EJB Edinburgh Journal of Botany

EDINBURGH JOURNAL OF BOTANY 79, *Begonia* special issue, Article 410: 1–46 (2022). https://doi.org/10.24823/EJB.2022.410

Published by the Royal Botanic Garden Edinburgh
ISSN (online): 1474-0036, ISSN (print): 0960-4286

OPEN ACCESS
PEER REVIEWED

ADDITIONS TO THE *BEGONIA* FLORA OF SARAWAK, BORNEO, I: TWELVE NEW SPECIES AND A NEW RECORD

S. Julia[1*], **R. Kiew**[2] **& C. Y. Ling**[1]

Twelve new species and one new record of *Begonia* (Begoniaceae) from Sarawak, Malaysia, are described. All species belong to *Begonia* sect. *Petermannia*. Three species are recorded from Totally Protected Areas, one species occurs both within and outside Totally Protected Areas, and eight species occur only outside Totally Protected Areas. Species descriptions, colour photographs and a distribution map are provided.

Keywords. *Begonia* sect. *Petermannia*, Lanjak Entimau Wildlife Sanctuary, Malaysia, Totally Protected Areas.
Received 13 August 2021 Accepted 21 February 2022 Published 18 August 2022

Introduction

Globally, *Begonia* L. is one of the ten largest genera of flowering plants (Frodin, 2004), and in recent years, the number of new species described worldwide has grown faster in *Begonia* than in any other genus (Moonlight *et al.*, 2018). To date, 931 *Begonia* species from Southeast Asia are listed as accepted (Hughes *et al.*, 2015–), and in Borneo, the genus is represented by at least 600 species (Julia & Kiew, 2014).

Currently, 216 species and one subspecies of *Begonia* are known from Borneo. For Sarawak, Kiew *et al.* (2015) listed a total of 96 species of the genus. Since then, an additional 50 new species and one new subspecies of *Begonia* have been described from Sarawak (Julia & Kiew, 2016a, 2016b; Julia *et al.*, 2016; Kiew *et al.*, 2016; Lin & Peng, 2017; Lin *et al.*, 2017; Julia *et al.*, 2018; Kiew *et al.*, 2018; Ling *et al.*, 2018; Lin & Peng, 2019), an average of at least 10 species described per year over the past 7 years. Elsewhere in Borneo, 10 new *Begonia* species have been described since publication of Kiew *et al.* (2015) (Girmansyah & Susanti, 2015; Low *et al.*, 2015; Girmansyah, 2017; Ardi *et al.*, 2019; Hughes *et al.*, 2020).

As part of our ongoing taxonomic study of *Begonia* in Sarawak, a further 13 species are described in this article. Twelve are new to science and one is a new record, bringing the total number of *Begonia* species for Sarawak to 159 species, alongside one subspecies (**Appendix**).

[1] Sarawak Herbarium, Forest Department Sarawak, KM10 Jalan Datuk Amar Kalong Ningkan, 93250 Kuching, Sarawak, Malaysia.
[2] Forest Research Institute Malaysia, 52109 Kepong, Selangor, Malaysia.
* Author for correspondence. E-mail: juliasang12@gmail.com.

Materials and methods

Our initial morphological study of all species described here was based on fresh material and herbarium specimens collected during fieldwork in remote forest areas in Sarawak between 2016 and 2017. Further morphological studies and comparisons of these species with those already known were made, based on descriptions in the literature, herbarium specimens in the Sarawak Herbarium (SAR), and specimen images available via the *Begonia* Resource Centre (Hughes *et al.*, 2015–).

The measurements in the descriptions are based on fresh material, unless stated otherwise. In each description, the measurement given for size of the capsule refers to the dimensions of the whole capsule, including the wings.

Results

Twelve *Begonia* species are described and illustrated below. All belong to *Begonia* sect. *Petermannia*. Figure 1 shows the distribution of the 12 new species. *Begonia papyraptera* Sands, previously known as endemic in Brunei, is a new record for Sarawak.

New species

1. Begonia bajik S.Julia & C.Y.Ling, **sp. nov.**

Most similar to *Begonia erythrogyna* Sands in its matt leaves, paniculate male inflorescence and large red capsules, but *B. bajik* has longer stipules, 2.5–4.3 cm (versus 1.5–2 cm long); shorter petioles, 2.5–5 cm (versus 5.5–14.5 cm long); longer inflorescences, 18–28 cm (versus 7–14 cm long); smaller tepals of female flower, 7–11 × 3–5.5 mm (versus 18–20 × 7–9 mm); and larger capsules, 30–43 × 25–43 cm (versus 28–32 × 18–20 mm). – Type: Malaysia, Borneo, Sarawak, Kapit District, Baleh, Kakap Camp, Tributary of Sungai Melatai, 1°20'11'N, 113°46'12'E, 9 iii 2016, *Ling* et al. SFC 5909 (holotype SAR!, isotype KEP!). Figure 2.

Cane-like herb up to 1 m tall. *Stems* little branched, dull green to reddish, internodes 2.5–8(–13) cm long, 5–8 mm thick, glabrous, slightly thicker at nodes. *Stipules* pale green to reddish brown, glabrous, triangular, 2.5–4.3 × 1.2–1.5 cm, margin entire, rather stiff and rolled backwards, apex setose, seta 2–3 mm long, caducous. *Leaves* alternate, distant, held vertically when young; held horizontally when older, oblique; petioles red brown, glabrous, 2.5–5 cm long; lamina plain, dark green with silvery sheen above, glabrous, magenta below, young lamina sometimes covered with irregular white spots above, in life succulent and thick, matt, asymmetrical, broadly ovate, 12.5–19 × 10–13 cm, broad side 6.6–9 cm wide, base cordate, basal lobes 4–5 cm long, margin minutely dentate, apex acuminate, acumen 1.5–2.5 cm long; venation palmate-pinnate, 6–11 veins on either side of the midrib, branching 3 or 4 times, 4 veins in basal lobe, green except near base above, magenta

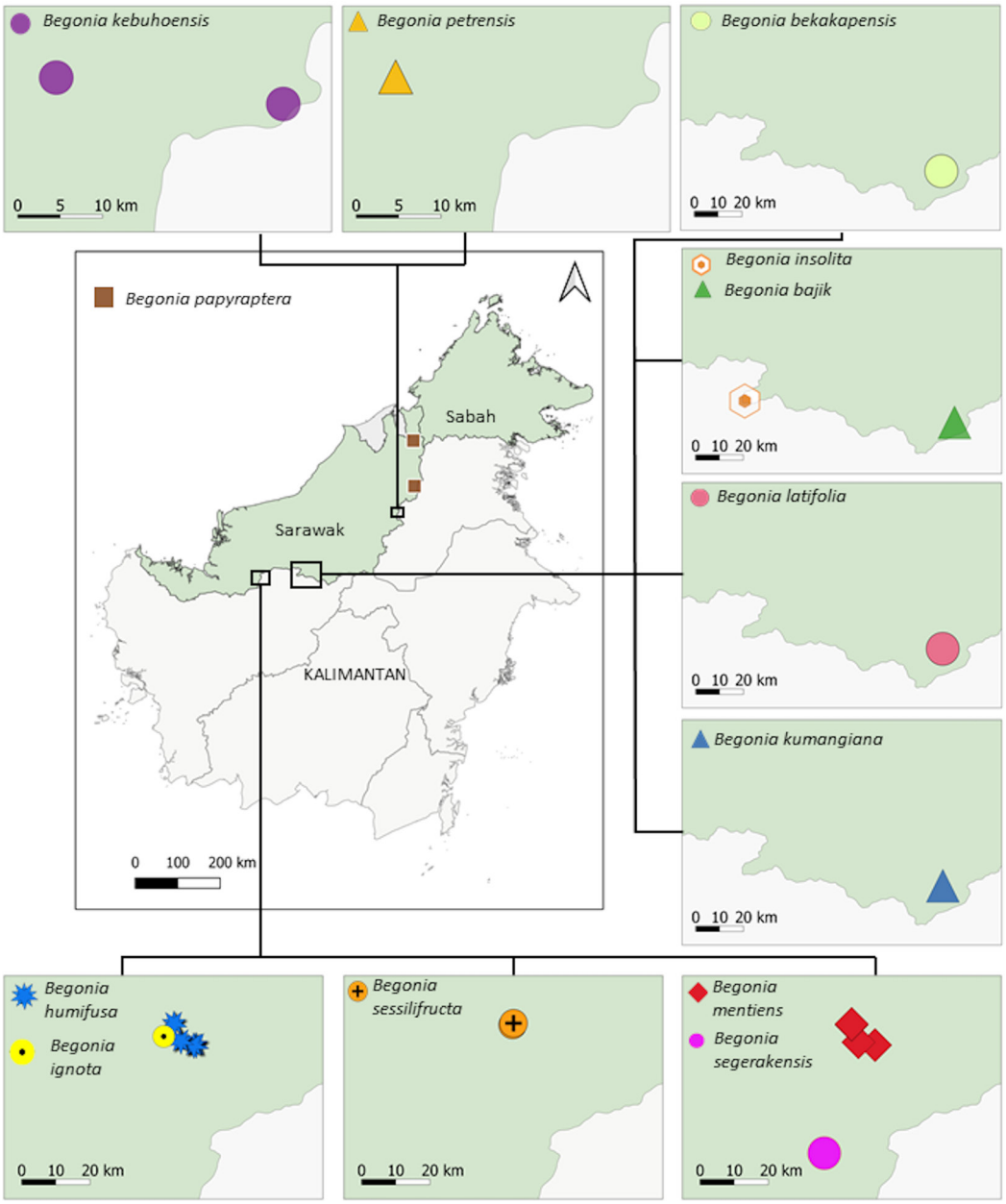

Figure 1. Distribution of *Begonia papyraptera* and the 12 new species of *Begonia* recorded from Sarawak and described in this article.

