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New species and taxonomic changes in the *Grevillea thelemanniana* Group (Proteaceae: Grevilleoideae: Hakeinae) from south-west Western Australia

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Abstract

Four species are added to the *Grevillea thelemanniana* Group, the constituency of which is discussed in light of recent phylogenetic analyses. Two new species are described. *Grevillea cooljarloo* Keighery and Olde was previously included by some in *Grevillea preissii* Meisn. subsp. *preissii* or as *G. pinaster* divided-leaf form, and is presently known informally as *Grevillea thelemanniana* subsp. Cooljarloo (B.J. Keighery 28B) by the Western Australian Herbarium. *Grevillea gillingarra* Olde and Keighery has previously been confused with *G. thelemanniana* Hügel ex Endl. *Grevillea preissii* subsp. *glabrilimba* Olde and Marriott is here recognised at specific rank, as *G. glabrilimba* (Olde and Marriott) Olde. *Grevillea preissii* is more narrowly circumscribed, in line with the original concept *sensu* Meisner (1845), without subspecies. A photo of the Blaschka glass model of *Grevillea preissii* is included with permission. The historical confusion between *G. thelemanniana.* and *G. preissii* is revisited. *Grevillea variifolia* subsp. *bundera* Keighery is recognised at species-level as *G. bundera* (Keighery) Olde and Keighery. A conservation assessment for all taxa is provided and a key to the revised *Thelemanniana* Group, as currently accepted, is supplied.

Introduction

The taxonomy around *Grevillea thelemanniana* Hügel ex Endl. and associated species currently included in the *Thelemanniana* Group *sensu* Makinson (2000) (Group 14 *sensu* Olde and Marriott 1994) is complex. It has been confused partly by the close relationships of many recognised species, partly by changing species concepts and partly by the attempts of taxonomists to embed perceived relationships in the nomenclature based on untested hypotheses regarding morphological similarity. Recent phylogenetic studies in *Grevillea* (Holmes *et al.* 2009, 2014; Mast *et al.* 2015; Hevroy 2016) have demonstrated that morphology can be an unreliable guide to relationships. For this reason, we take the view that species recognition should follow that advocated under the Phylogenetic Species Concept and be based in the first instance on morphologically irreducible, fully diagnosable populations that can be sampled and tested at any time, and to which data-sets can be added and boundaries refined if needed (Gao *et al.* 2019).

The operational definition of a phylogenetic species, given by Grubb and Groves (2011: 1) is similar. They treated species as 'the smallest population or aggregation of populations with heritable differences from other such populations or aggregations'. Here, we recognise such populations in the *Thelemanniana* Group as co-equal, distinct morpho-species. Irreducible species are the basic unit of evolution. Their genealogy can be traced and their relationships can be discovered by DNA testing and analysis. Although the species boundary may be undergoing expansion due to ongoing divergence, the concept of irreducibility is preferable to one in which allopatric populations that can be distinguished and diagnosed morphologically are added to the species concept to produce polytypic species, such as that tolerated under the Biological Species Concept.

Most existing subspecies of *Grevillea*, being populations fully diagnosable by morphological discontinuity, are actually closely related species under a phylogenetic model. In this context, subspecies may need re-definition. They should pass a rigorous test of relationship and certainty, but they mostly rely on untested assessments of morphological similarity. Only populations with a high degree of morphological overlap will be treated as subspecies in future, and even then we recognise that further investigation may provide evidence of full diagnosability that would enable their recognition as closely related species. An Integrative approach, succinctly outlined and updated by Hevroy (2016), following the unified concept of De Queiroz (2007) and others, is therefore supported strongly here. In recognising existing subspecies at specific rank, we have preferably used the same epithet, although this is not always possible, to provide continuity and to minimise disruption to names.

The taxonomic and horticultural history of the *Thelemanniana* Group is labyrinthine. On May 1 1839, Endlicher (1839: 6) published a description of *G. thelemanniana,* utilising a plant in Baron Karl von Hügel's garden at Heitzing, Austria. According to the protologue, it had been grown from seeds, probably sent back ['*allatis*'], or possibly brought back from south-west Western Australia (Endlicher 1839). Endlicher described his specimen as coming from a shrub about the size of a human, from which we conclude that the cultivated holotype was at least three years old or older. Even if von Hügel had sewn seed and planted germinated seedlings soon after his return from travels in 1837, the plants could not have reached this size by May 1839. Therefore, we conclude that he must have sent the seeds back, either to his sister or head gardener, sometime after he had collected them in 1833. Ducker (1900: 300) records von Hügel's enthusiasm for seed collection. The collection of seed for his garden formed part of his travel intentions, according to Clark (1994).

The holotype of *Grevillea thelemanniana,* if one ever existed, is lost and has not been located by any author. Although Endlicher failed to mention the diagnostic presence of simple leaves that are almost always intermixed with its divided leaves, McGillivray and Makinson (1993: 444) were able to unambiguously apply the name *G. thelemanniana* to known populations near the current city of Perth, Western Australia and select a neotype. Von Hügel probably only gathered a few seeds when he was there in 1833, sufficient for a single germination event, which occurred before his return. *Grevillea thelemanniana* is a rare, lignotuberous/seed-facultative species that sets very few seeds. Whether or not seed-obligate populations once occurred around Perth cannot be ascertained but we consider it unlikely.

Just a few weeks after Endlicher's publication, and apparently unaware of it, Lindley (July, 1839) also described '*G. Thelemaniana*' (sic!), citing correspondence with von Hügel about a plant 'with narrow pinnatifid leaves' 'that had recently been raised' in his garden. Although Lindley provided a Latin diagnosis that differed only in its brevity from Endlicher's, he did not cite, and may not even have seen, a specimen. There is no specimen in his herbarium at CGE. The epithet is in honour of Carl Friedrich Thelemann (1811–1889), and the abbreviated description may have also been supplied to him by von Hügel. It is presumed that the same cultivated plant was the source of both Endlicher's and Lindley's descriptions, and that therefore Lindley's treatment is *nomen superfluum, orth. var.*

According to Pfister (1889), Thelemann was recruited by von Hügel from England where he was working with Australian plants. Then a young man in his mid-twenties, Thelemann worked for von Hügel during the mid-1830s until he was appointed garden architect at the Botanical Garden in St. Petersburg in 1839. He gained horticultural experience and honed his skills, said to be 'exceptional', with von Hügel. He was possibly head gardener or in charge of his Australian collections at some point. It seems probable that he had a pivotal role in the introduction and cultivation of the eponymous *G. thelemanniana*.

Between 1839 and 1845 von Hügel distributed seedling or cutting-grown propagules under the name *G. thelemanniana* or similar, to nurserymen, aristocrats, botanic gardens and horticultural enthusiasts throughout Europe. The Frankfurt father and son, nurserymen, Sebastian Rinz and Jacob Rinz (1839: 31) first listed '*G. thelemaniana*' (sic!) for sale in their 1839–40 catalogue at the relatively high price of 12 fl. (*cf.* other *Grevillea* species listed at 1–5 fl., and one listed as 'species (*v. Hügel*)' for 20 fl.). It cannot be assumed that these plants are true to type. Rinz and Rinz (1842: 31) first publicly recognised a difference in the plants by listing *G. thelemanniana* (syn. *G. absintif.*.). Heynhold (1846: 275) indicated that *G. absinthifolia* was a synonym of *G. thelemanniana*, citing '*Hort. Belgique*', but again, *G. preissii* is implicated because there can be no obvious reason why there should be two names for the same taxon and none for the arguably more attractive plants ultimately named as *G. preissii*. Rovelli Brothers (1861), Italian nurserymen, listed both 'G. absynthifolia' and 'G. thellemannii' (sic!) clearly affirming two separate species.

In 1842, *G. thelemanniana* was being cultivated in the garden of the Royal Belgian Horticultural Society in Brussels, according to La Société Royale Belgique (1842: 26), from where plants were also sold to order. However, Jacques (1843: 191) also described a plant in the garden of M. Martine in Paris, one of seven that had been sent by 'M. le baron *Eugel*', called 'G. tellemani brillante; [syn.] G. tellemani splendens'. From the leaf description, 'diversement divisées en lobes filiformes…pointus' this is likely to have been *G. preissii*. De Noter (1909: 33) indicated that the name *G. splendens* Hort. was also a synonym of *G. preissii*. Taking all evidence into account, 1842 marks the probable year of the introduction of *G. preissii* to horticulture. However, it seems likely that when Endlicher (1842: 288) recorded *G. thelemanniana* in the University Garden at Vienna that confusion with *G. preissii* had not become an issue there.

LeMaire (1845) published a treatment of *G. thelemanniana,* as one of a number of new or little-known, useful ornamental plants. The description and illustration, which were based on a plant growing in a green house in the French National Museum, clearly identify it as *G. preissii* Meisn. According to LeMaire, it had been raised from seed received from south-west New Holland by von Hügel in 1838 and plants propagated from it were distributed to various European gardens. LeMaire listed three European nurseries who had it for sale. The confusion between the two closely related species, *G. thelemanniana* and *G. preissii,* dates from this time, though *G. preissii* was not actually described until 1845, so the confusion is understandable.

Rudolf Blaschka (1857–1939) supplied an exquisite glass model of *G. preissii,* being at the time cultivated near Dresden, Germany, to Harvard University which he created in 1913, as '*G. thelemanniana* syn. *G. preissii* Meissn'. The model employs a degree of artistic licence in its variable depiction of petaly but is otherwise a technically accurate portrayal (Fig. 1).

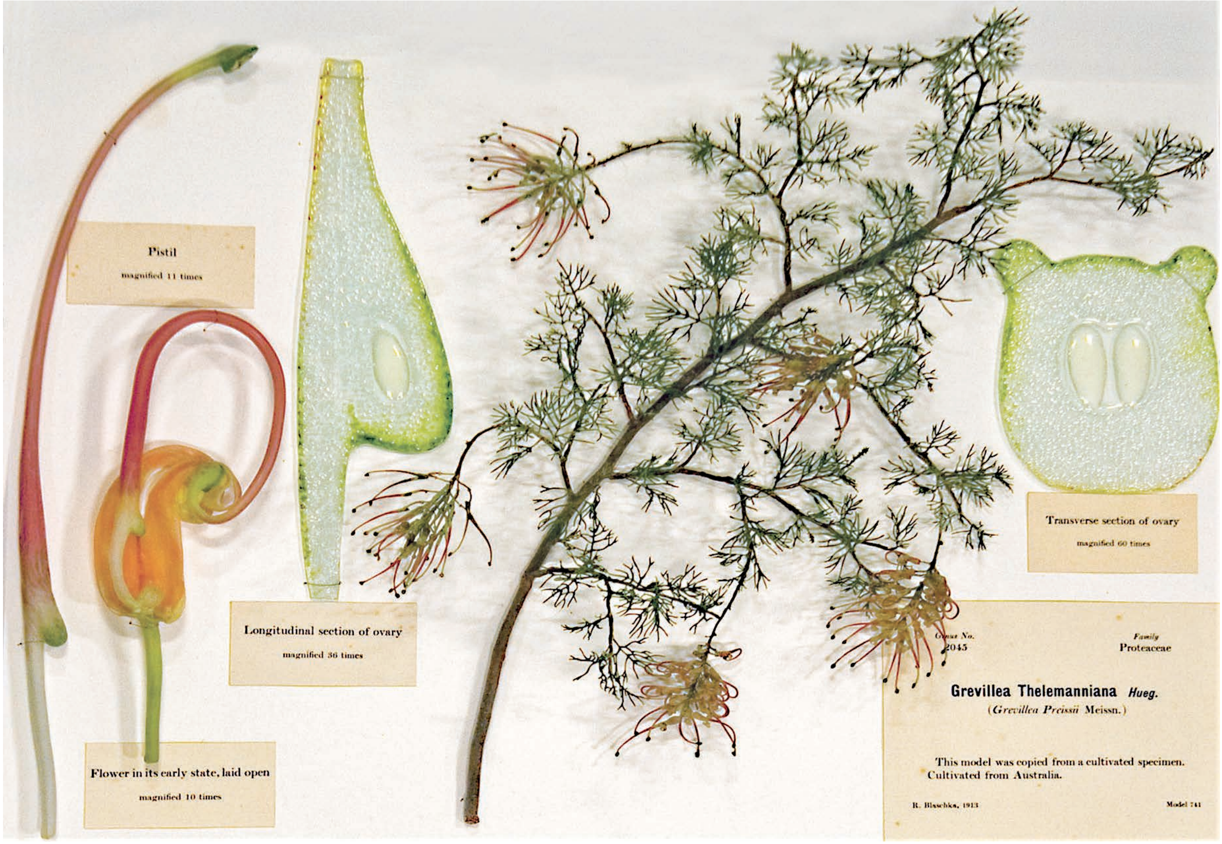

Fig. 1. *Grevillea preissii* glass model created by R. Blaschka (1913). Photo by Julie L. McIntosh for the Ware Collection of Blaschka Glass Models of Plants, Harvard University, Cambridge, Massachusetts, USA. Published with permission.

