

***Eucalyptus sweetmaniana* subsp. *noongaring*, a new four-winged mallee (*E. series Tetrapterae*: Myrtaceae) endemic to *boylya* (granite outcrops) of the *kwongkan* east of Esperance, Western Australia**

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SHORT COMMUNICATION

Eucalyptus sweetmaniana Hopper & McQuoid is a sprawling, lignotuberous mallee with relatively small buds, flowers and fruits confined to coastal granitic slopes of *Yorlining* (Mt Arid) in Cape Arid National Park. This species was originally recognised as distinct from *E. tetraptera* Turcz. in part due to it having larger leaves ranging from 17–26.5 cm long (vs 10–17 cm long in the latter) (Hopper & McQuoid 2009). However, while a 2010 collection from east of Scadden currently labelled as *E. sweetmaniana* (D. Nicolle & M. French DN 5482, PERTH 08299161) has large leaves to 26 cm long, this specimen appears more similar to *E. tetraptera* based on habit, fruit, bud and flower size (Table 1). Leaf measurements do not distinguish taxa consistently in this species complex as previously reported.

Here, a new subspecies is described of *E. sweetmaniana*, encountered in the course of extensive studies of the biodiversity, landscapes and cultural history of the Cape Arid National Park region over the past four decades (Brooker & Hopper 1993; Hopper *et al.* 1997, 2021; Mitchell *et al.* 2013). Although seen and collected by botanists since 1960, the new taxon named herein as *E. sweetmaniana* subsp. *noongaring* Hopper was not recognised as new and distinct from typical *E. tetraptera* or *E. sweetmaniana* until it was encountered in full flower at localities in or near Cape Arid National Park in October 2014 in company with colleagues participating on a Gabbie Kylie Foundation Field School (Mitchell *et al.* 2013).

To affirm the status of the new subspecies, individuals in a number of nearby populations of *E. tetraptera*, as well as the type location of *E. sweetmaniana*, were examined critically, photographed and illustrated in field notebooks. Specimens in the Western Australian Herbarium and living plants in Kings Park and Botanic Garden were investigated to undertake comparative observations and morphometrics (Table 1). These investigations revealed consistent morphological and ecological differences from other taxa in *E. series Tetrapterae* Blakely (see Brooker 2000), and established that *E. sweetmaniana* was a near relative, but the characters revealed were sufficient to warrant the following recognition of *E. sweetmaniana* subsp. *noongaring* as new. *Eucalyptus sweetmaniana* subsp. *noongaring* is confirmed as distinct from the typical subspecies based on differences such as an upright habit (vs prostrate), having a wider operculum in mature buds (14–18 mm wide vs 12.1–14 mm wide), generally longer stamens (9–12 mm long vs 8–10 mm long), and a ribbed hypanthium surface between wings vs a smooth (rarely slightly ribbed apically) hypanthium surface.

Eucalyptus sweetmaniana subsp. *noongaring* is distributed from Howick Hill, east of Esperance to Mt Baring. In contrast, the typical subspecies remains very rare indeed, now known only from the type population on the coastal slopes of *Yorlining*. In light of this, the conservation status of *E. sweetmaniana* subsp. *sweetmaniana* should be reassessed.

Subspecies concept. Following past modern practice (e.g. Brooker & Hopper 1991; Ellison *et al.* 2014), I define subspecies as diagnosable races with minor morphological differences, that are largely geographically isolated but may intergrade over narrow zones with at least 75% of their individuals across wild populations remaining distinguishable.

Eucalyptus sweedmaniana* subsp. *noongaring Hopper, *subsp. nov.*

Type: N of Cape Arid National Park, Western Australia [precise locality withheld for conservation reasons], 21 July 2016, *S.D. Hopper* 8696 (*holo:* PERTH 09723188 [sheet 1 of 2], PERTH 09723196 [sheet 2 of 2]; *iso:* AD, CANB, K, MEL, MO, NSW).