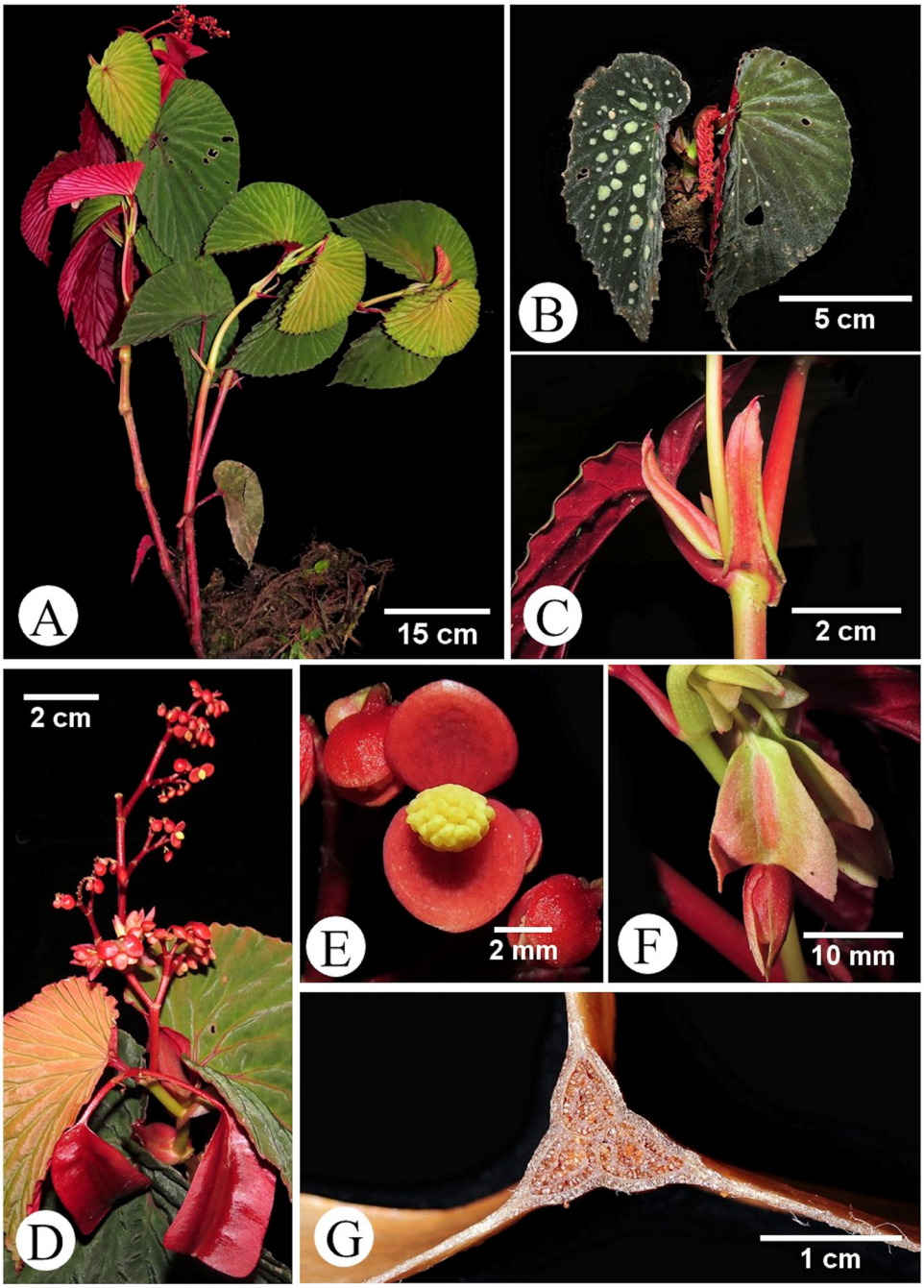

Figure 2. *Begonia bajik* S.Julia & C.Y.Ling, sp. nov. A and B, Habit; C, stipules; D, inflorescence and capsules; E, male flower; F, female flower; G, cross-section of capsule. All photographs of the type specimen, *Ling* et al. SFC 5909, taken by C. Y. Ling.

below, glabrous, sunken above, prominent below. *Inflorescences* protogynous, axillary in upper leaves, glabrous, 1 or 2 female flowers at the base, panicle of male flowers terminal of uppermost leaf axil, rachis 15–23 cm long, peduncle 3–5 cm long; bracts (young) pale green, lanceolate c.17 × 5 mm, caducous, bracteoles pale green or sometimes reddish, reddish on upper half towards apex, lanceolate, c.16 × 5 mm. *Male flowers*: pedicel red, pale green at base, 4–5 mm long; tepals 2, deep red, broadly ovate, glabrous, margin entire, apex rounded, 4–4.5 × 4–5 mm; stamens 24–26, cluster conical, subsessile; filaments 1–1.4 mm long; anthers pale yellow, obovate, c.1.2 × 0.6 mm, apex emarginate or rounded. *Female flowers*: pedicel pale green, 10–12 mm long, glabrous; ovary pale green, pink on locules and wings, ovary including wing triangular, 11–13 × 13–14 mm, glabrous, wings 3, equal, locules 3, placentas 2 per locule; tepals 5, pink-tinged pale green at margin, outer four tepals ovate, 8–11 × 5–5.5 mm, margin minutely dentate to entire, apex acute, inner tepal narrowly elliptic, 7–8 × 3 mm, margin entire, apex broadly acute; styles 3, pale yellow, c.2 mm long, divided to base, Y-shaped; stigma pale yellow, papillose forming a continuous twisted band. *Capsules* 1 or 2, axillary, triangular in outline or lanceolate, deep red to dark maroon, 3–4.3 × 2.5–4.3 cm, glabrous, locules 3, placentas 2 per locule, wings 3, equal, acute proximally, sharply pointed distally, 1.5–2.2 cm wide, dehiscing between the locule and wing, pendent on thin red pedicel, 2.5–4.1 cm long.

Distribution. Malaysia (Sarawak). To date, known only from Kapit District (see **Figure 1**).

Habitat. Near seasonal creeks in disturbed hill forest at elevations to 953 m.

Etymology. From the native Iban word *bajik*, which means ‘beautiful’, alluding to the attractive appearance of this species.

Begonia bajik is uncommon and known only from the type locality. It is striking in its large triangular fruits, in which the width almost equals the length and the wing tips are pointed.

This species resembles smaller plants of *Begonia sirukitii* S.Julia & C.Y.Ling in its leaf characters, inflorescence type and male flowers, but *B. bajik* can be distinguished by its female flowers and fruits.

Compared with *Begonia alabensis* Kiew, *B. bajik* has larger stipules, 2.5–4.3 × 1.2–1.5 cm (versus 2.5 × 0.8–10 cm); shorter petioles, 2.5–5 cm (versus 10.5–15 cm long); more numerous veins, 6–11 pairs (versus 4 pairs); and longer panicles of male flowers, 15–23 cm (versus short cyme to 9 cm long).

This species is also similar to *Begonia bekakapensis* C.Y.Ling & S.Julia in its succulent, matt and asymmetrical leaf. However, *Begonia bajik* differs in its stiff stipules with margins rolled backwards; venation dense, 6–11 (versus 4 or 5) veins on either side of the midrib, and 4 (versus 2 or 3) veins in basal lobe; inflorescence paniculate (versus racemose), 15–23 cm (versus 2–5 cm) long; pedicel of male flower 4–5 mm (versus 10–12 mm) long, the tepals 4–4.5 × 4–5 mm (versus 6–8.5 × 6.5–7 mm), with fewer stamens, 24–26

(versus 45–56); female flower with longer pedicel, 10–12 mm (versus 4–5 mm long), ovary triangular with sharply pointed wing tips (versus lanceolate with rounded wing tips), 11–13 mm (versus 18–20 mm) long; and wider capsule, 2.5–4.3 cm (versus 1.8–2.1 cm wide), and longer fruit pedicel, 2.5–4.1 cm (versus 1.1–1.2 cm long).

2. **Begonia bekakapensis** C.Y.Ling & S.Julia, **sp. nov.**
   Similar to *Begonia umbratica* S.Julia in its large stipules, large oblique ovate leaves and clustering inflorescences but differentiated by its monopodial stem to 40 cm tall (versus bushy branched stem to 1 m tall); much shorter petioles, 1.5–4 cm (versus 5–16 cm long); shorter peduncle, 7–8 mm (versus c.15 mm long); longer pedicels of male flowers, 10–12 mm (versus 6–7 mm long); and female flowers with exceptionally large tepals, 10–19 × 8–10 mm (versus 8–10 × 6–8 mm). – Type: Malaysia, Borneo, Sarawak, Kapit District, Baleh, Sungai Bekakap, 1°21'58"N, 113°43'33"E, 7 iii 2016, *Ling* et al. SFC 5904 (holotype SAR!, isotype KEP!). Figure 3.

