Three new species in Lindernia All. s.l. (Linderniaceae) for Australia

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Summary

Wannan, B.S. (2016). Three new species in Lindernia All. s.l. (Linderniaceae) for Australia. Austrobaileya 9(4): 508–523. Three new species from the genus Lindernia are described: L. stantonii Wannan, L. beasleyi Wannan from northern Queensland (Cape York Peninsula), and L. barkeri Wannan from northern Western Australia (Kimberley). Illustrations of flowers, fruits, seeds, leaves, stem anatomy, type specimen and a distribution map are provided for all species. Notes on habitat and conservation status are also provided for each. A key to Queensland species is provided.

Key Words: Linderniaceae, Lindernia, Lindernia barkeri, Lindernia beasleyi, Lindernia stantonii, Australia flora, Queensland flora, Western Australia flora, wetland plants, new species, taxonomy, identification key, seed morphology, stem anatomy

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Introduction

The genus Lindernia All. (Linderniaceae Borsch, K.Müll. & Eb.Fisch.) is a pantropical genus represented in Australia by approximately 50 species. Lindernia species have been collected and described in Australia for over 200 years in regional floras (Stanley & Ross 1986; Barker 1992a; Cowie et al. 2000), state floras (Bailey 1901; Ewart & Davies 1917; Barker 1992b) and national floras (Brown 1810; Bentham 1868). Australian Lindernia species have also been described in a Malesian revision (Philcox 1968) and a recent revision of the subgenus Bonnaya (Liang & Wang 2014). Species continue to be discovered and added to the Australian flora by descriptions of new taxa (Barker 1990, 1998) and by identification of previously unrecognised taxa (Wannan 2013). In spite of this work, many species are yet to be formally named, especially those from the Northern Territory and no overall account of the Australian species is available.

The current paper describes three new species for Australia: two from Cape York Peninsula (northern Queensland) and one from the Kimberley (northern Western Australia). The Kimberley species was treated as Lindernia sp. A by Barker (1992a). The new species are described under the genus Lindernia as the generic boundaries proposed by Fischer et al. (2013) are not well supported by molecular studies of Australian species (Wannan et al. unpubl.).

Materials and methods

The species descriptions are based on herbarium specimens (BM, BRI, CANB, CNS, DNA, MEL, PERTH, UNSW), spirit material (BRI and the author’s own collections), and examination of fresh material collected by the author. Length by width measurements in mm are indicated as length × width mm. Images of seeds are provided from scanning electron microscopy (SEM) at the Australian Museum, Sydney. Images from stem anatomy were obtained from freehand sections by the author and stained with Toluidine blue. An abbreviation used in the specimen citations is NP for National Park.

Taxonomy

A key to formally described Queensland species is provided below. A key to Western Australian Lindernia is provided in Barker (1992a).
Key to Queensland Lindernia species

1. Capsule > 2× length of calyx, cylindrical or fusiform ........................................ 2
2. Capsule < 2× length of calyx, globose or ovoid ....................................................... 5
3. Flowers axillary, 1 per axil (i.e. no differentiation between leaves & floral bracts) .... 3
4. Flowers in a loose raceme (i.e. floral bracts much smaller than leaves) ...................... 4
5. Upper stamens only, anthers without tails, leaf length < 3× breadth, pedicel 5–11 mm .......................... L. antipoda
6. Upper & lower stamens, anthers with tails, leaf length > 3× breadth, pedicel 15–20 mm ... L. anagallis
7. Leaves crenate with aristate margins, calyx 4.5–6 mm, corolla white with purple spots ... L. ciliata
8. Leaves ovate with 3–5 longitudinal veins, corolla 5–6.5 mm long, no internal flaps in corolla ................................................................. L. hyssopioides
9. Leaves crenate without aristate margins, calyx 3–3.5 mm, corolla pink ....................... L. tenuifolia
10. Leaves with 3–5 longitudinal veins, calyx fused for greater than ¼ of length at anthesis, 1 flower per axil ... L. crustacea
11. Corolla < 7 mm long, with no staminal appendages .............................................. L. aplectra
12. Corolla > 9 mm long, with appendages on lower stamens ........................................ L. stantonii
13. Corolla with spotted lower lobes, ovary without stalked-glandular trichomes, pedicels 31–63 mm with stalked-glandular trichomes, calyx 2.5–4 mm long .. L. beasleyi
14. Corolla without spotted lower lobes, ovary with stalked-glandular trichomes, pedicels 20–43 mm without stalked-glandular trichomes, calyx 4–5 mm long ............. L. subulata

