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Update to the taxonomy of *Hypocalymma* sect. *Hypocalymma* (Myrtaceae: Chamelaucieae), including hybrids and new species

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Abstract

Keighery, G.J., Rye, B.L. & Tauss, C. Update to the taxonomy of *Hypocalymma* sect. *Hypocalymma* (Myrtaceae: Chamelaucieae), including hybrids and new species. *Nuytsia* 34: 21–60 (2023). In updating the taxonomy of *Hypocalymma* (Endl.) Endl. sect. *Hypocalymma* (Myrtaceae: Chamelaucieae), the section is described, a key is provided to the species and hybrids, full descriptions given for 11 species (three of them new, one reinstated) and three hybrids (one newly named). Taxa needing further study are noted. Five species and two of the hybrids described here have conservation priority. Two new species are described from the *H. xanthopetalum* F.Muell. complex as *H. lateriticola* Keighery & Rye and *H. quadrangulare* Rye & Keighery. The circumscription of *H. angustifolium* (Endl.) Schauer is reduced with the reinstatement of *H. suave* Lindl. and the description of the new species *H. balbakiae* Tauss & Rye. A northern variant of *H. balbakiae* (previously known as *H. angustifolium* subsp. Hutt River) is considered to be insufficiently distinct to recognise formally as a subspecies. Evidence is presented that one previously named and two phrase-named taxa are hybrids. Two of the hybrids are known from more than one location and have been recorded in hybrid swarms: one between *H. angustifolium* and *H. tetrapterum* Turcz. is named as *H.* × *proliferum* Keighery & Rye, while the other, *H.* × *linifolium* Turcz., has the parent species *H. angustifolium* and *H. lateriticola*. The third hybrid is *H. tenuatum* × *H. xanthopetalum*. The description of *H. jessicae* Strid & Keighery is broadened to include a new variant that has mostly higher ovule and stamen numbers. Amendments are made to the stamen and ovule numbers recorded for *H. sylvestre* Strid & Keighery; this species has up to 200 stamens, which is the highest stamen number known for the tribe Chamelaucieae DC. A new fruit type that is indehiscent and somewhat winged, is recorded for the genus; it occurs only in *H. serrulatum* Strid & Keighery, which also has an unusual breeding system.

Introduction

This paper updates the taxonomy of *Hypocalymma* (Endl.) Endl. sect. *Hypocalymma* and presents a key to its species and three of its hybrids. Fairly extensive natural hybridisation within this section has contributed to difficulties in determining how many species should be recognised. Recent collections at several sites where there are hybrid swarms, and observations at sites where co-occurring species fail to hybridise, have now resolved some of the taxonomic problems. The main hybrids are described along with descriptions of their parent species. One old name is reinstated and three new species are named. Some previously named taxa are also described because they have changed in delimitation or

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because significant new data are now available to correct or enlarge their previous descriptions, for example the presence of a new kind of fruit in the genus, found only in *H. serrulatum* Strid & Keighery.

Background

Hypocalymma is widely distributed in, and restricted to, the South West Botanical Province of Western Australia (Rye 2013: Figure 5C). It comprises more than thirty species.

Recent publications on *Hypocalymma* began with a review of the whole genus (Strid & Keighery 2002) in which eleven new taxa were named. Two of these new taxa were originally treated as subspecies but both have subsequently been raised to the species level (Rye 2010; Rye *et al.* 2013).

Four sections are now recognised in *Hypocalymma*. Two sections that are distinguished from *Hypocalymma* (Endl.) Endl. sect. *Hypocalymma* by their smooth to colliculate seeds, sect. *Cardiomyrtus* Schauer with five species and sect. *Verticilla* Rye with two species, were described in Rye *et al.* (2013). Another small section of five species, distinguished by having petals much longer than the stamens, has been described as sect. *Grandiflora* Rye, Keighery & M.D.Barrett (Rye *et al.* 2022). The remaining species belong to sect. *Hypocalymma*, which is by far the largest section; a total of 13 manuscript and phrase names (Table 1) have been applied to its members.

Need for further work in *Hypocalymma* sect. *Hypocalymma*

Two species complexes in need of further study are the *H. angustifolium* R.Br. complex and the *H. xanthopetalum* F.Muell. complex. The current study addresses some, but not all, of the problems in both complexes. Additional species or subspecies possibly should be recognised formally. Two varieties named by Schauer (1844), *H. angustifolium* var. *acerosum* Schauer and var. *verrucosum* Schauer, belong to the *H. angustifolium* complex but we have not examined all the relevant syntypes and so are not in a position to be able to select lectotypes. Each variety contains syntypes that might belong to different taxa.

Methods

Our treatment of hybrid taxa follows the guidelines in Thiele and Parker (2014) in determining whether they qualify for conservation status. For the single hybrid that does not qualify, localities have been obfuscated because one of the parent species does have conservation status. We have opted to use hybrid formulae for taxa known only from one or two specimens but to use epithets for more commonly encountered hybrids that are found in swarms because those have the potential to become permanently established in an intermediate ecotype between those of the parents or to maintain populations where the parent species are no longer present. This is the opposite approach to that taken by Hopper and Brown (2001: 20), who opted to use formulae for hybrids found in swarms and give formal names to those that are only found as sporadic individuals amongst mixed populations of their presumed parents. Either way, the occurrence of backcrosses in hybrid swarms makes it difficult to describe just the characteristics of the hybrids, i.e. excluding back-crosses, as we have attempted to do here.

Type specimens housed at PERTH or borrowed from MEL and K were examined. For the remainder of types cited, their images were viewed on *Global Plants* (https://plants.jstor.org/). Sharr (2021) was consulted for the derivations of epithets.

Table 1. Informal names for taxa belonging to *Hypocalymma* sect. *Hypocalymma*, showing date established and current name.

Date established	Manuscript or phrase name	Published name
1948	*Hypocalymma xanthopetalum* var. *linearifolium* C.A.Gardner ms	*Hypocalymma gardneri* Strid & Keighery
1991	*Hypocalymma* sp. Badgingarra (G.J. Keighery 4595)	*Hypocalymma serrulatum* Strid & Keighery
1992	*Hypocalymma xanthopetalum* var. Three Springs-Eneabba (W.E. Blackall 4393)	*Hypocalymma hirsutum* Strid & Keighery
1993	*Hypocalymma* sp. Cataby (G.J. Keighery 5151)	*Hypocalymma* × *proliferum* Keighery & Rye
1993	*Hypocalymma* sp. Lesueur (E.A. Griffin 1972)	*Hypocalymma tenuatum* Strid & Keighery
1998	*Hypocalymma* sp. Chittering (T. Palmer 1)	*Hypocalymma sylvestre* Strid & Keighery
1998	*Hypocalymma xanthopetalum* var. Dandaragan (C.A. Gardner 9014)	*Hypocalymma lateriticola* Rye & Keighery
2007	*Hypocalymma* sp. Dandaragan (C.A. Gardner 9014)	*Hypocalymma lateriticola* Rye & Keighery
2007	*Hypocalymma* sp. Gairdner Range (C.A. Gardner 9091)	*Hypocalymma tenuatum* × *H. xanthopetalum*
2007	*Hypocalymma* sp. Nambung (R. Spjut & R. Smith s.n. 22/09/1992)	*Hypocalymma quadrangulare* Keighery & Rye
2009	*Hypocalymma angustifolium* subsp. Dandaragan plateau (S. Patrick 702 A)	*Hypocalymma angustifolium* (Endl.) Schauer
2009	*Hypocalymma angustifolium* subsp. Hutt River (S. Patrick 2982)	*Hypocalymma balbakiae* Tauss & Rye
2009	*Hypocalymma angustifolium* subsp. Swan Coastal Plain (G.J. Keighery 16777)	*Hypocalymma balbakiae* Tauss & Rye

Descriptions are based on well pressed herbarium material, with measurements taken only from the larger leaves of each specimen and from fully mature organs as far as possible. Style measurements include the basal inset portion (when present) and are taken from fully mature flowers or from fruits. The fruit height and width are given before the valves begin to open; the fruit's height is reduced but its width expanded as the valves open sufficiently to release the seeds. Only fully mature seeds were measured, avoiding any similar-looking chaff. Seeds freshly extracted from the fruit were used where possible to avoid the possibility of the white elaiosome (inner protrusion) having been damaged. Sometimes there are chaff pieces that resemble seeds in both size and shape, but they are empty; they tend to be paler than the seeds and differ in the texture of the inner protrusion.

Description of *Hypocalymma* sect. *Hypocalymma*

Mostly small *shrubs* up to 1.5 m high, rarely up to 3 m high; flowering stems with flowers borne at few to numerous consecutive nodes, each node usually with 4 flowers forming a cluster. *Leaves* opposite and decussate, usually concolorous. *Peduncles* very reduced or up to 2.5 mm long, mostly 2-flowered. *Pedicels* absent or short. *Flowers* each subtended by a pair of opposite bracteoles, with each pair of

flowers often subtended by a similar or somewhat shorter bract. *Hypanthium* shallowly cup-shaped, with a broad lobe corresponding with each loculus of the ovary. *Sepals* tending to be about half as long as the petals, often scarious, persistent in fruit. *Petals* 1.5–5.5 mm long, white to bright yellow or to deep pink, persistent in fruit in most species. *Staminodes* usually absent. *Stamens* 12–200 in up to 3 series, united into a continuous ring at base or connate for some distance, rarely (when few) all antisepalous, about as long as or longer than the petals. *Anther cells* often curved around a central ventral connective gland, longitudinally dehiscent. *Ovary* 2- or 3-locular, usually prominently ridged on the summit; ovules 1–11 per loculus. *Fruits c.* 1/2–3/4-superior, broader than long to slightly longer than broad, 1.3–4.5 mm long, thick-walled, dehiscent by terminal valves or (in *H. serrulatum*) indehiscent. *Seeds* 1.3–2.65 mm long, with a large cavity and a prominent protrusion on the inner surface; testa of seed body crustaceous, reticulate-pitted, brown; inner protrusion (elaiosome) concentrated at the distal end of the cavity, nearly always also extending along each lateral margin of the cavity and often extending slightly beyond the apex of seed body, white or whitish, fleshy.

Size and distribution. A section with 21 species now recognised, extending from Kalbarri National Park south to Augusta and south-east to Cape Arid National Park, Western Australia.

Habit. Section *Hypocalymma* includes single-stemmed reseeder species and lignotuberous resprouter species. One of the lignotuberous species from the *H. angustifolium* complex was studied in swamp communities near Gnangara on the Swan Coastal Plain by Dodd *et al.* (1984) and was found to be unusual in this habitat in having both its taproot and lateral roots well developed; the only other species with this characteristic was a member of the related genus *Astartea* DC.

Pollinators. *Hypocalymma* species attract numerous insect species to their readily accessible nectar, including records by Houston (2000) of native bee species of *Hylaeus* and *Leioproctus* visiting flowers of the *H. angustifolium* complex. An image showing a bee fly (*Meomyia*) feeding from the *H. angustifolium* complex is given in Hansen and Horsfall (2016) and a wasp is shown here in Figure 1A. Other insects recorded visiting members of this plant complex include Jewel and Melyrid beetles, Thynnine wasps and a Zygaenid moth (Brown *et al.* 1997; Lamont 1985).

There is also a record of the Brown Honeyeater visiting the flowers of *H. xanthopetalum* and the Honey Possum visiting both *H. strictum* Schauer and *H. xanthopetalum* flowers (Brown *et al.* 1997).

Colour changes often act as a signal to pollinators that old flowers have passed the stage of nectar production. At a Crystal Brook locality where a member of the *H. angustifolium* complex (probably *H. angustifolium s. str.*) was associated with granite outcrops, Lamont (1985: 147) recorded an average of over 35,000 flowers per plant, of which over 5,000 were being visited by pollinators. Peak nectar production and pollinator visitation at Crystal Brook were restricted to the phase where the flowers were white. Within three days the flowers had turned to deep pink and were no longer producing any nectar. Four species, one bee, one wasp and two beetles, were observed taking nectar but none of these was harvesting pollen.

Detrimental insect associations. As discussed in previous papers (e.g. Rye 2013) on the *Astartea-Hypocalymma-Cyathostemon* clade, *Callococcus* (Hemiptera family Eriococcidae) is a sap-feeding genus that uses all three plant genera as hosts but does not attack any other members of the tribe Chamelaucieae DC. The characteristic shape of female *Callococcus* scales is illustrated in Rye *et al.* (2013: Figure 2C). Another kind of stem-attached scale, which has been recorded on a specimen of a member of the *H. angustifolium* complex (*S.A. Fisher* 338), is produced by a bug species in the Diaspididae.

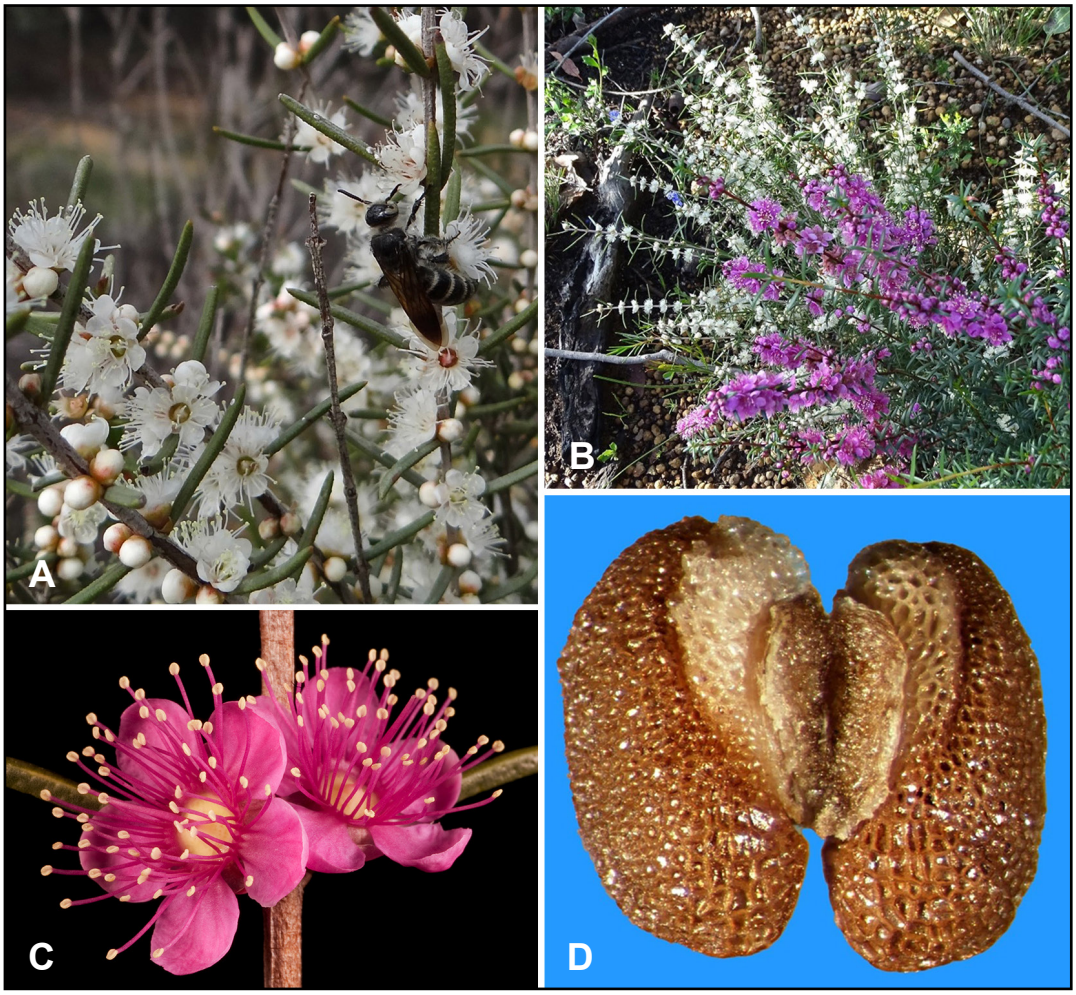

Figure 1. A – potential wasp pollinator on *Hypocalymma angustifolium*, showing the plant's relatively few stamens and flattened, tapering leaves and the ovary summit green at anthesis and reddish in late flower; B – co-occurrence at Korijekup Nature Reserve of the pink-flowered *H. robustum* and a white-flowered member of the *H. angustifolium* complex; C – *H. robustum* flowers with a yellow ovary summit and terminal style; D – *H. balbakiae*, two placentas with an apparently fertile (but actually empty) seed attached to the placenta on the left, showing its whitish eliaosome, and a more obviously infertile seed attached to the other placenta. The reticulate-pitted testa is clearly visible. Images by Greg Keighery taken on 9 August 2013 (A) and 12 September 2017 (B), by Kevin Thiele from *K.R. Thiele* 3043 (C) and by Alex Williams from *B.L. Rye*, *F. Hort & J. Hort* BLR 241206 (D).

Many other kinds of scales of sap-feeding insects are found on the leaves of members of *H.* sect. *Hypocalymma*, such as black scales formed by the larvae of white flies (Hemiptera family Aleyrodidae), but less commonly than in *H.* sect. *Cardiomyrtus* (see Rye *et al.* 2013 for details of scale-forming insects in that section).

In the *H. angustifolium* complex, Slater (1975, 1976) documented the destruction of seeds by diverse Lygaeid bugs. The 12 species of bug listed belonged to 11 genera and five of these species were also listed for *H. robustum* (Endl.) Lindl.

Breeding systems. *Hypocalymma* species are protandrous, typically releasing their pollen well before the stigma matures. Previously unpublished pollination trials were conducted by one of us (GJK)

on glasshouse-grown specimens of seven species of *Hypocalymma*, including five members of sect. *Hypocalymma*. In six of the species, *H. angustifolium*, *H. cordifolium* Schauer, *H. ericifolium* Benth., *H. robustum*, *H. speciosum* Turcz. and *H. xanthopetalum*, pollen is normally well dispersed before stigma maturation. Little fruit and seed set occurred after controlled self-pollination in these species, whereas over 80% of fruits set seed after cross-pollination, suggesting all are strongly outbreeding.