Erect monopodial cane-like herb to 40 cm tall. *Stems* reddish brown, occasionally with a short lateral branch, succulent, internodes 4–11 cm long, 5.5–9 mm thick, thicker at nodes. *Stipules* reddish, lanceolate, 3–4 × 0.8–1.2 cm, margin entire, apex acute, caducous. *Leaves* alternate, distant, oblique, held horizontally; petioles reddish brown, 1.5–4 cm long, grooved above; lamina glabrous, plain green above, dark green when older, with an iridescent silvery sheen, pale green sometimes magenta beneath, in life succulent, matt, asymmetrical, elliptic, 12.3–21.5 × 9–14.3 cm, broad side 6.5–10 cm wide, base cordate, basal lobe 3–4 cm long, margin slightly serrate, apex acuminate, acumen 1–2.5 cm long; venation palmate-pinnate, veins greenish above reddish near the leaf base, reddish beneath, with 4 or 5 veins radiating from the base, branching 2 or 3 times towards the margin, c.3 veins on each side of the midrib and 2 or 3 veins in basal lobe, slightly impressed above, prominent beneath. *Inflorescences* protogynous, axillary in upper leaf axils, clustered, 2–5 cm long, peduncle 7–8 mm long, 1 or 2 female flowers below, male flowers in compact cymules above; bracts pale green, red at base, lanceolate, 26–32 × 9–13 mm, margin entire, persistent; bracteoles pale green, ovate, 15–22 × 14–16 mm, persistent. *Male flowers*: pedicel pale green, 10–12 mm long, glabrous; tepals 2, white to pale green, reddish towards the base inside, outside white, glabrous, margin entire, apex broadly rounded, ovate, 6–8.5 × 6.5–7 mm; stamens 45–56, cluster conical, subsessile; filaments pale yellow, 0.8–1 mm long; anthers pale yellow, obovate, c.1 × 0.5 mm, apex emarginate. *Female flowers*: pedicel pale green, pink at base, 4–5 mm long, glabrous; ovary deep red to dark maroon with pale green centre, sometimes pale green with pinkish maroon wings, ovary including the wings oblong, 18–20 × 9–13 mm, glabrous, wings 3, equal, locules 3, placentas 2 per locule; tepals 5, white to pale green with reddish stripes, more prominent towards the base, glabrous, outer four tepals ovate or broadly elliptic, 10–19 × 8–10 mm, margin entire to minutely serrate, apex acute, inner tepal elliptic, 7–13 × 5–7 mm; styles 3, yellow, c.2 mm long, deeply

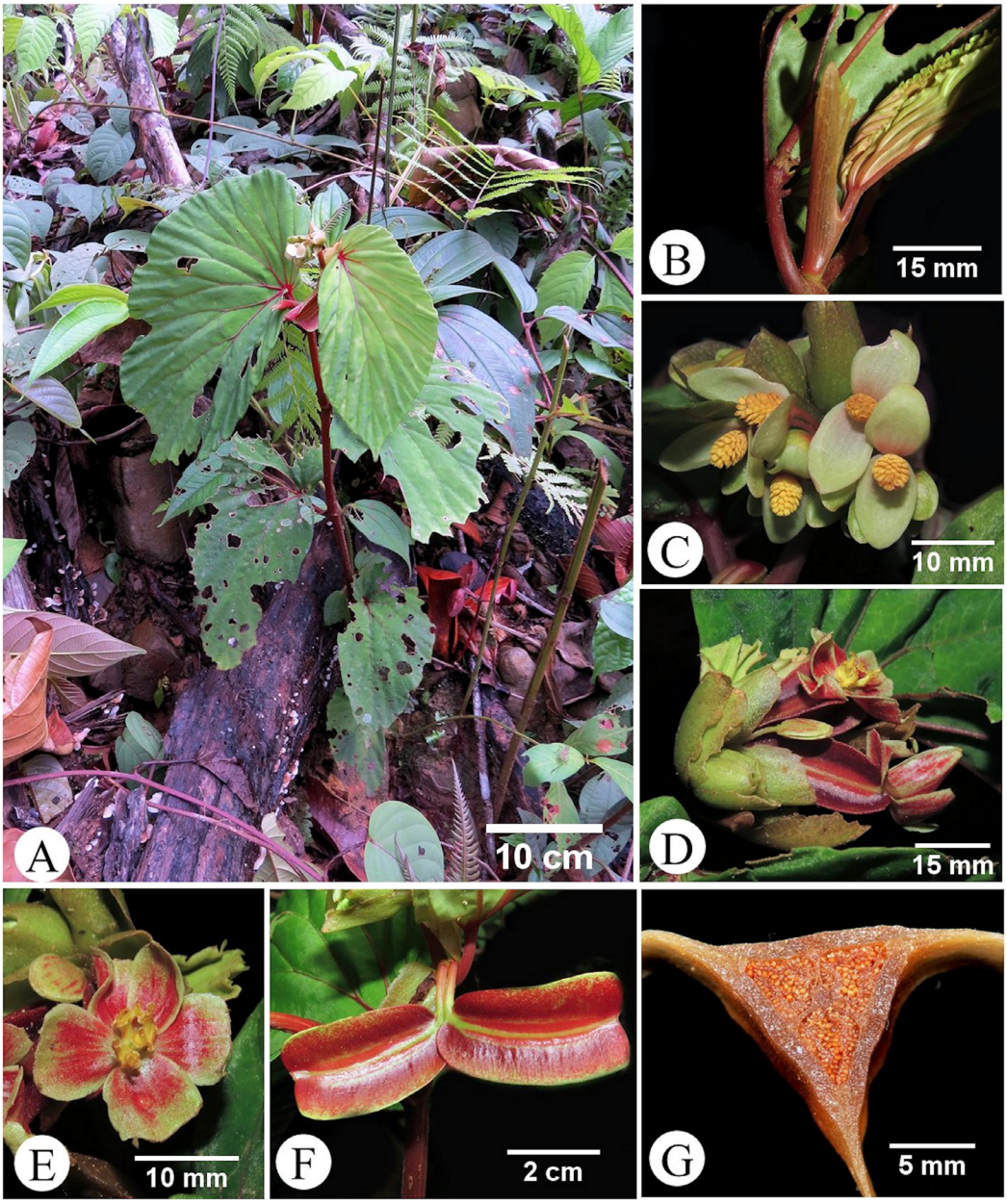

Figure 3. *Begonia bekakapensis* C.Y.Ling & S.Julia, sp. nov. A, Habit; B, stipule; C, male flowers; D, female inflorescence; E, female flower; F, capsules; G, cross-section of capsule. All photographs of the type specimen, *Ling* et al. SFC 5904, taken by C. Y. Ling.

divided to base; stigma yellow, papillose forming a twisted band. *Capsules* pale greenish to dark maroon, 3–4.5 × 1.8–2.1 cm, glabrous, locules 3, placentas 2, wings 3, equal, rounded proximally, truncate distally, wings equal 7–9 mm wide, thinly fibrous, dehiscing between locule and wing; pedicel pendent, 11–13 mm long.

Distribution. Malaysia (Sarawak). To date, known only from Sungai Bekakap, Kapit District (see **Figure 1**).

Habitat. Hill mixed dipterocarp forest growing near a small stream and seasonal creek in shade, and on forest margins exposed by logging activities at elevations to 684 m.

Etymology. Named after the type locality, Sungai Bekakap, from where the species was first collected.

An attractive species with relatively large flowers and in life with striking red fruits. The fruits of *Begonia bekakapensis* are similar to those of *B. magnicarpa* C.W.Lin & C.I Peng, but its inflorescence is much more compact and shorter than that of *B. magnicarpa*, which has cymosely branching panicles 17–26 cm long.

3. Begonia humifusa S.Julia & Kiew, **sp. nov.**

Similar to *Begonia addrinii* S.Julia & Kiew in its habit but distinguished by its unevenly bullate, obovate to rhomboid leaves (versus bullate, obovate to orbicular leaves); shorter ovate bracts, 2–3 × 2–3 mm (versus lanceolate, 4–7 × 2–3 mm); and stamens 36–41 (versus 25–30). – Type: Malaysia, Borneo, Sarawak, Julau District, Lanjak Entimau Wildlife Sanctuary, Mujok, Sungai Segak Mit, 1°40'56"N, 112°09'30"E, 21 v 2016, *Ling & Dino* SFC 5930 (holotype SAR!, isotype KEP!). **Figure 4.**

Creeping herb, rooting at the nodes. Stem, petiole and stipule densely pilose, hairs whitish. *Stems* to 33 cm long, unbranched, pale green, internodes 1.5–4.5 cm long, 4–6 mm thick, slightly thicker at nodes. *Stipules* pale green, ovate, 6–12 × 6–12 mm, margin entire, keeled, apex setose, seta 1–2 mm long, caducous. *Leaves* closely arranged when young, becoming distant when mature, slightly oblique; petioles pale green, reddish when young, 0.7–2.5 cm long, succulent, terete; leaves plain green above, sometimes with a metallic sheen, paler beneath, in life succulent, bullate, sometimes with hispid hairs in between veins above, hairs whitish, slightly asymmetrical, obovate to rhomboid, 4.5–7 × 3.2–8 cm, base cordate, overlapping, slightly unequal, basal lobe 0.6–1.3 cm long, margin shallowly serrate and ciliate, apex acute or rounded; venation palmate, 4 or 5 veins radiating from the base, branching 2 or 3 times towards the margin, with 2 veins in basal lobe, concolorous, slightly impressed above, prominent beneath. *Inflorescences* erect, axillary, several along the creeping stem, pinkish or brownish, simple dichasia, peduncle unbranched, 3–6 cm long, topped by 1 female and 2–4 male flowers; bracts reddish, ovate, 2–3 × 2–3 mm, margin entire, keeled, apex acute, persistent; bracteoles reddish, ovate to lanceolate, 2.5–4

