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Prostanthera conniana (Lamiaceae, Westringieae), a new species from the Southern Tablelands, New South Wales, Australia

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Abstract

A new species of *Prostanthera* (*P. conniana* T.C.Wilson) from the Southern Tablelands botanical region of New South Wales, Australia, is here described. This species is known only from the Shoalhaven River in the vicinity of Bungonia. Features that justify the recognition of this species are a compact inflorescence, a hairy calyx, and an anther appendage longer than the anther locule. A comprehensive description, diagnostic illustrations, and an assessment of the conservation status of *P. conniana* are accompanied by an updated section of the key to *Prostanthera* species of New South Wales.

Introduction

Most species of *Prostanthera* (Lamiaceae) grow in open rocky habitats typically associated with narrow gullies, slopes, cliff faces and cliff edges. The dissected topography of south-eastern Australia, particularly along the Great Dividing Range, accommodates 36 species of this genus, with 16 of those species being localised endemics (Conn 1993 onwards; Conn and Wilson 2015). The Shoalhaven River has its headwaters in the Great Dividing Range from where it flows north then east, forming the eastern margin of the Bungonia State Conservation Area. Bungonia State Conservation Area abuts Morton National Park to the east, and is characterised by the deeply incised gorges of the Shoalhaven River and its tributaries. Vegetation of the area is predominantly *Eucalyptus bosistoana* F.Muell – *E. eugenioides* Sieber ex Spreng. dry sclerophyll forest on the plateaus and slopes, with remnant dry rainforest along some water courses, and *Casuarina cunninghamiana* Miq. dominating the lower gorge. A number of rare or threatened angiosperms occur in the area: *Haloragis exalata* F.Muell., *Pterostylis calceolus* M.A.Clem., *Acacia chalkeri* Maiden and *Pimelea axiflora* subsp. *pubescens* Rye. The geology of the Bungonia State Conservation Area comprises three superimposed geological facies, namely: the late Ordovician Tallong sedimentary beds (shale, chert, arenite), the late Silurian Bungonia limestone group (shale and limestone), and the early Devonian Tangerang formation (Carr et al. 1980).

Eight species of *Prostanthera* have been recorded from the Shoalhaven river region, including *P. hirtula* F.Muell. ex Benth., *P. incana* A.Cunn. ex Benth., *P. ovalifolia* R.Br., *P. lasianthos* Labill., *P. rotundifolia* R.Br., *P. saxicola* var. *montana* A.A.Ham. as well as the localised endemic *P. tallowa* B.J.Conn & T.C.Wilson (Atlas of Living Australia; Conn and Wilson 2012). The geographic distribution of *P. ovalifolia* extends from Wagga Wagga, New South Wales, in the south to Wide Bay, Queensland, in the north (Conn 1993 onwards). *Prostanthera ovalifolia* is currently regarded as a morphologically variable species complex, and its delimitation with respect to *P. lanceolata* Domin and *P. cineolifera* R.T.Baker & H.G.Sm. is unclear (Conn 1992). One of the first specimens of *Prostanthera* collected from Bungonia State Conservation Area (*Rodd 6109*) was assigned to *P. ovalifolia* on account of its erect, open, multibranched growth habit, its narrow ovate leaves and its flowers clustered in racemose inflorescences. However, on closer examination, the specimen differs significantly from typical *P. ovalifolia* by having more compact inflorescences, a distinctive calyx indumentum, and longer anther appendages. The inflorescences and longer anther appendages better resemble those of *P. prunelloides* R.Br.; however, the Bungonia collection differs from this species in its corolla colour, calyx indumentum, and leaf dimensions. Thus, the morphology of the specimens from Bungonia do not match any previously described *Prostanthera,* and they are here described as a new species, *P. conniana* T.C.Wilson. Distribution of this species is described using terminology from the National Interim Biogeographic Regionalisation for Australia system (IBRA7), as well as the Southern Tablelands botanical division of New South Wales (Anderson 1961; Jacobs and Pickard 1981).

Taxonomy

Prostanthera conniana T.C.Wilson, ***sp. nov.***

Diagnosis: *Prostanthera conniana* differs from *P. ovalifolia* R.Br. by its compact inflorescences (racemose in *P. ovalifolia*), hairy calyx (calyx glabrous or glabrescent in *P. ovalifolia*), abaxial corolla lobe longer than corolla tube (abaxial lobe as long as corolla tube in *P. ovalifolia*), and anther appendages greatly exceeding the length of the anther locule (appendage shorter than the locule in *P. ovalifolia*).