Erect, lignotuberous *mallee* up to 2 m high and 4 m wide; bark smooth, shiny when fresh, to dull when older, silver-grey. *Cotyledons* reniform. *Seedling leaves* broadly lanceolate to elliptical. *Adult leaves* long-lived (several years), with lamina 14–25 cm long \times 5.1–8.7 cm wide, alternate, apiculate, concolorous, green, glossy, broad-lanceolate, robust, thick; petioles thick, parallel-sided, angular, 3.4–6 cm long; venation prominent, both the midrib and intramarginal vein conspicuous, side veins parallel, reticulation dense with scattered intersectional oil glands. *Inflorescence* axillary, unbranched, 1-flowered. *Buds* sparse, red, pendulous to horizontal, 37–60 mm long; operculum flattened, pyramidal, 13–22 mm long \times 14–18 mm wide; hypanthium square in cross-section, cuboid to shortly oblong, scarcely tapering towards the base, prominently ribbed, prominently winged (wings to 6 mm wide), 24–38 mm long \times 21–35 mm wide; pedicels absent; peduncle shortly winged and downcurved. *Stamens* pink, 9–12 mm long, inflexed; staminodes present. *Style* 12–17 mm long. *Ovary* with four locules. *Fruit* sparse, 31–50 mm long \times 27–45 mm wide, prominently ribbed between the wings, usually greenish-brown, cuboid to shortly oblong, square in cross-section, prominently winged (wings to 10 mm wide); disc descending, valves 4, enclosed; pedicels absent; peduncle as wide as base of fruit, margins curved, contorted, shortly winged, often downcurved. *Seed* black, 3.5–4.5 mm long \times 2.5–3.5 mm wide \times 1.5–2.5 mm thick, strongly flanged or winged, to 47 per fruit. (Figures 1, 2; Table 1)

Characteristic features. Small erect *mallee* to 2 m tall, large-leaved with glossy green, concolorous, thick lamina 14–25 cm long \times 5.1–8.7 cm wide. Buds and flowers sparse, bright red, with winged hypanthia, prominently ribbed between the wings. Floral hypanthium 24–38 mm long \times 21–35 mm wide; fruit cuboidal, 10–50 mm long \times 27–45 mm wide, usually greenish brown, prominently ribbed between the wings. Largely endemic to *boylya* (granite outcrops and inselbergs).

Other specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 25 Oct. 1963, *T.E.H. Aplin* 2628a (PERTH 01470817); 6 Dec. 1960, *A.S. George* 2067 (PERTH 01459236; PERTH 01459260; PERTH 09720278 (carpologica)); 20 Sep. 1976, *R. Hnatiuk* 761181 (PERTH 01456520); 11 Oct. 2014, *S.D. Hopper* 8691 (CANB, MEL, PERTH 09714588); 20 July 2016, *S.D. Hopper* 8695 (AD, K, PERTH 09714561); 21 Nov. 1994, *D. Nicolle* 1097 (PERTH 06094643 [ex AD 99625320]).

Distribution. Confined to the summits and flanks of *boylya* (granite outcrops and inselbergs) found east of Esperance in the western parts of Cape Arid National Park and west into adjacent farmland (Figure 3).

Habitat. At Hawes Hill *E. sweedmaniana* subsp. *noongaring* occurred in dense heath and low *mallee* with *Eucalyptus extrica*, *E. semiglobosa*, *Agonis baxteri*, *Banksia armata*, *Melaleuca globifera*, *Gastrolobium bilobum*, *Melaleuca fulgens* subsp. *fulgens*, *Anthocercis viscosa*, *Eutaxia myrtifolia*, *Spartochloa scirpoidea*, *Lepidosperma* sp., *Acacia nigricans*, *A. subcaerulea*, *Olix phyllanthi*, *Xanthorrhoea platyphylla*, *Hakea corymbosa*, *Grevillea anethifolia* and *Platysace compressa*. The subspecies occurs in both broken granite at the foot of steep slopes and in white sand on the surrounding base of Hawes Hill. On Mt Baring, *E. sweedmaniana* subsp. *noongaring* favours the summit and high plateau in shallow soil adjacent to sheet granite and boulders, growing with *E. semiglobosa* and *E. lehmannii* in dwarf *mallee* and *kwongkan* shrubland with scattered emergent *Xanthorrhoea platyphylla* and *Exocarpos sparteus*. A population south of Bebenorin grows on white sand in *kwongkan* (note that contemporary Noongar elders