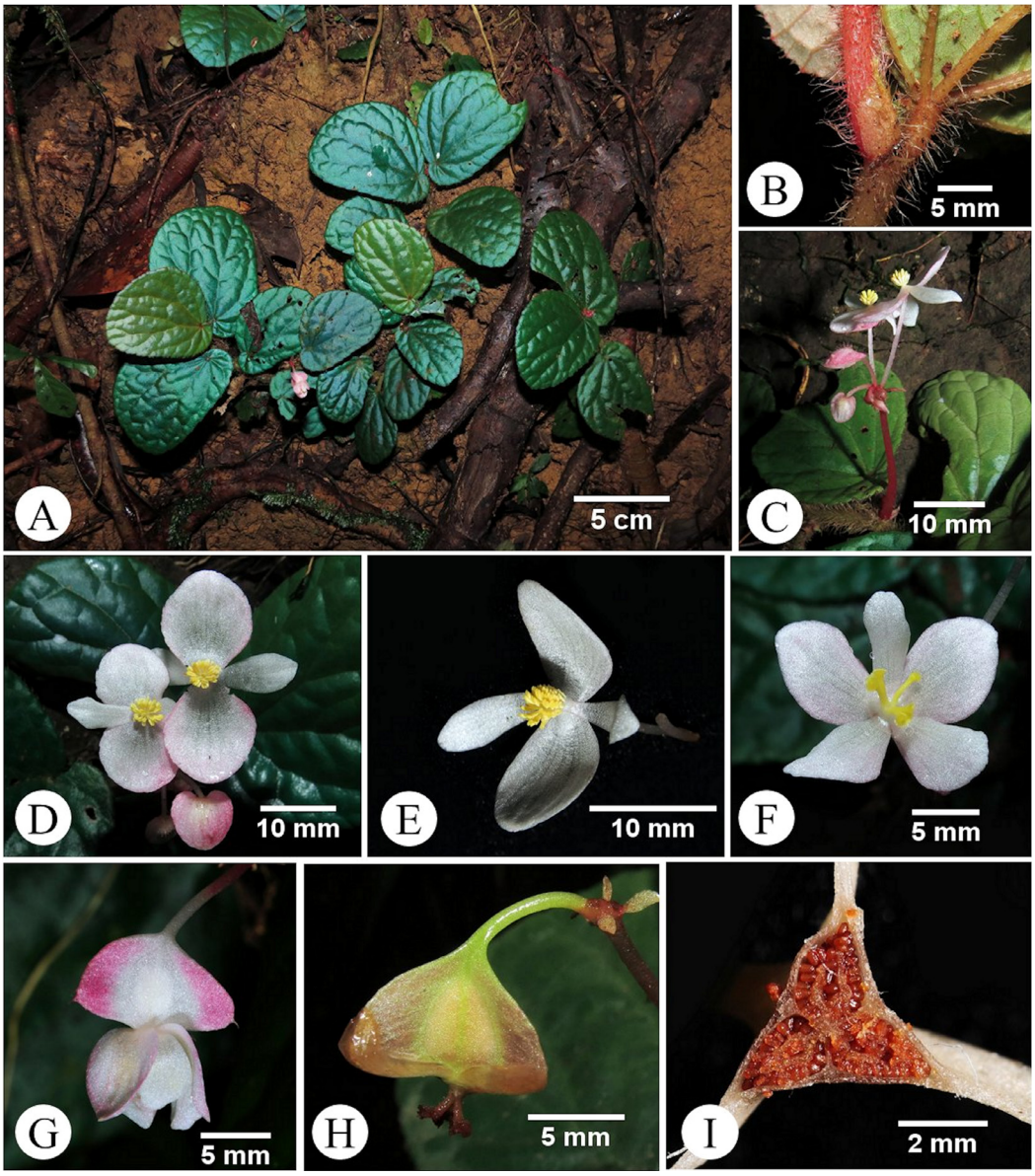

Figure 4. *Begonia humifusa* S.Julia & Kiew, sp. nov. A, Habit; B, stipule; C, inflorescence; D and E, male flowers; F and G, female flower; H, capsule; I, cross-section of capsule. All photographs taken by C. Y. Ling: A, B and I, *Ling & Dino* SFC 5930 (the type specimen); C–F and H, *Ling & Dino* SFC 5946; G, *Ling & Dino* SFC 5943.

× 1–2 mm, margin entire. *Male flowers*: pedicel white to pale pink, 8–17 mm long, glabrous or bristly, hairs pink; tepals 4, white or white tinged pink towards apex inside, with bristles outside, hairs white to pinkish, margin entire, apex broadly acute, outer two tepals broadly ovate to elliptic, 5–14 × 7–12 mm, inner two tepals narrowly elliptic to oblong, 5–13 × 2–4 mm, stamens 36–41, cluster loosely globose, subsessile, filaments c.1 mm long; anthers yellow, obovate, 1.2–1.5 × 0.4–0.6 mm, apex emarginate. *Female flowers*: pedicel whitish or greenish, 5–6 mm long, ovary pinkish or greenish tinged reddish, ovary and wings triangular, 5–8 × 8–14.5 mm, wings 3, slightly unequal, 2–3.5 mm wide, locules 3, placentas 2 per locule; tepals 5, whitish, pinkish or whitish green, broadly ovate; outer four tepals 5–10 × 4–7 mm, glabrous or bristly outside, hairs pink, inner tepal 4–8 × 3–4 mm, margin entire, apex broadly acute, styles 3, yellow, 2–3 mm long; stigma yellow, anchor-shaped, papillose. *Capsules* single, pale green or pale green tinged reddish, 0.5–0.8 × 0.9–1.3 cm, locules 3, wings 3, slightly unequal, 2–4 mm wide, acute proximally, rounded to acute distally, dehiscing between the locules and wings; pedicel pendent, green, stiff, 5–7 mm long.

Distribution. Malaysia (Sarawak). To date, known only from a few river systems in Julau District (see Figure 1).

Habitat. Locally abundant, growing near riverbanks in primary forest and also in disturbed forest areas on clayey exposed soils on steep slopes at 136–164 m elevation.

Etymology. Latin, *humifusus* ('spreading over the surface of the ground'), referring to its creeping habit.

Additional specimens examined. Malaysia. **Sarawak**: Julau District – Lanjak Entimau Wildlife Sanctuary, Mujok, Sungai Sengkadang, 1°40'53"N, 112°09'07"E, 22 v 2016, *Ling & Dino* SFC 5943 (KEP, SAR); Mujok, Sungai Nyamuk, 1°40'53"N, 112°09'07"E, 23 v 2016, *Ling & Dino* SFC 5946 (KEP, SAR); Mujok, Sungai Igan, 1°44'20"N, 112°06'02"E, 25 v 2016, *Ling & Dino* SFC 5969 (KEP, SAR).

In life, the leaves of *Begonia humifusa* are conspicuously bullate, but on drying this character is lost. This species is locally common and abundant. It occurs both within and outside the boundary of the Totally Protected Area (TPA) of Lanjak Entimau Wildlife Sanctuary.

Begonia humifusa resembles *B. gibbsiae* Irmsch. ex. Sands in its leaf shape, size and venation but differs in having longer stems, 33 cm (versus 3–25 cm long); wider stipules, 6–12 mm (versus 1.2–2 mm wide); and axillary inflorescences 3–6 cm long (versus terminal inflorescence 13–20 cm long).

4. Begonia ignota C.Y.Ling & Kiew, **sp. nov.**

Similar to *Begonia bintang* Rimi in its habit, leaf shape and single-flowered female inflorescence, but *B. ignota* can be distinguished by its longer internodes, 2–7.5 cm (versus 0.4–1.7 cm long); larger stipules, 14–18 × 9–10 mm (versus c.10 × 3–4 mm); larger oblanceolate leaves, 14–23 × 5–10 cm, with basal lobe 4–7 mm long (versus narrowly obovate, 6.5–12.5 × 2–3 cm, with an undeveloped basal lobe); larger bracts and

bracteoles, 13–15 × 7 mm and c.10 × 4 mm, respectively (versus bracts c.2 × 1.8 mm and bracteoles c.2 × 1 mm); larger oblong ovary, c.22 × 12 mm (versus ovary turbinate, c.4 × 7–14 mm); and larger oblong capsule, 22–30 × 10–15 mm (versus turbinate capsule, 4–5 × 15–20 mm). – Type: Malaysia, Borneo, Sarawak, Julau District, Lanjak Entimau Wildlife Sanctuary, Ulu Mujok, Sungai Jungin, 1°42'15"N, 112°04'25"E, 20 v 2016, *Ling & Dino* SFC 5920 (holotype SAR!, isotype KEP!). Figure 5.

Erect herb to 50 cm tall. Stems, stipules and lower leaf surface tomentose, hairs pale brown. *Stems* brown, internodes 2–7.5 cm long, 4–6 mm thick. *Stipules* pale green to yellow green, ovate, 14–18 × 9–10 mm, margin entire, keeled, apex setose, seta 1–2 mm long. *Leaves* alternate, distant, slightly oblique, asymmetrical, held horizontally; petioles brown, 0.4–0.8 cm long, grooved above; lamina glabrous, plain dark green above, pale green beneath, slightly falcate, in life succulent, matt, oblanceolate, 14–23 × 5–10 cm, broad side 3–6 cm wide, base unequal, broad side rounded with basal lobe 4–7 mm long, narrow side with cuneate base, margin minutely dentate, apex acuminate, acumen 1–2 cm long; venation pinnate, veins concolorous, prominent on both surfaces, 4–7 veins on either side of the midrib, 1 or 2 veins in basal lobe. *Inflorescences* protogynous, axillary in the lower leaf axils, female inflorescence simple dichasium; bracts pale yellow green, ovate, 13–15 × 7 mm, margin entire, apex acuminate, persistent; bracteoles similar to bracts but smaller, c.10 × 4 mm, persistent. *Male flowers*: not seen. *Female flowers*: pedicel white with a hint of yellow, c.7 mm long, tomentose; ovary white, tinged pale green on the wings, densely tomentose, oblong, ovary including the wings c.22 × 12 mm, wings 3, equal, locules 3, placentas 2 per locule; tepals 5, white tinged pale green at apex, narrowly elliptic, c.14 × 5 mm; styles 3, pale yellow, c.3 mm long, divided to base, anchor-shaped; stigma yellow, papillose and pale yellow forming a continuous twisted band. *Capsules* pale green, locules densely tomentose, hairs brown, oblong, 22–30 × 10–15 mm, locules 3, wings 3, equal, acute proximally, rounded to concave distally, 4–7 mm wide, thinly fibrous, dehiscing between locule and wing; pedicel stiff, perpendicular to stem, 5–6 mm long.

Distribution. Malaysia (Sarawak). To date, known only from Lanjak Entimau Wildlife Sanctuary (see Figure 1).

Habitat. Riparian forest along a small stream with occasional mudstone boulders, to 131 m elevation.

Etymology. Latin, *ignotus* ('unknown'), referring to this nondescript erect begonia without special features, which remained unnoticed and unknown until now.