Type: Australia: New South Wales: Southern Tablelands: Bungonia State Conservation Area: Along Shoalhaven River south of Blue Track, *T.C. Wilson 632, L. Elkan, M.J. Henwood, M.A.M. Renner, C. Wardrop,* 31 Oct 2015 (holotype: NSW987132 isotype: BRI, CANB, MEL).

Open, erect, woody shrub to 3.5 m tall, crown c. 2–4 m diam.; *stem* to 40 cm diam.; *Branchlets* quadrangular with ridges connecting to base of petiole, yellowish green when young, greenish red when mature, sparsely hairy (8–17 hairs/mm^2), moderately covered with sessile glands (10–40 glands/mm^2); *hairs* restricted to two narrow zones on opposite 'sides' of a branchlet, simple, straight to curled, spreading, 0.1–0.5 mm long, white; *glands* hemispherical, small, c. 0.1 mm diam; *bark* grey-brown on older branches and furrowing 10 mm wide and 10 mm deep. *Leaves* with petiole 1.5–3.5 mm long; lamina narrowly ovate to narrowly oblong, 16–24 mm long, 3.5–6.5 mm wide, partially folded lengthwise along the mid-vein towards the adaxial surface, discolorous; base shortly attenuate; margin flat to partially incurved and entire; apex rounded to obtuse; moderately glandular on both surfaces with glands hemispherical (c. 0.1 mm diam.); abaxial surface yellowish green, with mid-vein raised and rounded, lateral veins indistinct; adaxial surface green, with mid-vein yellowish green and situated in narrow furrow proximally, other veins indistinct. *Inflorescence* a frondobracteose botryoidal superconflorescence; conflorescences bracteose botryoidal with one pair of leaves basally, 4–8-flowered; uniflorescences monadic; pherophylls ovate 1.8–2.7 mm long, 0.7–1.3 mm wide, abaxial surface hairy (40 hairs/mm^2), hairs 0.3–0.5 mm long, caducous, adaxial surface glabrous. *Podium* 1.8–2.7 mm long, densely hairy (80 hairs/mm^2), yellowish green, propodium to anthopodium ratio 0.5–1. *Prophylls* caducous, inserted slightly to distinctly sub-opposite, linear, 1 mm long, 0.1 mm wide, sparsely hairy, with white hairs spreading. *Calyx* green sometimes with maroon tinge on margin or adaxial lobe; outer surface hairy (50 hairs/mm^2), hairs white, 0.2–0.5 mm long; inner surface glabrous; tube 2.5–3 mm long; lobes with margin entire; *abaxial lobe* broadly ovate, (2.4–)2.8–3.1 mm long, 3(–4) mm wide, apex rounded; *adaxial lobe* broadly ovate, 1.7–2.4 mm long, 3.7–3.9(–4.8) mm wide, apex rounded. *Corolla* 11–16 mm long, white or sometimes with pale-mauve tinge on distal parts of lobes and bright yellow irregular-shaped marking on throat, outer surface sparsely hairy (c. 10 hairs/mm^2); *tube* 5.5–7 mm long, inner surface sparsely hairy (c. 10 hairs/mm^2); hairs white, spreading, straight, 0.4–0.5 mm long; *lobes* with outer surface sparsely hairy (c. 10 hairs/mm^2), inner surface glabrous, margin distally undulate and irregular; abaxial median lobe broadly spathulate, 7.5–8.5 mm long, base c. 3.3 mm wide, 6–7 mm wide near apex, apex rounded, retuse to emarginate (sinus 0.6–1 mm long, 0.6–1.2 mm wide distally); lateral lobes narrowly oblong, 7–8 mm long, 1.5–3 mm wide, apex depressed ovate; adaxial median lobe pair very broadly ovate, (3–)5–6 mm long, (4.5–)7.5 mm wide, emarginate, apex on either side of sinus rounded, sinus 1.4–1.8 mm long. *Stamens* white, flushed with a rose colour at anther apex, inserted (2.4–)3.6 mm above corolla base, anther appendages terminating in 4 narrowly triangular hairs up to 0.2 mm long; *abaxial stamens*