Lindernia stantonii Wannan sp. nov.
Similar to L. aplectra W.R.Barker but differs in its possession of appendages on its lower stamens (versus appendages absent), presence of stalked-glandular trichomes on the ovary (versus absent), longer pedicels (2–7 mm versus 1–3 mm), longer corolla (9–15 mm versus 5–7 mm), shorter leaves (0.5–2.5 mm versus up to 12 mm), seed size (c. 0.35 × 0.2 mm versus c. 0.6 × 0.35 mm) and seed ornamentation (absence of regular fence-like pattern versus presence). Typus: Queensland. Cook District: Road to Pormpuraaw, 12 June 2008, B.S. Wannan 5243 & P. Graham (holo: BRI; iso: CNS).

Annual herb; stems erect, scape-like, rigid, 10–35 cm high, glabrous, green or sometimes red-purple. Leaves cauline, opposite, simple, subsessile, triangular and scale-like, 0.5–2.5 mm × 0.2–0.5 mm, glabrous; margins entire; single midvein obscure. Flowers crowded at the apex of stems, subtended by leaves that occasionally have stalked glandular trichomes; pedicels ascendent, 2–7 mm long with stalked glandular trichomes. Calyx divided to base, lobes triangular-lanceolate, 2.5–3(–4) × c. 0.5 mm, green, with stalked glandular trichomes, 3-nerved. Corolla 9–15 mm long; white, cream or mauve or yellow, with stalked glandular trichomes outside, internal flaps absent; tube 4–9 mm long, upper lobe porrect, emarginate, 2–2.5 mm long; lower lip 3-lobed, 4–6 mm long, reflexed downwards. Upper stamens 2 fertile, each with 2 cells; filaments 1–2 mm long; anthers cohering with cells 0.5–0.8 mm long, apiculate. Lower stamens 2 fertile, each with 2 cells; filaments 3–6 mm long; anthers cohering with cells 0.3–0.8 mm long, apiculate, one of each pair smaller. Staminal appendage simple, 0.5–0.8 mm long, included within the throat and with bullate trichomes. Ovary 1–1.5 mm long, with stalked glandular trichomes in upper half; nectariferous disc undulate around base of ovary; style 6–10 mm long, with sparse stalked glandular trichomes. Fruit with erect pedicels 5–7 mm long, with stalked glandular trichomes; calyx 3–4 mm long; capsule globular, 3–3.5 mm long, with stalked glandular trichomes at apex. Seeds rhomboidal, c. 0.35 × 0.2 mm, surface with 4 ridges in transverse section, sulcate, light brown. Stem anatomy in transverse section circular with four collenchyma bundles and secondary thickening in vascular cambium; few air spaces in outer cortex. Figs. 1–8.

Additional selected specimens examined: Queensland. Cook District: Moa, Torres Strait, 3 km NNE of Kubin, May 2003, Wannan 3090 & Toh (BRI, NSW); Coen, Aug 1976, Scarth-Johnson 3094 (BRI); 18 km SW of Silver Plains Homestead, Aug 1978, Paijmans 2934 (BRI, CANB); Silver Plains, Jun 2013, McDonald KRM14339 (CNS); Lama Lama NP, Princess Charlotte Bay, Jul 2010, Thompson SLT1036 (BRI); Lama Lama NP, Princess Charlotte Bay, Jun 2012, McDonald KRM13178 & Thompson (BRI); Lama Lama NP, Princess Charlotte Bay, Jun 2012, McDonald KRM13179 & Thompson (BRI); Road to Pormpuraaw, Fig. 1. Lindernia stantonii. Plants with white flowers – arrows indicate minute leaves, c. ×2 (Wannan 3090 & Toh, BRI). Photo: B.S. Wannan.