Figure 1. (A) Merningar Bardok Noongar man Harrison Rodd-Knapp at the type locality of *E. sweetmaniana* subsp. *noongaring* north of Cape Arid National Park with a plant in hand; (B) looking south down the west boundary of Cape Arid National Park to Hawes Hill. Photos by S.D. Hopper.



Figure 2. A bud, flower, fruit and leaf of *E. tetraptera* (A, top) and *E. sweetmaniana* subsp. *noongaring*, note the diagnostic smaller reproductive organs with their prominently ribbed hypanthia (A, bottom); subsp. *noongaring* *in situ* (B); dried fruits of subsp. *sweetmaniana* (C, top row) and fresh fruits of subsp. *noongaring*, illustrating the prominent ribbing (C, bottom row); seeds of subsp. *noongaring* (D); maturing buds of subsp. *sweetmaniana*, note the more prominent hypanthial wings and lack of ribbing (E, top), and subsp. *noongaring* (E, bottom); and top of fruit of subsp. *noongaring*, highlighting the prominent ribbing between the wings (F). Scale bars = 2 cm, except seed (A, E = 0.5 mm, and fruit (F = 3 mm). Voucher populations: *E. tetraptera* Wittenoom Road, E of Scadden, NE of Esperance (A, top); *E. sweetmaniana* subsp. *noongaring* Hawes Hill (bottom A, C, D, F) and Mt Baring (B); *E. sweetmaniana* subsp. *sweetmaniana* collections by Luke Sweetman from the type location in November 2012 (C, top) and type location ex cult. Kings Park & Botanic Garden (E, top). Photos S.D. Hopper.

Table 1. Comparative morphology of *E. sweetmaniana* subsp. *noongaring* and allied taxa, based on measurements of live samples plus PERTH herbarium specimens of *E. tetraptera*. Data for *E. brandiana* and *E. sweetmaniana* subsp. *sweetmaniana* are from the wild (Hopper & McQuoid 2009) and from the living and fruit collections of Kings Park & Botanic Garden. Populations and sample sizes (one of each organ per plant): *E. sweetmaniana* subsp. *noongaring* (Mt Hawes – 7 leaves, 3 buds, 3 flowers, 13 fruits (A); Mt Baring – 11 leaves, 3 buds, 2 flowers, 2 fruits); *E. sweetmaniana* subsp. *sweetmaniana* (Cape Arid National Park – 10 leaves, 4 buds, 1 flower, 11 fruits) (B); *E. tetraptera* (Wittenoom Rd E of Scadden, NE of Esperance – 4 leaves, 5 buds, 4 flowers, 5 fruits (C); S of Mt Ney – 4 leaves, 2 buds, 2 flowers, 4 fruits; N of Wittenoom Hills – 5 leaves; Hwy 1, 95 km W of Esperance – 7 leaves; herbarium specimens Stirling Range to Mt Ragged – 15 leaves); *E. brandiana* (Fitzgerald River National Park – 10 leaves, 4 buds, 2 flowers, 10 fruits) (D); Exemplar voucher specimens from a sample population of each taxon: *E. sweetmaniana* subsp. *noongaring* (A) Mt Hawes, S.D. Hopper 8691 (PERTH 09714588); *E. sweetmaniana* subsp. *sweetmaniana* (B) Cape Arid National Park, L.S.J. Sweedman 7210 (PERTH 08231265); *E. tetraptera* (C) Scadden Rd, NW of Wittenoom Rd, E of Scadden, NE of Esperance, D. Nicolle & M. French DN 5482 (PERTH 08299161); and *E. brandiana* (D) Fitzgerald River National Park, L.S.J. Sweedman 7008 (PERTH 07478488).