with filament 3.5–4(–4.8) mm long; anther locules 1–1.4 mm long and 0.9–1.6 mm wide; connective extended to form a basal appendage (1.4–)1.9–2.2 mm long; *adaxial stamens* with filament 2.7–3 mm long; anther locules 0.9–1.1 mm long and 1–1.3 mm wide; connective extended to form a basal appendage 1.6–2 mm long. *Pistil* (6.6–)7.4–7.9 mm long; ovary c. 0.6 mm long, c. 0.5 mm wide; abaxial stigmatic lobe longer (c. 0.1 mm) than adaxial lobe. *Fruiting calyx* similar to flowering calyx, brown; *tube* 2.3–3.4 mm long; *abaxial lobe* 2.4–2.8 mm long, 3.7–3.9 mm wide; *adaxial lobe* c. 2.4 mm long, 4.1–4.4 mm wide. *Mericarps* c. 1.9 mm long, 0.8–1.3 mm wide, papillose, distally extended 0.6–0.8 mm beyond base of style. Figs 1–3.

Other specimens examined: AUSTRALIA: NEW SOUTH WALES: Southern Tablelands: Bungonia State Conservation Area, *A.N. Rodd 6109*, 29 Nov 1987 (NSW198522); *J. Miles* ST07-40, 17 Oct 2007 (NSW887040); *T.C. Wilson 634, L. Elkan, M.J. Henwood, M.A.M. Renner, C. Wardrop*, 31 Oct 2015 (NSW987135); *640*, 31 Oct 2015 (NSW987141).

Recognition: The combination of crowded flowers and hairy inflorescences of *P. conniana* is unusual in *Prostanthera*; however, this species might easily be confused with *P. cruciflora, P. ovalifolia* and *P. prunelloides* on account of having dense clusters of flowers or having narrow-ovate leaves (Table 1). The leaves of *P. cruciflora* have a lamina length to width ratio of <2, whereas the leaves of *P. conniana* have a ratio of >2; and when in flower, *P. cruciflora* can be separated from *P. conniana* by the lack of anther appendages. *Prostanthera prunelloides* has very broadly ovate leaves and lacks hairs on its calyx, whereas *P. conniana* has narrowly ovate leaves and the indumentum of the outer surface of the calyx consists of long hairs. *Prostanthera ovalifolia* has reduced anther appendages (sometimes absent) and leaves often with margin dentate, whereas *P. conniana* has anther appendages longer than the pollen locule with leaves entire. Further information on similarities and differences between these species is summarised in Table 1.

Table 1. Comparison of selected morphological characters useful for distinguishing between *Prostanthera conniana* and morphologically similar species.

Morphological Characters	*P. conniana*	*P. cruciflora*	*P. ovalifolia*	*P. prunelloides*
Stem indumentum	restricted to decussate grooves	restricted to margins of decussate grooves	restricted to decussate grooves or covering entire stem	restricted to decussate grooves
Leaf margin	entire	entire	entire or toothed	shallow toothed, rarely entire
Leaf lamina	17–28 mm long 3–7 mm wide	6–20 mm long 3–10 mm wide	15–30 mm long 3–12 mm wide	16–65 mm long 9–40 mm wide
Lamina length: width ratio	>2	<2	>2	<2
Inflorescence	flowers in dense heads (botryoidal superconflorescence)	flowers in dense heads (botryoidal superconflorescence)	flowers in racemiform superconflorescence	flowers in racemiform superconflorescence
Calyx	hairy	glabrous	glabrous to hairy	glabrous
Corolla	white or pale mauve, sometimes with yellow marking in throat	white with orange and yellow markings in throat	purple, no markings	pale mauve with orange markings in throat
Anthers	white with rose colour at apex	white with magenta locules	yellow or dark purple	white with purple to purplish blue at apex
Anther appendage: pollen locule ratio	at least 1:1	appendage absent	<1:4 or appendage absent	at least 1:1