(CNS); 6 km N of Lilyvale on track to Running Creek, Jun 1993, Clarkson 10094 & Neldner (BRI, CNS); 7 km NE of Musgrave on road to Marina Plains, Jul 2000, Wannan 1864 & Wannan (BRI, NSW); SE of Musgrave, beside the Peninsula Developmental Road, Jun 2006, Wannan 4518 & Graham (BRI); Road to Pormpuraaw,
Jun 2008, Wannan 5243 & Graham (BRI); 20 miles [33.3 km] ENE of Musgrave Telegraph Office, Jun 1968, Pedley 2654 (BRI); Peninsula Developmental Road, 44 miles [7.3 km] beyond Laura, Jul 1965, Gittins 978 (BRI, CANB, NSW); 7.9 km S of Musgrave on road to Laura, Jul 1998, Bean 13559 (BRI, MEL); 3.5 km S of the Hann River on the Peninsula Development Road, May 1989, Clarkson 7953 (BRI, CNS); 9.7 km N of Morehead River, Jun 1989, Clarkson 8078 & Neldner (BRI, CNS); Rinyirru NP, 7.4 km along S boundary from Koolburra gate, Aug 2012, McDonald KRM13417 (BRI); Peninsula Developmental Road, 41 km beyond Laura, Jul 1965, Gittins 978 (BRI, CNS); Lakefield NP, 35 km along Marina Plains Road from Musgrave, Jun 2011, McDonald KRM11674 (BRI); 14 km NE of New Laura Ranger Station, Lakefield NP, May 1992, Neldner 4023 (BRI, CNS); 25 km SE of Lakefield Ranger base, Aug 2014, Thompson SLT14277 & Fell (BRI); 44 km SE of Lakefield Ranger base, Aug 2014, Thompson SLT14346a, SLT14354 & Fell (BRI); 42 km WNW of ‘Bulimba’ Homestead in Staaten River NP, Apr 2004, Fox IDF3110 & Wilson (BRI); Staaten River NP, Jul 2004, Williams 1632 (BRI); Staaten River NP, Jul 2004, Williams 1634 et al. (BRI); E of Miranda Downs Homestead, July 2001, Thompson NOR135 (BRI).

**Distribution and habitat:** *Lindernia stantonii* is endemic to Queensland and occurs from south-west Cape York Peninsula to Torres Strait (Map 1). It grows in moist sandy areas in woodland.

**Notes:** The novelty of this taxon is corroborated by sequence data (Wannan *et al.* unpubl.). It is similar to *Lindernia aplectra* that occurs over much the same distribution range in Queensland, but differs in numerous characters given above. The Torres Strait specimen (*Wannan 3090 & Toh*) is disjunct from the remaining specimens, but its characters fall within the range of the southern elements including lighter flower colour which is typical of other specimens (e.g. *Wannan 1864, McDonald KRM11674, Thompson SLT14534*). Corolla colour varies throughout the range of this species.

**Conservation status:** *Lindernia stantonii* has a broad range but remains infrequently collected. A status of **Least Concern** is recommended (IUCN 2001).

**Etymology:** The species is named for Peter Stanton who has been a leader in conservation on Cape York Peninsula for over 40 years.

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**Fig. 2.** *Lindernia stantonii*. Lateral view of mauve flower, c. ×6 (*Wannan 5243 & Graham, BRI*). Photo: B.S. Wannan.

**Fig. 3.** *Lindernia stantonii*. Adaxial view of mauve flower, c. ×5 (*Wannan 5243 & Graham, BRI*). Photo: B.S. Wannan.
Fig. 4. *Lindernia stantonii*. Corolla opened to show stamens (*Wannan 5243 & Graham*, BRI). Del. W. Smith.

Fig. 5. *Lindernia stantonii*. Capsule, c. ×6.5 (*Wannan 5243 & Graham*, BRI). Photo: B.S. Wannan.