Unlike those taxa, the seventh species, *H. serrulatum*, has anthers loosely clustered around the style and dehiscing only shortly before the stigma matures such that some of their pollen is deposited directly onto the mature stigma. Flowers pollinated naturally by this means, and also artificially selfed flowers, had a similar level of successful fruit set (79%) to flowers that were cross-pollinated (82%). There seems to be little nectar produced in *H. serrulatum* compared to other *Hypocalymma* species, suggesting that this species may be modally inbreeding, although cross-pollination is not excluded. Honeybees were observed visiting wild stands of *H. serrulatum* so the species does attract some potential insect pollinators.

Seed dispersal. In *Hypocalymma* the capsules normally remain attached to the plants until after they have dehisced by regular valves across the summit to release the seeds. However, *H. serrulatum* fruits are shed intact from the plant, i.e. they are multi-locular, indehiscent diaspores. The diaspores are somewhat three-winged on the summit and are usually only 1-seeded. How effective these wings are in enhancing dispersal of the diaspores needs investigation in the field. The development of indehiscent fruits within genera that are characterised by capsules has been documented in several other genera of tribe Chamelaucieae, including the closely related genus *Astartea* (Rye 2013).

Myrmechocory plays an important role in seed dispersal in *Hypocalymma*, as discussed in Rye *et al.* (2013). The elaiosome consists of a large white protrusion on the inner surface of the seeds, as can be seen on the seeds of *H. elongatum* (Strid & Keighery) Rye illustrated in Rye *et al.* (2013: Figure 4A). Ants have been observed by one of us (GJK) dispersing the seeds of *H. ericifolium* at Harvey.

Co-occurring species. Where species of *Hypocalymma* co-occur there are generally differences in habitat and in some cases there are also differences in flowering time and probably chromosome number. Despite this, hybridisation is common in the section.

Two of the natural hybrids recorded previously have a parent species from the *H. xanthopetalum* complex, which is fairly widespread in the northern part of the range of *Hypocalymma*, and most of them have a parent in the *H. angustifolium* complex. The latter complex has a large distribution covering about half of the South West Botanical Province, overlapping the ranges of many other members of the genus. One example of co-occurrence (Figure 1B) is between a member of this complex and the pink-flowered *H. robustum* (Figure 1C).

Notes. Members of the *H. angustifolium* complex were used by indigenous people to treat skin conditions, headaches and nasal congestion (Hansen & Horsfall 2016). Some species, notably *H. robustum* and members of the *H. angustifolium* complex, are important in horticulture and the cut flower trade.

Key to species and main hybrids of *Hypocalymma* sect. *Hypocalymma*

*Indicates a taxon that is keyed out more than once. Back-crossed hybrid specimens may occasionally key out to a parent species.

1. Ovary 2-locular

2. Leaves 50–70 mm long. Petals white or cream. Ovules 8–11 per loculus (Murchison River area)..... **H. longifolium**

2: Leaves 8–32 mm long. Petals pale to deep pink. Ovules 1–4 per loculus

3. Ovules 1 per loculus

4. Shrub up to 1.6 m high; branchlets with widely spaced leaves. Largest leaves ± sessile, 20–32 mm long. Flowers borne at 3–13 consecutive nodes. (E edge of Stirling Range–Wellstead) ..... **H. elongatum**

4: Shrub 0.3–1 m high; branchlets with densely clustered leaves. Largest leaves usually with a petiole 0.4–1.3 mm long and blade 6–15 mm long. Flowers borne at 1–3(–5) consecutive nodes (Ravensthorpe Ra.–Fitzgerald River NP)..... **H. jessicae***

3: Ovules 2–4 (usually 3) per loculus

5. Leaves 15–30 mm long, 1.2–3 mm wide, distinctly wider than thick. Petals medium to deep pink, 4–5.5 mm long (Moore River–Walpole)..... **H. robustum**

5: Leaves 3–16(–25) mm long, 0.6–1 mm wide, very thick. Petals pale to medium pink, 2.7–4 mm long

6. Leaves densely arranged on the branchlets; petiole usually well defined, and 0.4–1.3 mm long. Stamens (35–)55–100 (Ravensthorpe Ra.–Fitzgerald River NP)..... **H. jessicae***

6: Leaves widely spaced on the branchlets; petiole ± absent or poorly defined, up to 0.5 mm long. Stamens 25–55

7. Young stems with a rough surface of star-like protruding oil glands. Leaves 2.5–9(–13) mm long, with stellate protrusions similar to those on the stems (Mount Barker area–Cape Arid NP)..... **H. asperum**

7: Young stems smooth. Leaves 6–25 mm long, ± smooth (Augusta–Hassell Beach)..... **H. strictum**

1: Ovary 3-locular

8. Ovules 2–5 per loculus. Flowers yellow and with style base terminal on summit of ovary (see Figure 1C). Stamens 55–200. Stigma with long papillae (except in *H. sylvestre*), 0.15–0.5 mm diam. including the papillae.

9. Flowers 12–15 mm diam., densely arranged at 1–3 consecutive nodes. Ovules 3–5 in most loculi. Style 6–8 mm long; stigma with low papillae or smooth (Chittering area) ..... **H. sylvestre**

9: Flowers 5–11 mm diam., at up to 8(–16) consecutive nodes and often fairly widely spaced. Ovules 2 per loculus. Style 3.5–5.5 mm long; stigma with elongated papillae (*H. xanthopetalum* complex)

10. Leaves hairy on both surfaces, sometimes becoming scabrid on adaxial surface. Flowers bright yellow, turning orange with age. Stamen filaments united for 1/3 to almost half their length (Eneabba–Mt Peron area)..... **H. hirsutum**

10: Leaves glabrous or rarely scabrid on the surfaces, often ciliate on the margins. Flowers pale or lemon yellow, then fading. Stamen filaments united for up to 1/4 of their length

11. Young stems 4-angled, glabrous

12. Young stems with ridges incurved and often flattened over surface of stem. Leaf margins scarious, denticulate. Anthers 0.3–0.35 mm long. Occurring near the coast in the Spearwood soil type (Nambung NP–Moore River State Forest)..... **H. quadrangulare**

12: Young stems with ridges projecting at right angles to the adjacent surface of stem. Leaf margins entire in most specimens. Anthers *c.* 0.5 mm long. Occurring further inland in lateritic soils (Badgingarra–Dandaragan area) ..... **H. lateriticola**

11: Young stems ± terete or irregular, hairy

13. Lax, widely spreading subshrub to 0.3 m high, with numerous very fine stems from the base. Leaves 0.4–1.5 mm wide (Mt Lesueur area) ..... **H. gardneri**

13: Low-growing shrub up to 0.8(–1.2) m high, with multiple stems from a lignotuber but with fewer stems that are not as fine as in *H. gardneri*. Leaves (2–)3–9 mm wide (Mingenew–Muchea) ..... **H. xanthopetalum**

8: Ovules solitary in each loculus. Flowers white, pink or yellow, with style base slightly to deeply inset into ovary (rarely not inset in *H.* × *linifolium*). Stamens 12–55. Stigma with low papillae or entire (except sometimes in *H. tenuatum* × *H. xanthopetalum*), 0.05–0.1(–0.15) mm diam.

14. Style base usually only slightly inset, although sometimes seated between prominent wings, rarely terminal (see Figure 1C).

15. Leaves less than twice as wide as thick. Flowers opening predominantly in autumn and winter. Ovary 3-winged on summit. Fruits shed with seeds intact (Badgingarra area) ..... **H. serrulatum**

15: Leaves more than twice as wide as thick. Flowers opening predominantly in spring. Ovary 3-ridged on summit. Fruits dehiscent while attached to the plant, releasing seeds through 3 terminal valves

16. Stems minutely hairy. Leaves 1.2–2 mm wide (Mt Lesueur NP) .... **H. tenuatum × H. xanthopetalum**

16: Stems glabrous. Leaves 2–4 mm wide (Badgingarra–Dandaragan area)..... **H. × linifolium**

14: Style base inset in a cylindrical depression

17. Flowering stems densely papillose and/or narrowly winged. Leaves often with oil glands star-like or surrounded by a circle of papillae

18. Leaves 0.5–1.3 mm wide; apical point 0.2–0.4 mm long, Petals 2–2.5 mm long (Lesueur NP–Warradarge)..... **H. tenuatum**

18: Leaves 2–7 mm wide; apical point absent or up to 0.2 mm long. Petals 3–4 mm long (Eneabba–S of Badgingarra)..... **H. tetrapterum**

17: Flowering stems not papillose, not winged. Leaves with glands not as above

19. Young flowering stems with a loose papery epidermis obscuring their shape, bearing a dense inflorescence. Leaves 6–20 mm long. Petals cream to bright yellow

20. Petals 2.3–4 mm long, usually yellow. Stamens 20–50 in a full circle (N of Harvey–Augusta–Walpole)..... **H. ericifolium**

20: Petals 1.5–2.3 mm long, usually cream. Stamens 12–20, often with gaps opposite the petals (Lake Jasper–Cape Riche) ..... **H. scariosum**

19: Young flowering stems obviously 4-angled, usually with obvious gaps between the nodes of the inflorescence. Leaves (8–)15–50 mm long. Petals white or pink

21. Leaves with minutely crenulate margins; apical point 0.3–1.5 mm long, if less than 0.6 mm long then uncinate. Seeds 1.4–1.8 mm long

22. Shrubs lignotuberous. Leaves with apex straight but the apical point sometimes recurved; apical point 0.7–1.5 mm long. Associated with wetlands

or watercourses, mainly near the coast, always well west of the range of *H. uncinatum* (Hutt River–Busselton–near Northcliffe) ..... **H. balbakiae**

22: Shrubs single-stemmed. Leaves with apex strongly recurved or uncinate; apical point 0.3–0.5 mm long. Occurring on granite outcrops inland (Merredin–Lake King) ..... **H. uncinatum**

21: Leaves with entire margins, apex ± straight or incurved; apical point absent or up to 0.5 mm long. Seeds 1.8–2.3 mm long

23. Single-stemmed or multi-branched, reseeder shrub up to 3 m high at full maturity. Leaves 0.6–1(–1.2) mm wide, about as wide as thick or slightly wider, the oil glands rather densely packed and often prominent. Stamens (20–)30–50 (Wongan Hills–Perth–near Ongerup) ..... **H. suave**

23: Lignotuberous, resprouter shrub up to *c.* 1.5 m high. Leaves 1–6 mm wide, the floral leaves several times wider than thick, the oil glands usually sparser and less prominent than in *H. suave*. Stamens 18–30(–35)

24. Leaves (especially the floral ones) 1–2.3 mm wide; basal part broader than the upper third of the leaf (Badgingarra area–Albany area) ..... **H. angustifolium**

24: Leaves 1.8–6 mm wide; basal part similar in width to the upper third of the leaf (Cataby–Mullering Brook area)..... **H. × proliferum**

Descriptions of relevant species

Hypocalymma angustifolium (Endl.) Schauer, *Linnaea* 17: 241 (1843); *Leptospermum angustifolium* Endl., *Enum. Pl. Nov. Holl.* 50 (1837); *Hypocalymma angustifolium* Endl. var. *linophyllum* Schauer [as *linophylla*], *nom. illeg*. [= var. *angustifolium*], *Pl. Preiss.* 1: 112 (1844). *Type*: Swan River, Western Australia, *s. dat.* [prior to January 1834], *C.A. von Huegel s.n.* (*holo*: W 0047033).

Hypocalymma angustifolium subsp. Dandaragan plateau (S. Patrick 702 A), Western Australian Herbarium, in *Florabase*, https://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Shrub 0.4–1.2 m high, commonly 1–3 m wide, lignotuberous and therefore commonly with multiple stems from the ground, but sometimes recorded as single-stemmed or multi-branched near base (perhaps during fire-free periods). *Young stems* 4-angled and usually with 4 obtuse ridges protruding from the angles, glabrous. *Leaves* often reflexed on flowering stems, but otherwise varying from antrorse to patent, mostly at fairly widely spaced nodes. *Petioles* absent or poorly defined and less than 0.4 mm long. *Leaf blades* straight or slightly curved, very narrowly ovate-triangular to linear, mostly (or at least those subtending flowers) broadest at or near the base and tapering at a constant angle to an acute apex or tapering consistently in the distal half, 12–24 mm long, 1–2.3 mm wide, not thickened (but with margins often incurved) or moderately thickened distally, concolorous, entire, acute; abaxial surface convex or partially flat, grooved along the midvein, moderately densely dotted with numerous small oil glands; adaxial surface concave or partially flat, often more densely dotted than on abaxial surface; apical point 0.25–0.5 mm long. *Peduncles* borne at up to *c.* 18 (usually 6–11) widely spaced nodes of each flowering stem, very reduced, mostly 2-flowered. *Bracteoles* persistent, 1.2–2 mm long. *Pedicels* ± absent. *Flowers* 6–7.5 mm diam. *Hypanthium* 1.2–1.5 mm long, 3–3.5 mm diam., wrinkled-rugose; free part 0.3–0.5 mm long. *Sepals* very broadly or depressed ovate, 1.1–1.7 mm long, 1.7–2.5 mm wide, entire. *Petals* 2.3–3.2 mm long, white or pale pink, commonly turning deep pink with age, persistent, entire. *Stamens* 18–30(–35), in 1 or 2 series, united at base for 0.4–0.5 mm. *Longest filaments* 3–4 mm long, white. *Anthers* 0.35–0.5 mm long, pale yellow. *Ovary* 3-locular; summit prominently 3-ridged, becoming deep pink to red; ovules 1 per loculus, erect. *Style* 4–5 mm long; base deeply inset; stigma

with low papillae or entire, up to *c.* 0.1 mm diam. *Fruits c.* 2/3-superior, 2.5–2.7 mm long, 2.5–3 mm diam. *Seeds c.* 2.2 mm long, 0.8–1.2 mm wide, 1–1.2 mm thick, with a reticulate-pitted, medium brown testa; inner cavity *c.* 1.3 mm long; inner protrusion 1.1–1.5 mm long. (Figure 1A)

Diagnostic features. *Shrubs* 0.4–1.2 m high, with a lignotuber. *Young stems* 4-angled, glabrous. *Leaves* 12–24 mm long, the floral ones wider than thick and broader in the basal part than in the upper third, 1–2.3 mm wide, entire. *Petals* 2.3–3.2 mm long, white or pale pink, persistent. *Stamens* 18–30(–35). *Ovary* 3-locular; ovules 1 per loculus. *Style* 4–5 mm long; base deeply inset. *Seeds c.* 2.2 mm long.

Selected specimens examined. WESTERN AUSTRALIA: Guildford, Sep. 1901, *C. Andrews s.n.* (PERTH); no locality or date, *J. Drummond* 142 (MEL); 7 km N of Bullsbrook, 9 Aug. 1979, *R.K. Ellyard* 12 (CANB, PERTH); Badgingarra Rd, 6 km N from Dandaragan–Moora Rd, 30 Aug. 1984, *D.B. Foreman* 396 (AD, CANB, MEL, PERTH); 1.5 km E of Mogumber on Mogumber–Yarawindah Rd, 14 Sep. 1984, *D.B. Foreman* 709 (K, MEL, PERTH); Armadale, 17 Sep. 1920, *C.A. Gardner* 259 (PERTH); Mount Barker, Oct. 1898, *B.T. Goadby* 49 (PERTH); Jam Hill Reserve 25254, W of Moora, 27 June 1988, *E.A. Griffin* 4814 (PERTH); Reserve 12276, between Dandaragan and Moora, 11 Aug. 1988, *E.A. Griffin* 4883 (PERTH); granite outcrop off Mercer Rd, York. Transect 1, State Forest DEC A 47883, 5 Sep. 2008, *S. Gummow & T. Clack* EH 36 (PERTH); Blackboy Ridge Reserve, Chittering Rd, Chittering, 11 Aug. 2011, *G.J. Keighery* 17756 (PERTH); Bodhinyana Monastery, 216 Kingsbury Dr, Serpentine, 3 Aug. 2002, *B. Nyanatusita* 90 A (PERTH); 9.6 km N of Badgingarra Rd from Moora–Caro Rd at entrance to Strathmore, 13 Aug. 1991, *S. Patrick* 702 A (PERTH); Kalgan River, 21 Oct. 1991, *L.J. Pen* LJP 121 (PERTH); 13.5 km N of Regans Ford, along Brand Hwy, 6 Oct. 1982, *K.H. Rechinger* 58219 (PERTH); 17 km E of Frankland along the Cranbrook road at intersection with a road to Mount Barker, 8 Sep. 1976, *B.L. Rye* 76038 (PERTH); Norwood Reserve (Kalamunda Reserve 22502) off Norwood Rd, Maida Vale, 3.8 km WNW of Kalamunda, 23 Aug. 2003, *G. Smith* 58 (PERTH); above Moore River flats at Regans Ford, 31 Aug. 1966, *R.V. Smith* RVS 66/155 (MEL, PERTH).

Distribution and habitat. Extends from north of Badgingarra south-south-east to near Albany (Figure 2A), favouring lateritic or granitic habitats or associated with watercourses or swamps, often recorded with Jarrah or other eucalypts.

Phenology and insect associations. Flowers from late June to early October, with flowering beginning earlier in the north of the range. Mature fruits have been recorded in September and October. *Hypocalymma angustifolium* commonly has large floral galls, e.g. on *K.H. Rechinger* 58220, which also has the remnants of a *Callococcus* infection in the attached package.

Conservation status. As *H. angustifolium* is known from many localities, with some populations in nature reserves or other protected areas, it is not considered to be at risk.

