. Bot. Gard. Edinburgh, 42: 114 (1984). — *R. brookeanum* subsp. *gracile* (H.Low ex Lindl.) Argent, Edinburgh J. Bot. 52: 364 (1995).

Notes. Fide Argent et al. (1984) the leaf lamina is smooth, not puckered, and up to 3.5 cm wide. The species is well depicted in Argent (2006: 247, as *R.*

javanicum subsp. *gracile*). Argent (1995) considered the taxon as "clearly requiring at least subspecific status".

***R. javanicum* (Blume) Benn.**

Pl. Jav. Rar. 85 (1838), excl. t. 19, which is *R. teysmannii* fide Sleumer (1966). — *Vireya javanica* Blume, Bijdr. Fl. Ned. Ind. 15: 854 (1826).

Notes. See under *R. brookeanum* for the differences between these two species.

R. kinabaluense* (Argent, A.Lamb & Phillipps) Craven, *comb. et stat. nov.

Basionym: *R. javanicum* var. *kinabaluense* Argent, A.Lamb & Phillipps, Notes Roy. Bot. Gard. Edinburgh, 42: 113 (1984). — *R. brookeanum* var. *kinabaluense* (Argent, A.Lamb & Phillipps) Argent, Edinburgh J. Bot. 52: 363 (1995). — *R. javanicum* subsp. *kinabaluense* (Argent, A.Lamb & Phillipps) Argent, Rhododendrons of subgenus Vireya 248 (2006).

Notes. *Rhododendron kinabaluense* is characterised by its dispersed leaves, puckered leaf lamina, and appressed and often emarginate outer perulae.

***R. moultonii* Ridl.**

J. Straits Br. Roy. As. Soc. 63: 61 (1912). — *R. javanicum* subsp. *moultonii* (Ridl.) Argent, Bot. J. Linn. Soc. 85: 16 (1982). — *R. brookeanum* var. *moultonii* (Ridl.) Argent, Edinburgh J. Bot. 52: 364 (1995).

Notes. This species is characterised by the intermediate, dispersed-pseudowhorled arrangement of its leaves, the puckered leaf lamina, and the ovary abruptly tapering to the style.

R. palawanense* (Argent) Craven, *comb. et stat. nov.

Basionym: *R. javanicum* subsp. *palawanense* Argent, Gard. Bull. Singapore 56: 90 (2004).

Notes. *Rhododendron palawanense* is characterised by the dispersed leaves, flat leaf lamina, acute (never emarginate) outer perulae, and grey pollen.

***R. schadenbergii* Warb.**

in Perkins, Fragm. Fl. Philippines 172 (1905). — *R. javanicum* var. *schadenbergii* (Warb.) Sleumer, Reinwardtia 5: 195 (1960). — *R. javanicum* subsp. *schadenbergii* (Warb.) Argent, Edinburgh J. Bot. 52: 364 (1995).

Notes. *Rhododendron schadenbergii* is characterised by the dispersed leaves, apparently flat leaf lamina, and cream pollen. Argent (1995) comments that this plant "warrants at least subspecific status".

***R. teysmannii* Miq.**

Fl. Ned. Ind., Eerste Bijv. 3: 585 (1861). — *R. javanicum* var. *teysmannii* (Miq.) King & Gamble, J. As. Soc. Bengal 74: 75 (1905). — *R. javanicum* subsp. *teysmannii* (Miq.) Argent, Rhododendrons of subgenus Vireya 249 (2006).

Notes. This species is characterised by the flat leaf lamina, the very commonly hairy pedicels, and the more or less densely pubescent ovary. As noted above, *R. teysmannii* and *R. javanicum* may occur in biotic sympatry which is evidence in support of their being distinct species.

1.2. A new name for *Rhododendron seranicum* subsp. *sparsihirtum*

Rhododendron biappendiculatum* Craven, *nom. et stat. nov.

Replaced synonym: *R. seranicum* J.J.Sm. subsp. *sparsihirtum* Argent, Rhododendrons, camellias and magnolias 2013, 127 (2013) (as *sparsihirtus*).

Notes. *Rhododendron seranicum* subsp. *sparsihirtum* was distinguished from subsp. *seranicum* on the basis of it having hairs at the base of the filaments, on the disk and inside the corolla towards the base (Argent 2013). Argent also noted that the Binney plant, which is the type accession and the only specimen cited by Argent, "superficially looks identical to the other accessions of *R. seranicum* from Sulawesi, only on dissection of the flowers can the distinguishing hairs be seen" (Argent 2013).