The unusual character of this species is the capsule that is held perpendicular to the stem rather than hanging pendent as is usual. Among Bornean begonias, this type of capsule is seen only in *Begonia joffrei* S.Julia and *B. matangensis* S.Julia & Kiew. Both also have an oblanceolate ovary with silky hairs and green-yellowish tepals. However, *Begonia joffrei*

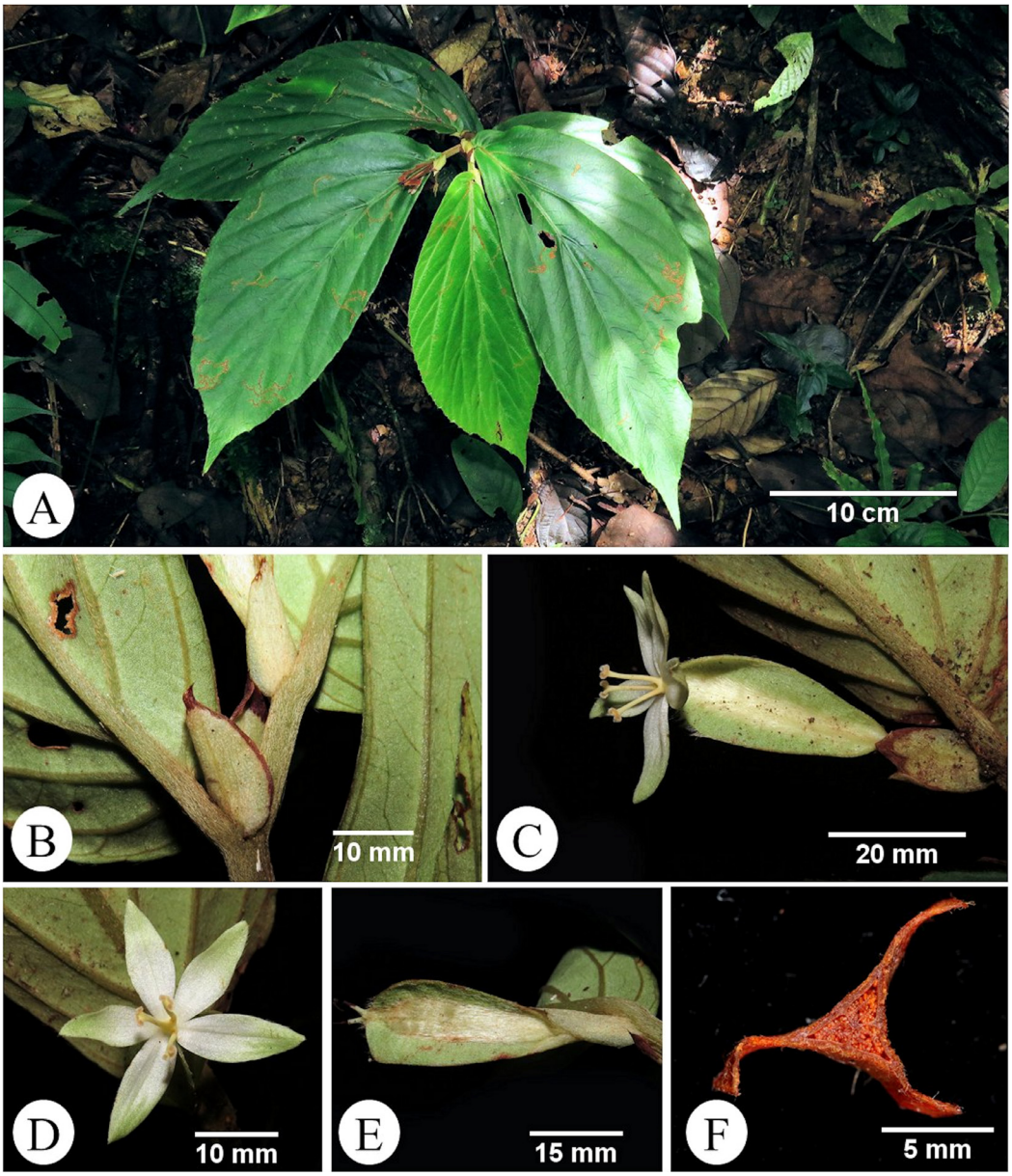

Figure 5. *Begonia ignota* C.Y.Ling & Kiew, sp. nov. A, Habit; B, stipule; C and D, female flower; E, young capsule; F, cross-section of capsule. All photographs of the type specimen, *Ling & Dino* SFC 5920, taken by C. Y. Ling.

can be differentiated from this species in having a bushy habit with stem to 1 m tall, leaf oblique, alternate on erect stem but then on branched stems the leaves appearing opposite. In its habit, the species is similar to *Begonia matangensis*, but in *B. matangensis*, the upper leaves are opposite whereas the lower leaves are arranged alternately, and the lamina is not oblique.

5. **Begonia insolita** C.Y.Ling & S.Julia, **sp. nov.**
   Similar to *Begonia tinjanii* S.Julia in its erect habit and oblanceolate leaves with a cordate base, but differs in having smaller stipules, c.5 × 3 mm (versus 10–12 × 4 mm); terminal inflorescences (versus axillary); bracteoles with glandular knobs along the margin (versus bracteoles non-glandular); smaller male flowers, outer two tepals c.4 × 4 mm, inner two tepals c.4 × 1.5 mm (versus outer two tepals 8–12 × 5–10 mm, inner two tepals 6–8 × 1–4 mm); ovary narrower, 7–8 × 5–8 mm (versus 10–12 × 10–12 mm); placentas 2 per locule (versus placenta 1 per locule); and fruit broader than long, 3–8 × 6–12 mm (versus longer than wide, c.12 × 8 mm). – Type: Malaysia, Borneo, Sarawak, Kapit District, Ulu Mengiong, 1°25'00"N, 112°58'45"E, 6 viii 2017, *Ling* et al. SFC 5584 (holotype SAR!, isotype KEP!). Figure 6.

Erect herb to 15 cm tall, leaves crowded towards top of the stem. *Stems* brownish, unbranched, rarely branching at the base, pubescent, hairs brown, succulent, 2–4 mm thick, internodes 0.5–3 cm long, slightly thicker at nodes, sometimes rooting at nodes. *Stipules* pale green, narrowly ovate, c.5 × 3 mm, margin entire, apex acute, caducous. *Leaves* alternate, distant, not oblique, held horizontally; petioles brownish, pubescent, hairs brown, 3–7 mm long, terete or slightly grooved above; lamina green above, pale green beneath, with green bristles between veins, in life succulent, glossy, asymmetrical, narrowly obovate, 5.5–9 × 2.3–3 cm, broad side 1.5–2.5 cm wide, base cordate, basal lobes c.2 mm long, margin toothed at the vein ending, apex acuminate, acumen to 1 cm long; venation pinnate, concolorous, 2–4 veins on each side of the midrib, inconspicuous on both sides. *Inflorescences* protogynous, terminal or opposite upper leaf axil, racemose, 3–5 cm long, peduncle brownish, 5–6 mm long; bracts pale green or whitish, elliptic, 5–6 × 2–3 mm, margin entire, caducous; bracteoles white or pale green, elliptic, 1.5–4 × 1–2 mm, margin studded with glandular knobs, apex acute or rounded, persistent. *Male flowers*: pedicel white, c.7 mm long, glabrescent; tepals 4, white, glabrous, margin entire, apex broadly acute to rounded, outer two tepals broadly ovate, c.4 × 4 mm; inner two tepals lanceolate, c.4 × 1.5 mm; stamens 13–17, cluster globose, subsessile; filaments pale yellow, c.1 mm long; anthers yellow, obovate, c.0.8 × 0.5 mm, apex emarginate. *Female flowers*: pedicel white, c.3 mm long; ovary white, sometimes tinged pink, elliptic, ovary including the wings 7–8 × 5–8 mm, glabrous, wings 3, equal, locules 3, placentas 2 per locule; tepals 5 or rarely 6, white, sometimes tinged pink, glabrous, outer four tepals broadly elliptic, 9–10 × 4 mm, margin entire, apex acute, inner one or two tepals lanceolate, 7–8 × 2 mm; styles