Fig. 6. *Lindernia stantonii*. SEM of seed (*Wannan 5243 & Graham*, BRI). Photo: Australian Museum.

Fig. 7. *Lindernia stantonii*. Transverse stem section, c. ×50 (*Wannan 5243 & Graham*, BRI). Photo: B.S. Wannan.
Fig. 8. Holotype of *Lindernia stantonii* (Wannan 5243 & Graham, BRI). Photo: W. Smith.
Lindernia beasleyi Wannan sp. nov. Similar to some forms of *L. subulata* R.Br., but differs in having spotted lower corolla lobes, shorter leaves (3–12 mm versus 4–20 mm in *L. subulata*), longer pedicels (31–63 mm versus 20–43 mm), presence of stalked glandular trichomes on pedicels (versus absent), and absence of stalked glandular trichomes from the ovary and fruit (versus present). **Typus:** Queensland. **Cook District:** Merapah, 4 August 2010, B.S. Wannan 5935 (holo: BRI; iso: CNS, NSW).

**Annual herb**: stems decumbent and with weakly ascending floral axes, glabrous. **Leaves** cauline, opposite, simple, 3–12 × 0.5–1.5 mm, triangular to subulate, glabrous; margins entire; single midvein often obscure; petiole absent. **Flowers** axillary, shoots sometimes terminated by a cluster of leaves and flowers; pedicels 31–63 mm long (at anthesis), ascending and with stalked glandular trichomes. **Calyx** divided to base, lobes triangular-lanceolate, 2.5–4 mm long, green, with stalked glandular trichomes, three nerved (lateral nerves often obscure). **Corolla** 11–13 mm long, purple and white, with distinctive purple spots on lower lobes; with stalked glandular trichomes externally, internal flaps absent; tube 5–7.5 mm long, upper lobe porrect, emarginate, 2.5–3 mm long, lower lip 3-lobed, 4.5–6.5 mm long, reflexed downwards. **Upper stamens** 2, each with 2 cells; filaments 1.5 mm long, anthers cohering with cells 0.5 mm long. **Lower stamens** 2, each with 2 cells; filaments 3–5 mm long; anthers cohering with cells 0.4–0.5 mm long, one of each pair smaller, both apiculate. Staminal appendage simple, 2.5–4 mm long, exceeding the throat, with bullate trichomes. **Ovary** 1–1.5 mm long, glabrous; nectariferous disc smooth around base of ovary; style 5–6.5 mm long, glabrous. **Fruit** with erect pedicels 32–73 mm long; calyx 3–4 mm long; capsule ovoid 2.5–4 mm long, glabrous. **Seeds** rhomboidal with longitudinal ridges, c. 0.3 × 0.2 mm, surface sulcate, brown. **Stem anatomy** in transverse section four-angled with collenchyma bundles in each corner, with separated vascular bundles; air spaces frequent in outer cortex. **Figs. 9–16.**

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**Additional selected specimens examined:** Queensland. **Cook District:** 2 km NE of Bamaga Airstrip, Aug 1978, *Paijmans 3012* (BRI); Between Bamaga and tip of Cape York, Sep 1980, *Scarth-Johnson 1041A* (BRI); Lake Wicheura, Cape York, Dec 2008, *Booth 5258 & Lynch* (BRI); Cape York N of Jardine River about 26 km S of Bamaga, Oct 1971, *Dodson s.n.* (BRI [AQ3598]); Cape York, *s.dat.* Hartmann *s.n.* (MEL 285765); Jardine River, May 1948, *Brass 18884* (BRI); Biffen Swamp c. 1.5 km S of Mutee Heads Turnoff on road from Bamaga to Jardine River, Aug 1985, *Clarkson 6190* (BRI, CNS); Lake Boronto, Newcastle Bay, Sep 1974, *Webb 13611 & Tracey* (BRI); Near Jacky Jacky Creek, May 1962, *Webb 6011 & Tracey* (BRI); Cape York Peninsula c. 50 miles [83 km] S of Cape York, 1943, *Whitehouse s.n.* (BRI [AQ36297]); Sanamere Lagoon c. 3 km N of Jardine River Crossing on the road to Bamaga, Aug 1985, *Clarkson 6174* (BRI, CNS); c. 2 km S of Ussher Point, Sep 1985, *Clarkson 6247* (BRI, CNS); Fruit Bat Falls, Mar 1992, *Johnson 5067* (BRI); SW of Somerset, Lake Bronto, Aug 1978, *Kanis 2068* (BRI); E of Vrilya...
Fig. 11. *Lindernia beasleyi*. Corolla opened to show stamens (*Wannan 5935*, BRI). Del. W. Smith.