The following material also originated from the Gunung Sojol complex in Sulawesi: *A.Rouse s.n.*, Australia, Victoria, cultivated in Hawthorn East, 20 July 2012 (CANB) [provenance: Indonesia, Sulawesi Tengah, the western lower slopes of the Gunung Sojol complex, on Tinombo-Sipatoh path, open steep grassy slope, leg. L.A. Craven, 23 July 2002, living material only collected]. This material must have been collected very close to, if not from the same, population from which living material was collected by David Binney, as, at the time of our visit in 2002, there was only the one path from the last village, Sipatoh; this was used by rattan harvesters, etc., to access the Gunung Sojol massif. The Binney-collected material subsequently afforded the type specimen of subsp. *sparsihirtum*. The Rouse material differs in several particulars from *R. seranicum*, as that species was circumscribed by Sleumer (1966). Sleumer noted that a slightly differing specimen, i.e., to *R. seranicum* in the Moluccas, had been collected from Sulawesi, but, as he gave the distribution of *R. seranicum* as being the Moluccas only, it can confidently be taken that his 1966 description and concept of the species is based upon Moluccan specimens only. The Rouse collection differs from *R. seranicum* sensu Sleumer in at least the following: the indumentum features noted by Argent (2013); the biappendiculate anthers (blunt or minutely apiculate in *R. seranicum*); the narrowly oblong-obovoid ovary, brownish when dry (oblong-conical, blackish when dry in *R. seranicum*); and the pedicels not, or scarcely, widened at the apex (thickened at apex in *R. seranicum*).

Argent (2013) also stated that the Gunung Sojol plant

> agrees quite closely to *R. javanicum* ssp. *schadenbergii* (Warb.) Argent a Philippine sub-species that was recorded from Manado in the north of Sulawesi (Sleumer, 1960). However the plants from Sulawesi have much shorter anthers than is recorded for *R. javanicum* ssp. *schadenbergii* from the Philippines and it seems safer for the present to keep that subspecies restricted to the Philippines.

It seems therefore that an association of the Gunung Sojol plant with the plant from the Moluccas may not be so strong that its inclusion within the circumscription of *R. seranicum* is the best possible taxonomic disposition for the Gunung Sojol plant. Given the several differences between the two plants noted above, and given that additional differences may be discovered in future (no material from the Moluccas has been available to me and I have relied on the data in Argent (2013) and Sleumer (1966), and that obtainable from the Rouse collection in CANB), my conclusion is that the Gunung Sojol plant should be recognised as a distinct species.

The epithet *sparsihirtum* is not especially appropriate at species rank in sect. *Schistanthe* given that many of its species, when hairy, are sparsely so and for that reason a new name is given. Although Sleumer (1966) indicates that a tendency towards the appendiculate condition may be present in *R. seranicum*, the biappendiculate anthers in the Gunung Sojol plant are a striking feature.

1.3. A new species from Sulawesi

Rhododendron torajaense* Craven, *sp. nov.

From *R. rhodopus* Sleumer it differs in the coriaceous, acuminate leaf lamina; the weakly sweet-fragrant flowers; the corolla being 45–50 mm long including the lobes; and the anthers being 3 mm long. In *R. rhodopus* the leaf lamina is obtusely acuminate to narrowly acute and cartilaginous, the flowers are strongly feijoa fruit-scented, the corolla is 65–79 mm long including the lobes, and the anthers are 6 mm long.

Holotypus: Indonesia, Sulawesi Selatan, Tana Toraja, Batutumonga, on way to Gunung Sesean, Lat. 02° 54' 32" N, Long. 119° 53' 02" E, alt. 1359 m, 12 July 2002, *G.Brown, L.Craven & L.Juswara 78* (BO). **Isotypus:** CANB.

