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Zieria nubicola (Rutaceae), a new and highly restricted species from New South Wales, Australia

Harvey K. Orel [1, 4], John D. Briggs[2], and Marco F. Duretto [3]

[1] *School of BioSciences, The University of Melbourne, Parkville, Victoria 3010, Australia*
[2] *NSW Department of Planning and Environment, Ecosystems and Threatened Species, Queanbeyan, New South Wales 2620, Australia*
[3] *National Herbarium of New South Wales, Botanic Gardens of Sydney, Australian Botanic Garden, Locked Bag 6002, Mount Annan, New South Wales 2567, Australia*
[4] *Corresponding author:* horel@student.unimelb.edu.au

Abstract

Zieria nubicola H.K.Orel & Duretto *sp. nov.* (Rutaceae), a highly restricted species from Cambewarra Mountain on the south-central coast of New South Wales, is formally described and illustrated. Notes on the species distribution, habitat and conservation status are also provided.

Introduction

Zieria Sm. (Rutaceae) is a genus containing 63 Australian species found from north-eastern Queensland to Tasmania and South Australia, and one New Caledonian species, *Z. chevalieri* Virot, which is found on Mt Kaala, Grande Terre. The genus contains many narrow endemics and though it has been revised recently (Armstrong 2002; Duretto and Forster 2007, 2008; George *et al.* 2013) additional species new to science are still being identified (Duretto 2019; Forster 2020). *Zieria tuberculata* J.A.Armstr. is endemic to the South Coast of New South Wales and known from two widely separated areas, the Mount Gulaga (Mount Dromedary) district between Tilba Tilba and Central Tilba, and the Cambewarra Range, c. 9.5 kilometres north of Nowra, Central Coast. The Mount Gulaga area is where the majority of collections of this species have been made, including the type collection. *Zieria tuberculata* is listed as a Vulnerable Species in the *New South Wales Biodiversity Conservation Act* (BCA 2016).

In footnotes in his seminal taxonomic treatment of the genus *Zieria*, Armstrong (2002, pp. 277, 278, 368) made reference to an undescribed species known from a single specimen that was labelled *Zieria granulata* C.Moore ex Benth., and collected at Good Dog Mountain, Cambewarra Range in 1931 (F.A. Rodway [Rodway Herbarium No. 993, NSW 19738]; notes with specimen indicate there is a possible duplicate, labelled *Rodway 597*, at Kew Gardens Herbarium (*n.v.*)). Prior to publishing his monograph, Armstrong and JDB searched for this species but were unable to find it. Several years later, JDB located the population and, being aware of its nonconformity to any existing species, collected four cuttings from different plants along with a voucher specimen. This voucher (Briggs, J.D. 2858a, 2000/09/20, CANB 627223.1), along with the Rodway collection and two additional collections of the same taxonomic entity (Tindall & Keith *s.n.*, 2002/09/18, WOLL 8031; Tindall & Keith *s.n.*, 2002/09/18, WOLL 8146), have since been treated as *Z. tuberculata* (e.g., George *et al.* 2013)

and entirely represent the disjunct population of *Z. tuberculata* from the Cambewarra Range. The cuttings made by JDB were subsequently grown at the Australian National Botanic Gardens (ANBG), Canberra, where they have been referred to as *Zieria* aff. *tuberculata*.

In the course of genetic studies on a group of closely related *Zieria* species, including material from *Z. tuberculata*, *Z. granulata* and *Z.* aff. *tuberculata* growing at the ANBG, it became apparent that *Z.* aff. *tuberculata* is a discrete taxon, sister to *Z. granulata*, that is worthy of recognition at the rank of species (Orel *et al.* 2023). However, Orel *et al.* (2023) did not evaluate the morphology of *Z.* aff. *tuberculata* and so did not formally describe the species. Subsequent field surveys and collections made by HKO and MFD from five plants have provided the morphological support necessary to recognise the new species, *Z. nubicola* H.K.Orel & Duretto, which is described herein.