Fig. 12. *Lindernia beasleyi*. Leaf, 4-angled stem and base of pedicel, c. ×7 (*Wannan 5896 & Spena*, BRI). Photo: B.S. Wannan.

Fig. 15. Lindernia beasleyi. Transverse stem section, c. ×65 (Wannan 5896, BRI). Photo: B.S. Wannan.

Station, Cape York Peninsula, Jul 2008, Wannan 5334 & McDonald (BRI); Rock Hole near Emu Lagoon, Errk Oykangand NP, Jun 2010, McDonald KRM9288 & Cockburn (BRI); W of Almaden near race track, Jul 2010, Wannan 5896 & Spena (CNS); Near Almaden Racecourse, Oct 2010, Wannan 5944 & Beasley (BRI, CNS, NSW); Mud Soak Spring, Mt Surprise, Jun 2001, Fensham 4521 (BRI).

**Distribution and habitat:** Lindernia beasleyi is endemic to Queensland where it occurs from Cape York to south-west Cape York Peninsula (Map 2). It grows in moist sandy areas in wetlands and woodlands.

**Notes:** The novelty of this taxon is corroborated by sequence data (Wannan et al. unpubl.). It is perhaps most likely to be confused with Lindernia subulata that occurs over a similar distribution range, but differs in a range of characters as outlined above.

**Conservation status:** This species has a broad range and is moderately common in appropriate habitats. A status of Least Concern is recommended (IUCN 2001).

**Etymology:** The species is named for the late John Beasley whose handbooks provided accessible information on North Queensland plants.

**Lindernia barkeri** Wannan sp. nov. Similar to L. cleistandra W.R.Barker but differs in its more erect glabrous habit with uncrowded leaves, shorter petioles (0.5–4 mm versus 5–22 mm), entire glabrous leaves, shorter calyx (1.5–3 mm versus 2–7 mm), much shorter corolla (4.5–6 mm versus 8–18 mm), and smaller capsule (1.5–3 mm versus 3.5–5.5 mm). **Typus:** Western Australia. KIMBERLEY: Garimbu Creek, 24 June 2014, B.S. Wannan 6687, M. Wardrop, P. Lane & H. Hofman (holo: PERTH; iso: BRI, CNS).