In describing *G. preissii*, it seems apparent that Meisner (1845) did not see a type specimen of *G. thelemanniana* because that species would be the most obvious comparator. Instead, Meisner (1845: 543) treated *G. thelemanniana* as a close relative of, and comparable to, *G. lindleyana* Meisn. (= *G. wilsonii* A.Cunn.) and in his description of *G. preissii*, Meisner (1845: 543–44) differentiated it from *G. crithmifolia* R.Br., making comparisons as well with *G. pectinata* R.Br. and *G. baxteri* R.Br., all species far more distantly related by comparison with *G. thelemanniana*. Meisner (1856: 372) continued recognition of the two species. Bentham and Fitch (1 May 1870) also treated *G. preissii* as distinct, but by October of that same year Bentham and Mueller (1870: 439) decided that it was a synonym of *G. thelemanniana*. For 116 years, indeed until 1986, this classification was accepted and *G. preissii* was 'lost' and went unrecognised formally.

McGillivray (1986: 15) reinstated *G. preissii* as *G. thelemanniana* subsp. *preissii* (Meisn.) McGill. within a conceptually broad *G. thelemanniana* comprising one autonymic and six additional subspecies, two of which had originally been named at specific rank (*G. obtusifolia* Meisn, and *G. pinaster* Meisn.). Two subspecies were novel, subsp. *delta* McGill. and subsp. *fililoba* McGill. Subsp. *hirtella* (Benth.) McGill. had previously been named by Bentham (1870: 427) as *G. pinaster* var. *hirtella*.

In their monograph of the genus *Grevillea*, McGillivray and Makinson (1993: 249–253) maintained *G. thelemanniana* as a broad species, enlarged to eight entities with the introduction of Form 'e', plus four collections unassignable to any subspecies, together with several anomalous specimens included in the descriptions of subsp. *delta*, subsp. *obtusifolia*, and subsp. *pinaster*. McGillivray and Makinson (1993: 250) justified this classification on the basis that the morphological differences between populations comprising these subspecies were slight compared with those between other related species, such as *G. stenomera* F.Muell., *G. variifolia* and *G. ripicola* A.S.George. Thus, they not only subscribed to the assumption that species should be accepted only when there is a certain unstated morphological distance between them but implied that the character values distinguishing their subspecies were hierarchical, without outlining their relative degrees of importance. McGillivray (1994) subsequently outlined his unique operational definition of species and his adherence to the principles of the Biological Species Concept (BSC) including reproductive isolation.

Olde and Marriott (1993) voiced their concerns in relation to the broad species concept being adopted by McGillivray. Olde and Marriott (1994) rejected the proposed classification in relation to *G. thelemanniana,* and some other broadly conceptualised species, and reinstated or recognised all seven subspecies of *G. thelemanniana sensu* McGillivray at species rank. They also described three additional species (*G. exposita* Olde and Marriott, *G. evanescens* Olde and Marriott and *G. humifusa* Olde and Marriott, together with one subspecies (*G. preissii* subsp. *glabrilimba*). At the time, Olde and Marriott (1994: 182) considered subsp. *glabrilimba* to be insufficiently distinct from *G. preissii* but did not cite any phylogenetic analysis. All these species plus others (15 taxa altogether) were considered intuitively and morphologically to belong to their Key Group 14 (Olde and Marriott 1994: 204).

The Thelemanniana Group

Makinson (2000) equated Group 14 with the *Thelemanniana* Group but with a revised constituency of 16 species, including two additional species, *G. acropogon* Makinson and *G. maccutcheonii* Keighery & Cranfield, and two non-autonymic subspecies, including *G. variifolia* subsp. *bundera* Keighery (18 taxa). The basis of this grouping, like that of Olde and Marriot, is entirely perceived phenotypic affinity. An updated morphological summary is provided by Makinson (2000), but although the *Thelemanniana* Group is comprised of species thought likely to stem from the same lineage, no single character has been identified as a potential synapomorphy. However, species phenetically closest to *G. thelemanniana sensu* McGillivray and Makinson (1993) have numerous potential synapomorphies including the ovary transversely to obliquely truncate at base and with a variably prominent suprabasal ridge or anterior heel, the gynophore conspicuous, compressed, concavo-convex, follicles cylindrical-trianguloid with a thin, rugose pericarp, and seeds with a downy coat.

The time-calibrated phylogeny inferred for subtribe Hakeinae from five genetic regions (4 plastid and 1 nuclear) combined by Mast *et al.* (2015) suggested that the *Thelemanniana* Group was not monophyletic and needed revision. In that study, the two tested species (*G. acropogon* and *G. preissii* subsp. *preissii*) were not resolved as sister, although both were resolved in the same large heterogeneous clade (Clade 4) of mainly simple-leaved species, with a crown age of *c.* 35 million years. *Grevillea acropogon* was nested in a more recently evolved subclade with a crown age of 5–7 million years that also contained the two species from Group 16 (the *Hakeoides* Group). *Grevillea preissii* was resolved as sister to a subclade comprising species from several Groups.

In a more focussed phylogeny restricted to the *Thelemanniana* Group *sensu* Makinson, inferred from two plastid genes and 12 nuclear microsatellites, Hevroy (2016) also found that the *Thelemanniana* Group was not monophyletic. Using molecular methods and dating technology, she found that there was a significant lineage divergence within the *Thelemanniana* group, dating back to the Miocene (5–20 Myr). All the southern species (*G. acropogon, G. maccutcheonii* and *G. ripicola*) were resolved with two outgroup species in the *Hakeoides* Group with similar southern distributions. Hevroy also stated that species recognition was warranted for two unique lineages identified by both cpDNA sequences and nDNA microsatellite data, viz. *G. cooljarloo* Keighery & Olde and *G. gillingarra* Olde & Keighery, both described below.

Although the results published by Hevroy suggest that the constituency of the *G. thelemanniana* Group should be divided along geographic lines, the species composition remains uncertain because another member of the *Hakeoides* Group, *G. commutata* F.Muell., was resolved with the remaining species in the northern lineage. This suggests, among other things, that there is a complex, unresolved relationship, with the *Hakeoides* Group more broadly and also the *Linearifolia* Group, both of which are paraphyletic with respect to the *Thelemanniana* Group in the study published by Mast *et al.* (2015). Indeed, *G. olivacea* might be more closely related to *G. commutata* than to *G. thelemanniana* (see also comments by Makinson 2000: 163). The ultimate grouping of species awaits results from a more comprehensive phylogenetic analysis of the whole genus currently led by Professor M. Cardillo (ANU) and collaborators, which has been delayed by the Covid-19 pandemic. Accordingly, we have not made any changes here to the constituency of the *Thelemanniana* Group, which now includes 20 species, pending the results of that study. Further, although taxonomic studies of the *Hakeoides* and *Linearifolia* Groups are ongoing, they are not well-advanced. However, a preliminary morphological overview supported by results published by Hevroy 2016 indicates that additional new species await recognition. In particular variation in *G. pinaster* warrants further study.

Morphology

In this paper and from now on we refer to the *floral rachis* as the *inflorescence rachis* since the flowers strictly speaking do not have a rachis. The term *single-stemmed* replaces the term *stenobasic* which, since its introduction in 1993, has not achieved widespread currency. The term *simple inflorescence* replaces the term *unit conflorescence,* which likewise has not achieved widespread usage. The distance between the proximal leaf lobes (divided leaves) and the branchlet has diagnostic value in several groups. Here and from now on, we refer to this area of the leaf rachis as the *basal rachis node*. The term *floral bracts*, which are widely accepted as bracts that subtend individual flowers, strictly do not occur in *Grevillea.* The term, in recent treatments, has been replaced by the term *common bracts*, which individually subtend flower pairs.

Key to species in the *Thelemanniana* Group (widely distributed from the Exmouth area to Lake Unicup, N of Frankland)

1 Leaf bases amplexicaul (E of Ludlow to Hithergreen) .... ***G. maccutcheonii***

1: Leaf bases linear to cuneate **2**

2 Leaves divaricately divided, the principal leaf rachis angularly refracted at first and/or terminal node **3**

3 Pistils 29–35 mm long; leaf rachis refracted at first node; outer surface of perianth glossy *in vivo*; leaf lobes 1.5–5 mm wide, linear to elliptic, the under-surface exposed, glabrous; simple leaves sometimes present; intramarginal veins evident on leaf upper surface (Collie to Bridgetown) .... ***G. ripicola***

3: Pistils 20–22 mm long; leaf rachis angularly refracted at all nodes; outer surface of perianth dull *in vivo*; leaf lobes 0.8–1.1 mm wide, linear, the under-surface enclosed by margins when dry, sericeous in the grooves beside the midvein; simple leaves never present; intramarginal veins not evident on leaf upper surface (near Lake Unicup) .... ***G. acropogon***

2: Leaves flat or secund, the principal leaf rachis straight or smoothly recurved........ **4**

4 All or some leaves divided **5**

5 Leaves coarsely divided, obovate or obtrullate to subcruciform; leaf base cuneate; venation conspicuously raised on the leaf upper surface........ **6**

6 Leaves 1.7–4.3 cm long, pliable, silvery, obovate, the apex obtuse, apically dentate or shallow-lobed in the distal half; leaf lobes linear to narrow-triangular; petioles 3–6 mm long; conflorescences usually branched (Cape Range) .... ***G. variifolia***

6: Leaves 1.0–1.5 cm long, rigid, grey, subcruciform, the apex acute, pungent, the lobes broad-triangular; petioles *c.* 2 mm long; conflorescences mostly simple (inland from Ningaloo)........ ***G. bundera***

5: Leaves deeply divided, usually with sub-sect division; leaf base linear to very narrowly cuneate; venation obscure to evident on the leaf upper surface **7**

7 Conflorescence development acropetal (floral buds enlarging first from base of the rachis towards the apex) **8**

8 Inflorescence rachises glabrous (rarely with scattered isolated hairs); perianth limb and pedicels glabrous (coastal and subcoastal; Leeman to Cervantes) .... ***G. glabrilimba***

8: Inflorescence rachises densely hairy; perianth limb and/or pedicels hairy or glabrous **9**