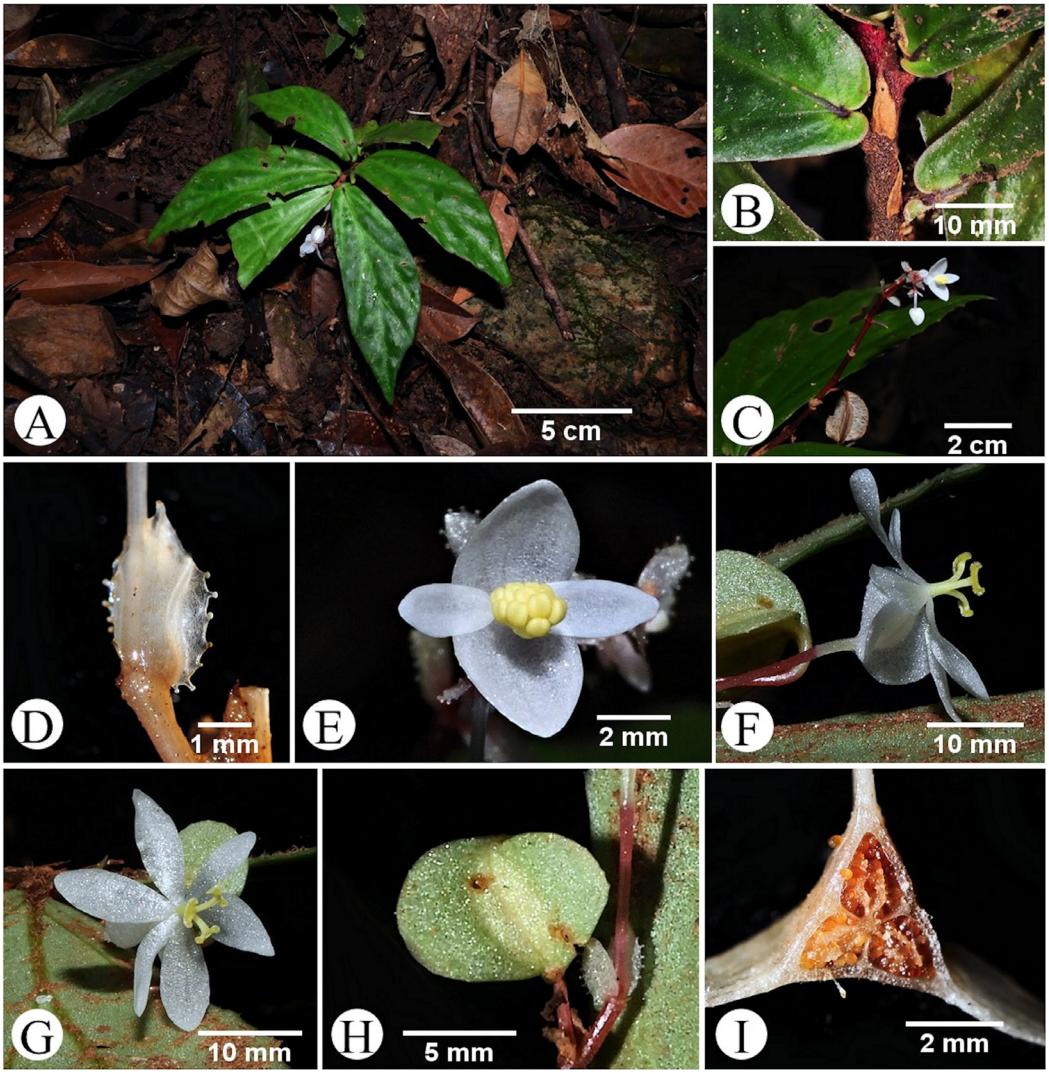

Figure 6. *Begonia insolita* C.Y.Ling & S.Julia, sp. nov. A, Habit; B, stipule; C, male inflorescence and capsule; D, bracteole; E, male flower; F and G, female flower; H, capsule; I, cross-section of capsule. All photographs of the type specimen, *Ling* et al. SFC 5584, taken by C. Y. Ling.

3, pale yellow, c.3 mm long, divided to base, anchor-shaped; stigma pale yellow, papillose forming a continuous twisted band. *Capsules* elliptic, broader than long, 3–8 × 6–12 mm, glabrous, locules 3, placentas 2 per locule, wings 3, unequal, acute proximally, rounded distally, 2–4 mm wide, thinly fibrous, dehiscing between the locule and wing, pendent on thin pedicels, 1–1.2 cm long.

Distribution. Malaysia (Sarawak). To date, known only from Kapit District (see Figure 1).

Habitat. On a steep slope above a stream in disturbed mixed dipterocarp forest.

Etymology. Latin, *insolitus* ('unusual'), referring to the combination of the terminal inflorescence and habit of the 'pubescens group'.

Although *Begonia insolita* is at present known from only one specimen, it is sufficiently distinct to be described as a new species. Although it resembles members of the '*Begonia pubescens* Ridl. group' in being a low, hairy begonia with non-oblique leaves, the short petiole not at an angle with the midrib and the venation pinnate, it is unique in the combination of its being glabrous and in the inflorescence being terminal whereas in the 'pubescens group' the short inflorescences are produced from many leaf axils lower down the stem. Among members of the 'pubescens group', which include *Begonia hexaptera* Sands, *B. hullettii* Ridley and *B. magentifolia* Kiew & S.Julia, *B. insolita* is most similar to *B. tinjanii* in being glabrous, but it differs in several other characters (see diagnosis above).

This new species also superficially resembles *Begonia incompta* Kiew, but *B. insolita* is much smaller in its habit (15 cm tall versus 87 cm tall) and has shorter internodes, 0.5–3 cm (versus 4–8 cm long); narrowly ovate stipules, c.5 × 3 mm (versus lanceolate, 8–16 × 2.5–4 mm); shorter petioles, 3–7 mm (versus (8–)20–30 mm long); much smaller leaves, 5.5–9 × 2.3–3 cm (versus 12.5–22 × 5–7.5 cm); and much smaller capsules, 3–8 × 6–12 mm (versus 16–24 × 14–18 mm).

6. Begonia kebuhoensis S.Julia & C.Y.Ling, **sp. nov.**

Among the 'calcarea group' of begonias (Kiew *et al.*, 2016), *Begonia kebuhoensis* is most similar to *B. sadirensis* Kiew & S.Julia in its habit and glabrous upper leaf surface, but it differs in its slightly bullate lamina when fresh, margin ciliate (versus lamina not bullate, margin minutely toothed); male flowers with 4 dimorphic tepals (versus 4 isomorphic tepals); smaller ovary, c.8–9 × 11 mm with rounded or truncate wings both distally and proximally (versus ovary c.12 × 18 m, wings narrowed proximally); and strongly recurved (versus straight) pedicel. – Type: Malaysia, Borneo, Sarawak, Belaga District, Linau Forest Management Unit, Sungai Kebuho, 2°18'40"N, 114°40'52"E, 22 ix 2016, *Ling* et al. SFC 7012 (holotype SAR!, isotype KEP!). Figure 7.

Robust creeping herb to 4.5–60 cm long, stem prostrate, rooting at nodes. *Stems* greenish, unbranched, succulent, 3–9 mm thick, sometimes with sparsely red or pale green hairs, hairs 2–3 mm long, internodes 0.5–4.5 cm long, slightly thickened at nodes. *Stipules* pale green, sometimes tinged pinkish, glabrous or sparsely hairy, hairs red, broadly lanceolate or ovate, 9–25 × 6–15 mm, margin entire, apex acute, persistent. *Leaves* alternate, distant, oblique, held horizontally; petioles stout, reddish when young, pale green when mature, glabrous or densely hispid, hairs red or pale green, sometimes glabrescent, 6–23 cm long, terete; lamina plain green above, glabrous above, pale green beneath, juvenile leaf reddish,

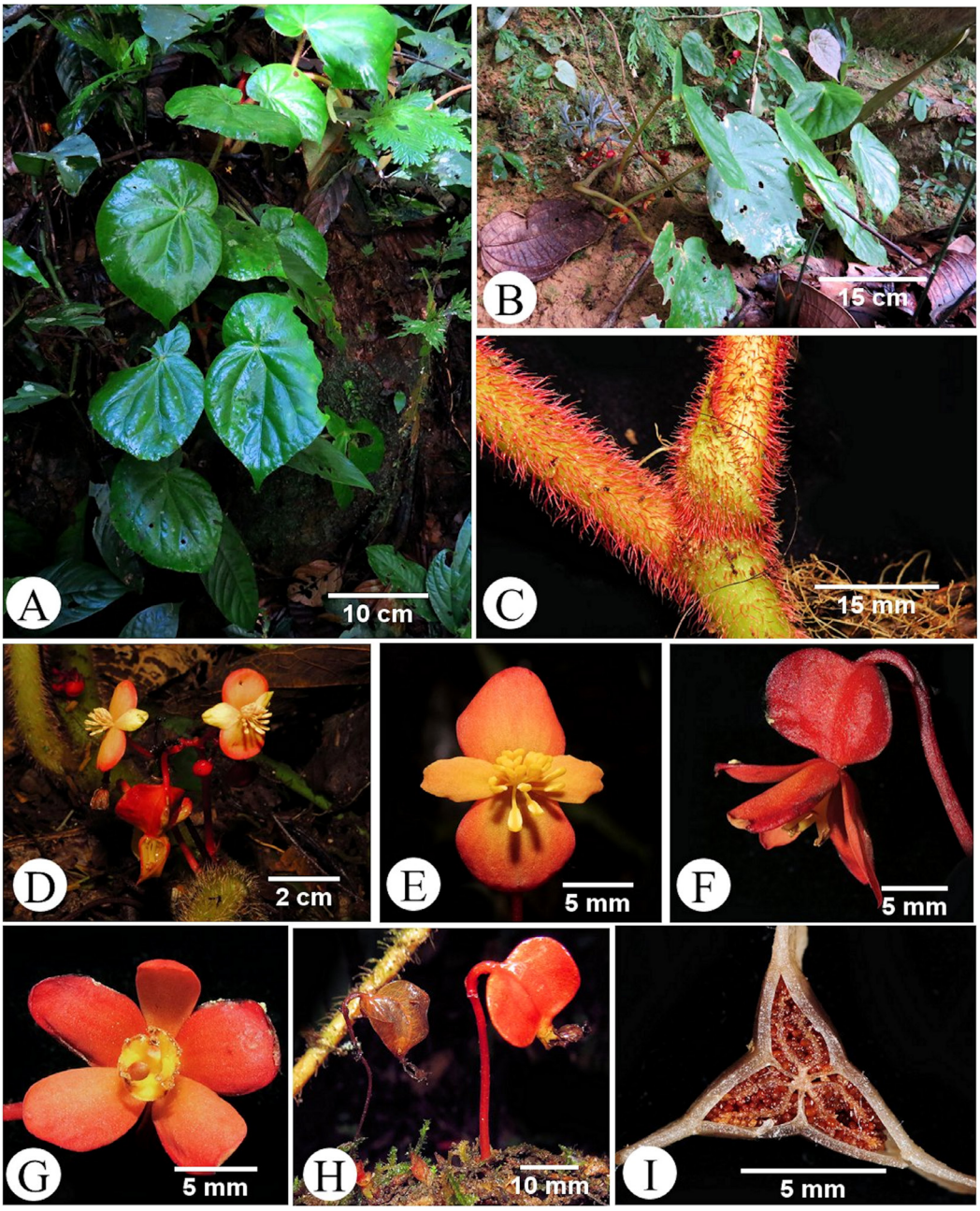

Figure 7. *Begonia kebuhoensis* S.Julia & C.Y.Ling, sp. nov. A and B, Habit; C, stipule and stem; D, inflorescence; E, male flower; F and G, female flower; H, capsules; I, cross-section of capsule. All photographs taken by C. Y. Ling: A and D, *Ling* et al. SFC 8293; B, E–G and I, *Ling* et al. SFC 7012 (the type specimen); C, *Ling* et al. SFC 8288; H, *Ling* et al. SFC 7022.

