

Reinstatement and revision of *Kayea* Wall. (Calophyllaceae) in Australia, including two new species from Queensland's Wet Tropics bioregion

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Summary

Cooper, W.E. & Zich, F.A. (2021). Reinstatement and revision of *Kayea* Wall. (Calophyllaceae) in Australia, including two new species from Queensland's Wet Tropics bioregion. *Austrobaileya* **12**: 1–13. The genus *Kayea* Wall. is taxonomically revised for Australia and comprises three species: *Kayea larnachiana* F.Muell. (syn. *Mesua larnachiana* F.Muell.), and two new species described here: *K. concinna* W.E.Cooper & Zich and *K. meridionalis* W.E.Cooper & Zich. All species are described and illustrated, with notes on habitat, distribution and a suggested conservation status. A comprehensive synonymy for the new species, listing published phrase names and a discussion of lectotypification in *Kayea larnachiana* are also provided. An identification key is included for the three species of *Kayea* in Australia.

Key Words: Calophyllaceae; Clusiaceae; *Kayea concinna*; *Kayea larnachiana*; *Kayea meridionalis*; *Mesua*; Australia flora; Queensland flora; Wet Tropics bioregion; taxonomy; new species; identification key

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Introduction

Calophyllaceae belongs to the clusioid clade (Malpighiales) which comprises five monophyletic families: Bonnetiaceae, Calophyllaceae, Clusiaceae *s.s.*, Hypericaceae, and Podostemaceae (Ruhfel *et al.* 2016; Cabral *et al.* 2021). Calophyllaceae is a pantropical family comprised of 14 genera and about 460 species (Stevens 2001 onwards). It includes the genera *Calophyllum* L., *Caraipa* Aubl., *Clusiella* Planch. & Triana, *Endodesmia* Benth., *Haploclathra* Benth., *Kayea* Wall., *Kielmeyera* Mart. & Zucc., *Lebrunia* Staner, *Mahurea* Aubl., *Mammea* L., *Marila* Sw., *Mesua* L., *Neotatea* Maguire, and *Poeciloneuron* Bedd. (Stevens 2001 onwards; Ruhfel *et al.* 2016; Cabral *et al.* 2021). *Calophyllum* (six species), *Mammea* (two species, including Christmas Island) and *Kayea* Wall. (three species) occur in Australia.

The Calophyllaceae is divided into two tribes, *Endodesmieae* Engl. and *Calophylleae* Choisy. In their reconstruction of phylogeny for the tribe, Cabral *et al.* (2021) placed the genera into four main clades: a Calophyllum clade [*Calophyllum* + *Mesua*], a *Mammea* clade [*Mammea*], a *Kayea* clade [*Kayea*], and a Neotropical clade. *Kayea* and *Mesua* have until quite recently been considered congeneric, but are in separate clades with other genera (Zakaria & Choong 2007; Ruhfel *et al.* 2016; Cabral *et al.* 2021), thus supporting the reinstatement of *Kayea* by Stevens (1993).

Early authors recognised *Kayea* and *Mesua* as distinct genera based on differences in the ovaries and stigma lobes (Wallich 1831; Bentham & Hooker 1862; Mueller 1887; Bailey 1899). Kostermans (1969) reduced *Kayea* to synonymy under *Mesua* and

recognised 40 species in the combined genus. Stevens (1993) distinguished the two genera morphologically and, stating that there was no evidence for them forming a monophyletic group, reinstated *Kayea* but this was not adopted, or was overlooked in the Australian context. *Kayea* is distinguished from *Mesua* by the presence of papillate stems, a four-carpelled ovary (*Mesua* with two) with 4–12 ovules (*Mesua* with two), a long style which is shortly branched, four narrow stigma lobes (*Mesua* with two that are broadly peltate), c-shaped staminal thecae with a terminal gland and accrescent sepals which continue to expand after anthesis enclosing the ripe indehiscent fruit (vs. not accrescent and not enclosing the fruit in *Mesua*) (Stevens 2007). The growing terminal bud in most *Kayea* species aborts as new growth emerges from the upper axils and this feature was considered a synapomorphy by Stevens (2007). However, Australian *Kayea* have terminal bud scales which are stipule-like, and often persistent.

Kayea is a genus of more than 70 species (Stevens 2001 onwards, 2007; Cabral *et al.* 2021) of monoecious trees and shrubs from the Old World tropics (Notis 2004; Ruhfel *et al.* 2016), occurring in India, Thailand, Vietnam, Cambodia, Malesia including New Guinea and Australia. The three *Kayea* species that occur in Australia are endemic to the rainforests of the Wet Tropics bioregion in north Queensland: *Kayea larnachiana* F.Muell., *K. concinna* W.E.Cooper & Zich sp. nov. and *K. meridionalis* W.E.Cooper & Zich sp. nov.

Kayea meridionalis was first collected at Boonjee in 1974 by A.K. Irvine (AKI 772, CNS) and the first collection of *K. concinna* was made near the head of Noah Creek in 1977 by B.P.M. Hyland (B.Hyland 9355, CNS). These two taxa have, until recently, been identified under one phrase name (*Mesua* sp. (Boonjee A.K.Irvine 1218), or numerous variants thereof; however, with additional specimens collected in recent years, two morphologically distinct species have been identified. In 1984 a manuscript describing one new taxon and recognising one putatively distinct but poorly collected taxon (then known from one sterile

specimen), was submitted for publication but never published (P.F. Stevens & B.P.M. Hyland, pers. comm.).

All Australian *Kayea* species are restricted in occurrence within the Wet Tropics bioregion with allopatric distributions. *Kayea meridionalis* is also altitudinally disjunct, occurring above 600 m at Boonjee and at the head of the East Mulgrave valley within Wooroonooran National Park, while *K. concinna* and *K. larnachiana* occur below 500 m in the Daintree National Park.