9 Distance from basal leaf lobe to branch 1–4 mm; branchlets densely hairy **10**

10 Simple inflorescence rachises mostly 20–50 mm long; habit of plant prostrate with elongate branches to 3 m long; branchlets densely tomentose, lacking conspicuous long hairs to 2 mm long interspersed; leaves grey; perianth glabrous with scattered appressed hairs confined to the limb (SE of Jurien Bay) .... ***G. humifusa***

10: Simple inflorescence rachises mostly 8–15 mm long; habit of plant shrubby with ascending branches < 1 m long; branchlets densely tomentose with conspicuous long hairs interspersed; leaves green; perianth glabrous or sometimes variably and sparsely hairy (Mt Lesueur area) .... ***G. delta***

9: Distance from basal leaf lobe to branch > 5 mm; branchlets glabrous to sericeous-tomentose **11**

11 Branchlets with a dense indumentum; leaves 2.5–5.2 cm long, divided, very rarely an occasional leaf simple; perianth outside (including below the limb), and pedicels, with few to many appressed hairs; inflorescence rachises densely tomentose (coastal and subcoastal; Lancelin–Yalgorup) .... ***G. preissii***

11: Branchlets glabrous or sparsely hairy; leaves 0.8–3.2 cm long, simple and divided; perianth outside and pedicels glabrous, (appressed hairs confined to the perianth limb); inflorescence rachises sparsely sericeous (Cooljarloo area) .... ***G. cooljarloo***

7: Conflorescence development basipetal (floral buds enlarging or opening first at the apex of the rachis) to synchronous **12**

12 All or some leaves with secondary and/or tertiary partite (-sect) division; leaf apices acute or obtuse **13**

13 Conflorescence subglobose-secund, lax; styles drooping; pistils 24–28 mm long; pollen-presenter 1.4–1.8 mm long; branchlets glabrous; widest leaves > 2 cm wide; leaf lobes 0.3–0.5 mm wide, filamentous, curved, terete, pliable; perianth 3–4 mm wide, often glaucous (Greenough River to Ellendale Pool) .... ***G. fililoba***

13: Conflorescence subcylindrical-secund, tight; styles spreading; pistils 20–22 mm long; pollen-presenter *c.*1.2 mm long; branchlets pilose; widest leaves ≤1.5 cm wide; leaf lobes 0.6–0.8 mm wide, not filamentous, straight, linear, stiff; perianth 2.2–2.5 mm wide, non-glaucous (Gillingarra area) .... ***G. gillingarra***

12: All leaves either once-divided or once-divided leaves and simple leaves intermixed **14**

14 Inflorescence rachises 35–60 mm long; leaf margins angular; all leaves silvery-grey, pinnately divided; leaf lobes 4–12.5 cm long; pedicels and perianth outside densely to sparsely hairy (Kalbarri to Tamala) .... ***G. stenomera***

14: Inflorescence rachises < 25 mm long; leaf margins smoothly revolute or recurved; all leaves green or bluish-green, either simple or if divided then intermixed with simple leaves); leaf lobes of divided leaves < 4 cm long; pedicels and perianth glabrous (the limb sometimes with appressed hairs) **15**

15 Branchlets pubescent, tomentose or villous (hairs spreading) **16**

16 Upper surface of leaves punctate or with spreading hairs; lower surface and sometimes also the midvein enclosed by strongly and often unevenly revolute margins; perianth limb flanged at the segment interfaces (between Mingenew to Walkaway) .... ***G. hirtella***

16: Upper surface of leaves smooth, glabrous; lower surface narrowly exposed beside midvein or enclosed and bisulcate, the midvein never obscured by margins; perianth limb smooth, without flanges at the segment interfaces **17**

17 Simple leaves (2.5–)4–8 cm long; lower surface either enclosed by revolute margins or narrowly exposed; leaf margins smoothly and evenly revolute; leaf lobes of divided leaves when present 0.5–2(–2.8) mm wide (Murchison River to Eneabba with disjunct occurrences at Hamelin Pool, Wongan Hills, Pithara)........ ***G. pinaster***

17: Simple leaves 1.3–3 (–3.5) cm long; lower surface exposed; leaf margins smoothly but loosely revolute; leaf lobes of divided leaves when present 1.2–5.5 mm wide (Eneabba, Arrowsmith to Arrino)........ ***G. exposita***

15: Branchlets glabrous, subsericeous or sericeous (hairs appressed)........ **18**

18 Simple leaves 2–4 mm wide, predominant (Pinjarra, Muchea to Gingin)........ ***G. obtusifolia***

18: Simple leaves absent or if present, then < 2 mm wide........ 19

19 Most leaves 2.5–8 cm long; lower surface of simple leaves enclosed by tightly and evenly revolute margins, rarely slightly exposed on leaves > 4 cm long; plants seed-obligate or lignotuberous (Murchison River to Eneabba with disjunct occurrences at Hamelin Pool, Wongan Hills, Pithara)........ ***G. pinaster***

19: Most leaves 1–2(–2.5) cm long; lower surface of some leaves narrowly exposed beside midvein; leaf lobes of divided leaves 0.5–1.7 cm long; plants lignotuberous (Kenwick area of Perth)........ ***G. thelemanniana***

4: All leaves simple and entire........ **20**

20 Leaf lower surface broadly exposed; leaf margins shortly recurved........ **21**

21 Outer surface of perianth hairy; simple inflorescences regular, dome-shaped (coastal from Jurien Bay to Coolimba)........ ***G. olivacea***

21: Outer surface of perianth glabrous or almost so; simple inflorescences secund........ **22**

22 Lower surface of mature leaves densely sericeous; plants prostrate to 3.5 m high, lignotuberous, their width greater than their height; leaves 2–4 mm wide........ **23**

23 Branchlets sericeous to glabrous (Pinjarra, Muchea to Gingin)........ ***G. obtusifolia***

23: Branchlets pubescent-tomentose (Eneabba–Arrowsmith River to Arrino)........ ***G. exposita***

22: Lower surface of mature leaves glabrous, rarely a few hairs scattered; plants tree-like 3–5 m high, seed-obligate, their height > than their width; leaves 2.5–9 mm wide (Yanchep to Neeragabby)........ ***G. evanescens***

20: Leaf lower surface either fully enclosed by leaf margins or partly visible in narrow grooves beside the midvein; leaf margins revolute, abutting the midvein on the under-surface or almost so........ [back to] 19

Taxonomy

1. ***Grevillea cooljarloo*** Keighery and Olde, **sp. nov.**

Type: Western Australia: Woolka Rd., 10 km W of intersection with Cooljarloo Rd, *G.J. & B.J. Keighery 917*, 22 Sep 2006 (*holo*: PERTH07851790; *iso*: MEL; NSW) (*distribuendi*).

Grevillea pinaster 'Pinnate-leaf form' *sensu* Olde & Marriott (1995b: 98) in part.

Grevillea preissii 'Palgarup Springs' Hort.

Grevillea thelemanniana subsp. Cooljarloo (B.J. Keighery 28 B). Western Australian Herbarium (1998–), in *FloraBase*, https://florabase.dpaw.wa.gov.au/browse/profile/48402 [accessed Dec 2016]

Grevillea sp. Cooljarloo (B.J. Keighery 28 B). Western Australian Herbarium (1998–), in *FloraBase*, https://florabase.dpaw.wa.gov.au/browse/profile/48402 [accessed 5 Dec 2021]

Differs from *Grevillea preissii* in its branchlets glabrous or almost so versus densely sericeous-tomentose, its leaves generally shorter (0.8–3.2 cm long versus 2.5–5.2 cm long) and with usually shorter basal rachis node 5–11 mm long versus 9–20 mm long, the ultimate lobes 5–10 mm long versus 10–27 mm long; its inflorescence rachises 10–22 mm long versus 20–40 mm long; its perianth below the limb glabrous versus sparsely sericeous.

Seedlings not seen. *Mature plants* lignotuberous, seed-facultative, spreading, multi-stemmed shrub 0.3–0.5(–0.7) m high, 0.5–1.5 m wide, with spreading to ascending branches from the trunk near to the ground. *Branchlets* 0.8–1.2 mm thick, terete to slightly angular, a raised glabrous rib sometimes decurrent from leaf bases, yellowish, glabrous to openly sericeous-tomentose, rarely densely tomentose-villous. *New growth* sericeous or sparsely so. *Adult leaves* simple and divided (usually both together), 0.8–2.2(–3.2) cm long, ascending, subsessile to shortly petiolate, mid to dark green, subglabrous; *simple leaves* 0.7–0.8 mm wide, linear, straight or slightly curved; *divided leaves* 4–10 mm wide, trisect to pinnatisect, secondary bi- or trisect division of primary lobes rare, more common in young plants where some tertiary division also evident (Olde *et al*. 15/99a) imparipinnate, secund, petiolate; *primary leaf lobes* (2–)3–4(–5); *basal rachis node* (divided leaves) 5–11(–13) mm long, 0.8 mm wide, linear, straight or recurved; *ultimate lobes* (2–)5–10(–23) mm long, 0.6–0.9 mm wide, linear, straight, the terminal lobe sometimes bipartite; *apices of leaves and lobes* subacute to obtuse-mucronate, the mucro *c*. 0.1 mm long, blunt, non-pungent; *adaxial surface* smooth or with scattered punctae, transversely convex or flat, glabrous, rarely with scattered appressed hairs, the venation obscure, the midvein impressed; *margins* smoothly revolute, tightly and evenly enclosing the abaxial surface except the midvein; *abaxial surface* bisulcate, the lamina enclosed by margins, the sulcae very narrow, usually glabrous, the midvein prominent; *texture* coriaceous; *petioles* 0.1–2.5 mm long, 1–1.2 mm wide, spreading slightly at the point of attachment, glabrous. *Conflorescences* terminal or subterminal, simple, erect on decurved peduncles or deflexed, secund, acropetal; *buds* narrow-ellipsoid, soon cylindrical, sericeous, subsessile to shortly pedunculate; *peduncles* (1–)2–5 mm long, decurved, sparsely to densely sericeous; *rachises* 10–22 mm long, 0.3–0.6 mm wide, sparsely to moderately densely sericeous, straight, with an erect caudate extension 0.5–1 mm long; *common bracts* 0.3–0.5 mm long, ovate with incurved apex, sparsely sericeous on the outer surface, caducous. *Pedicels* 5–6 mm long, 0.3 mm wide, red, glabrous or with a few scattered hairs towards the apex; *torus* 0.8 mm across, oblique at *c*. 15°–30°, squarish; *tepal attachment scar c*. 0.1 mm wide, visible above and on the toral rim; *nectary* conspicuous, cushion-like to slightly U-shaped, rising 0.4–0.5 mm above the torus, the margin 0.3 mm thick, smooth; *pistils* (21–)25–26 mm long, glabrous; *gynophore* 4–5 mm long; *ovary* 1.5 mm long, 0.8 mm maximum width at base, green, lateral, prominent, triangular, the base truncate or obliquely so, or slightly retrorse; *style* 0.4 mm wide, red, yellowish at the apex, gently incurved; *pollen-presenter* 0.8–1.2 mm long, 0.7–1 mm wide, yellow, very oblique at *c*. 70° to sublateral; *perianth c*. 6 mm long, 0.8–2 mm at base, red, the tubular section glabrous, narrowly ovoid-ventricose to oblong at anthesis, distally contracted below the revolute limb, soon deciduous and falling as a coherent unit, at anthesis, the limb segments all separated, the dorsal suture separated to base; *abaxial surface* glabrous below the limb; *perianth limb* 1 mm long, 0.5 mm wide, subcubic to depressed-globose, tightly revolute, sparsely sericeous, often minute white hair bases evident; *adaxial surface* glabrous at base for *c*. 1.5 mm, then tomentose to just below the curve, condensed into a beard above half-way along on the ventral tepals, glabrous elsewhere except along the tepal margins which are papillose-hairy. *Follicles* and *seeds* not seen. (Fig. 2)

Diagnostic characters: Lignotuberous growth habit; branchlets terete, glabrous to sparsely sericeous-tomentose; new growth glabrous or sparsely sericeous; leaves simple and divided (both present usually), 0.8–3.2 cm long; leaves and leaf lobes linear, bi- or trisect or pinnatisect with 3–5 pairs of primary lobes; secondary bi- or tri-partite division sometimes evident; maximally divided leaves secund; ultimate leaf lobes 10–23 mm long, <1 mm wide, the under-surface of leaves and lobes tightly enclosed by smoothly revolute margins; basal rachis nodes 6–13 mm long; common bracts 0.3–0.5 mm long, ovate, early caducous; rachises 10–22 mm long, sericeous or sparsely so; pedicels 5–6 mm long, glabrous or with a few appressed hairs near the apex; pistils *c*. 25 mm long; perianth glabrous outside except for scattered hairs on the limb.