in life succulent, sometimes slightly bullate, glossy, beneath with scattered bristles between veins and on the veins, hairs red, rarely glabrous, asymmetrical, ovate to oblanceolate, 8–16 × 7–17.5 cm, broad side 4.5–10.5 cm wide, base deeply cordate and overlapping, basal lobes 2.5–7.5 cm long, margin ciliate, apex acuminate, acumen 0.5–1.5 cm long; venation palmate-pinnate, 8–10 veins radiating from the base, branching 2–5 times towards margin, veins concolourous, prominent both sides. *Inflorescences* protogynous in upper leaf axils, simple cyme; slender, 4–6 cm long, peduncle 2–3.5 cm long; bracts several crowded at base, pale green or reddish, ovate, 3–5 × 2–3 mm, margin entire, glabrous, apex acute, persistent; bracteoles similar to bracts but smaller, ovate, 3–4 × 1.5–2 mm, glabrous, margin entire, persistent; female inflorescence to 2.5 cm long; bracts pale green or reddish, ovate, 2–4 × 2–3 mm, margin entire, apex acute, persistent; bracteoles reddish, ovate, 1–2 × 1 mm, margin entire, apex acute, persistent. *Male flowers*: pedicel reddish, 12–20 mm long; tepals 4, glabrous, outer two tepals reddish outside, pale orange red inside, obovate, 9–12 × 7–8 mm, margin entire, apex acute to rounded, inner two tepals peachy orange or pale orange, lanceolate to narrowly obovate, 11–13 × 3–5 mm; stamens 29–36, cluster globose, sessile; filaments pale yellow, 2–2.5 mm long; anthers lemon yellow, obovate, 1.2–1.5 × 0.5 mm, apex emarginate. *Female flowers*: pedicel reddish, 5–7 mm long; ovary deep red, ovate, ovary including the wings c.8–9 × 11 mm, wings 3, equal, locules 3, placentas 2 per locule; tepals 5, reddish to orangey, glabrous, outer four tepals broadly elliptic, 8–9 × 4–5 mm, margin entire, apex broadly acute or rounded, inner tepal 7–9 × 3–4; styles 3, lemon yellow, c.3 mm long, divided to base, broadly anchor-shaped; stigma yellow-orange, papillose forming a continuous twisted band. *Capsules* reddish, 9–13 × 12–16 mm, glabrous, locules 3, wings 3, equal, broadly rounded or truncate proximally and distally, 2–4 mm wide, thinly fibrous, dehiscing between locule and wing; pedicel strongly recurved, 2.5–6 mm long.

Distribution. Malaysia (Sarawak). To date, known only from Belaga District (see **Figure 1**).

Habitat. On sandstone boulders or disturbed seasonal creeks in mixed dipterocarp forest at 870–933 m elevation.

Etymology. Named after the type locality at Sungai Kebuho.

Additional specimens examined. Malaysia. **Sarawak**: Belaga District – Linau Forest Management Unit, Coupe 2A, tributary of Sungai Kajang, 2°16'59"N, 114°55'17"E, 24 ix 2016, *Ling* et al. SFC 7022 (KEP, SAR); Danum Forest Management Unit, Long Tanyit, 2°21'59"N, 114°33'35"E, 19 iv 2017, *Ling* et al. SFC 8288 (KEP, SAR), 21 iv 2017, *Ling* et al. SFC 8293 (KEP, SAR).

Plants in the population growing in a seasonal creek were more robust, having much larger leaves with petioles to 16 cm long and laminas to 16.5 × 15 cm and the petioles much more densely hairy compared with plants growing on sandstone boulders, whose largest leaves had petioles to 14 cm long that were sometimes glabrous and had laminas to 11 × 9 cm.

7. Begonia kumangiana S.Julia & C.Y.Ling, **sp. nov.**

Similar to *Begonia bosuangiana* S.Julia in its creeping habit, indumentum and rounded leaves sprinkled with stiff hairs, but it differs in its larger stipules, 10–15 × 7–12 mm (versus c.6 × 4 mm); inflorescences with larger persistent bracts, 12–15 × 11–14 mm (versus caducous, c.3 × 2 mm) and persistent bracteoles, 4–7 × 6–10 mm (versus caducous, 1–2.5 × 1–2 mm); smaller outer male tepals, 5.5–7 × 3–4 mm (versus c.9 × 5 mm); and larger female tepals, 4–5 × 2.5–3 mm (versus c.3 × 2 mm). – Type: Malaysia, Borneo, Sarawak, Kapit District, Baleh, Sungai Bekakap, 1°21'58'N, 113°43'33"E, 8 iii 2016, *Ling* et al. SFC 5905 (holotype SAR!, isotype KEP!). Figure 8.

Creeping herb rooting at nodes, prostrate stem to c.3 cm long, erect apex c.2 cm tall. Stems, stipules and petioles hirsute, hairs whitish, 2–3 mm long, more prominent on petioles and young shoots. *Stems* pale green to brown, unbranched, succulent, 3.5–4 mm thick, internodes 1.2–2 cm long, slightly thicker at nodes. *Stipules* pale green, ovate to oblanceolate, 10–15 × 7–12 mm, margin ciliate, apex acute, persistent. *Leaves* alternate, distant, scarcely oblique; petioles red brown to pale green, 1.3–3(–5) cm long, terete; lamina plain green above, paler beneath, in life succulent, glossy, with sparse stiff hairs above, hairs whitish, glabrous beneath, slightly asymmetrical, young leaves almost symmetrical, sometimes with bluish sheen, broadly ovate, 4.8–6.6 × 5.3–6.9 cm, broad side 3.1–4.3 cm wide, base cordate, occasionally overlapping, basal lobes 6–8 mm long, margin minutely serrate, fringed by sparse stiff hairs, apex broadly acute to rounded; venation palmate, veins greenish beneath, 4–6 veins on either side of the midrib, 1 vein in basal lobe, slightly impressed with sparsely stiff whitish hairs above, prominent and densely covered with minute white hairs beneath. *Inflorescences* protogynous, in upper leaf axils, held at a horizontal angle to the stem, racemose, 4–7 cm long, peduncle 2.2–4 cm long; bracts pale green, similar to stipules, ovate, 12–15 × 11–14 mm, margin ciliate, glabrous, persistent; lower bracteole similar to bracts (sometimes absent), ovate, c.7 × 5 mm, upper bracteoles 2–6 pairs, broadly ovate, 4–7 × 6–10 mm. *Male flowers*: pedicel white, 9–11 mm long, glabrous; tepals 4, outer two tepals white to deep pink, glabrous, ovate to elliptic, 5.5–7 × 3–4 mm, margin entire, apex broadly acute to rounded, inner two tepals lanceolate, 5–6.5 × 1.5 mm, margin entire, apex acute to rounded; stamens 10 or 11, cluster globose, subsessile; filaments yellow, 1.8–2 mm long; anthers yellow, obovate, c.2 × 2 mm long, apex emarginate. *Female flowers*: sessile; ovary greenish white, pink at the side of wings, ovate, ovary including the wings, 3–5 × 3–6 mm, glabrous, wings 3, subequal, locules 3, placentas 2 per locule; tepals 5, outer four tepals pinkish, glabrous, ovate or broadly elliptic, 4–5 × 2.5–3 mm, margin entire, apex acute, inner tepal narrowly elliptic, 4.5–5 × 1.5 mm; styles 3, yellow, c.2.5 mm long, divided to base, anchor-shaped; stigma pale yellow, papillose forming a twisted band. *Capsules* not seen.