Character	<i>E. sweetmaniana</i> subsp. <i>noongaring</i>	<i>E. sweetmanian</i> subsp. <i>sweetmaniana</i>	<i>E. tetraptera</i>	<i>E. brandiana</i>
Habit	erect mallee to 2 m tall	sprawling to prostrate mallee to 1 m tall	erect to prostrate mallee to 5 m tall	erect mallet to 5 m tall
Canopy	covers most levels above ground	covers most levels above ground	covers most levels above ground	confined to upper stems
Mature leaf:				
lamina L (mm)	140–250	165–263	110–280	140–238
lamina W (mm)	51–87	45–67	35–84	42–62
petiole L (mm)	34–60	38–48	25–70	38–45
Mature bud:				
length (mm)	37–60	36–45	68–99	50–65
operculum length (mm)	13–22	13.8–16.7	25–44	24.4
operculum width (mm)	14–18	12.1–14	18–31	34
hypanthium length (mm)	24–38	26.9–27.6	40–65	60.7
hypanthium width (mm)	21–35	24–26	35–52	30–59
max wing width (mm)	4–6	5.7–8.2	6.4–15.7	14.1
Flower:				
hypanthium length (mm)	28–35	34	39–53	53–56
hypanthium width (mm)	23–30	28	35–50	44–51
stamen length (mm)	9–12	8–10	15–20	17–20
style length (mm)	12–17	11	13–22	17–20
max wing width (mm)	5–9	5.1	6.3–15.7	16.2–16.8
Fruit:				
length (mm)	31–50	34–38	42–58	56–68
width (mm)	27–45	30–41	46–60	48–59
max wing width (mm)	5–10	7.3–11.9	9.9–17.8	6.4–14.3
hypanthium surface between wings when fresh	ribbed	smooth, rarely slightly ribbed apically	smooth	smooth