Materials and methods

The study is based upon the examination of herbarium material from BRI and CNS combined with field observations. Images of types and other specimens held at BRI, K and MEL have also been examined and are indicated as *i.d.v.* (*imago digitalis visa*).

Measurements of the floral parts and fruits are based on freshly collected specimens and material preserved in 70% ethanol. Common abbreviations in the specimen citations are: LA (Logging Area), NPR/NP (National Park Reserve/National Park) and TR (Timber Reserve). Boonjee has sometimes been spelt as ‘Boonjee’ on specimen labels; however, the accepted spelling has the ‘ie’ (QPNS 2022).

Botanical terminology is based on Beentjie (2010).

Taxonomy

Kayea Wall., *Plantae Asiaticae Rariores* 3(10): 4 (1832).

Type: *Kayea floribunda* Wall.

***Kayea* in Australia:** Monoecious subcanopy trees, glabrous; bark smooth or slightly flaky, exudate meagre or absent; twigs flattened at nodes, papillate; new growth pink; stipules absent. Interpetiolar bud scales stipule-like, mostly persistent, collectors at base. Leaves petiolate, simple, opposite, glabrous, apex often mucronulate; venation brochidodromous, tertiary venation reticulate with a latex cavity within each reticulum. Inflorescence terminal or rarely axillary, a 1–6-flowered racemose cyme; bracts and bracteoles present; sepals 4, 2-whorled, outer

pair initially connate, concave, inner pair free; petals 4; stamens numerous with slender filaments; anthers with a gland at base; ovary superior, 4-carpellate with 4–12 ovules, placentas intrude at the base; style solitary; stigma 4-fid. Fruit indehiscent, a woody berry

surrounded by large, accrescent, furfuraceous sepals.

Etymology: *Kayea* is named in honour of English botanist, mycologist, bryologist and artist Dr Robert Kaye Greville (1794–1866).

Key to Australian *Kayea* species

- 1 Mature leaves greater than 150 mm long; leaf base cordate or rounded . . . **3. *K. larnachiana***
 1. Mature leaves less than 80 mm long; leaf bases cuneate **2**
 2 Stipule-like bud scales up to 1.5 mm long; leaf lamina broadly ovate, width at widest point greater than one third of the length; sepals green **2. *K. meridionalis***
 2. Stipule-like bud scales 3–5 mm long; leaf lamina lanceolate, width at widest point less than one third of the length; sepals pinkish-fawn **1. *K. concinna***

1. *Kayea concinna* W.E.Cooper & Zich sp. nov.

Similar to *Kayea stylosa* Thwaites, but differs from that species by having leaf bases cuneate (vs. obtuse or rounded); inflorescence length up to 18 mm (vs. 30–35 mm); flower diameter 8–11 mm (vs. *c.* 5 mm); style extending beyond anthers by up to 2 mm (vs. 5 mm). **Typus:** Australia. Queensland. COOK DISTRICT: Noah Creek, 20 February 2020, *W. Cooper 2635 & R. Russell* (holo: CNS 151003.1 [1 sheet + spirit]), iso: BRI, CANB, MO *distribuenti*).

Mesua sp. (Boonjee A.K.Irvine 1218) (in part): Jessup (1997: 50, 2021).

Mesua sp. Boonjee (A.K.Irvine 1218) (in part): TSCS (1998); Hyland *et al.* (2010); Zich *et al.* (2020).

Mesua sp. (Boonjee AKI 1218) (in part): Hyland *et al.* (1999: 60).

Mesua sp. (Boonjee A.K.Irvine 1218) (in part): Jessup (2002: 49, 2007: 49, 2010: 44, 2019).

Mesua sp. (Boonjee) (in part): Cooper & Cooper (2004: 126).

Mesua sp. 1 Boonjee (in part): DEH (2004).

Mesua sp. (A.K.Irvine 1218; Boonjee) (in part): DEH (2004).

Mesua sp. Boonjee (A.K.Irvine 1218) Qld Herbarium (in part): CHAH (2005, 2021).

Illustrations: Cooper & Cooper (2004: 126, as *Mesua* sp. (Boonjee)).

Small tree to 7 m, dbh to 90 cm; buttresses absent; exudate meagre and clear, or absent; bark with numerous vertical fissures and occasional \pm horizontal creases, thin, papery, smooth but seasonally flaky, reddish-brown; **twigs** \pm terete, flattened at nodes with several minutely shallow longitudinal ribs becoming slightly flaky, minutely papillate becoming less pronounced in older growth, internodes 13–38 mm long; new growth pink; interpetiolar bud scales often persistent, initially connate but soon dehiscent into a pair, narrowly triangular, 3–5 mm long, *c.* 0.5 mm wide at base, glabrous. **Leaves:** **petioles** flat along upper side and becoming shallowly grooved in dried specimens, 4–8 mm long; **lamina** lanceolate, coriaceous, 53–103 mm long, 13–30 mm wide, discolorous, glabrous, base cuneate, apex acuminate and usually mucronulate, margins entire; **venation:** primary vein slightly raised on both surfaces; secondary veins 10–14, 3–5.5 mm apart, angle of divergence from primary vein 10–20°, forming loops 1–2 mm from margin, flush with adaxial surface, slightly raised abaxially; tertiary veins reticulate with a solitary round or slightly elongated latex cavity in the centre of each reticulum. **Inflorescence** a terminal (rarely axillary) 3–5-flowered racemose cyme, 13–18 mm long; bracts several, triangular, *c.*