Etymology. From the Latin *angustus* (narrow) and *-folius* (leaved) in reference to the narrow leaves of this species, although its close relatives *H. balbakiae* Tauss & Rye and *H. suave* usually have narrower leaves.

Vernacular names. White Myrtle. Noongar names for this or related species have been recorded as Koodgeed and Kudjidi (Abbott 1983; Hansen & Horsfall 2016).

Chromosome number. *2n = c.* 44, *fide* B.L. Rye, *Austral. J. Bot.* 27: 571 (1979). Voucher: *B.L. Rye* 76038.

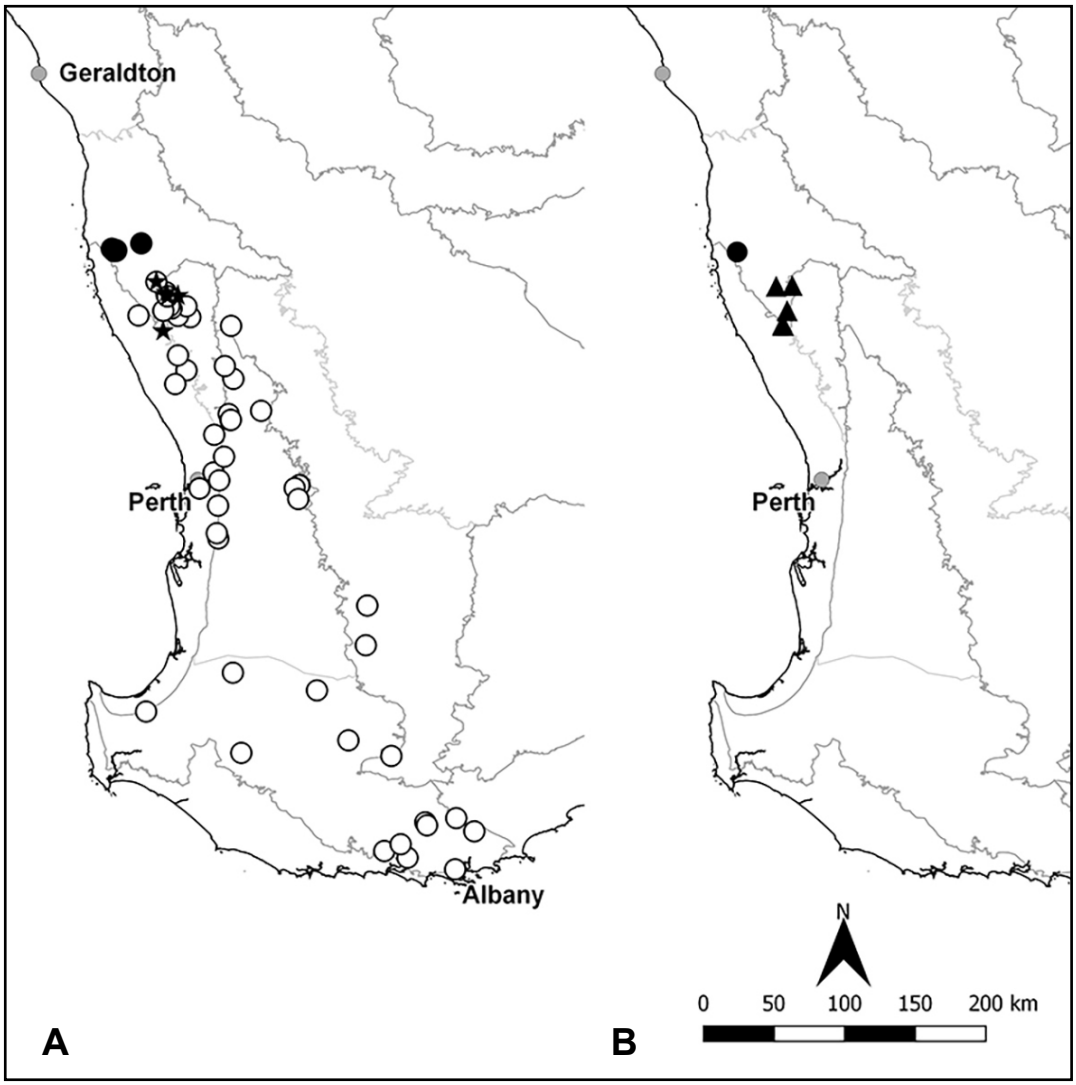

Figure 2. Distribution maps for *Hypocalymma* hybrids and two of the five parent species. A – *H. angustifolium* (○), *H.* × *linifolium* (★) and *H. tenuatum* (●); B – *H. tenuatum* × *H. xanthopetalum* (●) and *H.* × *proliferum* (▲).

Co-occurring species. *Hypocalymma angustifolium* hybridises readily with two species that have a similar flowering season, *H. tetrapterum* Turcz. and *H. lateriticola*, producing hybrid swarms (see discussion under their hybrids *H.* × *linifolium* and *H.* × *proliferum* respectively). It occupies higher or lower ground respectively than the other parent species. See the discussion under *H. xanthopetalum* for another possible hybrid involving *H angustifolium*.

Strid and Keighery (2002: 543) indicated that the flat-leaved variant of *H. angustifolium* (*E.A. Griffin* 4883), i.e. typical *H. angustifolium*, could be found not far from the variant described here as *H. balbakiae* (*E.A. Griffin* 4876) but was separated ecologically by its occurrence on upland sites rather than swampy sites. Whether the two taxa ever show strict co-occurrence is uncertain, but they are mounted together on a single herbarium sheet (now with two barcodes) of a very old collection (*Turner s.n.*, 1843), with *H. angustifolium* (PERTH 09484191) in more advanced flower than *H. balbakiae* (PERTH 02350580).

Hypocalymma angustifolium might also co-occur with *H. serrulatum*, as discussed under that species.

Affinities. The *H. angustifolium* complex includes *H. balbakiae*, *H. suave* and *H. uncinatum* Strid & Keighery, with considerable overlap in the ranges of the first three species but with *H. uncinatum* well separated geographically from the remainder of the complex.

What seems to distinguish *H. angustifolium* from *H. balbakiae* and *H. suave* best is that its leaves (or at least the ones subtending flowers) are more flattened throughout or at the base and usually taper continuously from the broad base to the apex or at least taper in the distal half, whereas in the two related species, the leaves are relatively uniform in width over most of their length. *Hypocalymma angustifolium* is similar to *H. balbakiae* in having a lignotuber but its leaves are shorter, less curved on average, and more commonly reflexed (on flowering stems) than in *H. balbakiae* and have smoother margins and a shorter apical point. It also has larger seeds and tends to have fewer stamens.

Hypocalymma suave and *H. uncinatum* differ from *H. angustifolium* in being single-stemmed and readily killed by fire, and *H. angustifolium* may have larger seeds than both these species, judging from the very few samples available for study. *Hypocalymma uncinatum* also differs from *H. angustifolium* in having crenulate leaf margins and an uncinate point to its leaves, while *H. suave* tends to have more densely glandular leaves and more numerous stamens.

Hypocalymma angustifolium may differ from the other members of its complex in having a tetraploid chromosome number, as a diploid number has been recorded for *H. suave*, but *H. balbakiae* and *H. uncinatum* have not yet been checked for chromosome number. A survey of chromosome number is needed for *H. angustifolium* to establish whether or not the tetraploid number occurs throughout its distribution.

Type collection. Huegel visited Fremantle, Darling Range and King George Sound between 27 November 1833 and 11 January 1834 (George 2009), well past the normal flowering time of *H. angustifolium*. Some specimens included in his collection might have been collected earlier by a resident collector, such as James Drummond, when more species were out in flower. Hence the true collector of the type specimen is not certain. Another possibility is that Huegel collected seeds and the collection was made from plants in cultivation in Europe.

Notes. The ability of *H. angustifolium* to regenerate from a lignotuber after fires is clearly evident from the specimen *K.R. Thiele* KRT 5581, which shows several dead, charred stems as well as new, more slender flowering shoots growing from the base of the plant. Additional material in mature fruit is needed for the species.

Hypocalymma balbakiae Tauss & Rye, *sp. nov.*

Type: Alison Baird Reserve, Bush Forever Area 387 (Greater Brixton St Wetlands), Kenwick, Western Australia, 30 September 2021, *B.L. Rye & C. Tauss* CT 8105 (*holo*: PERTH 09492488; *iso*: CANB, K, MEL, NSW).

Hypocalymma angustifolium subsp. Hutt River (S. Patrick 2982), Western Australian Herbarium, in *Florabase*, https://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777), Western Australian Herbarium, in *Florabase*, https://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Illustrations. W.E. Blackall & B.J. Grieve, *How Know W. Austral. Wildflowers* 3A: 90 (1980); B.L. Rye & M.E. Trudgen, *Nuytsia* 18: 244, figure 3C (2008) [both as *H. angustifolium*].

Shrub 0.3–1.3(–2) m high, 0.5–2.5 m wide, with multiple stems from a lignotuber. *Young stems* 4-angled, glabrous. *Leaves* usually widely antrorse or patent, mostly widely spaced. *Petioles* absent or poorly defined and less than 0.5 mm long. *Leaf blades* moderately to strongly curved (incurved or recurved), linear or long-linear in outline, of fairly uniform width and thickness throughout their length, (20–)30–45 mm long, 0.6–1.3 mm wide, 0.3–1 mm thick, concolorous, with minutely crenulate margins, acute; abaxial surface deeply convex and usually flattened or grooved along the midvein in the basal half, rather sparsely to moderately densely dotted with numerous small oil glands; adaxial surface with a broad, v-shaped indentation along almost its full length; apical point 0.7–1.5 mm long, its tip often recurved. *Peduncles* borne at 5–26, usually widely spaced nodes of each flowering stem, very reduced, mostly 2-flowered. *Bracteoles* persistent, 1.5–2.2 mm long. *Pedicels* ± absent. *Flowers* 6–8 mm diam. *Hypanthium* 1.2–1.4 mm long, *c.* 3 mm diam., usually with a few large, prominent oil glands, often with some longitudinal ribs or somewhat rugose; free part 0.25–0.5 mm long. *Sepals* very broadly or depressed ovate, 1.3–1.8 mm long, 2.2–2.8 mm wide, scarious, often purple- or pink-tinged, entire. *Petals* 2.3–3.3 mm long, white or rarely pale pink at anthesis, often becoming deep pink to red with age, persistent. *Stamens* (23–)30–45, in 2 series, united at base for 0.3–0.6 mm. *Longest filaments* 2.5–3.7 mm long, white. *Anthers* 0.3–0.5 mm long, pale yellow. *Ovary* 3-locular; summit prominently ridged, becoming deep pink to red; ovules 1 per loculus, erect. *Style* 3.5–4.5 mm long; base deeply inset; stigma with low papillae or entire, up to *c.* 0.1 mm diam. *Fruits c.* 2/3-superior, 1.9–2.3 mm long, 2.5–3 mm diam. *Seeds* 1.4–1.8 mm long, 0.6–1 mm wide, 0.75–1.1 mm thick, with a reticulate-pitted, medium brown to very dark red-brown testa; inner cavity 0.7–0.8 mm long; inner protrusion 0.8–1.2 mm long. (Figure 1D)

Diagnostic features. *Shrubs* with a lignotuber. *Young stems* 4-angled, glabrous. *Leaves* moderately to strongly curved, (20–)30–45 mm long, thick, minutely crenulate along margins, with a broadly v-shaped adaxial surface. *Petals* 2.3–3.3 mm long, white or pale pink at anthesis. *Stamens* (23–)30–45. *Ovary* 3-locular; ovules 1 per loculus. *Seeds* 1.4–1.8 mm long.

Selected specimens examined. WESTERN AUSTRALIA: *c.* 600 m W of Seaton Ross Rd on Corbalup Rd, *c.* 27 km ENE of Manjimup, 29 Oct. 1996, *A.R. Annels* ARA 5802 (PERTH); 26 km from Wanneroo Rd (near Yanchep), towards Gingin, 8 Oct. 1981, *L.A. Craven* 6965 (AD, CANB, MEL, PERTH); Northcliffe Forest Park, 8 Sep. 1991, *L. Graham* 776 (PERTH); Water Reserve 15538, between Dandaragan and Moora, 11 Aug. 1988, *E.A. Griffin* 4876 (PERTH); off Bunney Rd, Three Springs, 29 Aug. 2001, *S. Hamilton-Brown s.n.* (PERTH); Nine Mile Lake Nature Reserve, Herron Point Rd, WSW of Pinjarra, 22 Sep. 2005, *G.J. Keighery* 16777 (CANB, PERTH); Sabina River, just E of Sabina River bridge, Whicher National Park, 20 Oct. 2005, *G.J. & B.J. Keighery* 858 (PERTH); Ellis Rd, 1 km W of Old Coast Rd, Yalgorup National Park, 23 Aug. 2007, *G.J. & B.J. Keighery* 1222 (MEL, PERTH); Mt Roe National Park, 1 Nov. 2013, *R. Meissner, C. McCormack & M. Langley* 5023 (PERTH); 1.6 km from Yerina Spring Rd SE along Yerina Creek then *c.* 2.7 km NE along Hutt River, 2 Aug. 2007, *C. Page & G. Phelan* CP 170 (PERTH); Yerina Spring Rd, 2.3 km S of intersection with Ogilvie West Rd, 23 Sep. 1997, *S. Patrick* 2982 (PERTH); 2.5 km S of Brookton Hwy on Leona Rd, 30 Dec. 2004, *B.L. Rye, F. Hort & J. Hort* BLR 241206 (PERTH).

Distribution and habitat. Occurs along the west coast from near Hutt River south to Busselton, with somewhat inland locations extending south to near Northcliffe (Figure 3A), mainly in sandy wetland habitats on the margins of swamps and watercourses or mound springs, in low shrublands and sedgelands often dominated by taller shrubs or trees of *Melaleuca* or *Eucalyptus*.

Phenology and insect associations. Flowers mainly from late August to early November, with mature fruits recorded from October to February. Unlike *H. angustifolium* and *H. suave*, *H. balbakiae* does not appear to be prone to the development of large galls. It is susceptible to *Callococcus* (*B.L. Rye, F. Hort & J. Hort* BLR 241206) and small galls have been observed on *M.N. Lyons & S.D. Lyons* 3531.

Conservation status. Widespread and not considered to be at risk. One of its variants is listed as Threatened (Endangered) by the State and Commonwealth governments (Western Australian Herbarium 2018–;

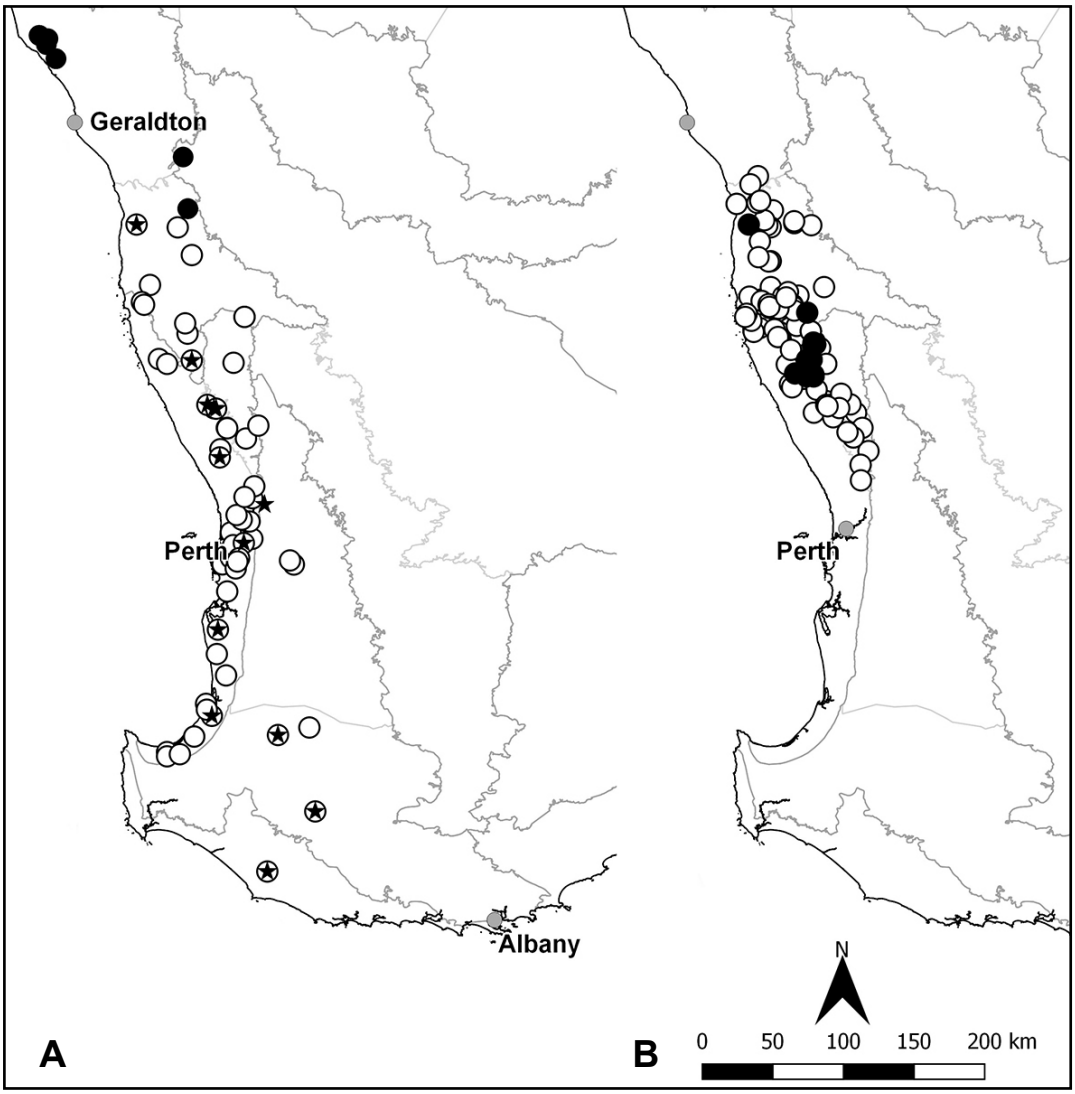

Figure 3. Distribution maps for three *Hypocalymma* species. A – *H. balbakiae* typical variant (○), Hutt River variant (●) and southern long-leaved specimens (★); B – *H. tetrapterum* (●) and *H. xanthopetalum* (○).