Materials and methods

Collections of closely related species (informed by Orel *et al.* 2023) housed at the National Herbarium of New South Wales, along with new field collections of *Zieria nubicola* were examined, as were the descriptions of *Z. granulata* and *Z. tuberculata* published and illustrated by Armstrong (2002). Type material of *Z. granulata* and *Z. tuberculata* at Kew Gardens Herbarium was observed via their online website (accessed 23 January 2023: http://apps.kew.org/herbcat/gotoHomePage.do). Measurements of features made during these examinations provide the basis for our description of this species. Material was collected under NSW DPIE permits SL100569 (issued to the Botanic Gardens Trust, Botanic Gardens of Sydney) and SL102586 (issued to Harvey Orel).

Taxonomic treatment

Zieria nubicola H.K.Orel & Duretto, sp. nov.

Type [precise locality details withheld]: Australia, New South Wales: Cambewarra Range Nature Reserve, 34°48'S 150°34'E, 22 Sept. 2022, *H.K. Orel HKO79 & M.F. Duretto* (holotype: MELUD131643a; isotypes: BRI, CANB, MEL, NSW).

Tall shrub or small tree up to 3.5 m high. *Branchlets* sparsely to moderately-densely glandular-tuberculate, with a dense indumentum of white stellate hairs, hairs covering tubercles, without decurrent leaf-bases; older branches with less prominent tubercles, indumentum present but not as dense. *Leaves*: petiole 5–12 mm long, densely stellate-hairy, sparsely to moderately-dense glandular tuberculate, hairs covering tubercles; lamina trifoliolate, leaflets similar though central leaflet longer; central leaflet linear to broadly linear, 23–53 mm long, 3–6 mm wide; upper surface deep green, glabrescent or having a sparse indumentum of stellate hairs, with scattered raised glandular tubercles, midvein sunken; lower surface whitish, with a dense velvety indumentum of stellate hairs, densely glandular tuberculate, tubercles also scattered along raised midvein, lateral veins also slightly raised; apex rounded and blunt; margin entire, not appearing dentate, slightly recurved (becoming revolute on drying). *Inflorescence* a dichasial cyme, axillary, shorter than the leaves, (5–)15–50 flowers per inflorescence; peduncle 2–20 mm long, secondary branches 1–11 mm long, slightly glandular tuberculate, with a dense stellate indumentum; bracts 1 or 2 at each node of inflorescence, 0.5–5.0 mm long, persistent or deciduous; pedicels 1.0–3.1 mm long, densely stellate hairy, usually with glandular tubercles. *Flowers* 5.5–7 mm diameter at anthesis. *Sepals* 1.0–1.5 mm long, c. 1 mm wide, ovate to triangular shape; abaxial surface with a dense indumentum of stellate hairs and ± tuberculate; adaxial surface smooth and hirsute with simple hairs. *Petals* white to light/faded pink, valvate in bud, 4.0–4.5 mm long, 1.5–2.0 mm wide; stellate-pubescent on both surfaces; apex inflexed. *Disc* 4-lobed, glabrous. *Stamens* 4; filaments *c.* 1.2 mm long, glabrescent to sparsely hairy abaxially (on the outer side), glabrous adaxially, smooth or with minute tubercles just before the apex, not strongly dilated towards the base; anthers *c.* 0.6 mm long, not apiculate. *Gynoecium* glabrous; style *c.* 0.7 mm long. *Cocci* (immature only seen, *Rodway 993*, NSW 19738) not obviously tuberculate. (Figs 1–3)

Diagnostic characters: *Zieria nubicola* differs from *Z. granulata* in having branches with a dense stellate indumentum that also covers the glandular tubercles (versus pubescent on young branches only, and glandular tubercles glabrous), broader leaflets (3–6 mm wide) with only slightly recurved margins (on fresh material; versus 0.5–2.5 mm wide, margins revolute), larger flowers, in particular, longer sepals (1.0–1.5 mm long, versus 0.5–0.8 mm long) and longer petals (4.0–4.5 mm long, versus 1.7–2.5 mm long); and from *Z. tuberculata* in having petals that are valvate in bud (versus imbricate), sepals that are ovate (verses narrowly triangular and tapering), shorter bracts/bracteoles on the inflorescence (to 5 mm long, versus to 13.3 mm long), and filaments which are not strongly dilated at the base and have hairs on the abaxial surface (versus dilated at base

and glabrous). *Zieria nubicola* differs from both *Z. granulata* and *Z. tuberculata* in possessing fewer-flowered inflorescences (5–50 flowers per inflorescence versus 50–180 flowers).