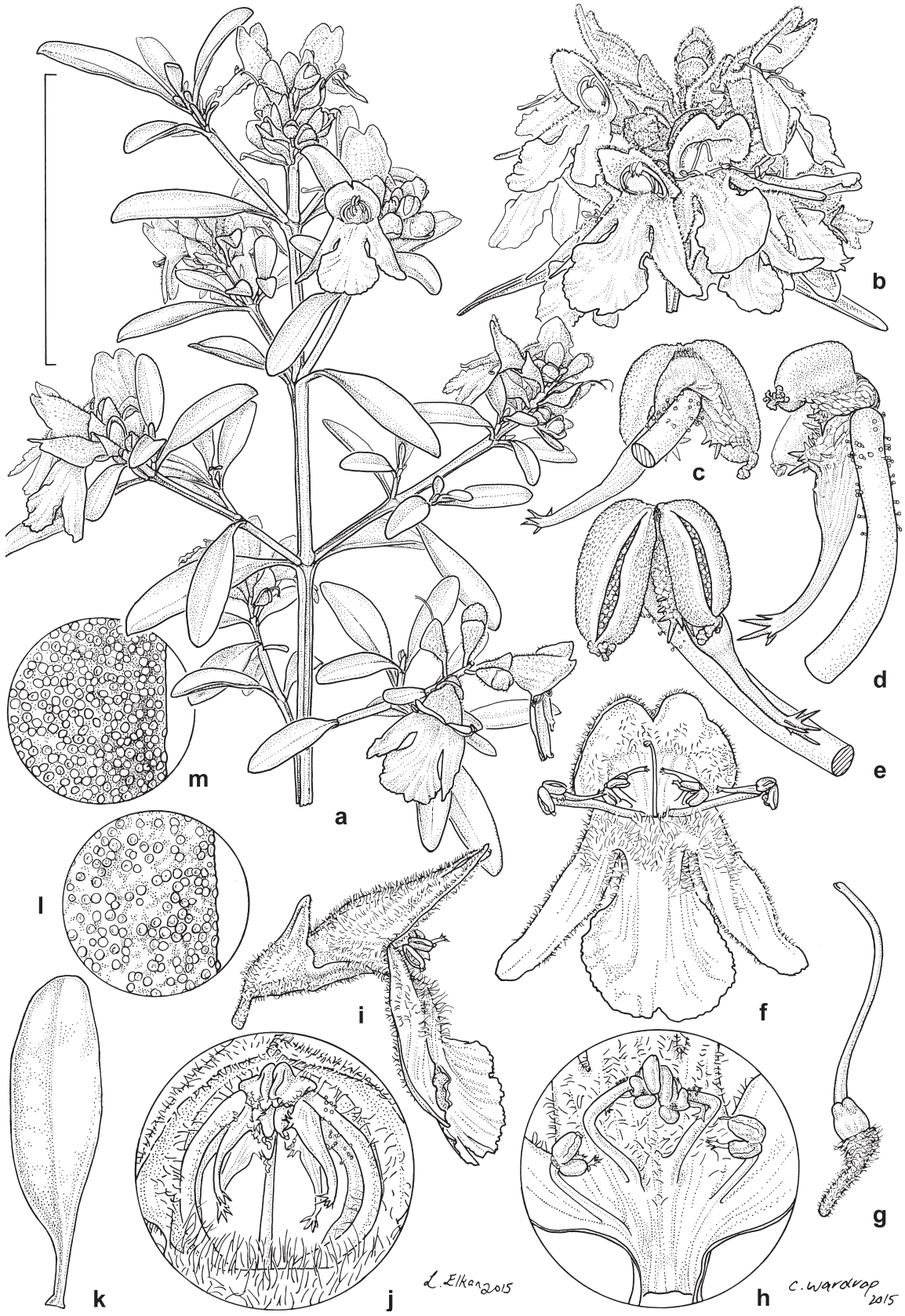

Fig. 1. *Prostanthera conniana*. **a.** habit; **b.** inflorescence; **c.** anther, (abaxial) dorsal view; **d.** anther, oblique abaxial view; **e.** anther, (adaxial) ventral view; **f.** flower (female phase, front view) showing inner surface of corolla tube and lobes, stamens, style and stigma; **g.** pistil, profile view; **h.** dissected corolla (male phase) showing position of stamens; **i.** flower (female phase, lateral view), showing calyx, corolla and anthers; **j.** corolla throat (male phase, front view), showing relative position of stamens and style; **k.** leaf, adaxial view; **l.** detail of abaxial leaf lamina surface, showing hemispherical glands; **m.** detail of adaxial leaf lamina surface, showing hemispherical glands. Scale bar: a = 54.5 mm; b = 37.5 mm; c–e, l, m = 3 mm; f, i = 15 mm; g, h = 10 mm; j = 6 mm; k = 24 mm. Illustration: L. Elkan and C. Wardrop.