Department of the Environment 2022) under the name *H. angustifolium* subsp. Hutt River (S. Patrick 2982); a nomination will be prepared to the Threatened Species Scientific Committee for delisting.

Etymology. Named in honour of 'Granny' Balbak (1840–1907) a Whadjuk-Noongar, *boordiya yorga* (woman leader) and granddaughter of Yellagonga, who was the traditional owner of *Boorlo* (Perth). *Balbak* was known amongst the European colonists of her time (including the journalist Daisy Bates) as Balbuk, Fanny Balbuk, and even the trinomial Fanny Babulk Yooreel, that mimics European name structure. These names have remained in use until the present day, even though Balbak's Noongar descendants do not pronounce her name as Balbuk and usually avoid the other names.

Prior to colonization, Balbak's traditional country (*boodja*) including the current city centre of *Boorlo,* was a biodiverse landscape of rich food resources and many wetlands (Seddon 1972). The new *Hypocalymma* species was probably common there. As an adult, Balbak proudly wielded her superior, traditional knowledge, powers and social status in a setting where most of the Noongar lived in subjugation, fear and poverty. She actively resisted the usurpation of her country by the colonists and asserted her traditional ownership until the very end of her life (Pickering 2017; Ryan *et al.* 2019).

In her later years Balbak lived at Maamba Aboriginal Reserve, which was close to the Alison Baird Reserve in Kenwick, where H. balbakiae co-occurs with H. suave. At Maamba, the journalist and self-taught ethnographer Daisy Bates often interviewed Balbak and the other elderly Noongar incarcerated there, and recorded many details of the Noongar language, culture, plants and animals (Bates 1992). In 2006, the Federal Court of Australia ruled that the Noongar people held Native Title rights over the city of Perth and its surrounds. Though much of Bates' work is now considered highly inappropriate and paternalistic, it (and Balbak's information) played a part in securing the Noongar Native Title claim.

The use of the name Balbak in this paper complies with the pronunciation that is used for her name by the contemporary Noongar community and the spelling of this name, according to the orthography of the Noongar Dictionary (Whitehurst 1997) that was developed through a consensus of linguists and Noongar elders. Some examples of the pronunciation of Balbak are in the National Trust video (Pickering 2017) in which several *yorga* share their memories of the stories that their grandmothers (who were of the same generation as Balbak) told them, and her legacy. The Noongar place the emphasis in this name on the first syllable.

In forming the scientific epithet, there is a requirement for the Latin ending *iae* to be added to the epithet to indicate that the species is named after a woman. In the species epithet, *balbak* is written and pronounced according to the rules of the Noongar language and is also the correct Latin rendering of the authentic Noongar pronunciation. That is, both of the vowels of *balbak* are pronounced as the short sound 'a' (similar to the English, short sound 'u', as in hut.) Thus, *balbakiae* is pronounced in English as bul-buk-ee-ay.

Vernacular names. Balbak's White Myrtle. Noongar names for this or related species have been recorded as Koodgeed and Kudjidi in Abbott (1983) and Hansen and Horsfall (2016), where their use in traditional medicine is outlined.

Co-occurrence. Hybridisation was recorded by Strid and Keighery (2002: 543) between *H. balbakiae* (*G.J. Keighery* 13623) and *H. ericifolium* Benth. (*G.J. Keighery* 13625) at Capel Nature Reserve, with a number of hybrid plants (*G.J. Keighery* 13624) present. *Hypocalymma balbakiae* also co-occurs occasionally with *H. robustum*, which tends to flower later in the year, but one hybrid (*G.J. Keighery*

13435) between these two taxa has been collected from near Busselton.

Co-occurrence that has not resulted in hybridisation has been under study by two of us (CT and BLR) at a swamp in Kenwick, where *H. balbakiae* (*B.L. Rye & C. Tauss* CT 8105) and *H. suave* (*C. Tauss* 6838) grow somewhat intermixed in a very narrow zone, usually with *Pericalymma elliptica*, on the lower slopes of sand dunes adjacent to muddy flats. Here, *H. balbakiae* also extends into the somewhat deeper sand upslope of *H. suave* but does not grow with *H. suave* on the muddy flats. The two species have different flowering periods, although there must occasionally be an opportunity for cross-pollination to occur. *Hypocalymma suave* usually begins to flower in late June or July, reaches its peak of flowering in August and is in fruit in September or October, whereas *H. balbakiae* begins flowering later, usually reaching its peak in mid September. A fire in January 2007 destroyed the above-ground parts of *H. balbakiae*, which resprouted later in the year from a lignotuber, whereas the single-stemmed *H. suave* was killed and regenerated from seed.

Affinities. This member of the *H. angustifolium* complex is late-flowering and tends to have the longest and most curved leaves, with the v-shaped adaxial surface one of its more important diagnostic characters. It is possibly closest to the allopatric *H. uncinatum*, which it resembles in having minutely crenulate margins to the leaves and small seeds. *Hypocalymma uncinatum* is taller than *H. balbakiae* and single-stemmed and its leaves are more likely to have prominent oil glands and to be somewhat compressed.

See differences noted under *H. angustifolium* and *H. suave*.

Variation. Strid and Keighery (2002: 543) noted that 'Prostrate pink flowered populations with straight not curved leaves occur in the Jandakot area', citing a specimen from Rowley Rd (*B.J. Keighery* 760B). Re-examination of this specimen shows that it is not fully prostrate, only low-growing, and has curved leaves and pale pink flowers. Thus the distinctiveness of this population is now considered less than it was previously.

In the north of its range, *H. balbakiae* is restricted to relatively low-lying parts of swamps and other very damp locations, whereas it may occur at a greater distance from the wettest parts of swamps in the higher-rainfall zones in the south of its range. In one southern locality where *H. balbakiae* occupies the higher ground, *H. ericifolium* occupies the lower ground of a swamp and hybrids occur between these two species (see above). Northern populations all appear to have at least 30 stamens. In the south of its range *H. balbakiae* tends to have fewer stamens on average.

The widespread typical variant of *H. balbakiae* extends from near Arrowsmith River south to near the south coast and is usually 0.3–1.3 m high, commonly becoming dormant after its late flowering season and, except in good seasons, mostly having shorter internodes and leaves shorter on average than in a less common variant that extends north to Hutt River (see Figure 3A). The northern variant, which was given the phrase name subsp. Hutt River, is restricted to particularly damp habitats, such as mound springs, and is often taller, 1.3–2 m high, tending to grow throughout the year and produce long internodes and long leaves mostly 30–45 mm long. However, there are some occurrences of plants up to 2 m high (e.g. *D.G. Bright* ABC 02) further south, and some specimens have leaves up to 45 mm long in damp habitats further south too (see Figure 3A), especially near the Moore River (e.g. *S. Patrick* 1301), with no clear separation in their morphology. The fragmented distribution of such plants is likely to be associated with considerable genetic distance between the populations but low genetic variation within populations. The origin of each occurrence may have been through

completely independent response of neighbouring typical *H. balbakiae* populations to the very damp habitat, resulting in only a superficial resemblance in these isolated occurrences. Therefore it appears that subsp. Hutt River should be regarded as an ecological variant rather than as a distinct taxonomic entity and we elect not to recognise it as a new subspecies. Molecular studies could be very valuable in examining these variants and other taxonomic problems in the *H. angustifolium* complex.

Notes. An image of the contents of two loculi from a fruit of *H. balbakiae* (Figure 1D) shows on the right the typical appearance of an infertile seed (or chaff piece) with the entire testa markedly reticulate-pitted, including the abortive elaiosome. The somewhat larger, more normal-looking seed in the same image has a more whitish elaiosome with puffed-out testa cells distally but even this seed was found to lack a viable embryo. Similar-sized seeds on other specimens sometimes do contain a fully formed white embryo.

Hypocalymma jessicae Strid & Keighery, *Nord. J. Bot.* 22: 562–563 (2002). *Type*: middle and upper slopes, south-east side, East Mt Barren, Western Australia, 2 January 1983, *A. Strid* 21892 (*holo*: C *n.v.*; *iso*: B 10 0279312, G 00223370, K 000797339 & 000797340, MEL 2290296 & 2290297, MO *n.v.*, PERTH 01945130).

Shrub 0.3–1.2 m high, commonly 1.2–1.5 m wide, single-stemmed or multi-branched at the base. *Young stems* somewhat angular to terete, glabrous. *Leaves* antrorse to ± patent, mostly widely antrorse, densely arranged on young stems. *Petioles* usually clearly differentiated from the blade, 0.4–1.3 mm long, yellow-brown. *Leaf blades* straight or moderately curved, narrowly obovate to linear in outline, 5–15 mm long, 0.5–1 mm wide, 0.4–1 mm thick, concolorous, glabrous, entire; abaxial surface deeply convex, with a narrow groove along the midvein, usually with 2 main rows of oil glands on each side of midvein; adaxial surface shallowly concave or with a broader groove distally than on abaxial surface; apical point absent or rarely up to 0.2 mm long. *Peduncles* borne at 1–3(–5) crowded or moderately spaced nodes on each flowering stem, 1–2.5 mm long, mostly 2-flowered. *Bracteoles* caducous, 1.3–1.8 mm long. *Pedicels* 0.3–0.8 mm long. *Flowers* 8–10.5 mm diam. *Hypanthium* 1.3–2 mm long, 2.5–3.5 mm diam., pitted-rugose with each pit corresponding with an oil gland; free part 0.35–0.5 mm long. *Sepals* broadly or very broadly ovate, 1.1–1.6 mm long, 1.5–2.3 mm wide, entire. *Petals* 3–4 mm long, pale to bright pink, usually shed before fruit matures. *Stamens* 35–100, in 2 or 3 series, united at base for up to 0.8 mm. *Longest filaments* 4–5.5 mm long, pink. *Anthers* 0.35–0.4 mm long, yellow. *Ovary* 2-locular; summit prominently ridged across the top; ovules 1–4 per loculus, most commonly 1 or 3, erect. *Style* 3.5–5.5 mm long; base not inset; stigma with low papillae or entire, up to *c.* 0.1 mm diam. *Fruits c.* 2/3-superior, 2.5–3.75 mm long, 3–3.5 mm diam. *Seeds* 1.6–2 mm long, 0.7–1.2 mm wide, 0.8–1.3 mm thick, with a deeply reticulate-pitted, medium brown testa; inner cavity 0.9–1.2 mm long; inner protrusion 1.1–1.3 mm long.

Diagnostic features. *Young stems* glabrous, densely leafy. *Petioles* 0.4–1.3 mm long, usually clearly defined. *Leaf blades* 5–15 mm long, about as thick as wide, entire. *Peduncles* 1–2.5 mm long. *Pedicels* 0.3–0.8 mm long. *Petals* 3–4 mm long, pale to bright pink, usually shed before fruit matures. *Stamens* 35–100. *Ovary* 2-locular; ovules 1–4 per loculus. *Style* 3.5–5.5 mm long; base not inset. *Seeds* 1.6–2 mm long.

Distribution and habitat. Occurs in the Ravensthorpe Ranges and Fitzgerald River National Park, in shallow sand on rocky outcrops, the parent rock often quartzite.

Phenology and insect associations. Flowers and fruits recorded all year. A few leaf-attached scales may be present, for example black scales produced by white fly larvae on *M. Hislop* 2201.

Etymology. Named after Jessica Strid, who assisted with locating this species while in the field with her father Arne Strid.

Vernacular name. Barrens Myrtle.

Affinities. Closely related to *H. asperum* Schauer, *H. elongatum* (Strid & Keighery) Rye and *H. strictum*, but differing from all three species in its more densely clustered leaves and in being more variable in ovule number. The leaves tend to be less sharply angled in *H. jessicae* than in related species and have a better defined petiole.

Notes. Most species of sect. *Hypocalymma* have a fixed ovule number of either one or two per loculus. A further three species have three ovules per loculus. Only two species, *H. sylvestre* Strid & Keighery with 3–5 ovules and *H. longifolium* F.Muell. with 8–11 ovules per loculus, are known to have variable ovule numbers apart from *H. jessicae*.

When *H. jessicae* was described by Strid and Keighery (2002), the stamen number was given as *c.* 50 and the ovule number as one per loculus, although one of the cited specimens (*K.R. Newbey* 3122 from near Thumb Peak) actually had three ovules per loculus. Recent collections from both north-east and south-west of Thumb Peak also have consistently more than one ovule per loculus, and sometimes have 80–100 stamens per flower. They also tend to have shorter leaves.

If there were a complete difference in ovule and/or stamen numbers between the typical variant and this new variant, we would consider them to be distinct species or subspecies. Instead, we regard them as insufficiently distinctive to warrant formal treatment at this stage. Both variants exhibit some variation in ovule number. As currently delimited, *H. jessicae* has ovule numbers that are variable, even within populations, but most commonly either one or three per loculus.

a. typical variant of **Hypocalymma jessicae**

Leaf blades 7–15 mm long, 0.5–1 mm wide, 0.4–1 mm thick. *Stamens* 35–65, in 2 series. *Ovules* 1(–3) per loculus, not consistently more than 2.

Selected specimens examined. WESTERN AUSTRALIA: top of large easterly gully SE of Annie Peak, 27 Mar. 2012, *S. Barrett* 2101 (PERTH); summit area of Mt Drummond, Fitzgerald River National Park, 31 Jan. 1986, *J.M. Fox* 86/124 (CANB, MEL, PERTH); East Mt Barren, 29 Aug. 1962, *C.A. Gardner* 14040 (PERTH); West Mt Barren, Fitzgerald River National Park, 10 Nov. 2011, *D.A. Rathbone* DAR 783 (PERTH); Mt Short, 10 miles [16 km] N of Ravensthorpe, 5 Nov. 1968, *J.W. Wrigley s.n.* (CANB, PERTH).

Distribution. As given for the species, but not known from the small area where the new variant occurs.

Conservation status. This variant does not appear to be under threat. It has a range *c.* 100 km long, with most of its populations in a large national park and the remainder also having some protection by their occurrence on hillsides in the Ravensthorpe Range.

Notes. For all populations except at East Mt Barren, the only ovule number recorded so far is one per loculus. In the East Mt Barren area, ovule number varies from one to three although most specimens or flowers still have only one ovule in each loculus. Perhaps the greater variability here is due to the specimens occupying a large area, part of which may not be far from a population of either the new variant of *H. jessicae* (although not so far recorded from that area) or *H. asperum*, introducing the possibility of hybridisation as the source of ovule number variability. Alternatively, it may just be a region where variability in morphology is common as a result of plant populations occurring over a range of altitudes and microhabitats.

b. new variant of **Hypocalymma jessicae**

Leaf blades 5–8 mm long, 0.7–1 mm wide, 0.8–1 mm thick. *Stamens* (40–)55–100, in 2 or 3 series. *Ovules* 2–4 per loculus, mostly 3 per loculus.

Selected specimens examined. WESTERN AUSTRALIA: S of Thumb Peak, Fitzgerald River National Park, 5 July 2011, *S. Barrett* 2080 (PERTH); Fitzgerald River National Park, rough track between Quoin Head and Whalebone Beach, immediately S of adjacent quartzite ridge, 13 April 2001, *M. Hislop* 2201 (K, MEL, PERTH); 1.5 miles [2.4 km] S of Thumb Peak, 21 March 1970, *K.R. Newbey* 3122 (PERTH); *c.* 1.6 km ENE of mouth of Dempster Inlet on Fitzgerald Beach, Fitzgerald River National Park, 22 Sep. 2011, *C. Tauss* 6200 (PERTH).

Distribution and habitat. Occurs between Dempster Inlet and the Quoin Head area of Fitzgerald River National Park, with all localities close to the coast but protected to some degree from the salt-laden winds.

Conservation status. This geographically restricted variant is only known from an area *c.* 20 km long, but its populations are all protected by being in a large national park.

Notes. A recent collection (*C. Tauss* 5760) has more numerous ovules than previously recorded for the species, with up to four ovules per loculus, and another recent collection (*S. Barrett* 2079) has much more numerous stamens, with up to 100 per flower. A consequence of this great variability in ovule number is that *H. jessicae* appears twice in the key to members of the section presented above.

The new variant has a tendency to have shorter leaves than the typical variant, but the westernmost populations of the 1-ovulate (i.e. typical) variant also have shorter leaves than normal, so leaf characters also fail to give a reliable separation of the two variants recognised here.

Hypocalymma lateriticola Rye & Keighery, *sp. nov.*

Type: Dandaragan, Western Australia, 24 August 1948, *C.A. Gardner* 9014 (*holo*: PERTH 01059386 [sheet 1 of 3], PERTH 01059394 [sheet 2 of 3], PERTH 02108429 [sheet 3 of 3]; *iso*: K, MEL).