1 mm long and wide, clustered at peduncle bases and persistent well after inflorescences have dehisced; colleters several, coppery-coloured, clustered amongst and behind bracts; peduncle 4.5–11 mm long; bracteoles paired at pedicel junctions, caducous, narrowly triangular, *c.* 2.5 mm long and 0.2 mm wide at base, glabrous, entire; lateral pedicels 1.5–4 mm long; terminal pedicels up to 3 mm long. **Flowers** not recorded as fragrant, diameter 8–11 mm; sepals in outer whorl ovate-orbicular, apex obtuse, inner pair orbicular, deeply concave, 3–4 mm long and wide, pale pinkish-fawn coloured; petals broadly ovate, becoming convex, *c.* 7 mm long \times 4.5 mm wide, white, apex acute, margin entire but fimbriate near apex and folding to a point, glabrous; stamens numerous, filaments *c.* 4.5 mm long; anthers c-shaped, *c.* 0.8 \times 0.6 mm; ovary broadly ellipsoid, *c.* 2 \times 1.5 mm; ovules usually 4 per locule, *c.* 1 mm long; style *c.* 5 mm long; stigma rays 0.25–0.6 mm long. **Fruit** unknown. **Fig. 1.**

Additional selected specimens (from 7 examined): **Queensland.** COOK DISTRICT: VCL Noah, head of Noah Creek, Mar 1977, *Hyland 9355* (CNS); Noah Creek, Cape Tribulation, Mar 1996, *Jensen 643* (BRI, CNS); Noah Creek, Feb 1998, *Cooper & Jensen 73* (BRI, CNS, NSW); Noah Creek, Daintree NP, Feb 2019, *Cooper 2584*, *Jensen & Hawkes* (CNS); *ibid*, Feb 2020, *Cooper 2629*, *Hawkes & Carmichael* (CNS); *ibid*, Jun 2020, *Cooper 2639 & Ford* (CNS).

Distribution and habitat: *Kayea concinna* is known from mesophyll and notophyll rainforest on riparian granite silt in the braided channel of the Noah Creek valley within the Daintree National Park (**Map 1**) at altitudes from near sea level to 500 m.

Kayea concinna has morphological similarities to *K. stylosa* from Sri Lanka rather than to other species from Australia, Asia or Malesia.

Notes: Several visits were made to *Kayea concinna* trees that sparsely flowered over a season of more than 6 months but failed to set fruit over 2 years. Other plant features are enough to confirm that this species belongs in *Kayea*: papillate twigs, colleters behind bud scales and bracts, a small latex gland on the

anther connective, 4-fid stigma and ovary 1-locular with accrescent sepals around the fruit.

Specimens from Noah Creek were first collected in 1977 and were maintained as a distinct taxon from specimens collected at Boonjee by Bernie Hyland at the Australian National Herbarium – Atherton (QRS; now Australian Tropical Herbarium, CNS) until 1996 when they were incorporated into *Mesua* sp. (Boonjee AKI 1218).

Phenology: Flowers have been recorded from February, March, May, June and September. Fruiting has not yet been observed.

Conservation status: *Kayea concinna* is known from only a few collections along Noah Creek in Daintree National Park. The population is very restricted in area and only recorded within the National Park and while no immediate threats were observed, plants have not been found in fruit despite monitoring of flowering individuals over two years. Using GeoCat (Bachman *et al.* 2011) based on known locations, Extent of Occurrence is estimated at 10 km², and Area of Occupancy is estimated at 24 km². A suggested conservation status for *Kayea concinna* is **Endangered** [EN B1ab(i, iii, iv)+B2ab(i, iii, iv)] (IUCN 2012).

Etymology: The specific epithet is derived from the Latin *concinna* (neat, pretty, elegant); referring to the elegant leaves and growth habit of this tree.

2. *Kayea meridionalis* W.E.Cooper & Zich sp. nov.

Similar to *Kayea stylosa* Thwaites but differs from that species in the length of the stipule-like bud scales up to 1.5 mm (vs. 2–3 mm); leaf shape broadly ovate (vs. lanceolate); flower diameter greater than 7.5 mm (vs. 5 mm); inflorescence length up to 23 mm (vs. *c.* 40 mm); style extending beyond anthers by 1 mm (vs. *c.* 5 mm). **Typus:** Australia. Queensland. COOK DISTRICT: Timber Reserve 1230, Boonjee Logging Area, 4 March 1975, *A.K. Irvine 1218* (holo: CNS [comprising 3 sheets

QRS 20579.1, QRS 20580.3, QRS 20581.4 and spirit QRS 20579.2]], iso: A, BRI, CANB, K, L, MEL, MO, SING *distribuenti*).

Mesua sp. aff. *M. elmeri*: Hyland (1982: 107, 133, 143, Code 745).

Mesua sp. 'Boonjee' (A.K.Irvine 1218): Thomas & McDonald (1987: 21, 1989: 22).

Mesua sp. (=RFK/3128): Hyland & Whiffin (1993: 106, 116, 174, Code 745); Christophel & Hyland (1993: 4, 35, 83, pl. 21(b), Code 745); Hyland & Whiffin (1993: 74, Code 745).

Mesua sp. (Boonjee AKI 1218): Hyland *et al.* (1994: 302); (in part) Hyland *et al.* (1999: 60).

Mesua sp. (Boonjee A.K.Irvine 1218): Jessup (1994: 74); (in part) Jessup (1997: 50, 2021).

Mesua sp. Boonjee (A.K.Irvine 1218): (in part) TSCS (1998); Hyland *et al.* (2010); Zich *et al.* (2020).

Mesua sp. (Boonjee A.K.Irvine 1218): (in part) Jessup (2002: 49, 2007, 2010: 44, 2019).

Mesua sp. (Boonjee): (in part) Cooper & Cooper (2004: 126).

Mesua sp. 1 Boonjee: (in part) DEH (2004).