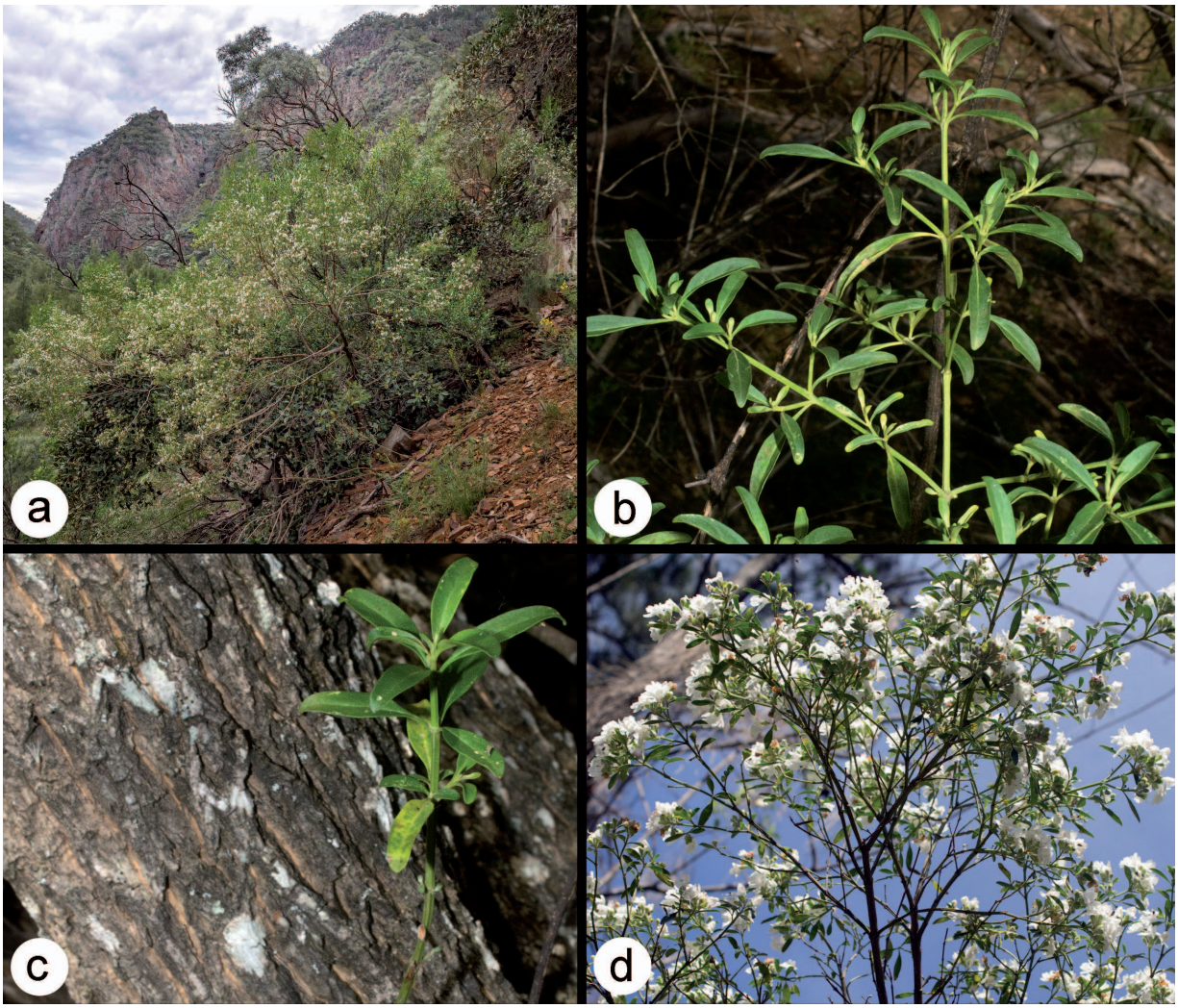

Fig. 2. *Prostanthera conniana*. **a**, growing in low shrubland along steep slopes, in scree and soils derived from shale and limestone; **b**, vegetative branchlet showing decussate phylotactic pattern and open habit; **c,** young shoot suckering from the main branch that has developed furrowed bark; **d**, flowering branchlet showing open habit and compact inflorescences. Photographs: M.J. Henwood (a) and T.C. Wilson (b–d)