Hypocalymma xanthopetalum var. Dandaragan (C.A. Gardner 9014), G. Paczkowska & A.R. Chapman, *West. Austral. Fl.: Descr. Cat.* p. 388 (2000); Western Australian Herbarium, in *Florabase*, https://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Hypocalymma sp. Dandaragan (C.A. Gardner 9014), Western Australian Herbarium, in *Florabase*, https://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Shrub commonly 0.2–0.3 m high, multi-stemmed at the base from a lignotuber. *Young stems* 4-angled, glabrous, each angle with a ridge that projects widely outwards (directly out from the margin of one surface and at right angles to the adjacent surface), often forming a narrow wing. *Leaves* widely antrorse to widely retrorse on flowering stems, antrorse on vegetative stems, fairly widely spaced, sessile, ± straight (not incurved or recurved), narrowly obovate or obovate, 15–18 mm long, 3.5–10 mm wide, concolorous or discolorous, acute or obtuse, with thickened margins entire or rarely with teeth less than 0.2 mm long; abaxial surface shallowly convex to flat, dotted with numerous tiny oil glands; adaxial surface shallowly concave to flat; apical point absent. *Peduncles* borne at 2–6(–8) usually widely spaced nodes of each flowering stem, very reduced, mostly 2-flowered. *Bracteoles* persistent, 2–3.5 mm long. *Pedicels* ± absent. *Flowers* 9–11 mm diam. *Hypanthium* 1.7–2 mm long, 3.5–4 mm diam., dotted with numerous small, pustule-like oil glands, sometimes also longitudinally wrinkled; free part *c.* 0.5 mm long. *Sepals* very broadly or depressed ovate, 1.6–2.6 mm long, 3–3.5 mm wide, entire or denticulate. *Petals* 3–3.5 mm long, bright yellow, persistent. *Stamens* commonly 65–125, in 2 or 3 series, united at base for 0.25–0.4 mm. *Longest filaments* 4–5 mm long, yellow. *Anthers c.* 0.5 mm long, yellow. *Ovary* 3-locular; summit prominently 3-ridged; ovules 2 per loculus, erect. *Style* 4–5 mm long; base not inset; stigma with elongated papillae, *c.* 0.3 mm diam. (including papillae). *Fruits* not seen at maturity but immature ones up to 5 mm diam.

Diagnostic features. *Young stems* 4-angled, glabrous, each angle with a ridge that projects widely outwards. *Leaves* sessile, 15–18 mm long, 3.5–10 mm wide, usually entire. *Petals* 3–3.5 mm long, bright yellow, persistent. *Stamens* 65–125. *Anthers c.* 0.5 mm long. *Ovary* 3-locular; ovules 2 per loculus. *Style* 4–5 mm long; base not inset.

Selected specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 21 Aug. 1953, *H.F. & M. Broadbent* 1288 *p.p.* (PERTH 07733143); 10 Sep. 1979, *G.J. Keighery* 2549 (CANB, PERTH); 26 Aug. 2015, *G.J. & B.J. Keighery* 2362 (PERTH).

Distribution and habitat. Occurs near Badgingarra and Dandaragan (Figure 4), one record from grey sand with lateritic pebbles and another from lateritic soil over clay in sedgeland on the margin of a *Eucalyptus drummondii* mallee/tall shrubland upslope.

Phenology and insect associations. Flowers recorded in August and September. Narrow terminal galls are present on *G.J. Keighery* 2549.

Conservation status. Listed as Priority One under Conservation Codes for Western Australian Flora (Western Australian Herbarium 1998–), under the name *H.* sp. Dandaragan (C.A. Gardner 9014). This species is known from few collections over a range *c.* 30 km long.

Etymology. From the Latin *lateritius* (brick-red) and *-cola* (inhabitant), referring to its occurrence in lateritic soils.

Vernacular name. Dandaragan Myrtle.

Co-occurring species. A collection cited above, *H.F. & M. Broadbent* 1288, has material of both this species (now separated onto PERTH 07733143) and *H. xanthopetalum* (PERTH 01059378), suggesting that the two species were growing together. Two other species, *H. serrulatum* and *H. tetrapterum*, may slightly overlap in range, but there are no records of co-occurrence with *H. lateriticola.*

Hypocalymma angustifolium co-occurs and hybridises with *H. lateriticola* (see under *H.* × *linifolium*).

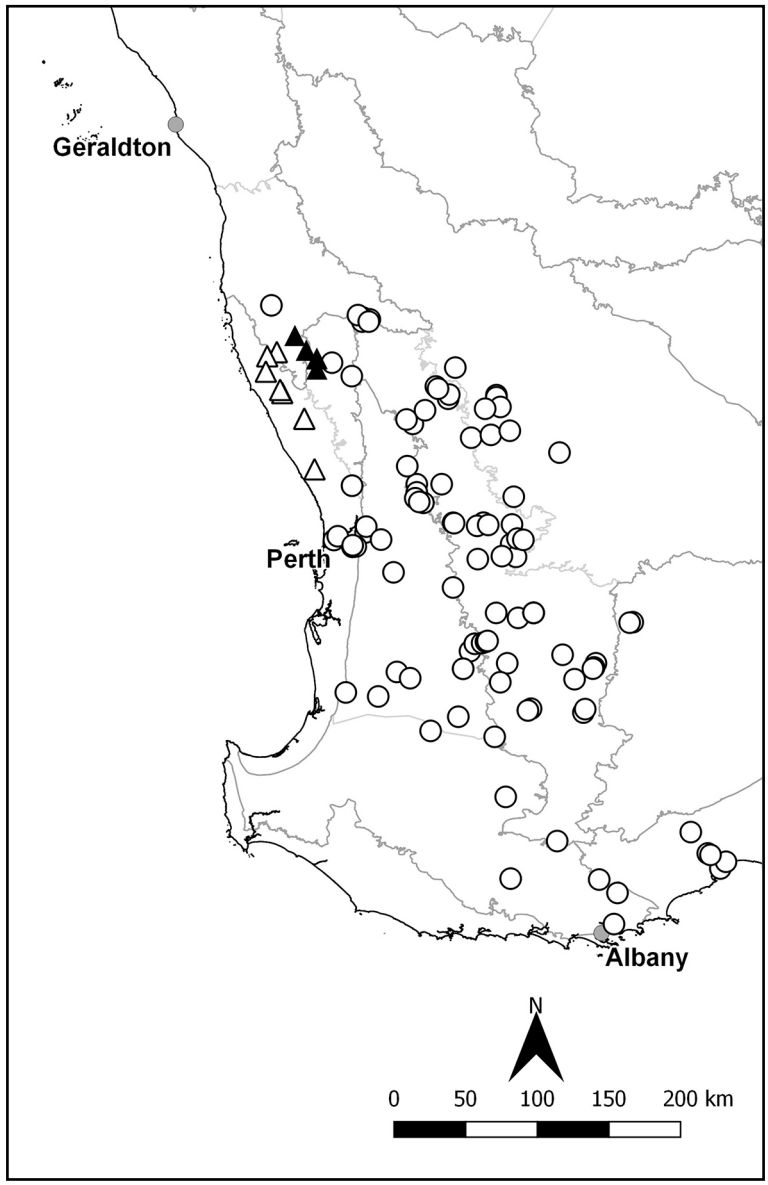

Figure 4. Distribution of *Hypocalymma quadrangulare* (△), *H. lateriticola* (▲) and *H. suave* (○).

Affinities. This species belongs to the *H. xanthopetalum* complex and is most similar to *H. quadrangulare*, which occurs closer to the coast and tends to be a taller shrub. The two taxa differ in the ridging of their young stems. In *H. lateriticola* the four marginal ridges of the stems extend out at right angles to the adjacent surface whereas *H. quadrangulare* has the ridges more rounded and scarcely protruding (with the four ridges incurved and often flattened over the surface between the angles). *Hypocalymma quadrangulare* has denticulate leaf margins with the teeth up to 0.3 mm long whereas the leaves of *H. lateriticola* are ± entire or have teeth less than 0.2 mm long.

Notes. This taxon is still quite poorly known. The type specimen *C.A. Gardner* 9014, on which both its phrase names were based, has the broadest leaves known in the *H. xanthopetalum* complex.

Three collections have entire or almost entire leaves, while the fourth (*H.F. & M. Broadbent* 1288) has minutely denticulate-ciliate margins to most leaves. In its leaf margins *H.F. & M. Broadbent* 1288 resembles *H. quadrangulare* but it is typical of *H. lateriticola* in its larger anther size and in its stem shape in transverse section.

Hypocalymma quadrangulare Rye & Keighery, *sp. nov.*

Type: west of Mimegarra Road [north of Lancelin], Western Australia [precise locality withheld for conservation reasons], 20 August 2011, *K.R. Thiele* 4190 (*holo*: PERTH 08430012; *iso*: CANB).

Hypocalymma sp. Nambung (R. Spjut & R. Smith s.n. 22/09/1992), Western Australian Herbarium, in *Florabase*, https://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Shrub commonly 0.3–0.7 m high (in cultivation recorded as 0.9 m high), multi-stemmed or multi-branched at the base. *Young stems* 4-angled, glabrous, each angle with a ridge that is incurved and often flattened over surface of stem. *Leaves* widely antrorse to widely retrorse on flowering stems, antrorse on vegetative stems, fairly widely spaced, sessile, ± straight (not incurved or recurved), narrowly obovate to obovate or ± oblong, 13–20 mm long, 3–8 mm wide, concolorous or discolorous, obtuse or acute, the margins scarious and denticulate with teeth up to *c.* 0.3 mm long; abaxial surface shallowly convex to flat, dotted with numerous tiny oil glands or the glands scarcely visible; adaxial surface shallowly concave to flat; apical point absent or rarely up to *c.* 0.25 mm long. *Peduncles* borne at 3–8 usually widely spaced nodes of each flowering stem, very reduced, mostly 2-flowered. *Bracteoles* persistent, 1.7–3 mm long. *Pedicels* ± absent. *Flowers* 8–10 mm diam. *Hypanthium* 1.7–2 mm long, 3–4 mm diam., often dotted with numerous small, prominent or pustule-like oil glands, longitudinally wrinkled; free part 0.4–0.6 mm long. *Sepals* broadly or very broadly ovate, 1.6–2.3 mm long, 2.3–3.5 mm wide, denticulate-ciliolate. *Petals* 3–3.5 mm long, yellow, persistent. *Stamens* 55–90, in 2 or 3 series, united at base for 0.3–0.7 mm. *Longest filaments* 3.5–5 mm long, yellow. *Anthers* 0.3–0.35 mm long, yellow. *Ovary* 3-locular; summit prominently 3-ridged; ovules 2 per loculus, erect. *Style* 3.5–5.5 mm long; base not inset; stigma with elongated papillae, 0.3–0.4 mm diam. (including papillae). *Fruits* *c.* 2/3-superior, 2.5–3 mm long, *c.* 4 mm diam. *Seeds* not seen at maturity, with a reticulate-pitted testa.

Diagnostic features. *Young stems* 4-angled, glabrous, each angle with a ridge that is incurved and often flattened over surface of stem. *Leaves* sessile, 13–20 mm long, 3–8 mm wide, denticulate. *Petals* 3–3.5 mm long, yellow, persistent. *Stamens* 55–90. *Anthers* 0.3–0.35 mm long. *Ovary* 3-locular; ovules 2 per loculus. *Style* 3.5–5.5 mm long; base not inset.

Selected specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 5 Sep. 1978, *J. Dodd s.n.* (PERTH); cultivated material, 20 July 2005, *B.L. Rye & M.E. Trudgen* BLR 250707 (K, PERTH); 22 Sep. 1951, *N.H. Speck s.n.* (PERTH); 22 Sep. 1992, *R. Spjut & R. Smith s.n.* (PERTH); 25 Sep. 2000, *G. Woodman* 51-1 (PERTH).

Distribution and habitat. Extends along the west coast from Nambung National Park south to Moore River State Forest (Figure 4), occurring in Spearwood sands in *Banksia* woodlands or in shrublands, sometimes with *Eucalyptus todtiana* or *Conospermum* dominant, sometimes on limestone.

Phenology and insect associations. Flowers from July to October. Fruits at least from September to November. A small gall, observed on *J. Dodd* '57' (PERTH 02353563), appears similar to those on *H. tenuatum* specimens.

Conservation status. Recently listed as Priority Three under Conservation Codes for Western Australian Flora (Western Australian Herbarium 1998–), as *Hypocalymma* sp. Nambung (R. Spjut & R. Smith s.n. 22/09/1992). This species is known from few collections over a range *c.* 100 km long. It is, or has been, in cultivation in Perth.

Etymology. From the Latin *quadri-* (four) and *angularis* (angled), referring to the quadrangular stems which distinguish it from the previously named species with yellow flowers.

Vernacular name. West Coast Myrtle.

Co-occurring species. Overlaps in range with three other *Hypocalymma* species, *H. serrulatum*, *H. tetrapterum* and *H. xanthopetalum*, but there are no records of co-occurrence. However, there is a possible hybrid with *H. angustifolium* (see under *H. xanthopetalum*).

Affinities. This species is very similar to *H. lateriticola*, which occurs further inland. Differences between the two species in shrub size, stems and leaves are described under the latter species. *Hypocalymma quadrangulare* also has smaller anthers and usually fewer stamens than *H. lateriticola*.

Notes. Specimens from the southern part of the distribution have narrower leaves on average than those occurring further north.

Hypocalymma serrulatum Strid & Keighery, *Nord. J. Bot.* 22: 550–551 (2002). *Type*: Badgingarra National Park, Western Australia, 8 April 1982, *G.J. Keighery* 4595 (*holo*: PERTH 02352737; *iso*: PERTH 01175807).

Hypocalymma sp. Badgingarra (G.J. Keighery 4595), Western Australian Herbarium, in *Florabase*, https://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Shrub 0.3–1.8 m high, width not recorded, probably single-stemmed at base. *Young stems* tending to be terete, glabrous. *Leaves* antrorse to patent or rarely some retrorse. *Petioles* absent or poorly defined, up to 0.8 mm long. *Leaf blades* linear in outline, 6–15 mm long, 0.8–1.3 mm wide, 0.5–0.8 mm thick, concolorous, serrulate or ciliolate on margins with teeth or cilia up to 0.2 mm long, acute; abaxial surface convex or deeply convex, with 1 or 2 main rows of oil glands on each side of midvein and usually 8–11 glands per row; adaxial surface shallowly to deeply concave or v-shaped, sometimes also grooved along the midvein; apical point 0.1–0.3 mm long. *Peduncles* borne at 1–6 nodes of each flowering stem, often with two clusters of flowers separated by several sterile nodes, very reduced, mostly 2-flowered. *Bracteoles* persistent, 2–3 mm long. *Pedicels* ± absent. *Flowers* 7–8 mm diam. *Hypanthium c.* 1.5 mm long, 3–4 mm wide, rugose in bud, becoming more wrinkled or smoother with small glands; free part 0.4–0.7 mm long. *Sepals* broadly or very broadly ovate, 1.5–2.2 mm long, 1.8–2.7 mm wide, entire. *Petals* 3–3.5 mm long, white or pink, persistent. *Stamens* 40–55, in 2 or 3 series, united at base for 0.3–0.4 mm. *Longest filaments* 3.5–5.5 mm long, white. *Anthers* 0.45–0.55 mm long, pale yellow. *Ovary* 3-locular; summit prominently 3-winged; ovules 1 per loculus, erect. *Style* 4–5 mm long; base inset between wing-like ridges but not into ovary; stigma with low papillae or entire, up to *c.* 0.1 mm diam. *Fruits c.* 2/3-superior, 3.5–4 mm long, 4–5 mm diam., usually 1-seeded, somewhat 3-winged on summit, shed as a diaspore (indehiscent). *Seeds* 2.1–2.4 mm long, 1–1.1 mm wide, 1.1–1.4 mm thick, with a reticulate-pitted, medium brown testa; inner cavity 1.3–1.5 mm long; inner protrusion reduced to being entirely terminal to the hilum, 0.45–0.7 mm long.

Diagnostic features. Unique in having indehiscent fruits. Other important characters: ovary summit prominently 3-winged; seeds with inner protrusion reduced.

Selected specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 18 Nov. 2010, *D. Coultas & J. Kelt* PE Opp 37 (PERTH); 9 July 2005, *G.J. & B.J. Keighery* 474 (CANB, PERTH); 30 May 1994, *S. Patrick* SP 1802 (MEL, PERTH); 9 May 1974, *B.L. Powell* 74152 (PERTH).

Distribution and habitat. Extends from near Hill River to south of Badgingarra National Park, in sand, sometimes over laterite in low-lying areas at the base of low hills, often in *Banksia* woodlands and with *Eucalyptus todtiana*.

Phenology and insect associations. Flowers recorded almost all year but mainly from March to July, with fruits recorded from August to January. Galls forming stem swellings are sometimes present as on *C. Menzel s.n.* (PERTH 02352753).

Conservation status. Listed as Priority Two under Conservation Codes for Western Australian Flora (Western Australian Herbarium 1998–). This geographically restricted species extends for only about 20 km, or possibly about 60 km based on its oldest collection (*D. Young* Y78, in May 1967), but is protected in one large national park.

Etymology. From the Latin *serrula* (a small saw) and *-atus* (likeness to), referring to the margins of the leaves.

Vernacular name. Early Myrtle.

Co-occurring species. *Hypocalymma serrulatum* (*S. Patrick* SP 1587) is recorded with *H. 'angustifolium'*. Although there is no specimen to check the exact identity of the latter species, no specimens of *H. balbakiae* or *H. suave* have been recorded from this region, whereas there are several records of true *H. angustifolium* in the region, so the identification is probably correct as it stands.

Affinities. As there are no obvious close relatives for this very distinctive species, it would be a good candidate for DNA analysis to explore its affinities.

Notes. *Hypocalymma serrulatum* is unusual in tending to flower in autumn and winter, as other species flower mostly from late winter to early summer. It is self-fertile and self-pollination can occur by the stamens closing around the stigma (see *breeding system* section under the description of sect. *Hypocalymma*). This may be a unique breeding system in the genus.

See also the earlier discussion of the unique fruit of this species in the *seed dispersal* section under the description of sect. *Hypocalymma*. The reduced protrusion on the seeds in *H. serrulatum* is to be expected since the fruits are indehiscent and hence seed dispersal does not rely on an elaiosome being present.

Hypocalymma suave Lindl. [as *suavis*], *Edwards's Bot. Reg.* 30: misc. 27 (1844). *Type citation*: 'It was raised in the garden of the Horticultural Society from Swan River seeds' [Western Australia] (*holo*: K 000821999).