Mesua sp. (A.K.Irvine 1218; Boonjee): (in part) DEH (2004).

Mesua sp. Boonjee (A.K.Irvine 1218) Qld Herbarium: (in part) CHAH (2005, 2021).

Illustrations: Christophel & Hyland (1993: 83) as *Mesua* sp. (=RFK/3128); Zich *et al.* (2020) as *Mesua* sp. Boonjee (A.K.Irvine 1218).

Small tree to 20 m, dbh 22 cm; buttresses absent; exudate meagre and clear, or absent; bark mostly smooth with horizontal creases and sections of circular impressions which resemble beaten copper, reddish-brown; **twigs** ± terete, flattened at nodes, with several minutely shallow longitudinal ribs becoming slightly flaky, minutely and sparsely papillate, internodes 14–38 mm; new growth pink; interpetiolar bud scales, persistent or caducous, initially connate but soon dehiscing into a pair, ovate or triangular, 0.65–1.5 mm long, 0.6–0.8 mm wide; colleters coppery-coloured, glabrous, often becoming dehiscent.

Leaves: petioles flat along upper side and not grooved in fresh specimens but grooved in dried material, 6–11 mm long; **lamina** broadly ovate, 45–73 mm long, 16–30 mm wide, discolorous, glabrous, base cuneate, apex acuminate and mucronulate, margins entire; **venation:** primary vein slightly raised on upper side and distinctly raised below; secondary veins 10–14, 2–3 mm apart, angle of divergence from primary vein 30–40°, forming loops 1.5–3 mm from margin, slightly raised on both surfaces; tertiary veins reticulate with a solitary round or slightly elongated latex cavity in the centre of each reticulum. **Inflorescences** a terminal (rarely axillary) 1–6-flowered (rarely 4 or more) cyme or racemose cyme 20–23 mm long or a solitary flower; bracts triangular, several, clustered at peduncle bases and persistent, *c.* 0.75 × 0.75 mm, several colleters at base between bract and peduncle; **peduncle** 4–20 mm long; **bracteoles** in opposing pairs part way along peduncle or apical, caducous, narrowly ovate, *c.* 1.8 × 0.5 mm, glabrous, entire; **solitary flowers** with pedicels 2.5–7 mm long; **cymose flowers** with lateral pedicels 5–11.5 mm long, terminal pedicels 3–5 mm long. **Flowers** not noted as fragrant, diameter 7.5–12 mm; sepals in outer whorl oblate, apex rounded or minutely acute; inner pair ± orbicular, concave, *c.* 4.5 × 4.5 mm, green, entire; **petals** broadly elliptical, concave, boat-shaped, or obovate, *c.* 7 × 4 mm, white, apex acute, margin entire; stamens numerous, filaments *c.* 5 mm long; anthers c-shaped, *c.* 0.5 × 0.7 mm, gland near base; ovary broadly ovoid or turbinate, 2–2.25 mm long and wide; ovules usually 4, *c.* 0.7 mm long; style 5–6 mm long; stigma rays 0.5–0.7 mm long. **Fruiting** peduncle 8–12 mm long. **Fruit** a dry and somewhat woody berry surrounded by accrescent furfuraceous sepals, apex of the fruit exposed, stigma lobes persistent, obovoid, 25–35 mm long and wide, rusty brown; seeds 1 or 2, *c.* 14 mm long × 20 mm wide × 18 mm deep. **Figs. 2 & 3.**

Additional selected specimens (from 21 examined): Queensland. COOK DISTRICT: East Mulgrave River, Nov 1995, *Jensen 484* (CNS); Stockwellia Track, Boonjee, Dec 1998, *Jensen 944* (CNS); TR 1230, Boonjee, Nov 1974, *Hyland 3129RFK* (BRI, CANB, CNS); *ibid.*, Nov 1974, *Hyland 3130RFK* (BRI, CANB, CNS); *ibid.*, Nov