Distribution: Scattered populations in the Lesueur Sandplain Subregion of the Geraldton Sandplain IBRA Region in the Dandaragan LGA, Western Australia.

Phenology: Recorded in flower most of the year with a spring peak.

Habitat and ecology: Occurs mostly in winter-wet flats in grey sand over clay with *Banksia telmatiaea, Calothamnus, Senecio, Hakea trifurcata,* in low heath, on floodplains or around drainage lines and creeks.

Conservation status: Listed as Priority 1 by the Western Australian Department of Parks and Wildlife. However, Hevroy (2016) recommended downgrading this rating to Priority 4, given a survey of its range found large continuous populations.

Etymology: The epithet is an indeclinable noun in apposition, and derives from an Aboriginal word of the Yued or Billinue Aboriginal community relevant to the locality where the new species occurs, the precise meaning of which is uncertain.

Fig. 2. *Grevillea cooljarloo*. A. Seasonally waterlogged habitat (Wongonderrah Road). B. Decumbent to spreading habit (Woolka Road). C. Flowering branches (Woolka Road). D. Leaves and inflorescence (Wongonderrah Road). Photos: A, D: R. Barrett; B, C: P. Olde.

Variation: The collection Olde 17/37 differs from other specimens in its densely tomentose-villous branchlets. It also has more hairs on the distal section of the pedicels. This and other specimens from Pen Road may be introgressed by plants of *G. delta.* Although no evidence for introgression or hybridisation was reported by Hevroy (2016) for any included species in the Group, it is possible that plants at or near this site were not sampled.

Discussion: The informal classification of *Grevillea cooljarloo* was based on a shared ecological and morphological association with *G. thelemanniana.* It was initially phrase-named as *Grevillea thelemanniana* subsp. Cooljarloo (B.J. Keighery 28 B) by the Western Australian herbarium. However, Hevroy (2016), using sequences from only two cpDNA introns and 12 nuclear microsatellite markers designed specifically for *Grevillea thelemanniana* and cross-amplified across the *Thelemanniana* group, resolved *G. cooljarloo* as sister to *G. delta*. Both have unique cpDNA haplotypes and showed no evidence of admixture in the nuclear data. *G. thelemanniana* was resolved in a separate subclade. Hevroy showed that molecular evidence supported the recognition of *G. cooljarloo* as a distinct lineage, occupying an explicit floodplain and creek line habitat at low altitude (37–79 m asl).

Delimitation of *G. cooljarloo* here geographically expands the number of populations sampled by Hevroy from which she reported high genetic variability. Seven unique haplotypes were detected in populations from different sampling localities.

Grevillea thelemanniana differs phenetically in its basipetal inflorescence development, its simple leaves wider, and its divided leaves flat with leaf lobes lacking secondary development. The leaf margins of *G. thelemanniana* are loosely revolute and the leaf under-surface bears a narrow, sericeous laminal strip clearly visible between the leaf margin and midvein, especially noticeable on wider leaves.

Grevillea cooljarloo was included in *G. pinaster* by Olde and Marriott (1995b), as a divided-leaf form. It is still uncertain whether other collections of *G. pinaster* with divided leaves form populations or are morphological variants within populations that are mainly simple-leaved. However, *G. pinaster* differs from *G. cooljarloo* in its basipetal inflorescence development. Divided leaves are flat and are also without secondary division. In most populations, *G. pinaster* has only simple, longer leaves (2–4 cm long).

Grevillea cooljarloo has also been confused with *G. preissii* because it (sometimes) has twice-divided leaves, acropetal inflorescence development and hairy inflorescence rachises. However, *G. preissii* [subsp. *preissii*] is distinguishable from *G. cooljarloo* by its densely tomentose branchlets, by the presence of appressed hairs on the perianth tube, by its generally longer inflorescences and by its lack of simple leaves. *G. preissii* subsp. *glabrilimba*, here recognised as a distinct species, differs in its villous branchlets, its glabrous inflorescence rachises and glabrous perianth limb. It also usually has longer inflorescences.

G. exposita differs in its densely pubescent-tomentose branchlets, its simple leaves wider (1.2–1.4 mm wide), and in its basipetal inflorescence development. Its infrequent divided leaves are never with secondary division.

Recognition of this species here is based on genetic, ecological and morphological evidence, with more than one line of evidence satisfying criteria for species recognition under differing concepts.

Although it is accepted by Hevroy (2016) that there is no obvious mechanism evolved for seed dispersal beyond gravity, seed morphology in the Group generally shows clear evidence via the presence of an elaiosome, of myrmecochory (Auld & Denham 1999). However, the lack of follicles formed on a cultivated specimen at Oakdale, New South Wales, suggests that this species may not be self-compatible, only rarely seed facultative, probably long-lived and very largely reliant on a fire-tolerant rootstock as a fire defence.

Specimens seen: Western Australia: 2 km N of junction of Eneabba South Rd and Coorow–Greenhead Rd, *C. Chapman s.n.*, 28 Aug 1977 (PERTH 01845446); Woolka Rd, *c.* 10 km W of Cooljarloo Rd, NW of Cataby, *A. Crawford ADC 2602*, 24 Nov 2014 (PERTH 08721750); Corner Wonganderrah and Munbinea Rds, Jurien Bay, *K. Himbeck KJH 1*, 8 Sep 2008 (PERTH 08709580); 8 km along Cantabilling Rd from Mumbinea Rd, 20 km SE of Jurien Bay, *G.J. & B.J. Keighery 1562*, 27 Jul 2009 (PERTH 08461651); West Mumbinea Rd at junction of Munbinea and Wonganderrah Rd, *B.J. Keighery 28B*, 11 Jun 1988 (PERTH 01109138); N. side of Woolka Rd, c. 8 km W of junction with Cooljarloo Rd, *B.J. Keighery 544B*, 5 Nov 1988 (PERTH 01109146); Woolka Rd, NW of Cataby, *B. Loudon & S. Coultas BLSC* – Opp 6, 10 Oct 2012 (PERTH 08564779); Woolka Rd, NW of Cataby, *J. Milner & S. Hines 283-04*, 12 Oct 2012 (PERTH 08564760); Cantabilling Rd, 10.6 km east of Munbinea Rd, *P.M. Olde* 99/55, 9 Oct 1999 (NSW 534590); Pen Rd, 0.8 km N of Coorow–Greenhead Rd, *P.M. Olde* 99/64, 10 Oct 1999 (NSW 534494, CANB, PERTH); Woolmulla Rd, east of Cockleshell Gully Rd, *P.M. Olde* 99/69, 10 Oct 1999 (NSW 534603, PERTH); Woolka Rd, 10.6 km west of Cooljarloo Rd, W of Cataby, *P.M. Olde* 15/99, *R.F. Brown & G. Meiklejohn*, 29 Aug 2015 (CANB, MEL, NSW, PERTH); Pen Rd, 0.7 km N of Coorow–Greenhead Rd, *P.M. Olde* 15/106, *R.F. Brown & G. Meiklejohn*, 30 Aug 2015 (AD, CANB, HOB, MEL, NE, NSW, PERTH); Cantabilling Rd, 100–200 m W of Black Arrow Rd, 8 km E of Munbinea Rd, *P.M. Olde* 17/36 *& K. Alcock*, 3 Sep 2017 (BRI, CANB, MEL, NSW, PERTH (distribuendi); Pen Rd, 0.8 km N of Coorow–Greenhead Rd, west of Half Mill Roadhouse, *P.M. Olde* 17/37 & *K. Alcock*, 3 Sep 2017 (AD, CANB, HO, MEL, NSW, PERTH, WELT); 10 km SE of the Pinnacles, *R. Orifici LE 6.15*, 27 Oct 1999 (PERTH 06378498); 21.5 km W along Cantabilling Rd, from Brand Highway, just west of creek crossing, *S. Patrick 1250*, 22 Sep 1992 (PERTH 07276079).

2. *Grevillea gillingarra* Olde and Keighery, sp. nov.

Type: Western Australia: on Mogumber to Moora Road [Precise locality withheld for conservation reasons], *G.J. & B.J. Keighery 1063*, 3 Sep 2007 (holo: PERTH 08570078; iso: CANB; K; MEL; NSW; PERTH 08570132) (distribuendi)

Grevillea sp. Gillingarra *R.J. Cranfield* 4087 in Western Australian Herbarium (1998–) https://florabase.dpaw.wa.gov.au/browse/profile/31354 (accessed 5 Dec 2021)

Differs from *Grevillea thelemanniana* in its taller and more open seed-obligate habit, its branchlets sharply angular and with a spreading indumentum, its new growth openly pilose, its leaves with secondary and sometimes with tertiary division, never simple, the under-surface fully enclosed by tightly revolute margins, its more conspicuous exposed conflorescences, its longer inflorescence rachises , and longer-persistent common bracts.

Seedlings not seen. *Mature plants* single-stemmed, seed-obligate, open, spreading, dark green *shrubs* (0.5–)1.5–1.8(–2.2) m high, 0.5–1.5 m wide, with ascending branches from the trunk near to the ground; *branchlets* 0.8–1.2 mm wide, angular, usually reddish, loosely villous or sometimes a few hairs scattered. *New growth* initially densely white-sericeous, soon sparsely to moderately densely pilose to subvillous. *Adult leaves* divided, 1.0–2.2(–3.2) cm long, 15–20 mm wide, ascending to suberect, dark green, subglabrous with scattered hairs spreading, bipinnatipartite, rarely bi- or tripartite, sometimes with bi- or tripartite tertiary division of one or more ultimate lobes, imparipinnate, secund, sessile; *primary leaf lobes* (2–)4–8; *basal rachis node*