Hypocalymma angustifolium var. *verrucosum* Schauer [as *verrucosa*], *Pl. Preiss.* 1: 112 (1844). *Type*: near Albany, October 1840, *L. Preiss* 336 (*syn*: LD 1355057, MEL 655028).

Shrub usually 0.5–3 m high, 0.3–3(–4) m wide, single-stemmed at base (no lignotuber), often multi-branched near base; basal stem commonly 9–15 mm diam. but sometimes more than 100 mm diam. *Young stems* 4-angled, glabrous. *Leaves* antrorse to patent, at fairly widely spaced to close nodes. *Petioles* absent or poorly defined and up to 0.8 mm long. *Leaf blades* straight or somewhat curved (incurved or recurved), linear or long-linear in outline, of fairly uniform width and thickness for most of their length, 8–30 mm long, (0.6–)0.8–1(–1.2) mm wide, 0.7–0.9 mm thick, concolorous, with entire margins, acute; abaxial surface deeply convex and narrowly grooved along midvein, usually densely dotted with oil glands, which tend to be prominent; adaxial surface fairly flat to shallowly deepening toward the centre, also narrowly grooved along midvein; apical point 0.3–0.5 mm long. *Peduncles* mostly borne at 3–20 closely to fairly widely spaced nodes of each flowering stem, very reduced, mostly 2-flowered. *Bracteoles* persistent, 1.2–2.3 mm long. *Pedicels* ± absent. *Flowers* 7–8 mm diam. *Hypanthium* 1–1.5 mm long, 2.7–3 mm diam., somewhat wrinkled-rugose and with some large oil glands; free part 0.7–0.8 mm long *Sepals* broadly to depressed ovate, sometimes auriculate, 1.3–1.4 mm long, 1.6–2.3 mm wide, pink- or purple-tinged, entire. *Petals* 2.5–3.5 mm long, white, remaining white in fruit or rarely becoming partially pink, persistent, entire. *Stamens* 20–50, in 1 or 2 series, united at base for 0.4–0.5 mm. *Longest filaments* 4–4.5 mm long, white. *Anthers* 0.4–0.45 mm long, pale yellow. *Ovary* 3-locular; summit prominently 3-ridged, turning deep pink to red; ovules 1 per loculus, erect. *Style* 4–5 mm long; base deeply inset; stigma with low papillae or entire, up to *c.* 0.1 mm diam. *Fruits* 1/2–2/3-superior, 2–3 mm long, 2.5–3 mm diam. *Seeds* straight, 1.9–2.2 mm long, 0.75–0.8 mm wide, 0.75–0.8 mm thick, with a reticulate-pitted, medium brown testa; inner cavity 1–1.3 mm long; inner protrusion 1.1–1.4 mm long. (Figure 5)

Diagnostic features. *Shrubs* 0.5–3 m high, without a lignotuber. *Young stems* 4-angled, glabrous. *Leaves* 8–30 mm long, (0.6–)0.8–1(–1.2) mm wide, not much wider than thick, entire. *Petals* 2.5–3.5 mm long, white, persistent. *Stamens* 20–50. *Ovary* 3-locular; ovules 1 per loculus. *Style* 4–5 mm long; base deeply inset. *Seeds* 1.9–2.2 mm long.

Selected specimens examined. WESTERN AUSTRALIA: 2 miles [3 km] N of Watheroo, 18 July 1962, *J.S. Beard* 1660 (PERTH); Brixton Street Wetlands, Kenwick, 4 July 2007, *K.L. Brown, G. Paczkowska & K. Clarke* KLB 659 (AD, PERTH); 0.5 km S along Brook Rd from Welshpool Rd, Wattle Grove, 27 July 1976, *A.M. George* 75 (PERTH); Bindoon Springs Rd, 2 km NE of Bindoon Dewars Pool Rd then on track SE for 3 km and then 200 m NE, Gallager Block, Julimar Conservation Park, 9 Sep. 2006, *F. Hort & J. Hort* 2854 (AD, CANB, PERTH); 200 m S along Alton Rd, Kenwick, 29 Aug. 1985, *N. Hoyle* 47 (CANB, K, PERTH); North Wagin Nature Reserve, 1 km N of Wagin, 8 Aug. 2013, *G.J. Keighery & B.J. Keighery* 2073 (PERTH); Kulin Rd Nature Reserve, SW of Kulin, 11 Sep. 2017, *G.J. & B.J. Keighery* 2616 (AD, BRI, NSW, PERTH); S of Ongerup, 7 Oct. 2008. *S. Oborne* 137 (MEL, PERTH); in a dip in Cunderdin–Minnivale Rd, 0.8 km N of Berry Rd, Minnivale Nature Reserve, S of Minnivale, 18 Oct. 2013, *B.L. Rye & R. Davis* DR 11 (PERTH); Badgin Rd, 3 km N of Doodenanning Rd, E of York, 10 Nov. 2008, *B.L. Rye, F. Hort, J. Hort* BLR 281113 (PERTH); start of Mt Matilda Walk trail, Wongan Hills, 20 June 2005, *I. Smith* 6 (PERTH); Maamba Rd near Bruce Rd, Wattle Grove, 1 Sep. 2013, *C. Tauss* 6860 (PERTH).

Distribution and habitat. Extends from Watheroo National Park south-east to near Beaufort Inlet (Figure 3B). *Hypocalymma suave* is an abundant and often dominant species in the vegetation of the Kenwick wetlands on the eastern side of the coastal plain near Perth. In the Darling Range *H. suave* has been recorded on laterite in open woodlands of *Eucalyptus wandoo*, Powderbark Wandoo, Marri

Figure 5. *Hypocalymma suave*. A – mature, single-stemmed specimen *c.* 2.7 m high at Julimar in 2006, B – in full flower at Kenwick on 21 July 2013; C – flowering branchlets with four buds or flowers per node, taken between Corrigin and Wagin on 8 August 2013. Images by Jean Hort (A), Cate Tauss (B) and Greg Keighery (C).

or other eucalypts. Inland collections are often also on laterite but they may also be from shrublands with *Allocasuarina*, often on sandplains or associated with granite.

Phenology and insect associations. Flowers mainly from late June to August. Fruits recorded from September to November. Many specimens have large flower galls and some have *Callococcus* infections, with both observed in a population at Kulin (*B.L. Rye* 290175).

Conservation status. This widespread species is not considered to be at risk.

Etymology. From the Latin *suavis* (sweet, pleasant, agreeable), described by Lindley (1844) as 'a graceful greenhouse shrub, very sweet-scented, and altogether a very nice plant'. Lindley gave the epithet as *suavis* but it should be *suave* to agree with the gender of the genus. That correction was made by Lemaire (1845).

Vernacular name. Tall White Myrtle. Noongar names for this or related species have been recorded as Koodgeed and Kudjidi (Abbott 1983; Hansen & Horsfall 2016).

Chromosome number. $n = 11$, *fide* B.L. Rye, *Austral. J. Bot.* 27: 571 (1979). Voucher: *B.L. Powell* 74009.

Co-occurring species. Although the single-stemmed *H. suave* co-occurs with the lignotuberous *H. balbakiae* at Kenwick, it is ecologically separated to some degree and has an earlier flowering period. As there is no evidence of hybridisation and intergradation between the two taxa, they appear to be fully reproductively isolated from one another (see full details under *H. balbakiae*).

Similarly, *H. suave* (*K.R. Thiele* KRT 5586) co-occurs with *H. angustifolium* (*K.R. Thiele* KRT 5581) at a site visited in September 2019 in the Darling Range without any hybridisation. Again, it flowers earlier on average than the lignotuberous *H. angustifolium*, although there seems to be a greater overlap in flowering times in this case as there were still a few buds present on *H. suave* as the first flowers were opening on *H. angustifolium*. There may also be a difference in chromosome number, with *H. angustifolium* tetraploid and *H. suave* diploid, but more chromosome number records are needed to be sure that this is a consistent difference.

Affinities. This is a member of the *H. angustifolium* complex. It differs from both *H. angustifolium* and *H. balbakiae* in being single-stemmed and easily killed by fires. It regenerates readily from seed and in long fire-free periods is likely to be a much taller plant (see Figure 5A), the maximum heights recorded for two specimens being 2.7 and 3 m respectively. *Hypocalymma uncinatum* is also single-stemmed and has been recorded up to 2.5 m high but is distinguished from *H. suave* by its more eastern area of occurrence and by its hooked leaf tips and minutely crenulate leaf margins.

Like *H. angustifolium*, *H. suave* is susceptible to a form of attack that results in large galls, a feature that suggests these species are very close as it has not been recorded elsewhere except in a hybrid of the former species. *Hypocalymma angustifolium* (see notes under that species) differs in having more flattened floral leaves that taper from a broad base to an acute apex or at least taper for much of their length, and the two appear to differ in chromosome number (see above).

Hypocalymma suave lacks the minute serrations found along the leaf margins of *H. balbakiae* and does not have the broad v-shaped groove in the adaxial surface of its leaves, which also have less tendency to be patent.

Notes. This was one of the first species of *Hypocalymma* to have been in cultivation in Europe, having been grown in London during the 1840s. It was synonymised under *H. angustifolium* by Bentham (1867) and retained as such by subsequent authors, although Strid and Keighery (2002: 543) noted variation in leaf width and suggested that more than one taxon might need to be recognised within *H. angustifolium s. lat.*

Two varieties named by Schauer (1844) may both be synonyms of *H. suave*. Certainly, one syntype of *H. angustifolium* var. *verrucosum* matches *H. suave* but the other syntype, referred to in the protologue just as ‘Drummond!’, has not been examined.

Regrowth in the Kenwick population six years after a fire included a plant with a basal stem *c.* 15 mm in diameter; however, stems can be much thicker in very mature specimens, such as in the specimen shown in Figure 5A, which has a main stem more than 100 mm in diameter.

A population of plants growing on limestone at Mt Henry on the Swan River (*M. Cambridge* 37) has been identified for now as *H. aff. suave* as it resembles *H. suave* in leaf morphology but is distinctive in its habitat. It also appears to resemble *H. suave* in being single-stemmed as it was killed in a recent hot fire and regenerated by seed.

Hypocalymma sylvestre Strid & Keighery, *Nord. J. Bot.* 22: 558 (2002) [as *sylvestris*]. *Type*: Chittering, Western Australia [precise locality withheld for conservation reasons], 10 October 1998, *T. Palmer* 29 (*holo*: PERTH 05202825; *iso*: CANB 2290298, K 000797348, MEL 2290298, NSW 538091).

Hypocalymma sp. Chittering (T. Palmer 1), in G. Paczkowska & A.R. Chapman, *West. Austral. Fl.: Descr. Cat.* p. 387 (2000); Western Australian Herbarium, in *Florabase*, https://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Shrub 0.4–0.8 m high, 0.4–1 m wide, base not recorded. *Young stems* almost 4-angled, glabrous. *Leaves* widely antrorse, densely arranged on young stems, sessile, straight or recurved, broadly ovate to cordate, mostly folded such that the leaf is v-shaped in TS but sometimes more flattened, 5–6 mm long, 4–5 mm wide, concolorous, with ciliate-laciniate margins, the largest cilia 0.25–0.45 mm long; abaxial surface with midvein thickened at base, dotted with numerous small oil glands on each side of midvein; adaxial surface folded inwards or hollowed along the midvein and with the margins recurved; apical point absent. *Peduncles* borne at 1–3 close nodes (resulting in a single dense cluster of flowers on each flowering stem), up to 1 mm long, 2-flowered. *Bracteoles* persistent, 3–4.5 mm long. *Pedicels* ± absent. *Flowers* 12–15 mm diam. *Hypanthium* 1.2–1.5 mm long, *c.* 3.5 mm diam., somewhat wrinkled-rugose and dotted with oil glands; free part 0.7–1.1 mm long. *Sepals* very broadly or depressed ovate, 2–3.5 mm long, 3–5 mm wide, entire. *Petals* 4–5 mm long, pale yellow, persistent. *Stamens* 100–200, in 2 or 3 series, united at base for *c.* 0.5 mm. *Longest filaments c.* 5 mm long, pale yellow. *Anthers* 0.5–0.65 mm long, yellow. *Ovary* 3-locular; summit prominently 3-ridged; ovules 3–5 per loculus, erect. *Style* 6–8 mm long; base not inset; stigma with low papillae or entire, 0.15–0.25 mm diam. *Fruits* 2/3–3/4-superior, 3.5–4 mm long, 5–5.5 mm diam. *Seeds* 1.8–2.3 mm long, 1–1.25 mm wide, 1.1–1.35 mm thick, with a deeply reticulate-pitted, yellow-brown testa; inner cavity 1.2–1.3 mm long; inner protrusion 1.3–1.5 mm long.

Diagnostic features. Distinguished from all other members of the genus by the combination of its high stamen numbers, of 100–200 per flower, and its 3-locular ovary with 3–5 ovules per loculus. Other important characters include: flowering stems with a single dense cluster of flowers; petals pale yellow; style 6–8 mm long, with base not inset.

Selected specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 16 Sep. 2019, *C. Bourke* CB 201901 (PERTH); 18 Aug. 2006, *V. Clarke* VTC 663 (AD, PERTH); 23 Aug. 1998, *M. Hislop* 1088 (PERTH); 8 Sep. 2011, *M. Swinburn* 03 (BRI, PERTH).

Distribution and habitat. Occurs in the Chittering area of the Darling Range, on lateritic ridges in Powderbark Wandoo woodland.

Phenology and insect associations. Flowers mainly from August to October, rarely continuing to December, with mature fruits recorded in October and November. Some specimens have scales on the leaves, for example black scales formed by white fly larvae on *V. Clarke* VTC 664, but there are no galls or *Callococcus* scales.

Conservation status. Listed by as Threatened under Conservation Codes for Western Australian Flora (Western Australian Herbarium 1998–; Department of the Environment 2022).

Etymology. From the Latin *sylvestris* (living in woods) as the species occurs in Powderbark Wandoo woodlands.

Vernacular name. Chittering Myrtle.

Co-occurring species. None recorded.

Affinities. A very distinctive species with broadly ovate to cordate leaves. It has no obvious close relatives, but is similar to members of the *H. xanthopetalum* group in having yellow flowers, high stamen numbers, more than 1 ovule per loculus and a non-inset style.

Notes. This species has more varied stamen and ovule numbers than previously recorded. Although stamen numbers were recorded in Strid and Keighery (2002: 558) as about 60 per flower, they have recently been found to be much higher, up to about 200 per flower. In fact *H. sylvestre* has the highest stamen numbers recorded in the entire tribe Chamelaucieae. Ovule numbers, previously recorded as two or three per loculus, are now recorded as a minimum of three and maximum of five per loculus.

The seeds examined for *H. sylvestre* were paler and more yellowish than those of the other species described in this paper but may not have attained their mature colour.

Hypocalymma tenuatum Strid & Keighery, *Nord. J. Bot.* 22: 545–546 (2002). *Type*: Mt Lesueur, Western Australia [precise locality withheld for conservation reasons], 24 July 1980, *E.A. Griffin* 2727 (*holo*: PERTH 02351315).

Hypocalymma sp. Lesueur (E.A. Griffin 1972) in Western Australian Herbarium, in *Florabase*, http://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Shrub 0.2–0.7 m high, commonly 0.5–0.7 m wide, with a small lignotuber. *Young stems* 4-angled, densely papillose. *Leaves* antrorse to patent, often densely arranged on young stems. *Petioles* usually well defined, 0.2–0.4 mm long. *Leaf blades* straight or recurved, linear in outline, 6–9 mm long, 0.5–1.3 mm wide, 0.4–0.7 mm thick, concolorous, entire, with star-like prominent oil glands; abaxial surface deeply convex and with a groove along the midvein, with numerous prominent oil glands, each surrounded by a circle of papillae; adaxial surface ± flat; apical point 0.2–0.4 mm long. *Peduncles* borne at 4–15 widely spaced or fairly close nodes of each flowering stem, very reduced, mostly 2-flowered. *Bracteoles* persistent, 0.6–1.5 mm long. *Pedicels* ± absent. *Flowers* 5–6 mm diam. *Hypanthium* 1–1.3 mm long, *c.* 2.5 mm diam., wrinkled-rugose or with narrow longitudinal ribs; free part very reduced, *c.* 0.2 mm long. *Sepals* depressed ovate, 0.8–1.2 mm long, 1.5–2 mm wide, entire. *Petals* 2–2.5 mm long, white or pale yellow, persistent. *Stamens* 20–25, mostly in 1 series, united at base for up to 0.6 mm. *Longest filaments* 3–3.8 mm long, white or pale yellow. *Anthers* 0.25–0.3 mm long. *Ovary* 3-locular; summit prominently 3-ridged; ovules 1 per loculus, erect. *Style* 4.5–5 mm long; base deeply inset; stigma with low papillae or entire, less than 0.1 mm diam. *Fruits c.* 2/3-superior, 2.3–2.7 mm long, 2–2.5 mm diam. *Seeds* 1.8–2 mm long, 0.75–0.85 mm wide, 0.8–0.85 mm thick, with a shallowly reticulate-pitted, medium brown testa; inner cavity *c.* 0.9 mm long; inner protrusion 1–1.2 mm long.

Diagnostic features. *Young stems* 4-angled, densely papillose. *Leaf blades* 0.5–1.3 mm wide; apical point 0.2–0.4 mm long. *Petals* 2–2.5 mm long, white or pale yellow, persistent. *Stamens* 20–25. *Ovary* 3-locular; ovules 1 per loculus. *Style* 4.5–5 mm long; base deeply inset.