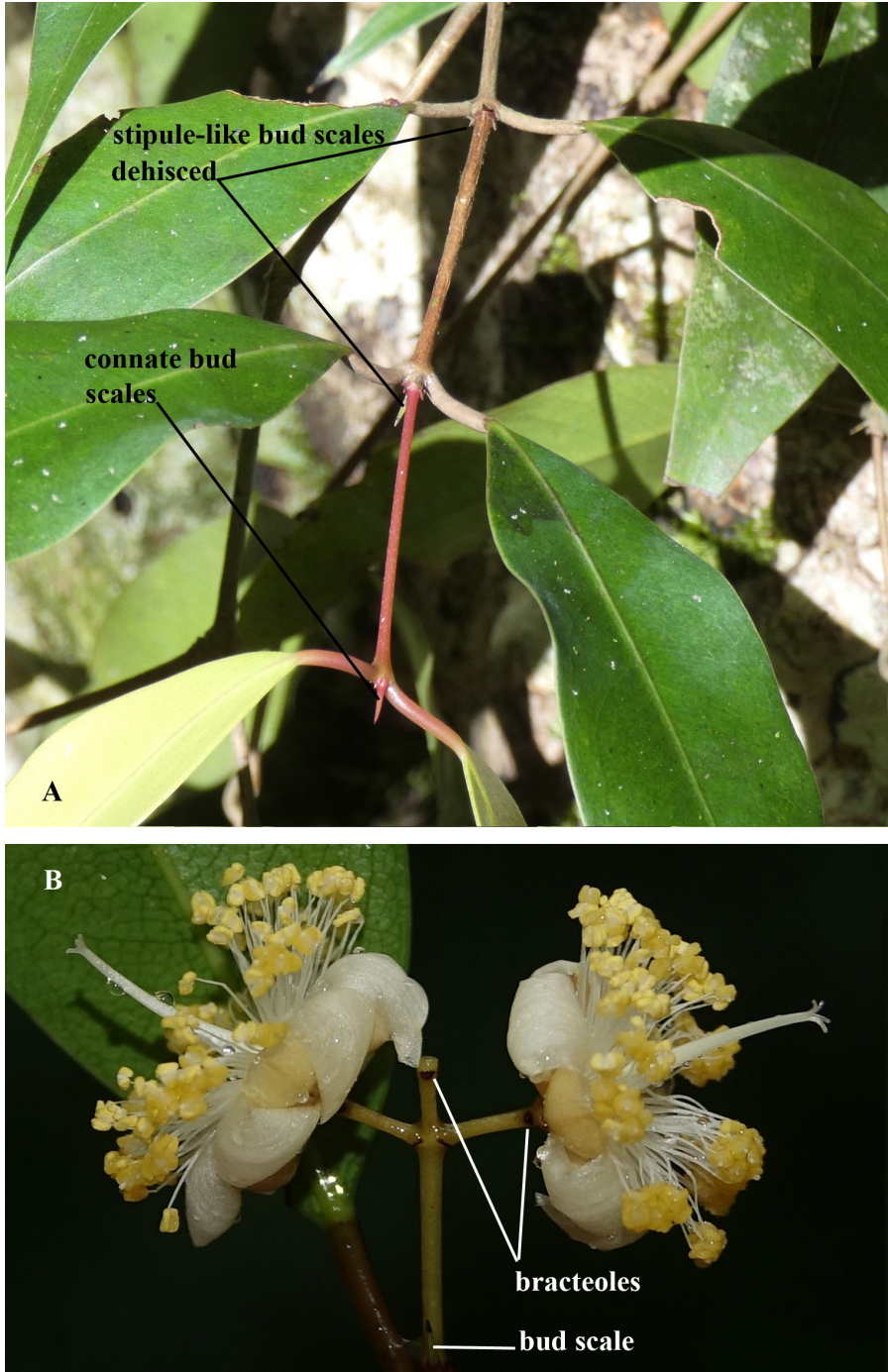


Fig. 1. *Kayea concinna*. A. showing terminal connate stipule-like bud scales and dehisced stipule-like bud scales (Cooper 2629, CNS). Photo: W. Cooper B. showing open-flowered inflorescence, stipule-like bud scale at inflorescence base, bracteoles and flowers at anthesis with 4-fid stigma (Cooper 2584, CNS). Photo: R. Jensen.

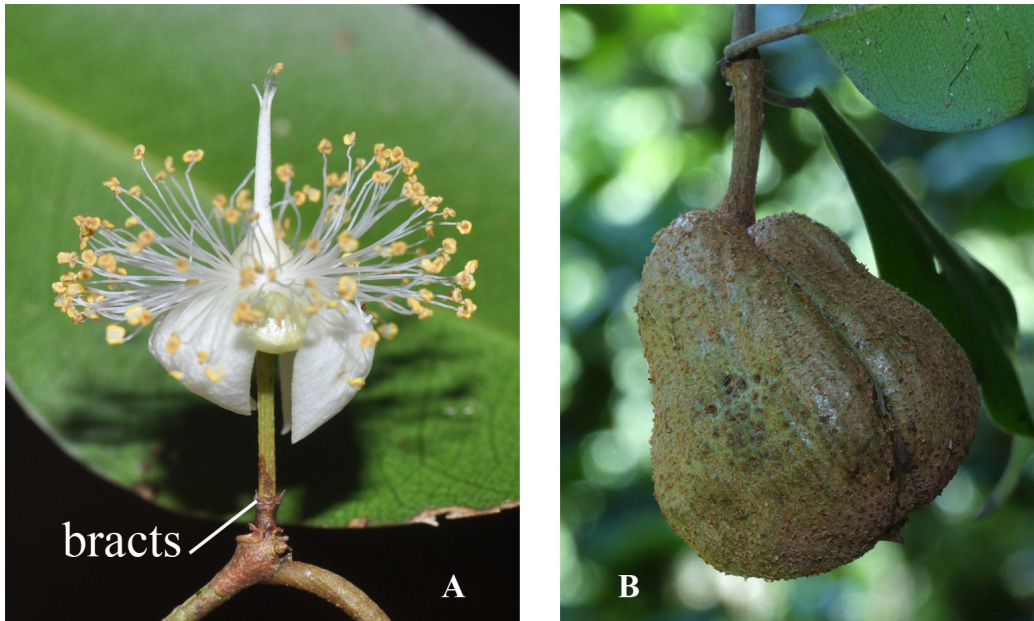


Fig. 2. *Kayea meridionalis*. A. flower at anthesis with 4-fid stigma and bracts (Cooper 2741A, CNS). B. fruit (Cooper 2734, CNS). Photos: T. Hawkes.

1974, *Hyland 3131RFK* (CNS); *ibid*, Jan 1975, *Irvine 1111* (CNS); *ibid*, Jan 1975, *Irvine 1136* (CNS); *ibid*, Jan 1975, *Irvine 1137* (CNS); *ibid*, Dec 1975, *Irvine 1682* (CNS); *ibid*, Jan 1976, *Irvine 1735* (CNS); TR 1230, Bartle Frere, Boonjee LA, Aug 1992, *Gray 5470* (CNS); Stockwellia Track, Boonjee, Oct 2020, *Cooper 2734 & Hawkes* (CNS); *ibid*, Jan 2021, *Cooper 2741A* (CNS).

Distribution and habitat: *Kayea meridionalis* occurs in complex notophyll rainforest on the contact zone of basalt and metamorphic geology in the Boonjee area on the Atherton Tableland and in the upper East Mulgrave River valley (**Map 1**) at altitudes between 600 m and 760 m.