Shrub to 1 m tall. *Branchlets* glabrescent (initially moderately densely scaly), c. 2.5–4 mm in diameter. *Leaves* 4–6-whorled (on vigorous growth the pseudo-whorls loose with the proximal leaves discretely inserted). *Leaf lamina* narrowly elliptic, elliptic, narrowly ovate or ovate, 85–170 × 35–75 mm, base cuneate to rounded, apex acuminate, margin subrevolute; abaxially and adaxially with moderately dense sessile scales with the rim irregular (but not incised) and with a raised centre; midrib prominent abaxially, adaxially prominent proximally and becoming slightly impressed towards the apex, lateral veins distinct, 8–14 per side. *Petiole* 12–27 mm long. *Inflorescence* a 7–8-flowered umbel, flowers erect to spreading. *Pedicel* 14–22 mm long. *Calyx* obsolete. *Corolla* short-salverform, 45–50 mm long including the lobes, white, weakly sweet-fragrant, tube 28–30 mm long, lobes 17–20 mm long and spreading at right angles to the tube, sparsely scaly outside and with or without pubescent hairs on the very proximal region of the tube. *Stamens* 10, unequal in length, slightly exserted; filaments 30–35 mm long, densely pubescent-hairy for the proximal c. 2/3 and glabrous above; anthers oblong, c. 3 mm long. *Disk* densely hairy. *Ovary* narrowly fusiform, 11–12 mm long, scaly and very densely hairy; style c. 18 mm long, exserted to c. 8 mm, densely hairy excepting the glabrous distal c. 4 mm; stigma subdiscoid, c. 3.5 mm in diameter. *Fruit* not available. **Fig. 1.**

Fig. 1. ***Rhododendron torajaense***. Cultivated at the Rhododendron Species Botanic Garden, Washington, USA. Photo: Hank Helm.

Distribution and ecology. Indonesia, Sulawesi Selatan, Tana Toraja, on way to Gunung Sesean, Batutumonga, Lat. 02° 54' 32" N, Long. 119° 53' 02" E, alt. 1359 m, on a disturbed roadside bank. Only known from one wild location.

Conservation status. This species is best given the conservation status Vulnerable according to the criteria of the IUCN Red List (IUCN 2012), although, as the necessary surveys have not been undertaken, Data Deficient would also be applicable. The type collection, the only collection seen, was made in the village of Batutumonga. The Batutumonga region is much disturbed with rainforest in the area above the village considerably cleared and converted to anthropogenic grassland.

Etymology. The specific epithet is derived from the region Tana Toraja.

Notes. The corolla form has been given as "short-salverform" in the description above. "Tubular-campanulate" might also be applicable. Argent (2006: 364) gives several examples of corolla form in sect. *Schistanthe* species and his illustration for "cylindrical" is the closest to the corolla form in *R. torajaense*. However, the term cylindrical is better applied to the corolla of species such as *R. perakense* King & Gamble in which the corolla lobes are erect, i.e. in line with the tube. In *R. torajaense*, the lobes are spreading at right angles to the tube and cylindrical is not the best term to use. Short-salverform is more appropriate.

The flowers of *R. torajaense* have a weak, sweet fragrance. It is not rich as in *R. konori* Becc., nor "spicy" as are the flowers of some other fragrant species, but

Fig. 2. ***Rhododendron gumineense***. Cultivated at East Hawthorn, Victoria, Australia. Photo: Andrew Rouse.

is a little reminiscent of gardenias. The first plant of *Brown et al. 78* to flower at Melba did so in February 2011 and the second plant flowered in June 2011. The fragrance of the latter was very much weaker than that of the summer-flowering plant, perhaps due to the cold weather, but the scent was so slight that it is difficult to describe in qualitative terms. The fragrance of the flowers of *R. rhodopus* is very different and in this species the flowers of the field-collected material (*Brown, Craven, Juswara & Ramadhanil 129*, BO, CANB) had a fragrance very much like that of the ripe fruit of feijoa, *Acca sellowiana* (Myrtaceae).

2. A new species of the Phaeovireya group from New Guinea

Rhododendron gumineense* Craven, *sp. nov.

From *R. beyerinckianum* Koord. it differs in having the leaf lamina narrowly elliptic to elliptic, 22–35 × 7–16 mm, base cuneate and often very narrowly so, apex obtuse or shortly acuminate to very narrowly acute to very narrowly acuminate; anthers 1.2–1.6 mm long; and the ovary subcylindrical and tapering to the style. In *R. beyerinckianum* the leaf lamina is narrowly ovate, to broadly elliptic, obovate or subcircular, 30–60 × 10–35 mm, base broadly tapering or rounded, apex obtuse, broadly acute, sometimes apiculate; anthers 2–2.5 mm long; and the ovary elongate conical or subovoid, usually abruptly tapering distally.

Holotypus: Australia, Victoria, Hawthorn East, cultivated in greenhouse, *A.Rouse s.n.*, 29 December 2012 (CANB).