Selected specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 31 Oct. 2002, *A. Crawford* ADC 278 (CANB, PERTH); 7 Nov. 2007, *A. Crawford* 1501 (K, PERTH);

24 Aug. 2002, *M. Hislop & F. Hort* MH 2725 (CANB, MEL, PERTH); 6 Oct. 1991, *S.J. Patrick* SP 865 (PERTH).

Distribution and habitat. Occurs from Lesueur National Park east to Warradarge (Figure 2A), with laterite in Wandoo woodland or associated with sandstone outcrops.

Phenology and insect associations. Flowers mainly from August to October. Mature fruits recorded from October to December. Small galls were observed on two specimens including *E.A. Griffin* 2619.

Conservation status. Listed as Priority Two under Conservation Codes for Western Australian Flora (Western Australian Herbarium 1998–).

Etymology. From the Latin *tenuis* (slender) and *-atus* (indicating something completed), referring to the thin, drawn-out branches.

Vernacular name. Lesueur Myrtle.

Co-occurring species. This species is believed to have hybridised with *H. xanthopetalum* (see hybrid description below) but is not known to co-occur with any other species of *Hypocalymma*.

Notes. The voucher specimen for the phrase name *Hypocalymma* sp. Lesueur (E.A. Griffin 1972) is missing but other specimens such as *E.A. Griffin* 1971 and *E.A. Griffin* 1973 indicate that the material must have been collected not far from Mt Lesueur on 20 July 1979.

Hypocalymma tetrapterum Turcz., *Bull. Soc. Imp. Naturalistes Moscou* 35(2): 325 (1862). *Type*: Swan River [between Moore and Murchison Rivers, Western Australia, 1850–1851], *J. Drummond* 6: 68 [as 7: 68] (*holo*: KW 001001306; *iso*: BM 001015084, G 00223374 & 00223375, K 000821998, LD 1034350, MEL 104653, NSW 456457, W 18890153077).

Illustration. W.E. Blackall & B.J. Grieve, *How Know W. Austral. Wildfl.* 3A: 90 (1980).

Shrub 0.4–1.5 m high, spreading to erect, width not recorded, with a small lignotuber. *Young stems* 4-angled to narrowly 4-winged, densely papillose at the flowering stage but sometimes becoming ± smooth in fruit, glabrous, the papillae usually minute and obtuse but up to 0.15 mm long. *Leaves* appressed to patent, mostly antrorse, rather crowded to moderately spaced. *Petioles* absent or poorly defined and less than 0.5 mm long. *Leaf blades* straight (not incurved or recurved), very narrowly or narrowly obovate to narrowly oblong, 9–20 mm long, 2–7 mm wide, concolorous, obtuse, with entire or toothed incurved margins; abaxial surface convex, with numerous prominent oil glands, each gland surrounded by a circle of papillae; adaxial surface concave; apical point absent or up to 0.2 mm long. *Peduncles* borne at up to 20 (usually 4–14) widely spaced or rather crowded nodes of each flowering stem, very reduced, mostly 2-flowered. *Bracteoles* persistent, 1.5–2 mm long. *Pedicels* ± absent. *Flowers* 7–9 mm diam. *Hypanthium* 1.1–1.3 mm long, *c.* 3 mm diam., rugose-wrinkled or with narrow longitudinal ribs; free part 0.4–0.6 mm long *Sepals* depressed ovate, 1.2–1.7 mm long, 2–3 mm wide, entire. *Petals* 3–4 mm long, white, persistent. *Stamens* 20–35, in 2 series, united at base for *c.* 0.5 mm. *Longest filaments* 3–4 mm long, white. *Anthers* 0.3–0.5 mm long, cream. *Ovary* 3-locular; summit prominently 3-ridged; ovules 1 per loculus, erect. *Style* 4–5 mm long; base deeply inset; stigma with

low papillae or entire, up to *c.* 0.1 mm diam. *Fruits c.* 2/3-superior, 2.5–3.5 mm long, 2.5–3 mm diam. *Seeds* 1.8–2.2 mm long, 0.7–0.8 mm wide, 0.75–0.8 mm thick, with a moderately deeply reticulate-pitted, medium brown testa; inner cavity 1–1.1 mm long; inner protrusion 1–1.3 mm long. (Figure 6)

Diagnostic features. *Young stems* 4-angled to narrowly 4-winged, densely papillose (when in flower). *Leaves* 9–20 mm long, 2–7 mm wide; apical point 0–0.2 mm long. *Petals* 3–4 mm long, white, persistent. *Stamens* 20–35. *Ovary* 3-locular; ovules 1 per loculus. *Style* 4–5 mm long; base deeply inset.

Selected specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 19 Sep. 2017, *A.I. Craigie* 1713-001 (PERTH); 9 Dec. 2003, *A.D. Crawford* 499 (PERTH); 10 July 2005, *G.J. & B.J. Keighery* 486 (AD, CANB, MEL, PERTH); 31 July 1991, *S.J. Patrick* 658 (CANB, PERTH).

Distribution and habitat. Occurs mainly from Eneabba to south of Badgingarra, with an isolated northern record from north of Arrowsmith River (Figure 3B), in sand or heavier soils, often in open eucalypt woodlands.

Phenology and insect associations. Flowers from June to October, especially from July to September. Mature fruits recorded from August to December. One specimen, *S.J. Patrick* 664, appeared to have remnants of two small galls, possibly similar to those on *H. tenuatum*.

Conservation status. Listed as Priority Three under Conservation Codes for Western Australian Flora (Western Australian Herbarium 1998–).

Etymology. From the Greek *tetra* (four) and *-pterus* (-winged), referring to the narrowly winged stems of the original collection.

Vernacular name. Papillose Myrtle.

Co-occurring species. Where this species co-occurs with *H. angustifolium*, hybrid swarms can be produced (see *H.* × *proliferum*).

Typification. As with other Turczaninow type specimens cited in this paper, the KW sheet is regarded here as the holotype because it was the only sheet available to Turczaninow. Strid and Keighery (2002) referred to the KW sheet as the lectotype but this lectotypification is invalid because the wording ‘here designated’ was omitted.

Notes. Drummond (1853) apparently referred to this taxon growing near Diamond Springs as ‘a white flowering and robust growing species, 5 or 6 feet high’ with leaves about as broad as in the yellow-flowered species.

Young stems are densely papillose as in *H. tenuatum* and both species also tend to have numerous prominent oil glands, each surrounded by a circle of papillae.

Figure 6. *Hypocalymma tetrapterum* showing a 4-angled, papillose stem, obovate leaves and white flowers with very pale anthers, taken by Kevin Thiele from *K.R. Thiele* 3988.

Hypocalymma xanthopetalum F.Muell., *Fragm.* 2: 29 (1860). *Type*: near Yatheroo [south of Dandaragan], Western Australia, 1859–1860, *A.F. Oldfield* 33 (*lecto*: MEL 104657, *fide* B.L. Rye, *Nuytsia* 28: 319 (2017).

Hypocalymma ciliatum Turcz., *Bull. Soc. Imp. Naturaliste Moscou* 35(2): 325 (1862). *Type*: Swan River [between Moore and Murchison Rivers, Western Australia, 1850–1851], *J. Drummond* 6: 66 [as 7: 66] (*holo*: KW 001001301; *iso*: BM 001015083, G 00223371, K 000821986, LD 1005390 & 1005454, MEL 104659, NSW 547529, W 18890153070).

Hypocalymma cuneatum Turcz. *loc. cit.* (1862). *Type*: Swan River [between Moore and Murchison Rivers, Western Australia, 1850–1851], *J. Drummond* 6: 67 [as 7: 67] (*holo*: KW 001001302; *iso*: BM 001015082, G 00223372, K 000821985, NSW 547530).

Illustration. W.E. Blackall & B.J. Grieve, *How Know W. Austral. Wildfl.* 3A: 91 (1980).

Shrub 0.1–0.8(–1.2) m high, 0.15–1.2 m wide, multi-stemmed from a lignotuber. *Young stems* ± terete, densely hairy; hairs minute or rarely a few of them *c.* 1 mm or more long. *Leaves* antrorse or patent, sessile, usually ± oblong, 12–25 mm long, 2–9 mm wide, scarcely thickened, concolorous or discolorous, with glabrous to densely ciliate recurved margins, often with a few small cilia towards the base, the cilia rarely up to *c.* 1 mm long, obtuse; abaxial surface concave or almost flat, dotted with numerous oil glands; adaxial surface tending to be convex rather than flat because of the recurved margins; apical point absent. *Peduncles* borne at up to *c.* 16 widely spaced to close nodes, but usually 2–5 moderately spaced nodes of each flowering stem, very reduced, mostly 2-flowered. *Bracteoles* persistent, 2–3 mm long, often densely ciliolate. *Pedicels* ± absent. *Flowers* 8–10 mm diam. *Hypanthium* 1.5–2 mm long, 4–5 mm diam., wrinkled-rugose, sometimes with scattered oil glands visible but glands not very prominent; free part 0.5–0.8 mm long. *Sepals* very broadly or depressed ovate, 1.5–2 mm long, 2.3–2.8 mm wide, denticulate or partially ciliolate. *Petals* 3–4 mm long, pale to intense yellow, persistent. *Stamens* 80–135, in 3 series, united at base for 0.4–0.8 mm, which is up to *c.* 1/4 of their length. *Longest filaments* 3–4 mm long, pale to bright yellow. *Anthers* 0.35–0.55 mm long, yellow. *Ovary* 3-locular; summit prominently 3-ridged; ovules 2 per loculus, erect. *Style* 4–5 mm long; base not inset; stigma with elongated papillae, 0.2–0.4 mm diam. (including papillae). *Fruits* 1/2–2/3-superior, 2.5–3.5 mm long, 3.5–4 diam. *Seeds* 1.9–2.65 mm long, 1.3–1.4 mm wide, 1.1–1.3 mm thick, with a reticulate-pitted, brown testa; inner cavity 1–1.6 mm long; inner protrusion 0.8–1 mm long.

Diagnostic features. *Young stems* ± terete, densely hairy. *Leaves* sessile, 2–9 mm wide, entire to densely ciliate. *Petals* 3–4 mm long, pale to bright yellow, persistent. *Stamens* 80–135. *Ovary* 3-locular; ovules 2 per loculus. *Style* 4–5 mm long; base not inset; stigma with elongated papillae.

Selected specimens examined. WESTERN AUSTRALIA: 21 Aug. 1953, *H.F. & M. Broadbent* 1288 *p.p.* (PERTH 01059378); 2 miles [3 km] N of Regans Ford, 19 July 1978, *R.J. Cranfield 212* (CANB, K, MEL, PERTH); 2 km onto Nebru Rd from Three Springs, 23 Sep. 1968, *M.E. Phillips* WA/68 1515 (AD, BRI, CANB, L, PERTH); 5 miles [8 km] W of Mogumber, 18 Sep. 1973, *G.L. Webster* 18637 (DAV, NSW, PERTH); S foot of Mt Lesueur, 7 Oct. 1961, *J.H. Willis s.n.* (MEL).

Distribution and habitat. Extends from Mingenew south to Muchea (Figure 3B), occurring on sandplains in low heath.

Phenology and insect associations. Flowers mainly from July to September, with mature fruits recorded from July to October. Some specimens have heavy *Callococcus* infections (e.g. *J.R. Cannon* 341) or light ones as in *M. Rose* 111.

Conservation status. This moderately widespread species has numerous populations and is not considered to be at risk.

Etymology. From the Greek *xanthos* (yellow) and *-petalus* (-petalled).

Vernacular name. Yellow Myrtle.

Chromosome number. $n = 11$, *fide* B.L. Rye, *Austral. J. Bot.* 27: 571 (1979). Voucher: *B.L. Powell* 74005.

Co-occurring species. Natural hybrids with *H. tenuatum* have been reported from Mt Lesueur National Park (see hybrid below) and *H. xanthopetalum* probably co-occurs with other species such as *H. angustifolium* (see under that species).

A recently collected specimen (*B. Ellery* BE 705) is reported to be a hybrid between *H. angustifolium* and '*H. xanthopetalum*' at a locality where it was found among the two parent species; however, the parent species were not collected so which precise member of the *H. xanthopetlum* complex was present is unclear. The hybrid looks similar to *H.* × *linifolium* except that it has much more numerous stamens and could be a hybrid with *H. quadrangulare*.

Notes. The circumscription of *H. xanthopetalum* was reduced when Strid and Keighery (2002) removed the narrowest-leaved specimens from *H. xanthopetalum s. lat.* and described them as *H. gardneri* Strid & Keighery. *Hypocalymma gardneri* is distinguished by its more spindly habit and by its narrow leaves (usually 0.4–1.5 mm wide), although there is no clear distinction in leaf width between it and some narrow-leaved specimens still placed in *H. xanthopetalum*. The *H. xanthopetalum* complex appears to show continuous variation in leaf width, with much variation in leaf width often present on individual plants. For example, *T.E. Aplin & R. Coveny* 3132 has leaves 2–5 mm wide, some of its stems with all leaves broad and others with all leaves narrow or with narrow leaves at the base and broader leaves above. This problem in distinguishing *H. gardneri* could be partly caused by seasonal and other factors affecting leaf width or by the occurrence of hybridisation. The description given here for *H. xanthopetalum* applies to the broad- or moderately broad-leaved specimens primarily.

A further reduction to the circumscription of *H. xanthopetalum* occurred by the placement of all specimens with glabrous stems under phrase names, which are treated here as *H. quadrangulare* and *H. lateriticola*. Even so, *H. xanthopetalum* remains extremely variable, and warrants further study of its variants. Currently there is little mature fruiting material available.

Descriptions of hybrids

Hypocalymma tenuatum × H. xanthopetalum

Hypocalymma sp. Gairdner Range (C.A. Gardner 9091), Western Australian Herbarium, in *Florabase*, https://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Shrub c. 0.5 m high, width and base not recorded. *Leaves* appressed to patent, usually antrorse. *Young stems* 4-angled to almost terete, minutely hairy. *Petioles* 0.3–0.6 mm long. *Leaf blades* ± narrowly elliptic to linear, 7–12 mm long, 1.2–2 mm wide, not thickened but margins gently incurved, concolorous, minutely denticulate on the margins, acute; abaxial surface convex and with a narrow groove along the midvein, dotted with numerous oil glands; adaxial surface concave; apical point 0.25–0.3 mm long. *Peduncles* usually borne at 3–8 somewhat spaced to close nodes of each flowering stem, very reduced, mostly 2-flowered. *Bracteoles* persistent, 1–1.5 mm long. *Pedicels* ± absent. *Flowers* 6–7 mm diam. *Hypanthium* 1.2–1.4 mm long, *c.* 3 mm diam., irregularly wrinkled and with some narrow longitudinal ribs; free part 0.3–0.4 mm long *Sepals* depressed ovate, 1–1.3 mm long, 2–2.3 mm wide, entire. *Petals* 2–2.5 mm long, yellow, persistent. *Stamens c.* 30, in 2 series, united at base for *c.* 0.3 mm. *Longest filaments c.* 3 mm long. *Anthers c.* 0.4 mm long. *Ovary* 3-locular; ovules 1 per loculus, erect. *Style c.* 3.5 mm long; base slightly inset; stigma with low to elongated papillae, *c.* 0.15 mm diam. (including papillae). *Fruits* unknown.

Diagnostic features. *Young stems* 4-angled to almost terete, minutely hairy. *Petioles* 0.3–0.6 mm long. *Leaf blades* ± flat, 7–12 mm long, 1.2–2 mm wide. *Petals* 2–2.5 mm long, yellow. *Stamens c.* 30. *Ovary* 3-locular; ovules 1 per loculus. *Style c.* 3.5 mm long; base slightly inset.

Specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons], 25 Aug. 1948, *C.A. Gardner* 9091 (PERTH, 2 sheets); 21 Aug. 1949, *C.A. Gardner* 9363 (CANB, PERTH).

Distribution and habitat. Recorded from Lesueur National Park (Figure 2B), on stony slopes.

Phenology and insect associations. Flowers recorded in August and September. No galls were observed on the few available collections.

Conservation status. This hybrid does not satisfy the requirements established by Thiele and Parker (2014) for listing with conservation priority. Previously it was listed as Priority Two (Smith & Jones 2018) as *H.* sp. Gairdner Range (C.A. Gardner 9091) but it will be delisted (Tanya Llorens pers. comm.).

Notes. This taxon is very poorly known. It was apparently collected twice by Charles Gardner from the same or almost the same locality, possibly even from the same plant, on Mount Lesueur in 1948 and 1949 respectively.

Two possible parent species, *H. tenuatum* Strid & Keighery and *H. xanthopetalum*, are recorded from the vicinity, and it is clear that the two Gardner specimens are intermediate in morphology between the putative parents in most characters but resemble each parent in at least two characters (Table 2). It is therefore concluded that *H.* sp. Gairdner Range (C.A. Gardner 9091) is the hybrid *H. tenuatum* × *H. xanthopetalum*. As the Gardner collections were made in what is now a national park, the hybrid may still be present in very small numbers. If not, the potential for it to reappear through cross-pollination between the parent species is still present.

Table 2. Comparison of three *Hypocalymma* taxa from Lesueur National Park.