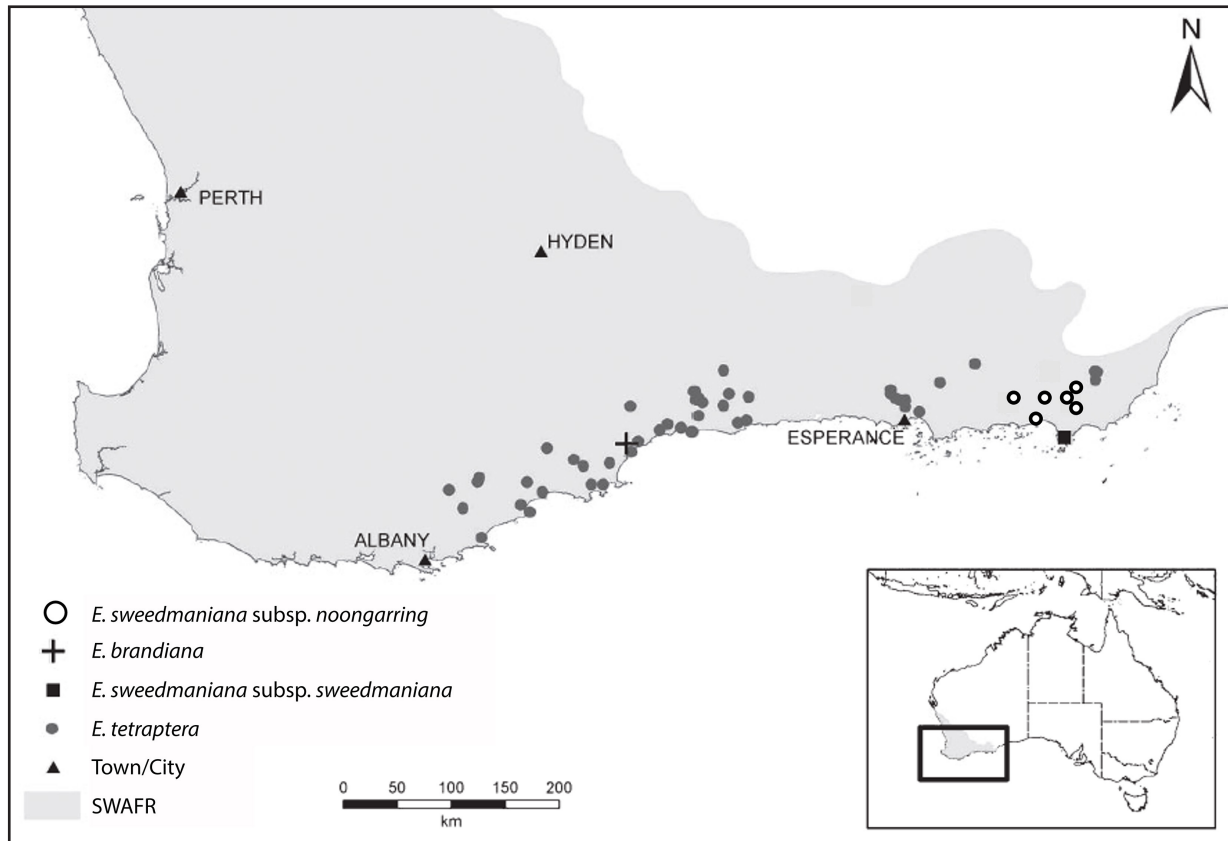


Figure 3. Map of distributions of *E. sweedmaniana* subsp. *noongaring* and related taxa based on collections in PERTH. Base map from Hopper and McQuoid (2009), with modifications. SWAFR refers to the Southwest Australian Floristic Region, *sensu* Gioia and Hopper (2017).

and linguists are followed in this preferred spelling of *kwongkan*, see Hopper 2014). At the Tagon Road type locality, on a subdued granite flatrock flanked by white sand, *E. sweedmaniana* subsp. *noongaring* occurs with *E. extrica*, *Nuytsia floribunda*, *Acacia cyclops*, *A. myrtifolia*, *Calothamnus quadrifidus*, *Banksia armata* and *Xanthorrhoea platyphylla*.

Phenology. Recording flowering in September, October, November and December.

Conservation status. To be listed as Priority Four under Conservation Codes for Western Australian Flora (Tanya Llorens pers. comm.). This subspecies is a narrow endemic, but not threatened. Although its habitat is geographically restricted, *E. sweedmaniana* subsp. *noongaring* is common where it occurs, numbering in thousands of plants for example on Mt Baring. Four of the six known populations are within Cape Arid National Park.

Etymology. Named as a noun in apposition to honour the *Noongar* Aboriginal people of south-west Australia, originally custodians of the land and carers of country in the Thomas River–Esperance region for thousands of years. They are known as the Shell People, or *Nyookuring* as recorded by the earliest white settlers at Lynburn Station on the Thomas River. These days the *Noongar* are part of the Wudjarri people or the Merningar Bardok of the Noongar nation of southwest Australia (Knapp *et al.* 2024). In 1988, linguist Carl von Brandenstein (1988) provided a detailed account of the derivation and meaning of the word ‘*Noongar*’. To Merningar Bardok Elder Lynette Knapp *Noongar* alludes to warriors (men) who have gone through two sets of law – inland and coastal (Knapp *et al.* 2024).

The suffix *-ing* or *-iny*, like *-ap* (= *-up*, for many place names) means ‘as’ (von Brandenstein 1988), implying related to, having become, concerning, having to do with, referring to, characteristic of, or symbolic for. Thus, it gives a more sophisticated nuance, indicating that the plant is a commemoration of *Noongar* people.