Shrub to 40 × 40 cm. *Branchlets* terete, densely scaly, c. 0.8–1 mm in diameter. *Leaves* 3–5-pseudo-whorled. *Leaf lamina* narrowly elliptic to elliptic, 22–35 × 7–16 mm, base cuneate and often very narrowly so, apex obtuse or shortly acuminate, very narrowly acute, or very narrowly acuminate, margin revolute; abaxially with dense dendroid scales each on a tubercle and with the limb deeply dissected; adaxially with the scales quickly deciduous and occasional hairs present along the midrib; midrib prominent abaxially, impressed to flat adaxially, lateral veins obscure abaxially and prominent adaxially, 5–8 per side. *Petiole* 7–12 mm long. *Inflorescence* 1–2-flowered, the flowers spreading to subpendulous. *Outer perulae* ovate, 8–8.5 mm long, acuminate with the acumen broad. *Pedicel* 6–9 mm long, scaly. *Calyx* obsolete. *Corolla* pink, tubular-curved with the tube flaring distally, c. 23–29 mm long including the lobes, tube curved, c. 17–20 mm long and 6–9 mm in diameter, lobes 6–9 mm long; outside the tube and lobes moderately scaly, inside glabrous. *Stamens* 10, slightly exserted; filaments c. 22–26 mm long, glabrous, anthers light brown, oblong, 1.2–1.6 mm long, base subapiculate. *Disk* scaly. *Ovary* subcylindrical and tapering to the style, 6 × 2 mm, densely scaly; style 15–20 mm long, slightly exserted and approximating the stamens in length, scaly to within 4–5 mm of the apex; stigma subcapitate, c. 1.7 mm in diameter. *Fruit* immature. **Fig. 2.**

Table 2. Character states of three Sulawesi *Rhododendron* species in the Solenovireya group. States have been taken from Argent (2006), Sleumer (1966) or are personal observations.

Taxon	Leaf lamina	Leaf scales	Outer perulae	Style
R. minahasae	obovate to elliptic, base cuneate to truncate, apex acute to obtuse	funnel-shaped and inserted on a pedestal or foot of lamina origin	± obtuse, subsericeous at the apex or practically glabrous	hairy and scaly almost to the top
R. pubitubum	elliptic or obovate elliptic, sometimes obovate, broadly attenuate towards the base, the very base rounded, not rarely subcordate, apex very broadly attenuate, obtuse to nearly rounded, occasionally very shortly retuse	marginal zone irregularly dentate or bitten, with a ± persistent, blackish and sunken centre	orbiculate to obovate, densely short subsericeous on both surfaces	subdensely hairy and laxly scaly below (the scales well visible there), laxly hairy in the middle, glabrous for the distal 10 mm
R. radians	ovate to ovate-oblong, base slightly to distinctly cordate, apex shortly obtusely attenuate, sometimes nearly rounded	almost regularly rounded in outline to distinctly incised	ovate-acuminate, acute, ± glabrous dorsally	laxly patent-pubescent to the lower 5/6 and bearing some scales in the lower part

Distribution and ecology. Papua New Guinea, Chimbu Province, Gumine. Nothing is known about the ecology of *R. gumineense*. However, the elevation of Gumine is c. 1700 m and consequently the forest type in the region would probably be lower- to mid-montane rainforest. Whether the species is epiphytic in rainforest or terrestrial on open ground is unknown. It is only known from one natural location.

Conservation status. *Rhododendron gumineense* is best given the conservation status Data Deficient according to the criteria of the IUCN Red List (IUCN 2012). Nothing is known about its population size or ecology.

Etymology. The specific epithet is derived from the place name Gumine.

Notes. *Rhododendron gumineense* keys to *R. beyerinckianum* Koord. in Argent (2006), from which it differs in the features given in the diagnosis above. Additionally, the species differs from *R. beyerinckianum* in habit, being a very small shrub in contrast to *R. beyerinckianum* which is a shrub or tree from 1–5 m tall. Initially I considered that the Gumine plant might represent a primary hybrid, but I have grown it to flowering from seed obtained from my own plant and there were no morphological differences between the parent plant and those plants grown from seed.

Even though described from cultivated material, *R. gumineense* has a known provenance. It was collected at Gumine by D.Stanton, Wollongong, NSW, Australia, in 1971, and sent to the Australian Rhododendron Society, Olinda, Victoria, Australia by L.Searle (Kundiawa, Chimbu Province, PNG) in 1974.

In cultivation in Australia, apparently from its first introduction, the species has been misidentified as *R.* ×*schoddei* Sleumer, which is a plant possibly of hybrid origin and is best treated as a nothospecies until its biological status can be verified.