Taxon	H. tenuatum	H. tenuatum × H. xanthopetalum	H. xanthopetalum
Flowering nodes / stem	4–15	3–8	2–5
Stem shape	4-angled	4-angled to terete	terete
surface	densely papillose	minutely hairy	hairy
Petiole length	0.2–0.4 mm	0.2–0.6 mm	absent
Leaf blade length	6–9 mm	7–12 mm	12–16 mm
width	0.5–1.3 mm	1.2–2 mm	2–5 mm
thickness	0.4–0.7 mm	scarcely thickened	scarcely thickened
mucro length	0.2–0.4 mm	0.25–0.3 mm	absent
Bracteole length	0.6–1.5 mm	1.5–2 mm	2–2.5 mm
Flower diameter	5–6 mm	6–7 mm	8–10 mm
Sepal length	0.8–1.2 mm	1–1.3 mm	1.5–2 mm
Petal length	2–2.5 mm	2–2.5 mm	3–3.5 mm
colour	white or pale yellow	yellow	yellow
Stamen number	20–25	*c.* 30	*c.* 80–135
filament length	3–3.8 mm	*c.* 3 mm	3–4 mm
anther length	0.25–0.3 mm	0.25–0.3 mm	*c.* 0.5 mm
Ovules per loculus	1	1	2
Style base	deeply inset	slightly inset	not inset

Hypocalymma × linifolium Turcz., *hybrid stat. nov.*

Hypocalymma linifolium Turcz., *Bull. Soc. Imp. Naturalistes Moscou* 35(2): 325 (1862). *Type*: Swan River [between Dandaragan and lower Murchison River, Western Australia, 1850–1851], *J. Drummond* 6: 65 [as 7: 65]; (*holo*: KW 001001303; *iso*: BM 001015085, E 00394754, G 00223369, K 000821997, LD 1034286 & 1035774, MEL 104602 (left piece only), NSW 456458, W 18890153069).

Illustration: W.E. Blackall & B.J. Grieve, *How Know W. Austral. Wildfl.* 3A: 90 (1980).

Shrub 0.3–0.6 m high, commonly 0.2–0.3 m wide, multi-stemmed at the base from a small lignotuber. *Young stems* 4-angled, glabrous, each angle with a ridge that projects at right angles to the adjacent surface. *Leaves* antrorse or patent, ± sessile, ± flat, narrowly ovate to very narrowly obovate or almost linear, 12–20 mm long, 2–4 mm wide, concolorous, acute, entire or denticulate; abaxial surface convex, with a groove along the midvein, dotted with numerous oil glands; adaxial surface concave; apical point 0.25–0.4 mm long. *Peduncles* borne at 5–15 widely spaced nodes of each flowering stem, very reduced, mostly 2-flowered. *Bracteoles* persistent, *c.* 2 mm long. *Pedicels* ± absent. *Flowers* 6–8 mm diam. *Hypanthium* 1–1.3 mm long, 2.5–3 mm diam., wrinkled-rugose and with some oil glands; free part *c.* 0.5 mm long. *Sepals* depressed ovate, 1.3–1.6 mm long, 2.5–2.8 mm wide, entire or denticulate. *Petals* 2.5–3 mm long, pale yellow, persistent. *Stamens* usually 20–35 in 2 series, united at base for *c.* 0.25 mm. *Longest filaments* 2.75–3 mm long. *Anthers* 0.4–0.45 mm long. *Ovary* 3-locular, prominently 3-ridged on summit; ovules 1 per loculus, erect. *Style* 3–3.5 mm long; base slightly inset or not inset; stigma with low papillae or entire, up to *c.* 0.1 mm diam. *Fruits c.* 2/3-superior, 2.5–3 mm long, *c.* 3 mm wide. *Seeds* (possibly not fully mature) *c.* 2.1 mm long, *c.* 1 mm wide, *c.* 1.1 mm thick, with a reticulate-pitted, medium brown testa; inner cavity *c.* 1.3 mm long; inner protrusion *c.* 1.5 mm long.

Diagnostic features. *Young stems* glabrous. *Leaf blades* 12–20 mm long, 2–4 mm wide, not very thick. *Petals* pale yellow. *Ovary* 3-locular; ovules 1 per loculus. *Style* base not or slightly inset.

Selected specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 27 Sep. 1932, *W.E. Blackall* 2903 (PERTH); 26 Aug. 2015, *G.J. & B.J. Keighery* 2359 (AD, PERTH); Aug. 2015, *G.J. & B.J. Keighery* 2363 (CANB, PERTH); 23 Aug. 1968, *K.R. Newbey* 2784 (PERTH).

Distribution and habitat. Recorded from south of Badgingarra and north of Dandaragan (Figure 2A). Recorded in sand or in clayey soils associated with damp habitats, at one site with *Eucalyptus drummondii* trees over low heath.

Phenology and insect associations. Flowers and fruits recorded in August and September. Small galls similar to those on *H. quadrangulare* and *H. tenuatum* are present on *G.J. & B.J. Keighery* 2363.

Conservation status. Listed as Priority One under Conservation Codes for Western Australian Flora (Western Australian Herbarium 1998–) as *H. linifolium*. This hybrid appears to satisfy the requirements for this priority because of its long history of collection, its capacity to reproduce itself, and its occurrence in several populations with few or no specimens of the parent species present.

Etymology. From the Latin *linum* (flax, thread) and *-folius* (-leaved).

Typification. Strid and Keighery (2002) referred to the KW sheet as the lectotype but this lectotypification

is not valid because the wording 'here designated' was omitted.

Notes. *Hypocalymma linifolium* Turcz. was reinstated in Rye (2017), where the possibility of its being a hybrid was raised. It has now been collected south of Badgingarra at a locality where it co-occurs with both parent species, *H. angustifolium* and *H. lateriticola*, although the majority of plants present are of the hybrid; a comparison of the three taxa at this locality is given in Table 3. *Hypocalymma* × *linifolium* has also been collected where one or both parent species were absent.

Hypocalymma × proliferum Keighery & Rye, *hybrid nov.*

Type: south of Cataby [precise locality withheld for conservation reasons], Western Australia, 28 August 1982, *G.J. Keighery* 5151 (*holo*: PERTH 01059432; *iso*: CANB 364603, K, MEL 0247681).

Hypocalymma sp. Cataby (G.J. Keighery 5151), in G. Paczkowska & A.R. Chapman, *West. Austral. Fl.: Descr. Cat.* p. 387 (2000); Western Australian Herbarium, in *Florabase,* https://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Shrub commonly 0.5–1 m high, probably up to 1.6 m high, up to 1 m across, with a lignotuber. *Young stems* 4-angled, glabrous. *Leaves* antrorse or patent, ± sessile, very narrowly ovate or rarely narrowly obovate, 13–23 mm long, 1.8–6 mm wide, concolorous, with entire margins, acute or rarely obtuse; abaxial surface convex, with numerous prominent oil glands, each gland surrounded by a circle of papillae; adaxial surface concave; apical point absent or up to 0.2 mm long. *Peduncles* usually borne at 4–22 widely spaced nodes of each flowering stem, very reduced, mostly 2-flowered. *Bracteoles* persistent, 1.3–2 mm long. *Pedicels* ± absent. *Flowers* 7–8.5 mm diam. *Hypanthium* 1.1–2 mm long, *c.* 3 mm diam., wrinkled-rugose and with oil glands; free part 0.7–0.8 mm long. *Sepals* depressed ovate, sometimes auriculate, 1.3–1.5 mm long, 2.3–2.5 mm wide, entire. *Petals* 2.5–3 mm long, white, persistent. *Stamens* 22–35, in 2 series, united at base for *c.* 0.5 mm. *Longest filaments* 3–3.5 mm long. *Anthers* 0.3–0.5 mm long. *Ovary* 3-locular, prominently ridged on summit; ovules 1 per loculus, erect. *Style* 4–4.5 mm long; base deeply inset; stigma with low papillae or entire, up to *c.* 0.1 diam. *Fruits* unknown.

Diagnostic features. *Shrub* probably up to 1.6 m high. *Young stems* 4-angled, glabrous. *Leaves* 13–23 mm long, 1.8–6 mm wide, entire. *Petals* 2.5–3 mm long, white, persistent. *Stamens* 22–35. *Ovary* 3-locular; ovules 1 per loculus. *Style* 4–4.5 mm long; base deeply inset.

Selected specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 16 Aug. 1973, *T.G. Hartley* 13930 (CANB, PERTH); 1 Aug. 1991, *S.J. Patrick* 662 (CANB, PERTH); 5 Sep. 2010, *K.R. Thiele* 3990 (PERTH).

Distribution and habitat. Occurs along the margins of watercourses in the Cataby and Mullering Brook areas (Figure 2B).

Phenology and insect associations. Flowers from June to October, especially from July to September. At least one specimen (*S.J. Patrick* 664 a) has *Callococcus* scales and another (*G.J. Keighery* 5151) has large flower galls.

Etymology. From the Latin *prolifer* (proliferating), referring to the frequent production of hybrids

Table 3. Comparison of *Hypocalymma* × *linifolium* with parent taxa at a locality south of Badgingarra.

Taxon and voucher	**H. angustifolium** *G.J. & B.J. Keighery* 2364	**H. × linifolium** *G.J. & B.J. Keighery* 2363	**H. lateriticola** *G.J. & B.J. Keighery* 2362
Position in landscape	low	intermediate	high
Flowering nodes / stem	8–16	5–15	2–6
Leaf length	12–15 mm	12–20 mm	15–23 mm
width	1–1.7 mm	2–2.8 mm	4–6 mm
apex shape	acute	acute	obtuse or acute
mucro length	0.25–0.4 mm	0.25–0.4 mm	0–0.25 mm
Bracteole length	1.2–1.5	*c.* 2 mm	2–3.5 mm
Flower diameter	6–7.5 mm	6–8 mm	*c.* 9 mm
Petal length	2.3–3.2 mm	2.5–3 mm	3–4 mm
colour	white or pink	pale yellow	yellow
Stamen number	*c.* 21	19–24	63–97
filament length	2.3–4 mm	2.75–3 mm	3–5.5 mm
anther length	0.25–0.3 mm	0.4–0.45 mm	*c.* 0.5 mm
Ovules per loculus	1	1	2
Style length	3.5–5 mm	3–3.5 mm	*c.* 5 mm
base	deeply inset	not or scarcely inset	not inset

and backcrosses.

Conservation status. This hybrid has been recognised for some time (see below) and was listed as Priority One (Western Australian Herbarium 1998–) as *H.* sp. Cataby (G.J. Keighery 5151). It satisfies at least two of the requirements for listing with conservation priority (see Thiele & Parker 2014). The only question is whether it is self-perpetuating or requires the presence of the parent species. Although no mature fruits have been found on the herbarium specimens, the hybrid is apparently fertile since back-crosses appear to be present and it may be more common than the parent species.

Notes. In 1990 Arne Strid labelled the PERTH sheet of *T.G. Hartley* 13930 as a probable hybrid between *H. angustifolium* and *H. tetrapterum*, and Strid and Keighery (2002: 543) noted that these two taxa possibly hybridised where their ranges overlapped. The occurrence of such hybrids has since been confirmed in the field by several collectors.

On a small tributary of Mullering Brook, specimens were collected in early September 2010 of the parent species, *H. tetrapterum* with obtuse, obovate leaves 6–7 mm wide (*K.R. Thiele* 3988), *H. angustifolium* with pointed, linear leaves *c.* 1 mm wide (*K.R. Thiele* 3991), and two representatives of a hybrid swarm, one with obtuse, narrowly obovate leaves 5–6 mm wide (*K.R. Thiele* 3989) and the other with more pointed, very narrowly ovate leaves 2–3 mm wide (*K.R. Thiele* 3990); Table 4 presents data from these four specimens.

Acknowledgements

Table 4. Comparison of two *Hypocalymma* hybrid specimens with specimens of the parent species collected in 2010 from the Muellering Brook area.

Taxon and voucher	**H. angustifolium** *K.R. Thiele* 3991	**H. × proliferum** *K.R. Thiele* 3990	**H. × proliferum** *K.R. Thiele* 3989	**H. tetrapterum** *K.R. Thiele* 3988
Position in landscape	high	intermediate	intermediate	low
Flowering nodes / stem	2–11	3–22	3–14	8–20
node separation	widely spaced	widely spaced	widely spaced	rather crowded
Stem 'wings'	absent	narrow	absent	narrow
Leaf shape	linear	very narrowly ovate	narrowly obovate	obovate
length	16–21 mm	20–23 mm	17–20 mm	12–15 mm
width	0.9–1.1 mm	2–3 mm	5–6 mm	6–7 mm
apex	acute to acuminate	acute	obtuse	obtuse
mucro length	0.3–0.6 mm	*c.* 0.2 mm	absent	absent
oil glands	small	small	large	large
Petal length	*c.* 2 mm	*c.* 2.5 mm	*c.* 3 mm	*c.* 3 mm
Stamen number	20–21	*c.* 35	*c.* 33	*c.* 30–35
filament length	*c.* 2.3 mm	*c.* 3 mm	*c.* 3 mm	*c.* 3 mm
anther length	*c.* 0.3 mm	*c.* 0.3 mm	*c.* 0.3 mm	0.45–0.5 mm

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References

Abbott, I. (1983). Aboriginal names for plant species in south-western Australia. *Forests Department of Western Australia Technical Paper* No. 5.

Bates, D. (1992). Edited by P.J. Bridge. *Aboriginal Perth (Bibbulmun Biographies and Legends)*. (Hesperian Press: Bayswater.)

Bentham, G. (1867). *Flora Australiensis*. Vol. 3. (Lovell Reeve & Co.: London.)

Brown, E.M., Burbidge, A.H., Dell, J., Edinger, D., Hopper, S.D. & Wills, R.T. (1997). *Pollination in Western Australia: a Database of Animals visiting Flowers*. Handbook No. 15. (Western Australian Naturalists' Club: Perth.)

Department of the Environment (2022). *Hypocalymma angustifolium* subsp. Hutt River (S. Patrick 2982) in Species Profile and Threats Database. Department of the Environment, Canberra. Available from: https://www.environment.gov.au/sprat. [accessed 23 August 2022].

Dodd, J., Heddle, E.M., Pate, J.S. & Dixon, K.W. (1984). Rooting patterns of sandplain plants and their functional significance. *In*: Pate, J.S & Beard, J.S. (eds) *Kwongan – plant life of the sandplain*. pp. 146–177. (University of Western Australia Press: Nedlands, Western Australia.)

Drummond, J. (1853). On the botany of the north western district of West Australia. *Hooker's Journal of Botany and Kew Miscellany* 5: 115–122.

George, A.S. (2009). *Australian Botanist's Companion*. (Four Gables Press: Kardinya, Western Australia.)

Hansen, V. & Horsfall, J. (2016). *Noongar Bush Medicine Plants: Medicinal Plants of the south-west of Western Australia*. (UWA Publishing: Crawley, Western Australia.)

Hopper, S.D. & Brown, A.B. (2001). Contributions to Western Australian orchidology: 1. History of early collections, taxonomic concepts and key to genera. *Nuytsia* 14: 1–26.

Houston, T.F. (2000). *Native Bees on Wildflowers in Western Australia*. Special Publication No. 2. (Western Australian Insect Study Society Inc.: Perth.)

Lamont, B. (1985). The significance of flower colour change in eight co-occurring shrub species. *Botanical Journal of the Linnean Society* 90: 145–155.

Lemaire, C.A. (1845). (ed.) *L'Horticulture Universel: Journal General des Jardiniers et Amateurs* Vol. 6. (H. Cousin: France.)

Lindley, J. (1844). Miscellaneous matter of the Botanical Register: 32. *Hypocalymma suavis*. *Edwards's Botanical Register* 30: misc. p. 27.

Pickering, G. (2017). *Fanny Balbuk Yooreel. Realising a Perth Resistance Fighter*. (National Trust: Western Australia.) https://www.youtube.com/watch?v=bpnZYm2-_PY

Ryan, J.C., Brady, D. & Kueh, C. (2019). Where Fanny Balbuk walked: re-imagining Perth's wetlands. *Media/Culture Journal* 18(6) https://doi.org/10.5204/mcj.1038 [accessed 23 August 2022].

Rye, B.L. (2010). A lectotype and new combination in *Hypocalymma* (Myrtaceae: Chamelaucieae). *Nuytsia* 20: 323–326.

Rye, B.L. (2013). A revision of the south-western Australian genus *Astartea* (Myrtaceae: Chamelaucieae). *Nuytsia* 23: 189–269.

Rye, B.L. (2017). Reinstatement of *Hypocalymma linifolium* and lectotypification of *H. xanthopetalum* (Myrtaceae: Chamelaucieae). *Nuytsia* 28: 317–320.

Rye, B.L., Keighery, G.J. & Barrett, M.D. (2022). Description of a new south-western Australian plant group, *Hypocalymma* sect. *Grandiflora* (Myrtaceae: Chamelaucieae: Astarteinae). *Nuytsia* 33: 233–249.

Rye, B.L., Wilson, P.G. & Keighery, G.J. (2013). A revision of the species of *Hypocalymma* (Myrtaceae: Chamelaucieae) with smooth or colliculate seeds. *Nuytsia* 23: 283–312.

Schauer, J.C. (1844). Myrtaceae RBr. *In*: Lehmann, J.G.C. (ed.) *Plantae Preissianae*. Vol. 1, pp. 96–158. (Meisner: Hamburg.)

Seddon, G. (1972). *Sense of Place*. (University of Western Australia Press: Perth.)

Sharr, F.A. (2021). *Western Australian Plant Names and their Meanings*. Fourth edition by A.S. George. (Four Gables Press, Kardinya, Western Australia.)

Slater, J.A. (1975). On the biology and zoogeography of some Lygaeidae (Hemiptera: Heteroptera) with special reference to the southwest fauna. *Journal of the Australian Entomological Society* 14: 47–64.

Slater, J.A. (1976). The biology, distribution and taxonomy of some Lygaeidae of southwest Australia (Hemiptera: Heteroptera). *Journal of the Australian Entomological Society* 15: 129–151.

Strid, A. & Keighery, G.J. (2002). A taxonomic review of the genus *Hypocalymma*. *Nordic Journal of Botany* 22: 535–572.

Thiele, K.R. & Parker, C.M. (2014). Treatment of hybrid taxa on the census of Western Australian plants. *Nuytsia* 24: 311–314.

Western Australian Herbarium (1998–). *Florabase—the Western Australian Flora*. Department of Biodiversity, Conservation and Attractions. https://florabase.dpaw.wa.gov.au/ [accessed 23 August 2022].

Whitehurst, R. (1997). *Noongar Dictionary*. Second Edn. (Noongar Language and Culture Centre (Aboriginal Corporation): East Perth, Western Australia.)