**Lindernia** sp. A W.R. Barker; (Barker 1992a: 828, Fig. 254E).

**Annual herb:** stems erect, 4–16 cm high, sometimes rooting at lower nodes, glabrous, green or rarely reddish. **Leaves** cauline, opposite, simple, glabrous; blade broadly lanceolate to depressed ovate, 3–20 × 2.5–21 mm, diminishing in size up the stem, with 3–5 longitudinal veins; rounded to attenuate at base; margins entire, sinuate or rarely serrate; petiole 0.5–4 mm long. **Flowers** rarely axillary, mostly in racemes with triangular bracts 1–3.5 mm long; racemes sometimes with alternate bracts or when opposite with a single flower per node; pedicels erect 4–12 mm long, glabrous. **Calyx** deeply 5-lobed, almost to the base, triangular-ovate, lobes 1.5–3 mm long, acuminate, 1 or 3 nerved, with minute eglandular hairs. **Corolla** 4.5–6 mm long, white or mauve or pink; tube 2–4 mm long, externally with stalked glandular trichomes; upper lip porrect, c. 0.5 mm long, truncate, internally with longitudinal flaps enclosing the upper anther filaments; lower lip 3-lobed, 1.5–3 mm long, mid-lobe longer than lateral lobes, with the two laterals held at right angles to the mid lobe. **Upper stamens** 2, each with 2-cells, enclosed by the corolla flaps; filaments 0.8–1 mm long; anthers cohering, c. 0.5 mm long, the cells divergent. **Lower stamens** sterile represented by two short (c. 0.5 mm long) staminodes that are either linear or slightly clavate at the apex. **Ovary** c. 1.5 mm long, glabrous; style c. 2.5 mm long, glabrous. **Fruit** with pedicels to 25 mm long, calyx 1.5–3 mm long, capsule 1.5–3 mm long. **Seeds** cuboidal, c. 0.35 × 0.25 mm with 4 longitudinal angles.
Fig. 16. Holotype of *Lindernia beasleyi* (Wannan 5935, BRI), sheet 1 of 2. Photo: W. Smith.
Fig. 17. Holotype of *Lindernia beasleyi* (*Wannan 5935, BRI*), sheet 2 of 2. Photo: W. Smith.
and transverse ridges, light brown. Stem anatomy in transverse section four-angled with collenchyma bundles in each corner, with separated vascular bundles; air spaces uncommon in outer cortex. Figs. 18–25.

Additional selected specimens examined: Western Australia. Kimberley: Mt Hart Station, Jun 2002, Wannan 2476 (BRI, PERTH); Tributary of Garimbu Creek, Jun 2014, Wannan 6681 et al. (CNS, NSW, PERTH); Gorge in Garimbu Creek, Jun 2014, Wannan 6686 et al. (CNS); tributary of Roe River, Jun 2014, Wannan 6688 et al. (CNS, PERTH); c. 1 km upstream of King Cascade, Prince Regent River, Feb 1999, Barrett 715 & 716 (PERTH); c. 1 km E of falls at head of N arm of Bachsten Creek, Jan 1999, Barrett 678 (PERTH); Upper Prince Regent River, 3.5 km E of Mt Agnes, Feb 2001, Barrett 1044 (PERTH); Cypress Valley, beside Morgan River, S of New Theda Homestead, Jan 2001, Barrett 1113 (PERTH); Breakfast Creek flowing S into Charnley River, Jun 1993, Edinger 843 (PERTH).

Distribution and habitat: Lindernia barkeri occurs in the Kimberley of Western Australia (Map 3) and grows in wet sandy soil under sandstone overhangs or in the drip lines of cliffs, often in association with Stylidium muscicola F.Muell.

Notes: The novelty of this taxon, first proposed by Barker (1992a), is corroborated by its sequence data (Wannan et al. unpubl.) and although its leaf shape is similar to Lindernia cleistandra it differs from that species in many characters as outlined above.

Conservation status: This species has a broad, relatively undisturbed range but remains infrequently collected due to its remote habitat and wet-season phenology. A status of Least Concern is recommended (IUCN 2001).

Etymology: The species is named for W.R. (Bill) Barker who has worked on Australian Lindernia for over 30 years.
Fig. 20. *Lindernia barkeri*. Corolla opened to show stamens (*Wannan 2476*, CNS). Del. W. Smith.

Fig. 21. *Lindernia barkeri*. Leaf, c. ×3 (*Wannan 6681 et al.*, CNS). Photo: B.S. Wannan.

Fig. 22. *Lindernia barkeri*. Capsules, c. ×5 (*Wannan 6681 et al.*, CNS). Photo: B.S. Wannan.

Fig. 23. *Lindernia barkeri*. SEM of seeds (*Wannan 2476*, CNS). Photo: Australian Museum.

Fig. 24. *Lindernia barkeri*. Transverse stem section, c. ×70 (*Wannan 6687 et al.*, CNS). Photo: B.S. Wannan.
Fig. 25. Holotype of *Lindernia barkeri* (Wannan 6687 et al., PERTH). Photo: F. Zich.
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References


Map 1. Distribution of *Lindernia stantonii*.

Map 2. Distribution of *Lindernia beasleyi*.

Map 3. Distribution of *Lindernia barkeri*. 