(4–)5–12 mm long, linear, straight; *ultimate lobes* 0.2–1.2 cm long, 0.6–2.0 mm wide, linear-oblong to narrow-obovate, straight, often unequal; *apices of lobes* obtuse-mucronate, the mucro 0.1–0.2 mm long, recurved with a reddish-brown callous point; *adaxial surface* smooth, transversely convex or bi-convex, glabrous or with scattered spreading hairs, venation obscure, the midvein within an impressed midline groove; *margins* smoothly but loosely revolute, abutting or sometimes overtopping the midvein, obscuring the abaxial surface when dry, but the lamina narrowly exposed in a sericeous strip; *abaxial surface* bisulcate, the lamina obscured except occasionally at the proximal lobe sinuses, the sulcae very narrow, sometimes with a few appressed hairs, the midvein prominent; *texture* coriaceous; *petioles* obscure. *Conflorescences* either simple and pedunculate, or rarely 1-branched at base and sessile, terminal, subterminal on short side branches, or axillary, pedunculate; *buds* cylindrical, tomentose; *simple conflorescences* 2–4 cm long, decurved, subcylindrical to subsecund, the flowers loose to moderately condensed, 30–40-flowered, usually exceeding the foliage, basipetal; buds subcylindrical, pedunculate; *peduncles* 6–12 mm long, sparsely to moderately densely sericeous-tomentose; *rachises* (15–)20–40(–50) mm long, 0.8 mm wide, straight or curved, densely sericeous-tomentose; *rachis extension* 2–2.5 mm long, linear, erect or incurved distally, densely subsericeous; *common bracts* mostly 0.3 mm long, 0.3 mm wide, ovate, sericeous-tomentose on the abaxial surface, glabrous adaxially, variably persistent to anthesis, the proximal (?involucral) bracts sometimes to 2 mm long, ovate-acuminate. *Pedicels* 4–4.5 mm long, 0.3 mm wide, usually with a few appressed hairs, dilated below the torus to *c.* 1 mm wide; *torus* 0.8–1 mm wide, transverse to oblique at *c.* 10°, squarish; *tepal attachment scar* 0.1 mm wide, situated above or coincident with the toral rim; *nectary* yellow, conspicuous, cushion-like, rising 0.5–0.6 mm above the torus, thick; *pistils* 20–22(–23) mm long, glabrous; *gynophore* 3–3.5 mm long; *ovary* 1.3 mm long, *c.* 1 mm wide, lateral, prominent, triangular, the base truncate, obscurely ridged; *style* 0.35 mm wide, red, strap-like, gently incurved; *pollen-presenter c.*1.2 mm long, 1.2–1.3 mm wide, green to yellow, almost round, lateral to oblique at *c.* 70°; *perianth* 7–8 mm long, 2.2–2.8 mm maximum width, red, narrowly ovoid, tapering below the limb, glabrous outside except the limb, glabrous inside at base for *c.* 1.5 mm then sparsely tomentose for a few mm, the hairs short, simple, becoming condensed about half way along adjacent to the ovary, the tepal margins with short simple hairs, the adaxial surface glabrous distally; *tepals* coherent except along the dorsal suture, the tepal-limb segments separating and curling down after anthesis, the perianth falling as an entire unit; *perianth limb* 1.3 mm long, 1 mm wide, spheroidal with depressed apex or ovoid with short central apiculum, revolute, sparsely sericeous. *Follicles* and *seeds* not seen. (Fig. 3)

Fig. 3. *Grevillea gillingarra* (type location). A. Flowering branches. B. Leaves and inflorescences. Photos: P. Olde.

Diagnostic characters: Shrub, seed-obligate; cauline and foliar indumentum spreading, soon sparse; new growth pilose to subvillous; branchlets angular; leaves 1.5–2 cm long, divided, pinnatisect with 2–5 primary lobes, the primary lobes 0.8–1.4 mm wide, frequently with secondary division; basal rachis node 6–12 mm long; upper surface of leaf lobes smooth the venation obscure; margin smoothly revolute loosely enclosing the lower surface when dry; *conflorescences* decurved, subsecund to subcylindrical, basipetal; rachises (15–)20–40(–50) mm long, silky-tomentose; common bracts minute, variably persistent; pedicels 4–4.5 mm long, glabrous; pistils 20–23 mm long, glabrous; pollen-presenter 1.2 mm long; perianth outside glabrous except for the limb sparsely sericeous, the inner surface pubescent-tomentose.

Distribution: Western Australia, where confined to a small population north of the Moore River bridge. It occurs in the Victoria Plains LGA, in the Dandaragan Plateau–Northern Jarrah Forest Subregion of the Jarrah Forest IBRA Region.

Phenology: Flowers in August–September with sporadic flowering outside this period.

Habitat and ecology: Grows along an ephemeral creek line in red-brown stony clay-loam in *Allocasuarina huegeliana-Eucalyptus wandoo* woodland, sometimes known as kwongan. Associated species include *Isopogon dubius, I. divergens, Banksia kippistiana, Daviesia* sp., *Leptospermum erubescens, Grevillea pilulifera, Dampiera alata, Persoonia* sp., *Acacia pulchella, Baeckea crispifolia.*

Etymology: The epithet alludes to the town near which this species occurs. It is a non-declinable noun in apposition.

Conservation status: When first collected and recognised as a new species in 2007, *G. gillingarra* was estimated (label data PERTH08570078) to have a population of 'more than a hundred plants'. Although an assessment of numbers needs a proper survey, the population was less than 30 when surveyed in 2015, following illegal vehicular intrusion and soil dumping on the site. In the most recent survey (August 2022) by the authors there were only 8 plants alive. The Western Australian Species and Communities branch of DBCA have given a conservation rating of Threatened. According to the Department of Parks and Wildlife (2016) the species faces threats from rail maintenance, weeds, fire, low population size, insecure land tenure, poor recruitment, climate change including drought but immediate direct intervention is strongly recommended.

Discussion: *Grevillea gillingarra* has been regarded as a form of *G. thelemanniana. Grevillea thelemanniana* differs in its low habit, its lignotuberous, seed facultative, generative habit, its leaves often simple, more pliable, and the leaf under-surface narrowly exposed beside the midvein Its divided leaves are more or less flat and with primary division only. *Grevillea thelemanniana* also has shorter inflorescence rachises (5–15 versus (15–)20–40(–50) mm long), and more enclosed (less exserted) conflorescences. *Grevillea preissii* differs in its lignotuberous habit, its leaves longer (2.5–5 cm long) and softly pliable, its conflorescences acropetal, conical-secund, the perianth below the limb sparsely to moderately densely sericeous on the outer surface, and the perianth limb more densely sericeous.

G. cooljarloo is also a lignotuberous shrub and usually also has some simple leaves intermixed with divided leaves. It differs also in its branchlet and foliar indumentum appressed or glabrous, and in having shorter inflorescence rachises (10–15 mm long).

Hevroy (2016) found that *G. gillingarra* clearly constituted a distinct lineage and deserved formal recognition at specific rank. It was resolved in a clade comprising northern members of the *Thelemanniana* Group. It also occupies a unique soil type that is apparently not underlain by a calcareous layer, as only one population has been located despite all vegetated reserves (both State and Local Government) in the Mogumber to Moora area being searched. Its potential habitat range is difficult to assess.

Specimens seen: Western Australia: [Precise localities withheld] *L. Canackle LCH007*, 11 Sep 2013 (PERTH 08738653); *R.J. Cranfield* 4087, 17 Sep 1983 (PERTH 01845411); *A. Crawford ADC 2375*, 14 Oct 2013 (PERTH 08597960); *K. Himbeck KJH 43*, 16 Sep 2008 (PERTH 08709440); *S. Patrick 571*, 9 Jul 1991 (PERTH 01882503).

3. ***Grevillea preissii*** C.F.Meisner, *in* J.G.C. Lehmann [ed.], *Pl. Preiss.* 1: 543–4 (1845). *Grevillea thelemanniana* subsp. *preissii* (Meisn.) McGill., *New Names in Grevillea* 15 (1986); *Hakea dixoniana* Christenh. & M.W.Chase, *Global Flora* 4: 79 (2018).

Type citation: [Western Australia] In solo calcareo ad latus montis Elizamountain, Perth d. 19 Mai 1839. Herb. Preiss. No. 709.

Lectotype chosen by McGillivray & Makinson (1993: 444): 'In solo calcareo ad latus montis "Eliza Mountain", (Perth). Per. coccineum. Majo 19. 39 legit L. Preiss No. 709. NY 00284692 whole sheet including packet with additional barcode NY 00284693.

Isolectotypes (Preiss 382 is the same as Preiss 709, an early number with the same label data and collection date, but most were distributed as *Preiss* 709, following the arrangement in *Plantae Preissianae* (1845 & 1848): B (*n.v.)*; 'Preiss 709' BR 0000013462239 ex Hb. Martius; '382 Grevillea preissii Meisner, 3–5 pedalis, pulcherrima. In solo calc lat montis Eliza Swan River, 1839 5 19, Preiss' CGE 13219 - specimen at left of sheet; 'Preiss 709' G 389411 - specimen at right; G 389412 ex Hb. Boissy et Hb. Boissy-Barbier; G-DC 327655; LD 1084813 (lectoparatype *fide* McGillivray *et al.* (*loc. cit.*); HBG 508261; 'Preiss 709' K 000799248; LE -2 sheets (*n.v.*); 'Preiss 709' MEL 74845 ex Hb. Sonder; MEL 74846 ex Hb. Sonder; MEL 74847 ex Hb Sonder; 'Preiss 709' MO 100481287 (*n.v.*); '709 Grevillea preissii Meisn Australia occidentali Vendid. Preiss 1844'P 03354160 ex Hb. Lenormand ex Hb. Cadomense; '709 legit 19 Mai 1839 et communicavit Preiss' P00750752 ex Hb

Drake; 'No. 382. Frutex, 3–5 pedalis pulcherrimus In solo calcario lateris montis 'Eliza Mountain' Perianth rubridum Floret Martii Sep 39' [Preiss script] TCD 0017877.

Possible isolectotype: 'G. preissii nob. C.F. Meisner' GH 589431.

Grevillea splendens Hortulorum ex de Noter, *Revue Horticole* n.s. Vol. 9: 33 (1909), as 'Thelemanniana, var.) Hort. '(Syn. Preissii, Meissn.)', *nom. illeg.*

Seedlings not seen. Lignotuberous, seed-facultative, variable, multi-stemmed shrubs, 0.2–0.7(–1.5) m high, 1.0–1.5 m wide with branches ascending or spreading; *branchlets* 0.8–1.2 mm wide, terete to angular, densely to moderately densely tomentose to tomentose-villous, sometimes sparsely sericeous, often glabrous-ribbed. *New growth* glabrous or with scattered appressed hairs. *Adult leaves* divided, 2.5–5.2 cm long, 10–20 mm wide, ascending to spreading, light green to dark green, glabrous rarely a few scattered appressed hairs, bi-to tripartite or pinnatipartite, always some leaves with secondary or tertiary bi- or tripartite division of proximal lobes, imparipinnate, secund, petiolate; *primary leaf lobes* 3–8; *basal rachis node* 9–20 mm long, linear; *ultimate lobes* (3–)10–27 mm long, (0.5–)0.7–0.9 mm wide; *lobe apices* acute, scarcely mucronate; *terminal lob*e often shorter than subtending lobes, simple to tripartite; *adaxial surface* smooth, sometimes obscurely punctate, the venation obscure; *margins* smoothly and tightly revolute, enclosing the abaxial surface except the midvein; *abaxial surface* bisulcate, the sulcae 0.01–0.02 mm wide, glabrous or sometimes lined with sericeous hairs, the midvein of lobes prominent; *texture* coriaceous; *petioles* 3–5 mm long. *Conflorescences* mostly subterminal or axillary in the upper axils, simple, rarely 1-branched at base; *buds* ellipsoid to cylindrical, densely villous, pedunculate; *simple inflorescences* decurved, acropetal, dense, secund; *peduncles c.* 4 mm long, decurved, sparsely to densely sericeous-tomentose; *rachis* (12–)20–40 mm long, 0.5–0.8 mm wide, sparsely to densely sericeous or the hairs sometimes crinkled and slightly spreading, straight or curved, the apex with a wavy caudate extension *c.* 1 mm long; *involucral bract* solitary, *c.* 1.5 mm long, linear; *common bracts* 0.5 mm long 0.2 mm wide, elliptic, incurved, tomentose on the abaxial surface, glabrous adaxially, early caducous. *Pedicels* 2.5–4 mm long, sparsely to densely sericeous; *torus c.* 1 mm wide, transverse; nectary conspicuous, cushion-like to slightly U-shaped, rising 0.3–0.6 mm above the torus, the margin 0.3 mm thick; *pistils* (19–)21–25 mm long; *gynophore* 2.5–4.2 mm long; *ovary* lateral, prominent, triangular; *style* 0.3 mm wide, pinkish-red, glabrous; *pollen-presenter* 1 mm long, 0.7 mm wide, yellow to green; *perianth* 5–5.5 mm long 1.0–1.5 mm wide at base, pinkish red, linear-oblong, slightly narrowed below the revolute limb; abaxial surface sparsely to moderately densely sericeous; adaxial surface glabrous at base for *c.* 1.5 mm, then curly tomentose to just below the curve, condensed about half-way along, glabrous elsewhere except along the tepal margins; perianth limb obtuse, declined to revolute, sparsely to densely sericeous. *Fruits* 12 mm long, 4 mm wide, trianguloid-acuminoid with truncate or slightly retrorse base, prominently ridged sub-basally; exocarp glabrous, rugose; mesocarp crustaceous; endocarp smooth; fructual style persistent, fragile; pericarp thin-walled. *Seeds* not seen. (Fig. 4)