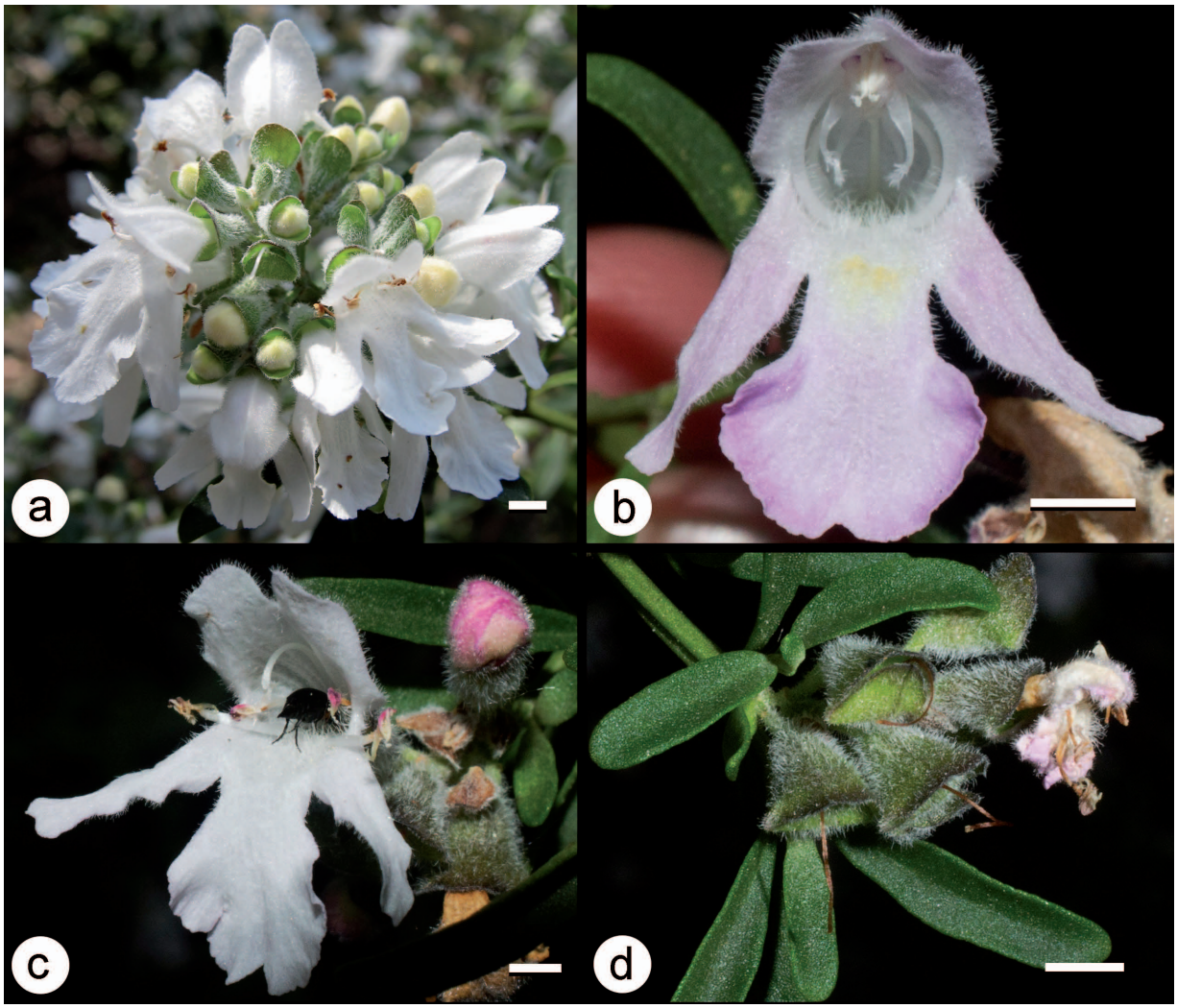

Fig. 3. *Prostanthera conniana*. **a**, compact inflorescence showing buds and open flowers (female phase); **b**, front view of dichogamous flower (male phase) showing inner surface and markings of corolla throat and lobes, anther locules, and position of anther appendages; **c**, oblique view of a dichogamous flower (female phase) showing inner surface and lobes without markings, incurved style, laterally repositioned stamens, and a floral visitor (pintail beetle: Mordelidae); **d**, calyx enclosing developing mericarps (not shown) with style and stigma extending through the calyx lobes. Scale bar = 2.5 mm Photographs: L. Elkan (a) and T.C. Wilson (b–d).