3. On the Solenovireya group in Sulawesi

Sleumer (1966) recognised two varieties within the Sulawesi species *R. radians*: var. *radians* and var. *minahasae* Sleumer. Argent (2006) added a third taxon, var. *pubitubum* (Sleumer) Argent, differentiating it from the other two varieties by "the corolla tube being densely hairy throughout its length and with the lobes hairy outside along the middle line". Differences between these three taxa are given in Table 2.

Scanning electron micrographs of *R. dissilistellatum* Craven, *R. minahasae* and *R. radians* showing abaxial scales and stomata are given in Fig. 3. The distribution of stomata relative to scales is worthy of note in *R. minahasae* and *R. radians*. In *R. minahasae* the stomata and scales are quite evenly distributed (Fig. 3B) whereas in *R. radians* the scales are inserted in a shallow depression in a zone which lacks stomata (Fig. 3D). A reason for this distribution pattern is not immediately evident. Material of *R. pubitubum* has not been available for examination.

Based on the data given in Table 2 plus the scale distribution data, it is my conclusion that these three taxa should be treated at species rank. A new combination for *R. minahasae* is provided below.

Living material of another species collected in 2002, of which fertile material was not available in the field, subsequently flowered in cultivation. It keyed to *R. radians* in both Argent (2006) and Sleumer (1966), which is not surprising as long-tubular, white-flowered plants would key to this species alone. The newly flowered plant proved to be distinct from all other Sulawesi species of Solenovireya and is described below as *R. dissilistellatum* Craven.

The Sulawesi species of the Solenovireya group (sensu Craven et al. 2011) can be distinguished by the following key:

1. Corolla 40–45 mm long including the lobes . . ***R. amabile***
1: Corolla more than 50 mm long including the lobes
  2. Leaf lamina narrowly elliptic to narrowly obovate . . . . . ***R. dissilistellatum***
  2: Leaf lamina ovate to ovate-oblong, obovate to elliptic, or obovate-elliptic
    3. Leaf lamina ovate to ovate-oblong . . . . . ***R. radians***
    3: Leaf lamina obovate to elliptic, or obovate-elliptic
      4. Perulae ± obtuse, subsericeous at the apex or practically glabrous; style hairy and scaly almost to the apex . . . . . ***R. minahasae***
      4: Perulae orbiculate to obovate, densely short sericeous on both faces; style hairy and scaly excepting the glabrous distal 10 mm . . . . . ***R. pubitubum***

Rhododendron dissilistellatum* Craven, *sp. nov.

From *R. radians* J.J.Sm. it differs in the leaf lamina being narrowly elliptic to narrowly obovate with the base cuneate to obtuse (in *R. radians* the lamina is ovate to ovate-oblong with the base cordate), the outer perulae being elliptic to broadly elliptic (ovate-acuminate in *R. radians*), and the style being hairy to within c. 2 mm of the apex (hairy in the proximal 5/6 of the style in *R. radians*).

Holotypus: Australia, Australian Capital Territory, Melba, cultivated in greenhouse (from living material of *G.Brown, L.Craven, L.Juswara & Ramadhanil 114*), *L.A.Craven 15044*, September 2010 (BO). **Isotypi:** A, CANB, CEB, E, L, P.

Lax shrubs to c. 60 × 70 cm. *Branchlets* moderately densely scaly and with moderately dense short hairs, c. 1.5–2 mm in diameter. Leaves 5–10-pseudowhorled. *Leaf lamina* narrowly elliptic to narrowly obovate, 25–64 × 7–19 mm, base cuneate to obtuse, apex retuse, margin subrevolute; abaxially with the scales sessile, mostly flat and rarely subfunnel-shaped, and with scattered hairs throughout; adaxially with sessile, funnel-shaped to flat, subentire to dentate scales with a broadish flattened centre, and with short scattered hairs that are more dense proximally along the midrib; midrib prominent abaxially, impressed adaxially, lateral veins more or less obscure, c. 5–6 per side, reticulate venation obscure. *Petiole* c. 1–3 mm long. *Inflorescence* a 7–15-flowered umbel, flowers in a more or less spreading band. *Outer maximally-developed perulae* elliptic to broadly elliptic, c. 8–11 mm long, obtuse to rounded and often secondarily retuse through rupturing occurring at anthesis. *Pedicel* 7–13 mm long, scaly and hairy. *Calyx* obsolete. *Corolla* white, salverform, c. 59–79 mm long including the lobes, tube straight, c. 50–67 mm long and 2–3 mm in diameter, lobes c. 9–12 mm long, outside the tube laxly scaly and proximally with a few hairs, inside hairy to about ¾ to the apex, lobes glabrous. *Stamens* 10, scarcely exserted; filaments c. 50–65 mm long, hairy for about ½ way to their apex, anthers light brown, oblong, c. 1.4–1.8 mm long, base obtuse to rounded. *Disk* hairy. *Ovary* 6.5–7 × 1.2 mm, subcylindrical and tapering to the style, densely scaly and hairy; style c. 60–65 m long, exserted to c. 12 mm, scaly proximally, hairy to within c. 2 mm of the apex, stigma c. 2 mm in diameter. *Fruit* not available. **Fig. 3A, 4.**