Diagnostic characters: Lignotuberous, spreading shrub; foliar indumentum tomentose to tomentose-villous; branchlets angular; new growth glabrous or with scattered appressed hairs; leaves 2.5–5.2 cm long, glabrous, pinnatisect to bipinnatisect, always some with secondary division, mostly with 4–10 primary lobes, the under-surface enclosed by margins, bisulcate; leaf base 9–10 mm long; conflorescences decurved, simple to 1-branched, secund, acropetal; rachises densely brown-silky to silky-tomentose; *pedicels* 2.5–4 mm long, sericeous; perianths sparsely to densely sericeous outside below the limb, densely so on the limb; pistils 21–25 mm long, glabrous; gynophore incurved, compressed; ovary subtriangular, truncate at base; pollen-presenter 1 mm x 0.7 mm, oblique; fruits trianguloid-acuminoid, rugose, the base truncate with prominent sub-basal ridge.

Distribution: Western Australia, between Lancelin in the north to Yalgorup in the south. It occurs in the Northern Jarrah Forest and Perth IBRA Subregions of the Jarrah Forest and Swan Coastal Plain IBRA Regions, involving a number of LGAs.

Phenology: Flowers from late winter to spring. Fruits appear from late spring.

Habitat and ecology: Grows in coastal and subcoastal calcareous brown, yellow or light grey sand over Tamala limestone with *Agonis flexuosa, Eucalyptus decipiens, Hibbertia hypericoides, Banksia sessilis, Banksia* spp. Also recorded on Quindalup yellow-sand dunes with *Acacia cyclops, Olearia axillaris, Scaevola crassifolia* and *Rhagodia baccata*.

Conservation status: *Grevillea preissii* is conserved in several reserves and is not considered to be presently endangered. However, much of its habitat is under pressure from urbanisation and it should be monitored regularly. The long-lived nature of the species also enables it to persist in small, disturbed sites, without any obvious recruitment.

Fig. 4. *Grevillea preissii*. A, B. Habit and habitat (Bold Park, Perth). C. Flowering branchlets (Kings Park, Perth). D. Fruit (Kings Park, Perth). Photos: A, C, D: R.Barrett; B: P.Olde.

Etymology: The epithet honours Johann August Ludwig Preiss (1811–1883) whose large, well-documented specimen collection in Western Australia between December 1838–1842 formed the basis for the names of over 2400 Australian species. McGillivray (1975: 1–18) has given an account of his stay in Western Australia. Haebich (2020) has provided updated information.

Variation: Collections from the south of the range have a sparser perianth and pedicel indumentum.

Olde & Marriott (1995b: 109) recognised a 'Prostrate green-leaf form' and a 'Superior form'. These horticultural forms are here considered to be part of the natural variation. Morphological forms linked to distribution could not be identified during this study.

Discussion: Following this review, *G. preissii* is treated as having no subspecies. The locality of the collection *C.A. Gardner 759* (PERTH01433334) may be incorrect as Cannington is not otherwise a recorded locality for this species, though there is another record from nearby Forrestfield. All other collections are from locations much closer to the coast. A collection from Brixton Street Wetlands, Kenwick, *K.L. Brown KLB652, K. Thiele & G. Paczkowska*, 1 Jun 2007 (PERTH07810024) which has a glabrous inflorescence rachis and glabrous flowers, is *G. glabrilimba*. This and other similar plants were planted in error (as *G. thelemanniana)* and have been removed because of the potential for hybridization with the local rare endemic *G. thelemanniana* (Keighery *et al*. 2019).

Specimens seen: Western Australia: Forrestfield, *R. Aitken s.n.*, Aug 1962 (PERTH 01433377); Cottesloe, *C. Andrews s.n.*, Jun 1902 (PERTH 01938878); 900 m NW of the intersection of Mulga Rd and Gordon Rd, Stakehill, *P.G. Armstrong s.n.*, 4 Nov 1998 (PERTH 05944716); Yanchep, 25 miles [40 km] NNE of Perth, *A.C. Beauglehole* 12372, 29 Aug 1968 (NSW 100647, NSW 269104); Peppermint Grove, *K. Bennewith s.n.*, Sep 1966 (PERTH 01845403); City Beach, *K. Bennewith s.n.*, Sep 1966 (PERTH 01845381); Wanneroo Rd., near Lake Neerabup, *V. Clarke VC16*, 24 Apr 2001 (PERTH 07400152); 36 km N of Yanchep on Lancelin Rd, *M.L. Clark* 196, 10 Sep 1975 (NSW 620556); Cottesloe, *J. Burton Cleland s.n.*, 30 Aug 1908 (NSW 92117); Neerabup National Park, *D. Clyne s.n.*, Sep 1969 (NSW 127175); 7 km NE Lancelin, *R.J. Cranfield 9915*, 8 Aug 1995 (PERTH 04368711); Coogee, *R. Cranfield* 11376, 2 Jul 1997 (PERTH 04917316); Ocean Reef, *R. Cranfield 641/78*, 30 May 1978 (NSW 620560, PERTH 01447874); North Guilderton, *R. Davis RD832*, 21 May 1996 (PERTH 04476794); Cottesloe Beach, *Diels & Pritzel*, Jun 1901 (PERTH 01938843); Swan River, *J. Drummond s.n.*, 1839 (CGE 13218 ex Hb. Lemann - specimen at right); Swan River, *J. Drummond* 637, *s.d.* (P 02372425); Fremantle, *A.J. Eames s.n.* & *A.J. Hotchkiss*, 23 Aug 1953 (NSW 92110); 31 miles [49.6 km] N of Bunbury on coast rd, *A.R. Fairall 895,* 21 Oct 1962 (PERTH 01938800); Cottesloe, *W.V. Fitzgerald s.n.*, Aug 1899 (NSW92118, PERTH 01938762); Claremont, *W.V. Fitzgerald s.n.*, Aug. 1901 (NSW92121); Tim's Thicket Reserve, *P. Foreman & J. Kelly TT127*, 20 Jun 2002 (PERTH 06388361); Treasure Block State Forest (proposed extension of Yalgorup National Park), *P. Foreman & G. Smith* TB534, 15 May 2008 (PERTH 07932251); Spearwood, *C.A. Gardner 747*, 15 Sep 1920 (PERTH01938819); [?]Cannington, *C.A. Gardner 759*, Oct 1923 (PERTH 01433334); Coogee, Beach, Spearwood, *C.A. Gardner 247*, 15 Sep 1920 (PERTH 01433342); East of Medina, *A.S. George* 21, 12 Jul 1959 (NSW 82897); Cottesloe, *L. Glauert s.n.*, Sep 1922 (PERTH 01938657); Floreat Park, *J.W. Green 343*, 29 May 1955 (PERTH 01938673); Yanchep National Park, E of Loch McNess, near Wanneroo Rd., *W. Greuter 22235*, 26 Sep 1991 (PERTH 03214591); Spearwood, *Dr Grieve*, Apr 1955 (PERTH 01845489); Cottesloe, *A.G. Hamilton 75*, 1902 (NSW92114); Serpentine, *A.G. Hamilton 474*, 17 Oct 1902 (NSW 92119); Between Perth and K.G. Sound, *W.H. Harvey* 709, April–July 1854 (P 02370769 ex Hb. Drake); W of Lake Joondalup, Wanneroo, *J. Havel s.n.*, 28 Jul 1965 (PERTH 04235487); Cottesloe, *R. Helms s.n.,* Aug 1895 (NSW 92113); Mouth of Swan River, *R.H[elms]*, 14 Aug 1897 (NSW 92111, PERTH 01938770); Near Fremantle, *R.H[elms]*, 14 Aug 1897 (PERTH 01845527); Fremantle, *R.H[elms]*, May 1897 (PERTH 01938827; PERTH 01845535); Plympton [?=Hillarys], *R. Helms* 41, 5 Sep 1899 (NSW 92120); NW of lighthouse at Guilderton, *M. Hislop 1064*, 21 Jun 1998 (PERTH 05390524); Yanchep National Park, *A.M. James 82*, 17 Oct 1963 (PERTH 01938711); 1 km E of Yalgorup, 32°50'10"S 115 3938”E, *E.D. Kabay* 1544, 13 Jul 1995 (PERTH 04384156); Lot 4 Mandurah Rd., Singleton, *B. Keighery s.n.*, 30 Jun 1999 (PERTH 05437601); Cockburn Sound beside Fremantle–Rockingham Rd, *K.F. Kenneally s.n.*, 13 Jul 1969 (PERTH 01845470); Off Ocean Rd., Florida, *M.R. Love 28*, 21 Jul 2000 (PERTH 05917247); Cottesloe, *A.H.S. Lucas s.n.*, Sep 1928 (NSW 92116); Swan River, *J. Mangles R.N. s.n.,* [1831] (CGE 13308, CGE 13318 ex Hb. Lindley); 32 mile peg [*c.* 51 km S of Perth on road to Mandurah], Mandurah Rd., *c.* 51 km S of Perth on the road to Mandurah, *N.G. Marchant 1*, 24 Jun 1956 (PERTH 01938754); Cottesloe, near mouth Swan River, *A. Morrison s.n.*, 4 Jul 1901 (PERTH 01938649); 70 km N of Bunbury on Highway 1, 3.7 km N of Tuart Grove Ave, *P.M. Olde 86/1001,* 30 Oct 1986 (NSW); Military Rd., *c.* 1 km from Indian Ocean Dr., north-east of Yanchep, *P.M. Olde 15/170 & I. Evans,* 7 Sep 2015 (CANB, NSW, NY, PERTH)*;* Meadow Springs Golf Course, Glendale St, Mandurah, *P.M. Olde 15/183 & I Evans*, 10 Sep 2015 (NSW 1001676); Old Coast Highway, cnr Old Bunbury Rd, Lake Clifton, *P.M. Olde* 15/185 *& I. Evans*, 10 Sep 2015 (NSW 1001678); Reabold Hill, Bold Park, City Beach, *P.M. Olde* 15/296, 22 Sep 2015 (AD, MEL, NSW, PERTH); Between Lake Clifton and Lake Preston, Yalgorup National Park, *S. Paust 1355,* 20 Oct *1972 (PERTH 01938835);* Kings Park, *H. Pearce s.n.,* Jul 1941 (PERTH 01845551); 36 miles N of Bunbury, *M.E. Phillips s.n.*, 21 Oct 1962 (CANB 005342, NSW 130180); Star Swamp Bushland Reserve, North Beach, *J. Pigott s.n.*, 29 Aug 1987 (PERTH 05940915); 1 km N of Kwinana turnoff on road to Mandurah, *J.M. Powell 2096*, 7 Nov 1985 (NSW 202536, PERTH 01845578); District Swan: in collibus calcareis prope mare, *E. Pritzel s.n.*, Jun 1901 (NSW 92122); Hadrell Rd, Yanchep, *J. Pryde, M. Morley, V. English, L. Sage s.n.*, 5 Sep 2005 (PERTH 07404859); *c.* 10 km from Two Rocks, *K. Richardson KCR63*, 27 Jun 2002 (PERTH 06145027); Mandurah, *W. Rogerson s.n.,* May 1961 (PERTH 01938746); 1 mile [1.6 km] N of Mandurah, *H. Salasoo* 4031, 20 Sep 1970 (NSW 120112); Waneroo to Yanchep, *c.* 8 miles [12.8 km] from Wanneroo, *H. Salasoo* 4172, 24 Sep 1970 (NSW 120121); Kings Park, *F.M.C. Schock 349*, 27 Jun 1918 (PERTH 01938789; PERTH 01938665); Perth, *J. Sheath s.n.*, Sep 1910 (NSW 92112); Yanchep area, *F.G. Smith 1810*, 17 Jun 1965 (PERTH 01938703); North Cottesloe, *M. Solomon s.n.*, undated (PERTH 01845497); Naval Base, *N.H. Speck s.n.*, Oct 1950 (PERTH 01845500); *c.* 10 km south-east of Lancelin on tracks east off coastal highway. *R. Spjut 724 & R. Phillips*, 26 Sep 1981 (PERTH 01845543); Smoke Tree Hill in state forest just N.E. of Yanchep NP, 57 km N of Perth, *R. Spjut 12333 & R. Smith*, 7 Sep 1992 (PERTH 04613201); 4 km S of Leach Highway at Fremantle, along Cockburn Rd, *R. Spujt 7013 & C. Edson*, 5 Sep 1981 (PERTH 01845519); 1 km E of Burns Beach, *A. Strid* 20288, 11 Sep 1982 (NSW 620557); Coronation Rd., Waroona, *D. Stewart BNC 1241*, 30 Aug 2004 (PERTH 07751494); 23.5 miles [37.6 km] S of Mandurah on Coast Rd., *M. Tindale* 3918, 1 Oct 1973 (NSW 620559); Extension of Camden Way between Railway and Pebble Beach Boulevard, Meadow Springs, Mandurah, *J. Wajon 1662*, 7 Jul 2008 (PERTH 08184518); *c.* 7 miles [12.8 km] NW of Gingin on Gingin–Eneabba Rd., *G.L. Webster* 18515, 14 Sep 1973 (NSW 620558); Walking trail on Martin's Tank Lake, *A. Worz* 044.10.20.05, 20 Oct 1994 (PERTH 04451732); 30 miles [48 km] from Perth towards Yanchep, *J.W. Wrigley s.n.*, 5 Oct 1968 (NSW 131980).