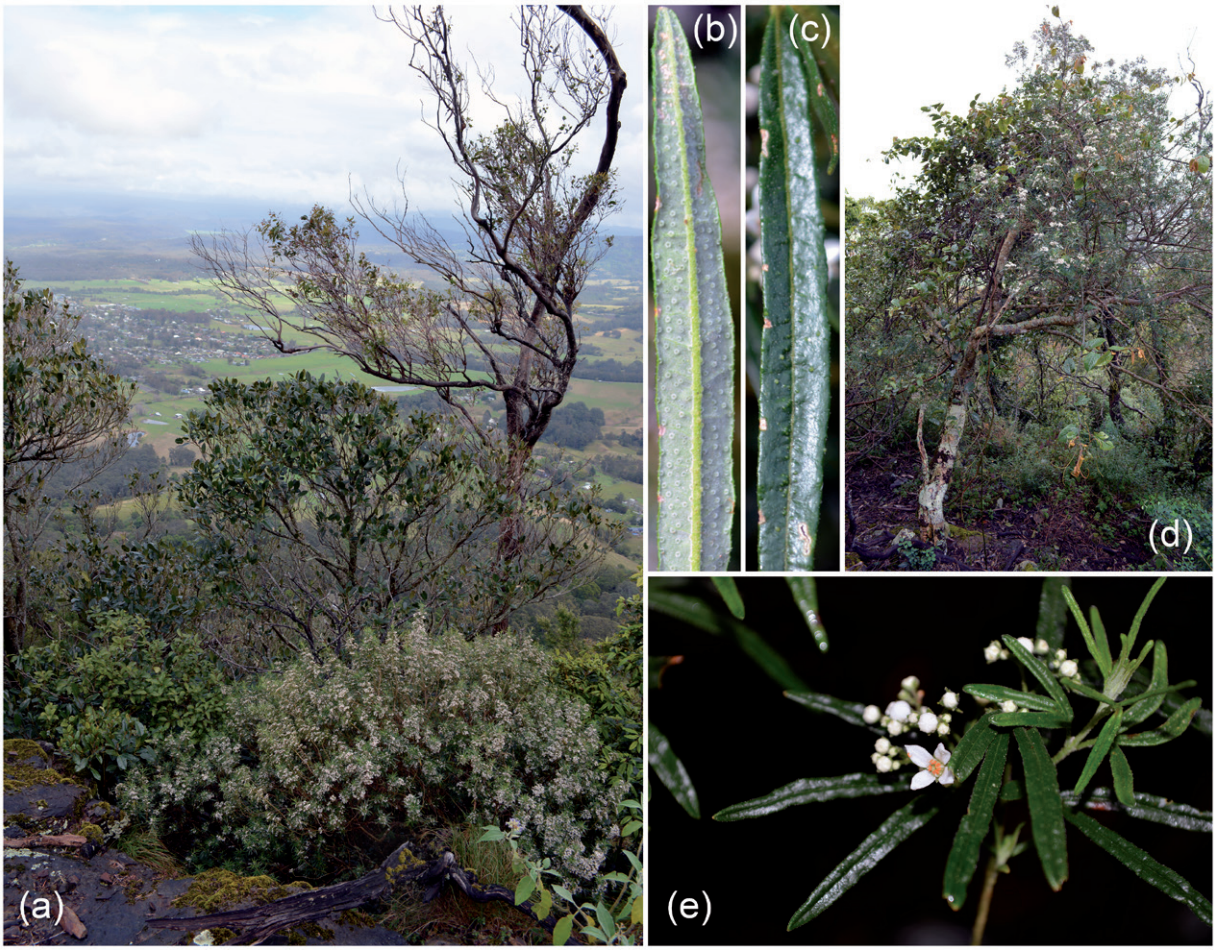

Fig. 1. *Zieria nubicola*. (a) Habitat; (b) abaxial surface of leaf; (c) adaxial surface of leaf; (d) whole plant (c. 3.5 m tall); (e) detail of inflorescence. Photographs by H. Orel.