Kayea meridionalis has morphological similarities to *K. stylosa* from Sri Lanka rather than to other species from Australia, Asia or Malesia.

Phenology: Flowers have been recorded in January and February and fruit in August, October, December, January and February.

Conservation status: *Kayea meridionalis* is known from two disjunct areas in Wooroonooran National Park, in the upper East Mulgrave River and the Boonjee area

near Mt Bartle Frere. Remote areas of the National Park remain poorly explored and the size of known subpopulations has not been assessed extensively, but the subpopulations are restricted in area and only recorded within the National Park. There are no immediate threats evident for the species. Using GeoCat (Bachman *et al.* 2011) based on known locations, Extent of Occurrence is estimated at 46 km², and Area of Occupancy is estimated at 32 km². A suggested conservation status for *Kayea meridionalis* is **Endangered** [EN B1ab(i, iii)+B2ab(i, iii)] (IUCN 2012).

Etymology: The specific epithet is derived from the Latin *meridionalis* (southern); referring to the distribution of this species being the southernmost of all known *Kayea* species.

3. *Kayea larnachiana* F.Muell., *The Victorian Naturalist* 3(9): 126 (1887).

Mesua larnachiana (F.Muell.) Kosterm., *Reinwardtia* 7: 427 (1969). **Type citation:** "On the Mossman-River; *W. Sayer*". **Type:** Australia. Queensland. COOK DISTRICT:

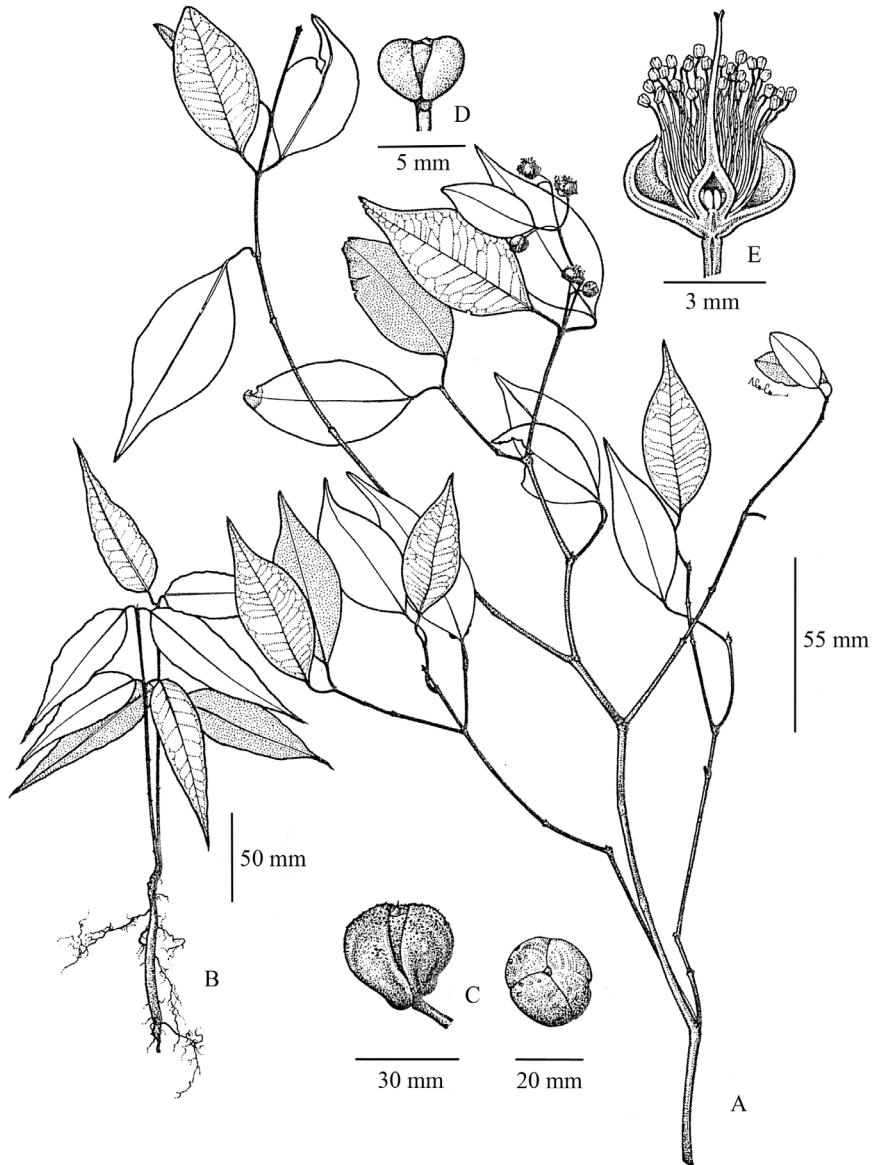


Fig. 3. *Kayea meridionalis*. A. habit of branchlet. B. seedling. C. fruit, lateral and apical view. D. embryo with 3 cotyledons. E. flower, longitudinal section. A & E from *Irvine 1218* (CNS); B–D from *Irvine 1735* (CNS). Del. T. Nolan © CSIRO

Mossman's River, Trinity Bay, *s.dat.*, *W. Sayer s.n.* (lecto: BM 000611321 *i.d.v.* [buds present], *fide* Kostermans (1969: 427); possible isolecto: *s.dat.*, *W. Sayer 147A* (BRI [AQ0166459] *i.d.v.* [fruit present], MEL 2227332 *i.d.v.*, [fruit present], MEL 2227333 *i.d.v.* [flower present]; MEL 2227334 *i.d.v.* [buds present]; *s.dat.*, *W. Sayer 143* (MEL 2227335 *i.d.v.* [buds present]).