4. *Grevillea glabrilimba* (Olde & Marriott) Olde, **comb. et stat. nov.**

Basionym: Grevillea preissii subsp. *glabrilimba* Olde & Marriott, *The Grevillea Book* 1: 182 (1994).

Type: 26.1 km W of Brand Highway on road to Greenhead, Western Australia, *P.M. Olde 91/89,* 14 Sep 1991 (holo: NSW362991; iso: NSW298991; PERTH04700201).

Grevillea 'Seaspray' Hort., *Grevillea* 'Gilt Dragon' Hort., *Grevillea* 'Soft Touch' Hort., *Grevillea* 'Magic Lantern' Hort.

Seedlings not seen. *Mature plants* lignotuberous, seed facultative, spreading to dome-shaped, multi-stemmed, grey-green to dark green shrub, 0.2–0.5(–0.7) m high, 1.0–1.5 m wide with branches spreading from base; *branchlets* 0.9–1.2 mm wide, angular, densely white-villous or tomentose-villous, with green striation decurrent from leaf bases, often decurved at the tip. *New growth* coppery green soon grey-green, openly subvillous. *Adult leaves* divided, 1.5–2.5 cm long, 5–10 mm wide, ascending to spreading, green or grey-green, openly villous, usually bipinnatisect, some primary lobes simple or rarely some lobes with tertiary bi- or tripartite division, imparipinnate, secund, shortly petiolate; *primary leaf lobes* 4–8; *basal rachis node* 4–12 mm long, linear; *ultimate lobes* 2–13(–15) mm long, 0.8–1 mm wide, linear, the *terminal lobe* usually shorter than subtending lateral lobes; *lobe apices* obtuse-mucronate, the mucro c. 0.2 mm long, recurved with a reddish-brown terminal spine 0.1–0.2 mm long, non-pungent; *adaxial surface* openly villous to glabrous, smooth, not punctate, the venation obscure; *margins* smoothly revolute, fully enclosing the under-face almost to the midvein; *abaxial surface* enclosed, bisulcate, the sulcae *c.* 0.1 mm wide, densely white-sericeous, the midvein prominent, *c.* level with margin, with scattered long, wavy, pilose hairs; *texture* softly coriaceous; *petioles* 0.5–2 mm long, villous. *Conflorescence* decurved, terminal or subterminal on side branches, simple, secund to subcylindrical, acropetal, pedunculate; *buds* narrow-cylindrical; *peduncles* 5–10 mm long, decurved, sparsely to moderately densely sericeous-tomentose; *rachises* (7–)23–30(–40) mm long, 0.8 mm wide, straight or slightly incurved, glabrous or with a few scattered spreading hairs, sometimes openly tomentose at base; *rachis extension* 0.7 mm long, linear, erect or incurved distally, glabrous or with a few spreading scattered hairs; *involucral and peduncular bracts c.* 5 mm long, 0.5 mm wide; *common bracts* 1.5 mm long 0.5 mm wide, ovate-acuminate, sparsely villous, the apex densely villous on the abaxial surface, glabrous adaxially, early caducous. *Pedicels* 3–4 mm long, 0.25 wide, glabrous; *torus* 0.8 mm wide, oblique at *c.* 10°; tepals attached to the outer rim of the torus; *nectary* conspicuous, cushion-like to slightly U-shaped, rising 0.5–0.6 mm above the torus, the margin 0.3 mm thick, entire; *pistils* 21–25 mm long; *gynophore* 3–4 mm long; *ovary* 1.3 mm long, lateral, prominent, triangular, the base truncate to retrorse; *style* 0.3 mm wide, pink-red, glabrous, gently incurved; *style*-end green to yellow; *pollen-presenter* 1.2–2 mm long, 0.7–1 mm wide, yellow, oblong-elliptic, lateral to oblique at *c.* 70°, the surface convex with raised stigma; *stigma* distally off-centre; *perianth* 5.5–7 mm long, 1.5–1.8 mm wide at base, red, pinkish red or orange-red, deciduous, falling as an entire unit, tepals coherent except along the dorsal suture, the tubular section narrowly ventricose, tapering below the revolute limb; *abaxial surface* glabrous; *adaxial surface* glabrous at base for *c.* 1.5 mm, villous above adjacent to the ovary, the hairs usually shorter towards the curve, the hairs not condensed into a beard, glabrous distally except along the tepal margins; *perianth limb* spheroidal with depressed apex revolute, glabrous. *Fruits* 12–15 mm long 4–6 mm maximum width, follicular, trianguloid-acuminoid with base transversely or obliquely truncate, prominently ridged; fruiting style persistent, fragile; exocarp rugose, shiny, non-viscid; pericarp thin-walled, crustaceous. *Seeds* not seen. (Fig. 5)

Summary of diagnostic characters: Lignotuberous, spreading shrub; foliar and cauline indumentum loosely villous or tomentose-villous; branchlets angular; new growth openly subvillous; leaves 1.5–2.5 cm long, secund, bipinnatisect with 2–3(–4) paired primary lobes, the primary lobes occasionally simple or with frequent tertiary division; ultimate lobes 0.8–1 mm wide, narrow-linear; margin smoothly revolute, fully enclosing the under-surface; adaxial surface with obscure venation; abaxial surface bisulcate with, two very narrow, sericeous sulcae, the midvein prominent; basal rachis node 4–10 mm long; simple leaves absent; conflorescences acropetal, decurved, subcylindrical to subsecund, subterminal or terminal; peduncles densely hairy; rachises 23–30(–40) mm long, glabrous or a few isolated, spreading hairs scattered; common bracts 1.5–5 mm long, 0.5 mm wide, caducous; pedicels 3.5–4 mm long, glabrous; pistils 21–25 mm long, glabrous; pollen-presenter 1.2 mm long, 0.7 mm wide; pedicels and perianth including the limb glabrous.

Distribution: Western Australia, in near-coastal areas west of the Brand Highway between Leeman in the north and Cervantes in the south, with the majority of specimens collected near Jurien Bay.

Phenology: Herbarium records indicate scattered flowers in autumn but the main flowering is from late July to September.

Habitat and ecology: Grows in shallow calcareous sand or crevices in limestone capstone.

Conservation status: Not presently endangered.

Etymology: Latin *glaber*, and *limbus*, a reference to the glabrous perianth limb of this species.

Fig. 5. *Grevillea glabrilimba*, flowering branchlets (Coorow-Greenhead Road). Photo: P. Olde.

Variation: Most specimens have grey foliage but a number, notably *P.M. Olde* 15/177 *&* *I. Evans* from Canover Rd, Jurien have green leaves. Whether this is indicative of some further variation warranting taxonomic recognition is presently under study, along with the 'Fine-leaf form' *sensu* Olde & Marriott (1995b: 110). The holotype and other specimens have glabrous inflorescence rachises whereas the isotype at NSW has a few scattered spreading hairs.

Discussion: Hevroy (2016) reported that *G.* [*preissii* subsp.] *glabrilimba* did not share a cpDNA haplotype with *G. preissii* subsp. *preissii* which suggests that they are not closely related. From four plants sampled, two haplotypes were found for *G. glabrilimba,* which alone invites further analysis and study of that taxon (see discussion above under Variation). However, the two haplotypes were resolved as sister in the nDNA microsatellite Neighbour Joining Tree and together were resolved as sister to *G. preissii*. This does not necessarily support their recognition as the same species because *G. gillingarra* and *G. exposita* were also resolved as sister in the same tree.