Phenology: Flowers recorded from September–November. Fruit recorded from November.

Etymology: The specific epithet combines the Latin word *nubes* ('cloud') with the suffix *-cola* ('dweller', 'inhabitor'), in reference to the mist and clouds that frequently shroud the mountain on which the species occurs.

Distribution and ecology: *Zieria nubicola* is apparently confined to Good Dog Mountain, Cambewarra Range, north of Nowra, New South Wales. This mountain is also referred to as Cambewarra Mountain (see Loughnan and Ward 1971; Carr 1983; Wright 2013), and this name appears to be more commonly used contemporarily. The species is localised to an exposed ridge of igneous rocks among tall heath/scrub, where it is common and dominant in the small area that it occurs. Individual plants probably number > 300, though an accurate number was difficult to assess by the authors on a single excursion to the site due to the terrain.

Conservation Status: The species is apparently very localised and known with certainty from a single population where it is common though restricted to a particular plant community. Surveys of similar habitat are required to ascertain if there are additional populations. A limited search of other areas near Cambewarra Lookout did not locate additional plants or suitable habitat of exposed rock. The population appears secure in the Cambewarra Lookout section of the Cambewarra Range Nature Reserve. When visiting the population in September 2022 no obvious threats to the species were apparent, except for some minor disturbance to the site caused by people walking through the population. Some recruitment was observed though most plants were large and probably quite old. Any development of the site or increased visitation could be catastrophic to the known population.