Kaya larnachiana F.Muell., *Systematic Census of Australian Plants Suppl.* 4: 3 (1889), *orth. var.*

Illustrations: Christophel & Hyland (1993: 83); Cooper & Cooper (2004: 125), Zich *et al.* (2020).

Small tree to 15 m, dbh 30 cm; buttresses if present are small; exudate meagre and clear, or absent; bark flaky; **twigs** \pm terete, flattened at nodes, bark flaky, papillate, internodes 25–70 mm; new growth pink; interpetiolar bud scales persistent or caducous, initially connate soon dehiscing into a pair, narrowly triangular with a midrib, 3.5–6.5 mm long, 0.75–1 mm wide at base, glabrous, colleters coppery-coloured, adaxially persistent. **Leaves:** petioles terete, flaky, 2–10 mm long, 2–3 mm thick; lamina oblong-ovate, 150–240 mm long, 40–100 mm wide, discolorous, glabrous; base cordate, obtuse or rounded; apex acuminate often mucronulate, entire; **venation:** primary vein slightly raised on upper side and distinctly raised below; secondary veins 15–25 mm apart, angle of divergence from primary vein 5–20°, forming loops 2–3 mm from margin, slightly raised on both surfaces; tertiary veins reticulate with latex cavities within each reticulum. **Inflorescence** a terminal (rarely axillary) 3–10-flowered cyme or racemose cyme, 20–23 mm long, or a solitary flower; bracts and bracteoles similar, caducous or persistent at peduncle and pedicel bases, triangular, 1–2 \times to 1.5 mm, several colleters at base between bract and peduncle; **peduncle** 4–20 mm long; pedicels 6–7.5 mm long, papillate. **Flowers** fragrant or not fragrant, diameter 11–13.5 mm; sepals in outer whorl orbicular, concave, glabrous, sometimes papillate, apex rounded *c.* 7 \times 8 mm; inner pair oblong-orbicular, concave, *c.* 7 \times 6 mm, white, entire; **petals**

concave or boat-shaped, broadly-elliptical or orbicular, *c.* 7 \times 6 mm, white, apex recurved, entire; stamens numerous, filaments 5–6 mm long; anthers c-shaped, *c.* 1 \times 0.9 mm, gland near base; ovary broadly ovoid, *c.* 3 mm long and wide; ovules usually 4–12, 1.5–2 mm long; style 4–5 mm long, stigma rays *c.* 0.4 mm long. **Fruiting** peduncle 5–12 mm long. **Fruit** a dry somewhat woody berry surrounded by accrescent furfuraceous sepals, only the apex of the true fruit is exposed and the stigma lobes are persistent, oblate-orbicular, 20–38 mm long, 26–51 mm wide and *c.* 46 mm breadth, rusty brown, endocarp *c.* 3 mm thick; seeds 1–3, 20–26 mm long, *c.* 16 mm wide and 20 mm deep. **Fig. 4.**

Additional selected specimens (from 27 examined): Queensland. COOK DISTRICT: Cooper Creek, Jun 1969, *Maclin 4346* (BRI *i.d.v.*); Parish of Alexandra, Cooper Creek, Dec 1984, *Gray 3817* (BRI, CNS); Portion 49V, Cooper Creek, *Hyland 13878* (BRI, CNS); Nr Portion 54V, Cooper Creek, Parish of Alexandra, Nov 1983, *Hyland 12859* (BRI, CNS, DNA, NSW); Portion 49, Alexandra, Cooper Creek, Oct 1975, *Hyland 3335RFK* (BRI, CNS); Cooper Creek between Daintree River and Noah Creek, Nov 1986, *Tucker MCT 129* (BRI *i.d.v.*); Cooper Creek, Turpentine Road, Nov 1989, *Jessup, Guymer & Dillewaard GJD2808* (BRI *i.d.v.*); W. of Cooper Creek between Daintree River and Cape Tribulation, Oct 1973, *Webb 11013 & Tracey* (CNS); Mossman Gorge NP, Jan 2000, *Gray 7754* (BRI, CNS); Mossman Gorge NP, Mossman River, Dec 1984, *Jessup 701* (BRI *i.d.v.*); Mossman River Gorge, Nov 2004, *Jago 6778 & Keith* (BRI, MEL, NSW *i.d.v.*); Mossman Gorge National Park, Dec 1997, *Forster PIF21951*, *Jensen & Booth* (BRI *i.d.v.*); *ibid.*, Nov 2018, *Cooper 2572 & Hawkes* (CNS); NPR 133, Mossman Gorge, Dec 1976, *Hyland 9243* (BRI, CNS).

Typification: The type citation in the protologue of *Kayea larnachiana* is given as “On the Mossman-River; W. Sayer.” and does not provide a collector's number or date. Following the taxon description, Mueller (1887: 127) writes that “The descriptive notes have been elaborated from specimens with young flower-buds and with over-ripe fruit”.