Grevillea glabrilimba is here distinguished from *G. preissii* at specific rank on phenetic grounds. *Grevillea preissii* differs in its generally longer basal rachis nodes, its flowers bearing hairs on the outer surface of the perianth both below and more densely on the limb, and by its usually densely tomentose inflorescence rachises and sparsely hairy pedicels. *Grevillea glabrilimba* is sometimes confounded with *G. delta* (McGill.) Olde and Marriott. *Grevillea delta* has sessile leaves with a short basal rachis node (3–4 mm long), generally longer ultimate leaf lobes, and shorter, conspicuously hairy rachises. The branchlet indumentum is sometimes similar to *G. glabrilimba* but *G. delta* has long hairs up to 2 mm long usually scattered throughout. Both have a glabrous abaxial perianth surface, but plants with perianths bearing scattered hairs are also presently accommodated in the circumscription of *G. delta.*

Specimens seen: Western Australia: 10.5 km ENE of Jurien, *B.G. Briggs* 6333, 26 Sep 1976 (NSW 605178, PERTH); Road to Jurien Bay, *D. Clyne* 124, Sep 1969 (NSW 605180, PERTH); 17.9 km SSE of Leeman towards Coorow, *R. Coveny 7996 & B.R. Maslin*, 2 Sep 1976 (K, NSW 605169, PERTH); 13 km from Green Head towards Brand Highway (9.2 km from turnoff, *J. McCarthy 16, D. Bedford, J. Everett, B. Slade*, 2 Nov 1985 (K, NSW 202630, PERTH); 3.5 km E of Jurien, *D.J. McGillivray 3290 & A.S. George*, 11 Jun 1976 (NSW 605173); 3.5 km E of Jurien, *D.J. McGillivray 3291 & A.S. George*, 11 Jun 1976 (NSW 605176); 3.5 km E of Jurien, *D.J. McGillivray 3292 & A.S. George*, 11 Jun 1976 (NSW 605177); 32 km from Halfway Mill Roadhouse, *P.M. Olde* 86/966, 26 Oct 1986 (NSW 908418); 29.3 km W of Halfway Mill Roadhouse, *P.M. Olde* 91/90, 14 Sep 1991

(NSW 534723, PERTH); 31.1 km from Halfway Mill Roadhouse, *P.M. Olde* 91/92, 15 Sep 1991 (NSW 363122); Canover Rd, Jurien, near corner Emma Rd, *P.M. Olde* 15/177 *& I. Evans*, 7 Sep 2015 (AD; NSW; PERTH); Corner Premier and Zendora Sts, Jurien Bay, *P.M. Olde* 17/34 *& K. Alcock,* 3 Sep 2017 (CANB, NSW, PERTH); Coorow-Greenhead Rd, 11 km west of Brand Highway, *P.M. Olde* 17/38 *& K. Alcock,* 3 Sep 2017 (CANB, MEL, NSW, PERTH *distribuendi*); Near Green Head, *M.E. Phillips s.n.*, 24 Sep 1962 (CANB 012380, NSW130179); 3 miles [4.8 km) east of Jurien Bay, *R.V. Smith* 66/171, 1 Sep 1966 (MEL, NSW 605167); Quarry, E of Jurien, *C. Woolcock G35 & D. Woolcock*, 16 Aug 1985 (NSW534722); alongside Indian Ocean Drive, *c.* 4.5 km south of Jurien Bay, *D.A. Young* Waherb 16_012, 8 Jul 2016 (NSW 1002526).

5. ***Grevillea bundera*** (Keighery) Olde and Keighery, **comb. nov.**

Basionym: *Grevillea variifolia* subsp. *bundera* Keighery, *Nuytsia* 12: 294 (1998).

Hakea bundera (Keighery) Christenh. & Byng, *Global Flora* 4: 78 (2018).

Type: 15.6 km N of Coral Bay turnoff on Exmouth Road, Western Australia, *G.J. Keighery & N. Gibson 323*, 25 Aug 1992 (holo: PERTH 04055217).

Diagnosis: Apparently related to *Grevillea variifolia*, but differing in its hard leaves with triangular, pungent lobes.

Seedlings not seen. *Mature plants* apparently seed-obligate, compact, dome-shaped, grey to grey-green *shrub* 0.3–1.6 m high, 0.3–2 m wide with spreading to ascending branches. *Branchlets* 0.6–0.9 mm wide, angular, subsericeous. *New growth* silvery-grey. *Adult leaves* simple and divided, 1.1–3 cm long; *simple leaves* 2.3–4 mm wide, obovate to elliptic, occasional; *divided leaves* 5–25 mm wide, flat to undulate, obovate to subcruciform, bifid to pinnatifid, usually with broad-triangular lobes, including one terminating the primary leaf rachis; *primary leaf lobes* (2–)3–7; *leaf lobes* 2–3(–6.2) mm long, 1.75–3.5 mm wide at base, triangular, spinose; spines 1.5–2.5 mm long, straight, pungent; *apices of leaf lobes* acute; *basal rachis node* not applicable; *leaf-base* cuneate; *margins* recurved to revolute; *adaxial surface* smooth, glabrous or almost so, the midvein, primary, secondary and tertiary lateral veins, intramarginal veins and reticulum prominently raised and discolorous; *abaxial surface* exposed, densely sericeous, the midvein and lateral veins evident similarly hair-covered; *texture* coriaceous; *petioles* c. 2 mm long. *Conflorescence* simple, erect on descendent rachises, ±secund, 12–30-flowered, acropetal to subsynchronous, pedunculate; buds not seen; *peduncles* 5–25 mm long, straight, subsericeous; *rachises* 15–25 mm long, ±densely subsericeous; *common bracts* not seen, caducous. *Pedicels* 2.5–3 mm long, openly sericeous; *torus* 0.8–1.2 mm wide, slightly oblique; *nectary* rising *c.* 0.5 mm above the torus, conspicuous, fleshy, lunate with thick walls; *pistil* (18–) 25–28 mm long, glabrous; *ovary* obliquely ovoid, the base truncate; *gynophore* 2.5–4 mm long; *style* red, gently incurved; *pollen-presenter* 0.9–1.5 mm long, 0.8–1.2 mm wide, yellow, oblique; *perianth* 6 mm long, 1.25 mm wide, pinkish red, narrow-ovoid, with sprinkled appressed hairs outside below the curve, subsericeous on the pink limb, densely pubescent inside, the hairs aggregated into a beard. *Follicles* 12–16 mm long, 6.5–7 mm wide, ovoid-ellipsoidal; *pericarp* 0.3–0.4 mm thick at the suture. *Seeds* not seen. (Fig. 6)

Distribution: Western Australia. It occurs in the Cape Range–Wooramel Subregions of the Carnarvon IBRA Region in the Carnarvon and Exmouth LGAs, roughly between Cape Cuvier (near S end of Lake McLeod) and Rough Ra. (inland from Ningaloo).

Habitat and ecology: Grows in open scrub on Quaternary calcarenites and Pleistocene limestones with red sand. Associated species often include *Triodia basedowii*, *Grevillea stenobotrya, Hakea stenophylla, Scaevola tomentosa, Acacia tetragonophylla, A. coriacea.*

Phenology: Flowers mainly in winter–spring, but abundance is often dependent more on rainfall than seasonality.

Conservation status: According to the Western Australian herbarium this species is not of conservation concern.

Etymology: Named after the Quaternary Bundera calcarenites on which this taxon is a common and distinctive component of the shrub flora (Keighery *et al.*1998).

Discussion: Mature leaves of *G. variifolia,* in which species *G. bundera* was previously included as subspecies, are obovate-cuneate and generally longer (17–) 25–43 mm long), apically dentate or deeply triangular-lobed, and with petioles 3–6 mm long. Among the specimens of *G. variifolia* examined, a greater proportion of simple leaves was observed than for *G. bundera*. The conflorescences of *G. variifolia* also tended to be longer (rachises up to 50 mm long) and regularly 1-branched. Although the two species are surely close-related, they occur in consistent, fully diagnosable populations in different habitats informed by underlying geology. We therefore recognise them both as deserving recognition as co-equal species. Both species have been examined in the field.

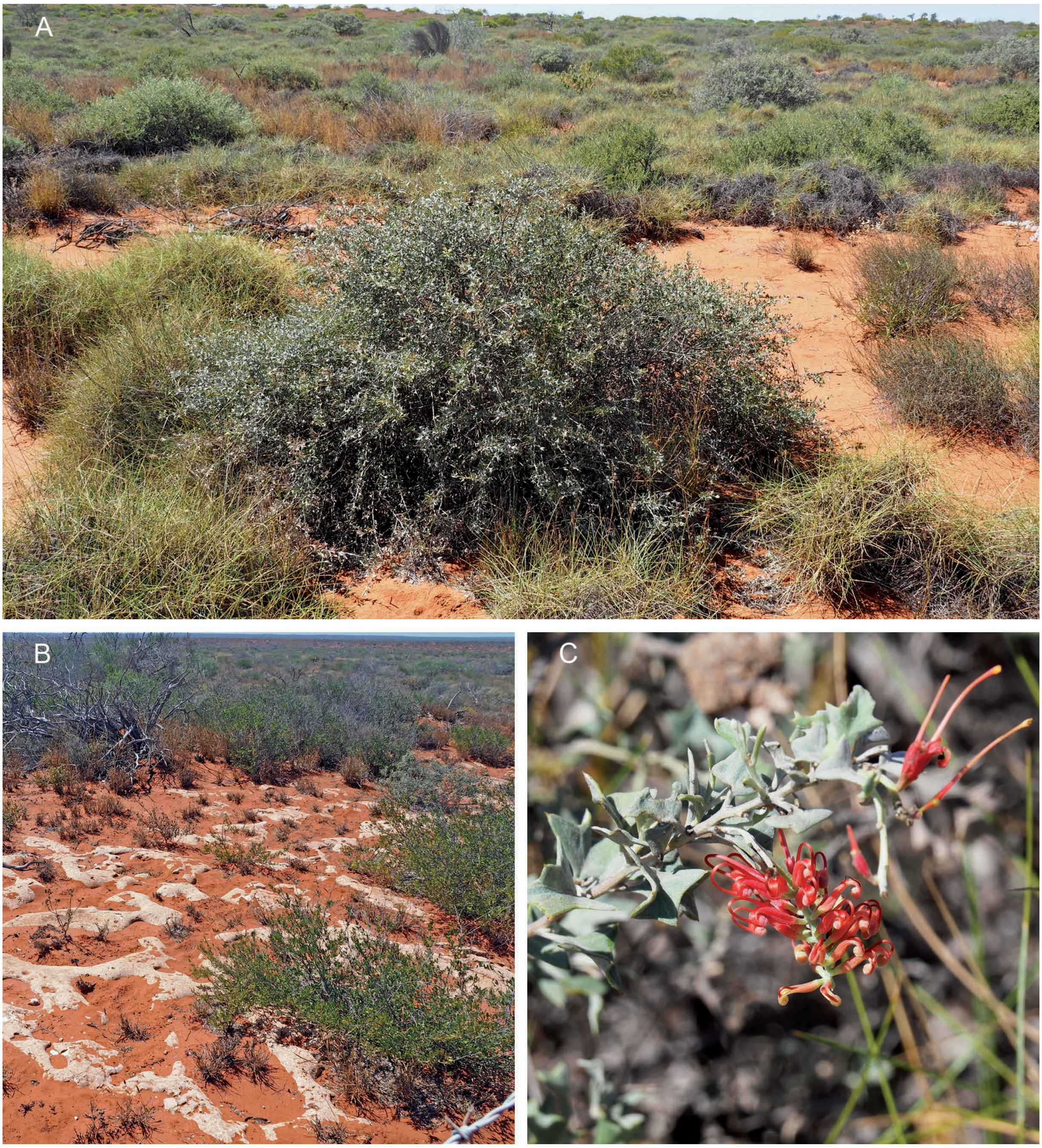

Fig. 6. *Grevillea bundera*, Exmouth Rd, Coral Bay. A, B. Habit and habitat. C. Flowering branchlet. Photos P. Olde.

Hevroy (2016) found that two sampled populations of *G. bundera* had two unique haplotypes, worthy of further investigation for the existence of a possible cryptic species. She also reported evidence of hybridism between *G. variifolia* and *G. bundera* in one sample. The existence of such a plant can be explained by the close-relatedness and geographic proximity of the two species and does not undermine, in our view, the change of classification proposed here.

Specimens seen: Western Australia: 127.1 km S of Learmouth, *A.S.George 2402* (CANB (*n.v.*), NSW 462963, PERTH (*n.v.*)); Exmouth Rd, Coral Bay, 58.5 km from turn-off at NW Coastal Highway, *P.M. Olde* 19/55 *& I. Evans,* 13 Sep 2019 (NSW, PERTH).

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