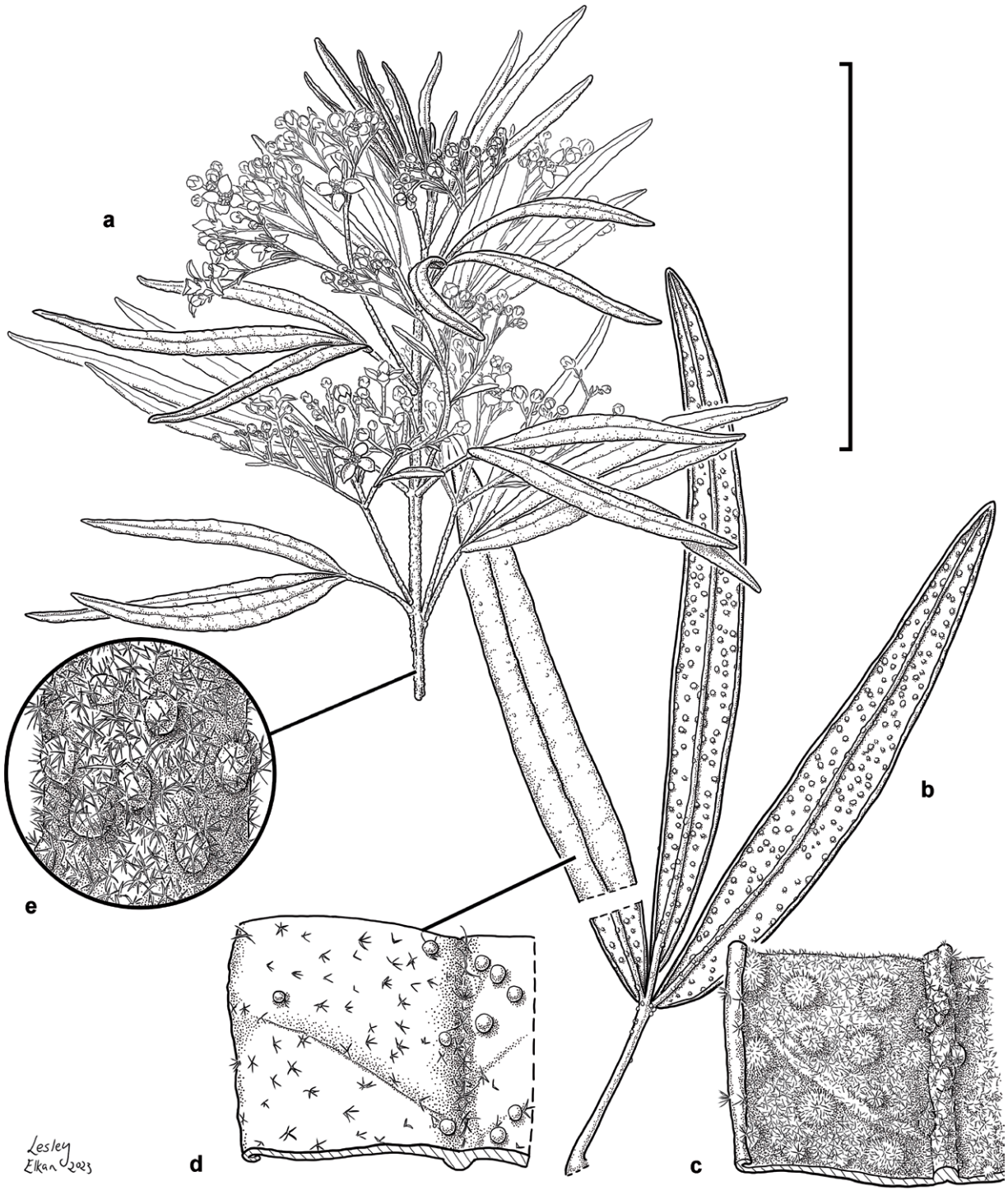

Fig. 2. *Zieria nubicola*. (a) flowering habit; (b) leaf, showing abaxial and adaxial surfaces; (c) abaxial leaf surface detail; (d) adaxial leaf surface detail; (e) stem detail. Scale bar: (a) = 60 mm; (b) = 30 mm; (c) & (d) = 5 mm; (e) = 2.5 mm. Voucher: *Orel 77 & Duretto* (NSW). Illustrations by L. Elkan.

The species appears to be eligible to be listed as a Vulnerable Species under the *New South Wales Biodiversity Conservation Act* (BCA 2016; see also IUCN 2012, 2022) following the criteria as set out in the *New South Wales Biodiversity Conservation Regulation* (BCR 2017) under Clause 4.7 (Very highly restricted geographic distribution of species–vulnerable species; IUCN criterion D2). The species satisfies this criterion as it is known for certain from one population with an area of occupancy (AOO) and an extent of occurrence (EOO) that are both less than 10 km^2. The species does not appear to be eligible, using the limited information at hand, to be listed under Clauses 4.2 (Reduction in population size of species) and 4.4 (Low numbers of mature individuals of species and other conditions) as there is no evidence of population decline, Clause 4.3 (Restricted geographic distribution of species and other conditions) as there is no evidence of population decline or, reduction or extreme fluctuations in geographic distribution or reduction or extreme fluctuations

in habitat extent and quality, Clause 4.5 (Low total numbers of mature individuals of species) as the number of mature individuals is unknown as a thorough survey has not been completed though there may be only a few hundred individuals, or Clause 4.6 (Quantitative analysis of extinction probability) as no immediate threatening processes affecting the known population were identified by the authors.