Six herbarium sheets have been located in BM, BRI and MEL that appear to be original material for *Kayea larnachiana*. They are all labelled as having been collected by Sayer and all lack a collection date. The collection locality is given as either “Mossman[’s] River” or “Trinity Bay” or both localities are given. Label locality information varies slightly

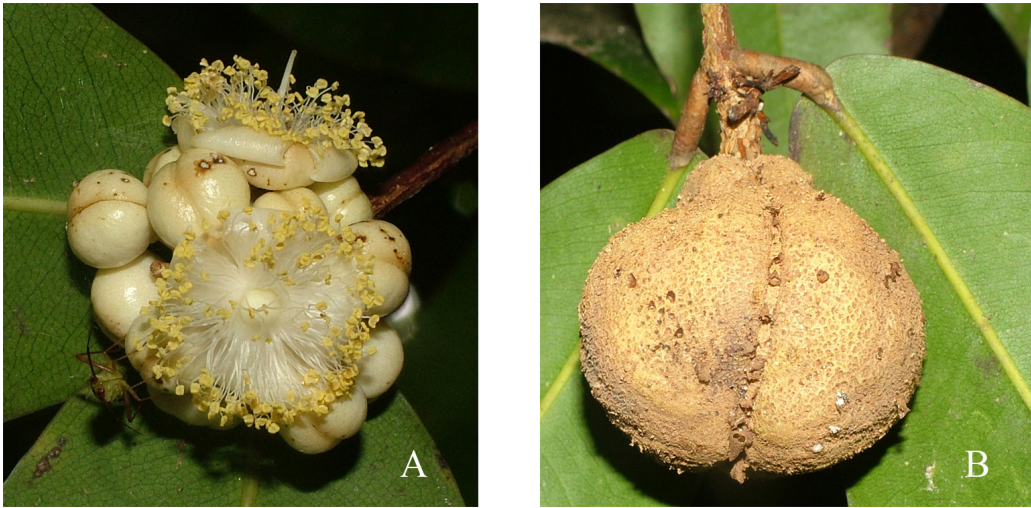


Fig. 4. *Kayea larnachiana*. A. tightly clustered inflorescence, flowers at anthesis. B. fruit. Both from Cooper 2572 and Hawkes (CNS). Photos: T. Hawkes.

between the sheets, and the specimens vary in phenology, having either flower buds or fruit (except for MEL 2227333 which has a single flower). Most of the sheets can be linked to Mueller through handwriting on original labels, except for the BM sheet which has no original label. Its label was clearly added much later and is typewritten, with no collector number, and the sheet is not annotated by Kostermans despite having been cited by him (Kostermans 1969: 427). Four of the sheets at MEL and BRI (MEL 2227332, MEL 2227333, MEL 2227334, BRI [AQ0166459]) have the same collector number '147A'. One sheet in MEL has the collector number '143' (MEL 2227335).

Despite these factors, all these specimens are likely to be part of the one collection, as Sayer appears to have only collected in Queensland in 1886–1887 (JSTOR 2021; ANBG 2021) and made one visit to the Mossman area after leaving Cairns on 30 Sept. 1886 with W.W. Froggatt (Anon. 1886: 2). They set up camp for about four weeks on the Mossman River where they collected specimens (Froggatt 1887: 1). Froggatt departed in late October leaving Sayer who had the intention of “staying a few weeks longer” (Froggatt 1887: 1), which suggests that

the collection were made during October and November 1886. It is not possible (although rather unlikely) to rule out the possibility that the specimens were collected from different plants or on different days.

The citation by Kostermans (1969: 427) of “*typus: W. Sayers [as Sayer] (BM), Trinity Bay, Queensland*” appears to be an effective, though possibly inadvertent, lectotypification under Art. 7.11 of the *International Code of Nomenclature for algae, fungi, and plants* (Turland *et al.* 2018). The lectotype sheet (BM 000611321) is a rather unfortunate choice due to the absence of handwritten and original labels, but we can see no grounds to supersede it. The remaining original specimens are herein recognised as possible isolectotypes.

Distribution and habitat: *Kayea larnachiana* is known from mesophyll and notophyll rainforest on granite derived substrates in the Daintree National Park in the Mossman River and Cooper Creek areas (**Map 1**) at altitudes from near sea level to 100 m.

Phenology: Flowers have been recorded in November and December; fruit has been recorded in from November to January.

Conservation status: *Kayea larnachiana* is known from two main areas that are disjunct in the Daintree National Park, along the Mossman River and along Cooper Creek. Much of the lowland vegetation outside of the National Park in the Mossman area has been cleared, and most of the remaining potential habitat in remote areas of the park remain poorly explored. The size of the known subpopulations has not been assessed extensively, but they are restricted in area and only recorded within the National Park. There are no immediate threats evident for the species. Using GeoCat (Bachman *et al.* 2011) based on known locations, Extent of Occurrence is estimated at 131 km², and Area of Occupancy is estimated at 40 km². A suggested conservation status for *Kayea larnachiana* is **Vulnerable** [VU Blab(i, iii)+B2ab(i, iii)] (IUCN 2012) and the species is currently listed as this under the Queensland *Nature Conservation Act 1992*.

Etymology: This species was named in honour of James McDonald Larnach (1837–1887), sometimes given as ‘James Macdonald Larnach’ (Anon. 1887: 6), one of the founders of the *Historical Society of Australasia* and member of the council of the *Royal Geographical Society (Victoria)*.

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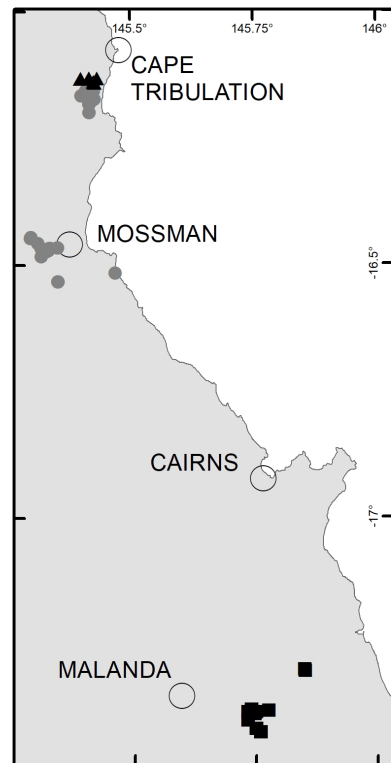
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Map 1. Distribution of *Kayea* species. ▲ *K. concinna*, ● *K. larnachiana* and ■ *K. meridionalis*.