Notes: The hermaphroditic flowers of *P. conniana* are protandrous (Wilson *et al.* manuscript in prep.). During early anthesis (male phase), the fertile anthers are positioned next to the inner adaxial surface of the corolla (Figs 1j, h; 3b). The female phase begins when the style becomes incurved, the stigma lobes part and become receptive, and the stamens begin senescing as they reposition laterally to the side of the inner surface of the corolla (Figs 1f; 3c).

The pollinators of *P. conniana* are poorly known. We have observed visits to *P. conniana* by syrphids and other small species of Diptera, Lepidoptera, and small Coleoptera (Fig. 3c); however, it is likely that only syrphid flies are able to contact anthers and transfer pollen. The floral morphology and corolla markings are consistent with flowers of other *Prostanthera* that have been observed by us to be pollinated by small bees and flies similar to the size of syrphids.

Etymology: The specific epithet '*conniana*' honours Dr Barry J Conn and Helen M Conn. Since Barry's studies of *Prostanthera* for the degree of Doctor of Philosophy (University of Adelaide, 1979–1982), he has described many species and has accrued an extensive knowledge of this genus. The name commemorates his ongoing contribution to this field, and also acknowledges the support of his wife Helen, who has always been a significant component of his successful career.

Barry has worked in systematics and botany for over 40 years, focusing on Lamiales, Loganiaceae, Urticaceae, Droseraceae, Oxalidaceae, and publishing over 200 papers. Barry has dedicated a significant portion of his botanical career to the Flora of Papua New Guinea. He began his botanical career posted at the Lae Herbarium,

Division of Botany, Office of Forests, Lae, Papua New Guinea (1974), which was followed by an appointment as herbarium curator and lecturer at the Papua New Guinea Forestry College, Bulolo (1976–1979). He initiated the *PNGtrees* project, a collaborative project with the Papua New Guinea National Herbarium (LAE), he has managed extensive fieldwork throughout Papua New Guinea, and continues to be Scientific Advisor to the Food and Agriculture Organisation & Mountain Partnership Project Biodiversity PNG National Forest Inventory. In Australia, he was a senior botanist at the National Herbarium of Victoria, Royal Botanic Gardens, South Yarra, Victoria (1982–1987), and botanist (later Principal Research Scientist) at the National Herbarium of New South Wales (1987–2015). He was appointed as the *Australian Botanical Liaison Officer* (1994–1995) at the Royal Botanic Gardens, Kew, UK. While at NSW, he managed the Plant Diversity Branch (2000–2004), pioneered the *PlantNET* botanical information system, assisted with the development and implementation of the *NSW Collections* (EMu) database system, managed the *Australia's Virtual Herbarium* Project at NSW, and has recently been the Scientific Editor of *Telopea* (2013–2015).

Distribution: *Prostanthera conniana* is known only from four sites over an area of 5 km^2 within the Shoalhaven Gorge of Bungonia State Conservation Area, New South Wales, Australia (Fig. 4). This area is within the South Eastern Highlands Biogeographic Region according to the national Interim Biogeographic Regionalisation for Australia system (IBRA7), as well as the Southern Tablelands botanical division of New South Wales (Anderson 1961; Jacobs and Pickard 1981).