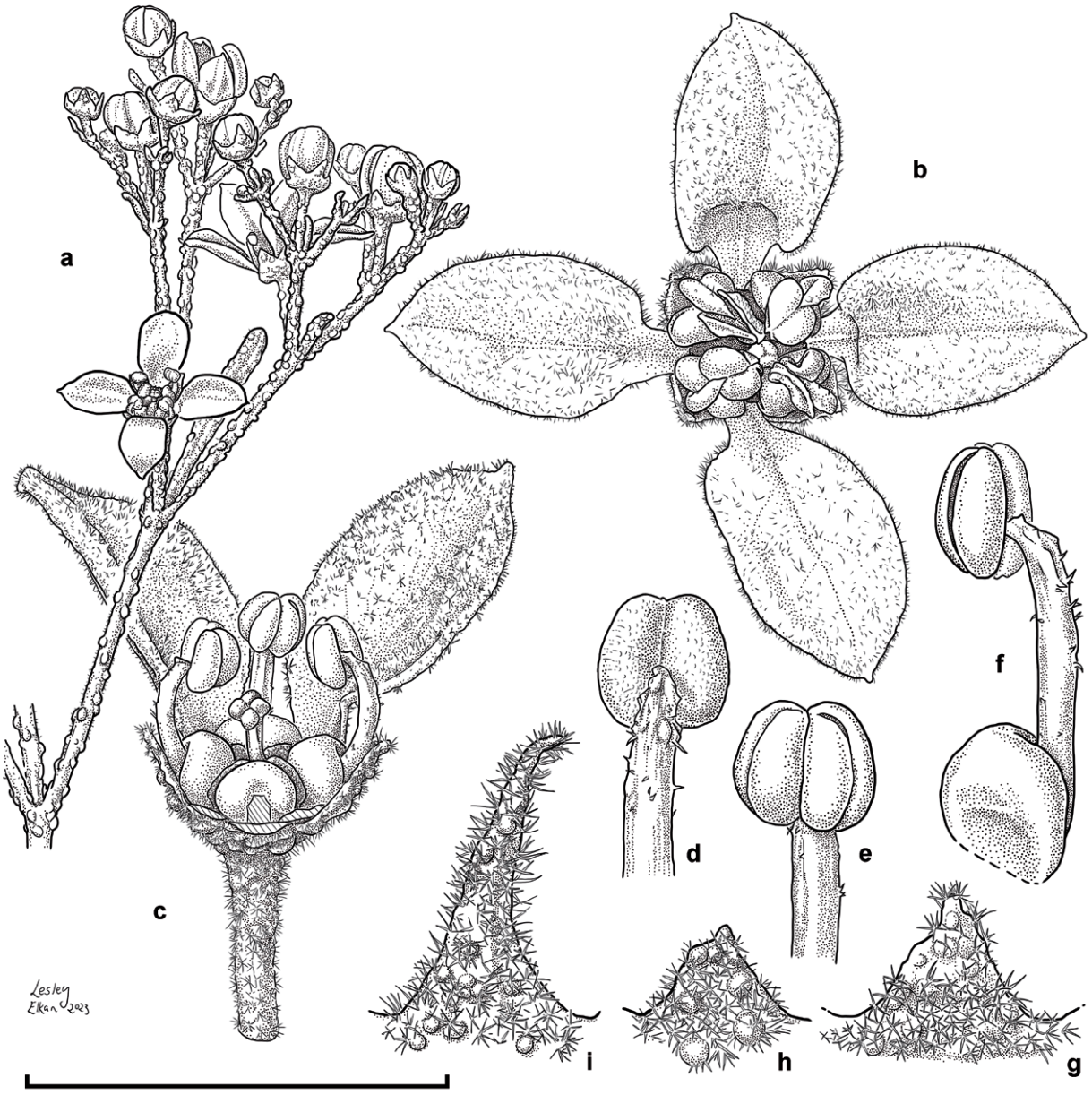

Fig. 3. *Zieria nubicola* (a–g): (a) inflorescence detail; (b) flower, top view; (c) flower, side view, two petals and one sepal removed; (d) stamen with anther, abaxial view; (e) stamen with anther, adaxial view; (f) stamen with anther, side view; (g) sepal, abaxial view. *Zieria granulata*: (h) sepal, abaxial view. *Zieria tuberculata*: (i) sepal, abaxial view. Scale bar: (a) = 15 mm; (b) & (c) = 5 mm; (d–i) = 2.5 mm. Vouchers: (a–g) *Orel 77 & Duretto* (NSW); (h) *J.J. Fletcher s.n.* (NSW2850); (i) *J.D. Briggs 2444* (NSW931867). Illustrations by L. Elkan.

The species appears to be secure as it is found on an isolated ridge that is found within a state Nature Reserve and is surrounded by forest; the site does not seem to be visited regularly. The woody weed, *Lantana camara*, was observed in areas near the species and is common locally; this will be a future threat if it becomes established within the population and overshadows plants and restricts recruitment. Climate change is considered a threatening process as the area where the species is found is wet and often shrouded in clouds. Any change in the local microclimate that could potentially make the area dryer and increase the frequency of fires may pose a threat to the species. If the site became more accessible, visitor numbers increased, the surrounding vegetation was disturbed or cleared, or the population number declined then the species would likely satisfy

the requirements to be listed as Critically Endangered under the *New South Wales Biodiversity Conservation Act* (2016).