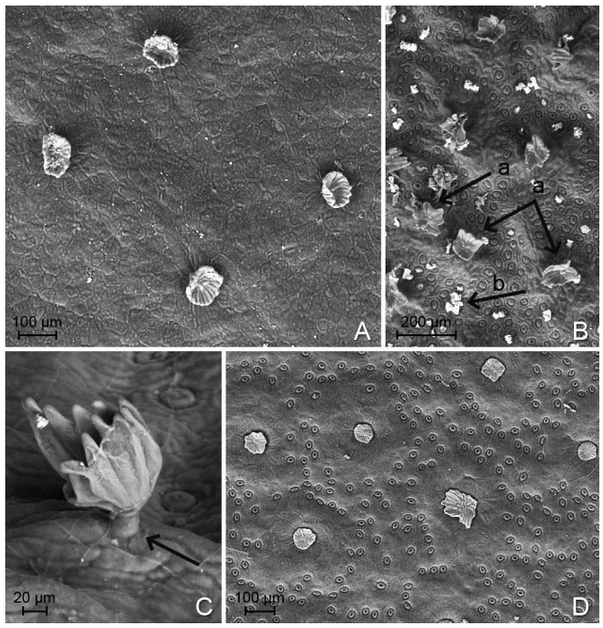

Fig. 3. Scanning electron micrographs of the abaxial leaf surfaces of *Rhododendron* species. **A *R. dissilistellatum***. **B–C *R. minahasae***: **B** (a) indicates scales; (b) indicates contaminant on the leaf surface; **C** arrow indicates the foot or pedestal that is of lamina origin. **D *R. radians***. — **A** *Craven 15044*; **B–C** *Alston 15800*; **D** *Brown et al. 128*.

Distribution and ecology. Indonesia, Sulawesi Tengah, the western lower-mid slopes of the Gunung Sojol complex, Balukang, on Tinombo-Siboang path (between camp 3 and camp 1), Lat. 00° 28’ 19” N, Long. 120° 08’ 27” E, alt. 1153–1344 m, lower montane rainforest. It is only known from one natural location.

Conservation status. This species is best given the conservation status Data Deficient according to the criteria of the IUCN Red List (IUCN 2012). Although known from only the one location in the wild, this location is unlikely to be disturbed by forest conversion operations or slash and burn gardening in the foreseeable future. Additionally, it is possible the species is widely distributed around the lower-mid slopes of the Gunung Sojol complex.

Etymology. The specific epithet is derived from the Latin *dissilio*, fly apart, burst and *stella*, star. A plant in full flower, especially on a dull day, brings to mind a certain type of modern firework, in which the primary rocket explodes into numerous smaller rockets that themselves explode, giving rise to numerous radiating shafts of brilliant light (often white); the inflorescences are analogous to these final displays.

Other specimens examined.

INDONESIA, SULAWESI TENGAH: the western lower slopes of the Gunung Sojol complex, Balukang, on Tinombo-Siboang path (between camp 3 and camp 1), Lat. 00° 28' 19" N, Long. 120° 08' 27" E, alt. 1153–1344 m, lower montane rainforest, *G.Brown, L.Craven, L.Juswara & Ramadhanil 114*, 23 July 2002 (BO, CANB).

***R. amabile* Sleumer**

Reiwardtia 5: 127 (1960).

R. minahasae* (Sleumer) Craven, *comb. et stat. nov.

Basionym: *R. radians* var. *minahasae* Sleumer, Reinwardtia 5: 130 (1960).

***R. pubitubum* Sleumer**

Reinwardtia 5: 126 (1960). — *R. radians* var. *pubitubum* (Sleumer) Argent, Rhododendrons of subgenus Vireya 170 (2006).

***R. radians* J.J.Sm.**

Bull. Bot. Buitenzorg III, 1: 403, t. 51 (1920.

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