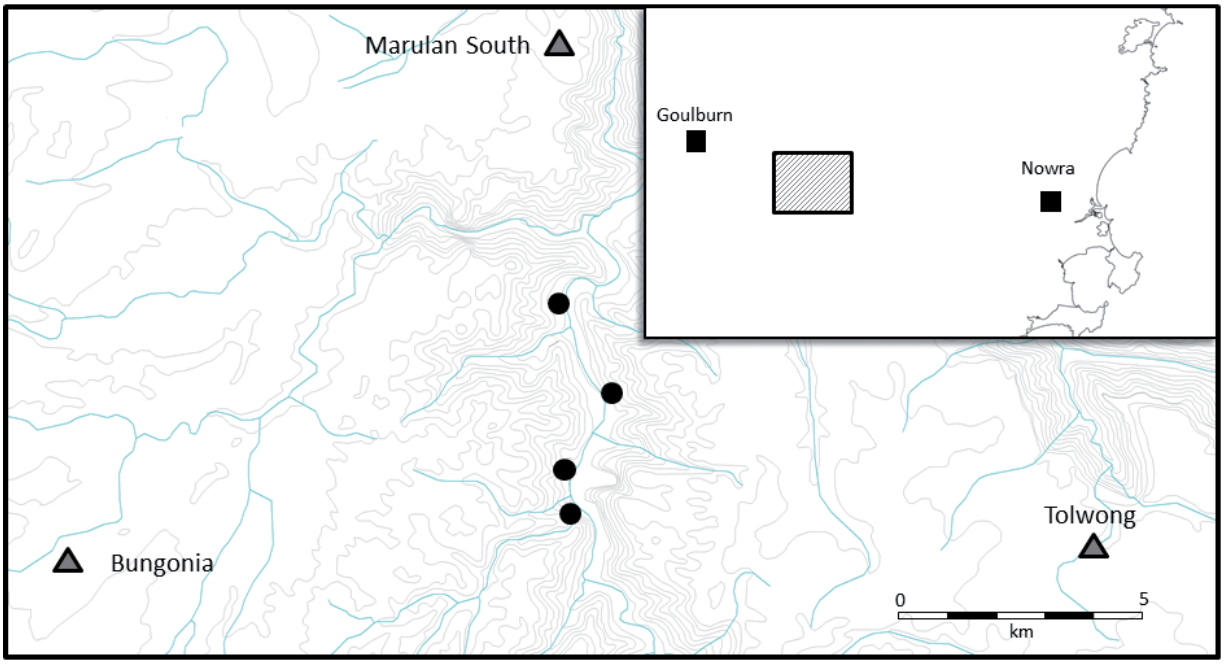

Fig. 4. Distribution map of *Prostanthera conniana* in New South Wales, south-eastern Australia.

Habitat: Steep slopes, toe/out-wash slopes, and riparian areas in skeletal soils and scree derived from late Ordovician Tallong sedimentary beds (shale, chert, arenite), at elevations between 130 and 350 m (Fig. 2a). Vegetation consists of low, open scrub dominated by *Acacia binervia* (J.C.Wendl.) J.F.Macbr. or open mixed eucalyptus woodland with *Backhousia myrtifolia* Hook. & Harv., *Plectranthus* sp., *Callistemon* sp., *Calytrix tetragona* Labill., *Teucrium corymbosum* R.Br., *Bulbine glauca* (Raf.) E.M.Watson, *Cassinia* sp., *Prostanthera lasianthos* Labill., *Euchiton japonicus* (Thunb.) Holub, and emergent *Casuarina cunninghamiana* (to 10 m tall) and *Eucalyptus tereticornis* Sm. (to 20 m tall).

Conservation status: This species is known only from a 5 km^2 area. Based on our recent observations, two populations are in less accessible locations and are estimated to contain about 100 individuals; a third population consisted of three individuals, and is the only population where recruitment was observed. Although its distribution and population size have not been assessed extensively, we conclude that the conservation status of *P. conniana* should be regarded as data deficient as defined by the IUCN criteria (IUCN 2015), and accordingly, no advice can be suggested for a listing under the *New South Wales Threatened Species Conservation Act (1995)* until further demographic studies and surveys of suitable habitat are completed.

Key to species

A section of the key to the New South Wales species of *Prostanthera* (Conn and Wilson 2015) is here amended to incorporate *P. conniana*.

6 Anther appendages as long as anther locule **6a**

6* Anther appendages absent or less than half the anther locule length **7**

6a Leaf lamina >8 mm wide, length to width ratio <2; leaf margin usually with widely spaced, shallow teeth; flowers clustered in racemiform conflorescences; calyx glabrous ..... ***P. prunelloides***

6a* Leaf lamina <7 mm wide, length to width ratio >2; leaf margin entire; flowers clustered in dense head-like bracteose botryoidal conflorescences; calyx hairy ..... ***P. conniana***

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