I favour the name as a mark of respect to the many Elders who have helped me learn about their culture over the past four decades, and in particular to those descendants of the Shell people who remain living in the Albany–Esperance district and have so generously shared their knowledge and company on joint field trips undertaken as part of the Gabbie Kylie Field School programme and subsequent trips with the Knapp family (e.g. Knapp *et al.* 2024).

Common name. Noongaring muert. The word *muert* means ‘plant, mallee scrub’, or possibly the *moort* tree (*E. platypus* – von Brandenstein 1988). *Muert* also alludes to *muerditj*, meaning ‘hard, strong, fast’. Given that *mallee* is a north-west Victorian *Wergaia* people’s word for the white mallee (*E. dumosa*), or *mallee* scrub, and the new subspecies is named to celebrate the strong *Noongar* people, the local *Noongar* word for a strong mallee seems apposite.

Affinities. *Eucalyptus sweedmaniana* subsp. *noongaring* is distinguished from *E. sweedmaniana* subsp. *sweedmaniana* in its erect mallee habit (vs sprawling to prostrate), its prominently ribbed hypanthia (vs smooth, rarely ribbed apically between the wings), its mature buds with longer, broader opercula, 13–22 mm × 14–18 mm (vs 13.8–16.7 × 12.1–14 mm) and narrower wings on the hypanthium 4–6 mm wide (vs 5.7–8.2 mm wide), and in its preference for inland granite inselbergs or *boylya* (vs near-coastal low elevation granite). It would be useful to explore population genetic relationships within and between these sister subspecies.

Notes. The *boylya* of the *kwongkan* east of Esperance continue to yield botanical novelties with intensifying survey in recent decades. *Eucalyptus sweedmaniana* subsp. *noongaring* joins more than 20 species now known to be endemic to *boylya* in the region (Hopper *et al.* 2021), including *Acacia conniana* Maslin, *A. incanearca* A.R.Chapman & Maslin, *Caladenia exstans* Hopper & A.P.Br., *Gastrolobium involutum* G.Chandler & Crisp, *Gonocarpus pycnostachyus* (F.Muell.) Orchard, *Gonocarpus scordioides* (Benth.) Orchard, *Goodenia quadrilocularis* R.Br., *Hydrocotyle perforata* A.J.Perkins, *Kennedia becxiana* (F.Muell.) F.Muell., *Myriophyllum balladoniense* Orchard, *Myriophyllum* sp. Mt Arid (L.S.J. Sweedman 6767) and *Prostanthera carrickiana* B.J.Conn.

These *boylya*, conspicuously emergent from the surrounding plains (Figure 1), are culturally significant, replete with evidence of the ceremonies, artefacts, and plant and animal husbandry of the *Noongar* Shell People. Unless the Shell People moved and cultivated *E. sweedmaniana* subsp. *noongaring* for cultural purposes from *boylya* to *boylya*, the disjunct populations of the new species would be expected to display high genetic differentiation among locations, comparable to that documented for other granite rock endemics such as *Eucalyptus caesia* (Byrne & Hopper 2008; Bezemer *et al.* 2019).

A single hybrid of *E. lehmannii* × *E. sweedmaniana* subsp. *noongaring* was collected on 1 Nov. 1989 from Mt Baring, represented by a single fruit (*G.J. Keighery s.n.*, PERTH 01643185). It must be rare, as two ascents undertaken of the inselberg, each with ample time for inspection of many of the low mallees, failed to locate this hybrid. Both parental taxa are common on the summit plateau and grow thoroughly intermixed. This hybrid, and *E. sweedmaniana* subsp. *noongaring* itself, show considerable potential for horticulture, with their small compact habit and colourful flowers attractive to birds and mammals as pollinators. Kings Park and Botanic Garden have commenced research in this arena.

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