Additional specimens examined [precise details withheld]: NEW SOUTH WALES: Central Coast: Good Dog Mountain, Cambewarra Range, *F.A. Rodway [Rodway Herbarium No. 993]*, 8 Nov. 1931 (NSW 19738) Cambewarra Range Nature Reserve, 34°48'S 150°34'E, 22 Sept. 2022, *H.K. Orel HKO 76 & M.F. Duretto* (MELUD131640a, NSW); *ibid*, *H.K. Orel HKO 77 & M.F. Duretto* (MELUD131641a, NSW); *ibid*, *H.K. Orel HKO 78 & M.F. Duretto* (MELUD131642a, NSW); *ibid*, *H.K. Orel HKO 80 & M.F. Duretto* (MELUD131644a).

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References

Armstrong JA (2002) *Zieria* (Rutaceae): a systematic and evolutionary study. *Australian Systematic Botany* 15, 277–463. https://doi.org/10.1071/SB00040

BCA (2016) *New South Wales Biodiversity Conservation Act 2016* (https://legislation.nsw.gov.au/view/html/inforce/current/act-2016-063) (Accessed 24 January 2023)

BCR (2017) *New South Wales Biodiversity Conservation Regulation 2017* (https://legislation.nsw.gov.au/view/html/inforce/current/sl-2017-0432) (Accessed 24 January 2023)

Carr PF (1983) A reappraisal of the stratigraphy of the upper Shoalhaven Group and lower Illawarra Coal Measures, southern Sydney Basin, New South Wales. *Proceedings of the Linnean Society of New South Wales* 106, 287–297.

Duretto MF (2019) *Zieria fordii* and *Z. wilhelminae* (Rutaceae), two new restricted Queensland species related to the widespread *Z. cytisoides*. *Telopea* 22, 135–140. https://doi.org/10.7751/telopea13458

Duretto MF, Forster PI (2007) A taxonomic revision of the genus *Zieria* Sm. (Rutaceae) in Queensland. *Austrobaileya* 7, 473–544.

Duretto MF, Forster PI (2008) New subspecies for *Zieria odorifera* J.A.Armstr. (Rutaceae) from northern New South Wales. *Austrobaileya* 7, 681–690.

Forster PI (2020) *Zieria abscondita* P.I.Forst. (Rutaceae), a new and restricted species from southeast Queensland. *Austrobaileya* 10, 621–627.

George AS, Duretto MF, Forster PI (2013) *Zieria* (Rutaceae). Pp. 282–336 in *Flora of Australia Volume 26, Meliaceae, Rutaceae, Zygophyllaceae*. (ABRS/CSIRO Australia: Melbourne)

IUCN (2012) *IUCN Red List Categories and Criteria: Version 3.1. Second edition*. Gland, Switzerland and Cambridge, UK: IUCN. iv + 32pp. http://www.iucnredlist.org/technical-documents/categories-and-criteria

IUCN (2022) *IUCN Standards and Petitions Committee. 2022. Guidelines for Using the IUCN Red List Categories and Criteria. Version 15.1*. Prepared by the Standards and Petitions Committee. https://www.iucnredlist.org/resources/redlistguidelines

Loughnan F, Ward C (1971) Pyrophyllite-bearing flint clay from the Cambewarra area, New South Wales. *Clay Minerals* 9, 83–95.

Orel HK, McLay TGB, Guja LK, Duretto MF, Bayly MJ (2023) Genomic data inform taxonomy and conservation of critically endangered shrubs: a case study of *Zieria* (Rutaceae) species from eastern Australia. *Botanical Journal of the Linnean Society*, boad069. https://doi.org/10.1093/botlinnean/boad069

Wright T (2013) A Koori's perspective of place: connections to the NSW Upper South Coast. *Coolabah* 11, 296–304.

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