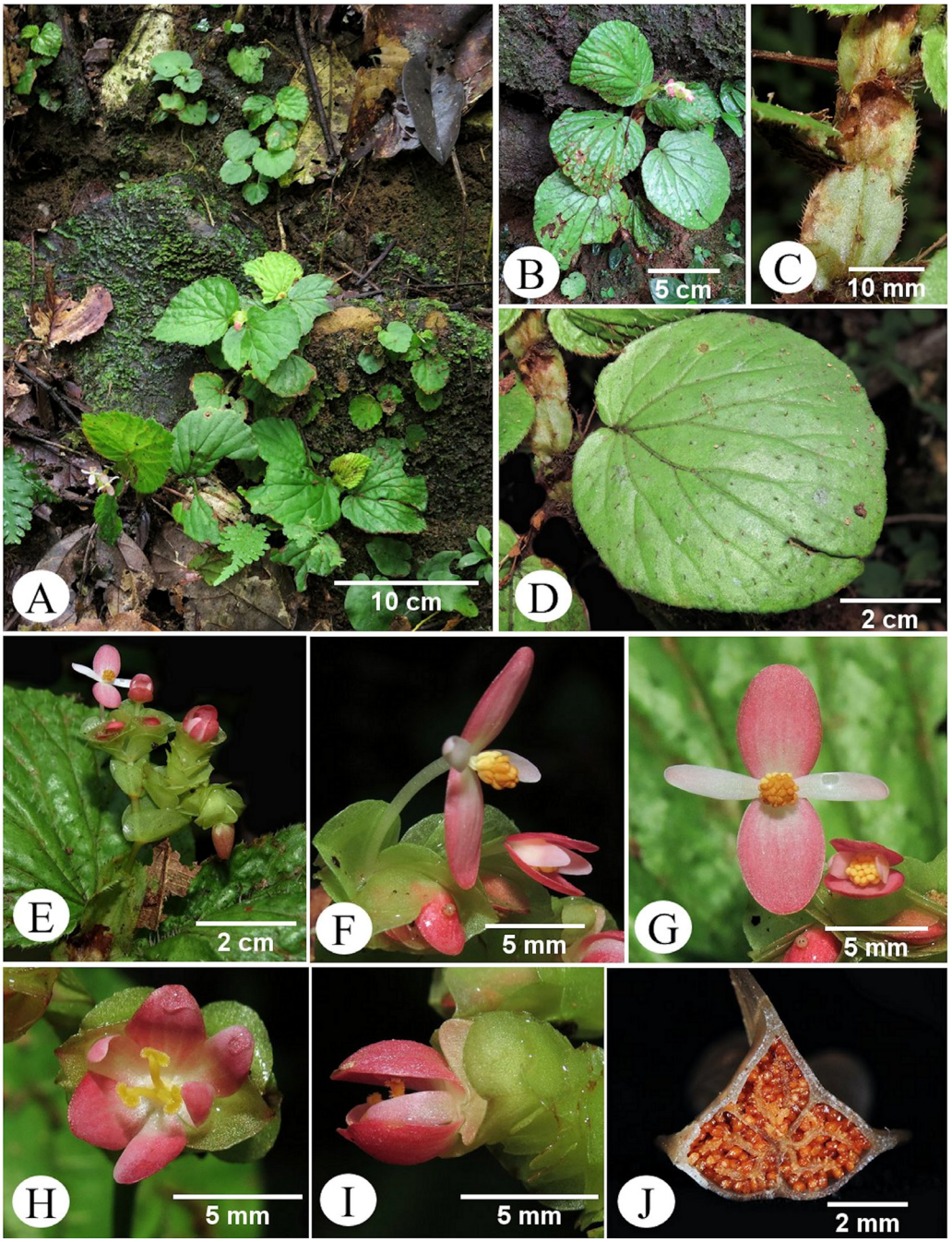

Figure 8. *Begonia kumangiana* S.Julia & C.Y.Ling, sp. nov. A, Habitat; B, habit; C, stipule; D, upper surface of lamina; E, inflorescence; F and G, male flower; H and I, female flower; J, cross-section of ovary. All photographs of the type specimen, *Ling* et al. SFC 5905, taken by C. Y. Ling.

Distribution. Malaysia (Sarawak). To date, known only from Sungai Bekakap in Kapit District (see **Figure 1**).

Habitat. Locally common in steep hill forest on slightly mossy sandstone boulders, above a seasonal creek, at elevations to 684 m. It creeps vertically up small, mossy sandstone boulders. Its leaves are held vertically against the substrate, and the inflorescences are held perpendicularly to the stem.

Etymology. *Kumang* is the name of one of the mystical people in Iban (Sea Dayak) culture, who is believed to be pretty and knowledgeable, and an appropriate inspiration for the name of this pretty, dainty begonia.

Begonia kumangiana is uncommon in its known locality. In its habit and leaf characters, it resembles *Begonia addrinii* but can be distinguished from that species by its conspicuously larger bracts (12–15 × 11–14 mm versus 4–7 × 2–3 mm) and bracteoles (4–7 × 5–10 mm versus 4–9 × 2–4 mm). This species co-occurs with *Begonia bekakapensis*.

8. Begonia latifolia S.Julia & C.Y.Ling, **sp. nov.**

Similar to *Begonia celata* S.Julia & Kiew in its habit but differs in having longer internodes, 2–5.5 cm (versus 0.7–2 cm long); much larger bracts, 10–20 × 15–25 mm (versus 6–11 × 3–5 mm); fewer bracteoles, up to 5 pairs (versus 12 pairs); wider lower bracteoles, 6–10 mm (versus 4 mm wide), and upper bracteoles, 4–8 mm (versus 2–3 mm wide); fewer stamens, 15–20 (versus 28–35); and smaller female flowers with ovary 4–5 × 5–6.5 mm (versus 6–7 × 8–9 mm). – Type: Malaysia, Borneo, Sarawak, Kapit District, Baleh, Kakap Camp, Sungai Bekakap, 1°21'55"N, 113°43'31"E, 9 iii 2016, *Ling* et al. SFC 5907 (holotype SAR!, isotype KEP!). **Figure 9**.

Creeping herb, 4–8 cm long. Stem, stipule and petiole densely hirsute, hairs c.3 mm long, magenta, sometimes white on juvenile plants. *Stems* red brown, little branched, succulent, 3.5–6 mm thick, internodes 2–5.5 cm long, slightly thicker at nodes. *Stipules* pale green to yellow green, sometimes reddish at base, broadly ovate, 1.3–2.8 × 1.4–2.7 cm, keeled, margin ciliate, apex acute or rounded, persistent. *Leaves* alternate, distant, oblique, held horizontally, upper lamina surface and lower veins densely hirsute, hairs magenta, sometimes white on upper leaf surface and on juvenile plants, c.3 mm long; petioles red brown, (1.5–)3–7.5 cm long, terete or slightly grooved above; lamina dark green above, pale green beneath, in life succulent, matt, asymmetrical, ovate, 5.5–9.5 × 6.5–12 cm, broad side 3.6–8 cm wide, base cordate, sometimes overlapping, basal lobes 1–2 cm long, margin minutely dentate and ciliate, apex acuminate, acumen 3–5 mm long; venation pinnate-palmate, veins green, above reddish near base, beneath pale green, pale brown near base, 4 pairs from the base and 2 veins on either side of the midrib, 1 or 2 veins in basal lobe, slightly impressed above, prominent beneath. *Inflorescences* protogynous, in upper leaf axils, racemose to 3–5 cm long, peduncle glabrous, 2.3–2.5 cm long; bracts

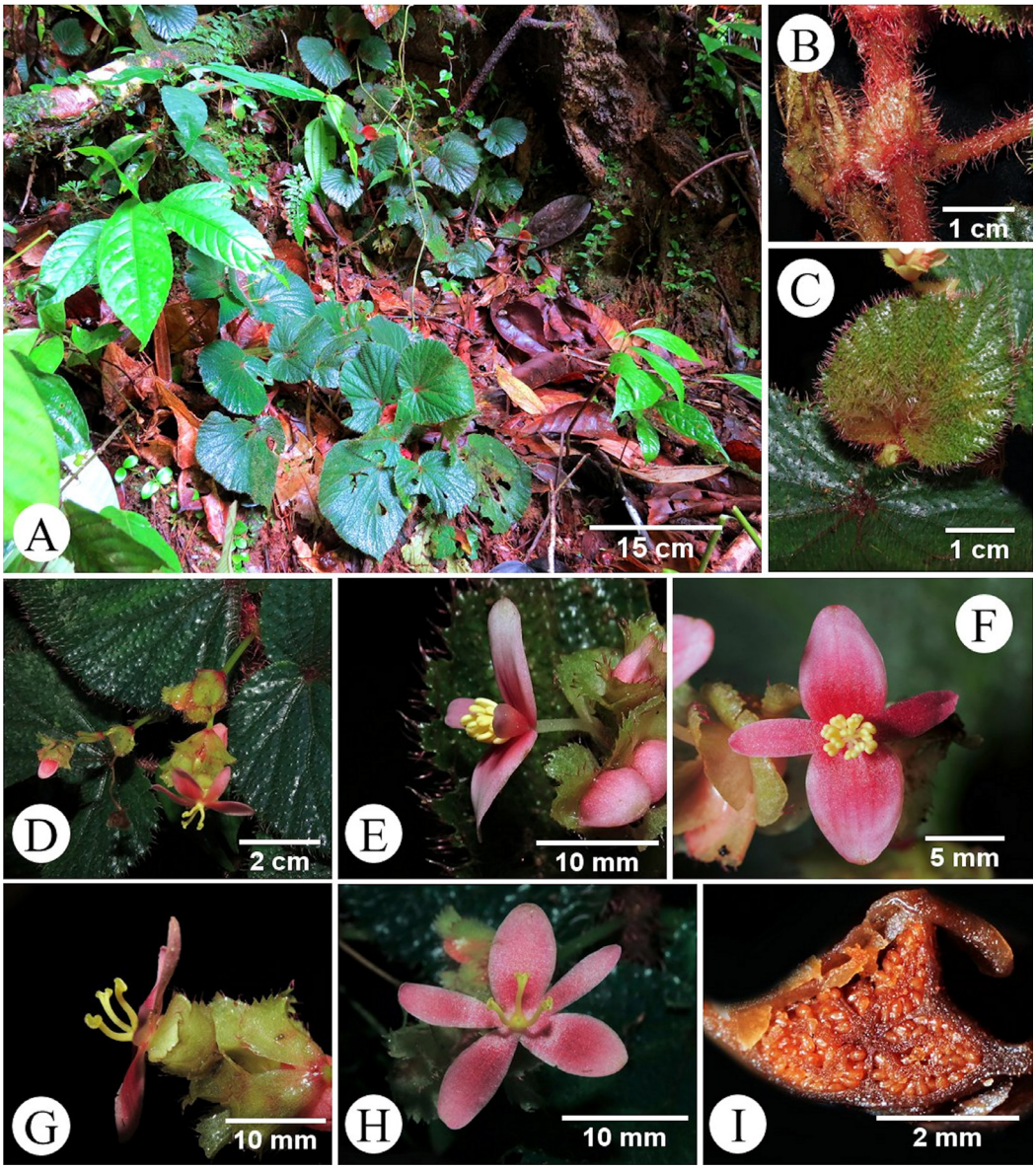

Figure 9. *Begonia latifolia* S.Julia & C.Y.Ling, sp. nov. A, Habit and habitat; B, stipule; C, juvenile leaf; D, inflorescence; E and F, male flower; G and H, female flower; I, cross-section of ovary. All photographs of the type specimen, *Ling* et al. SFC 5907, taken by C. Y. Ling.

similar to stipules, pale green or yellow green, reddish at base, ovate, 10–20 × 15–25 mm, margin ciliate, persistent; bracteoles to 5 pairs, lower bracteoles pale green, reddish at base, 9–12 × 6–10 mm, margin ciliate, sometimes sparsely hirsute, hairs red, upper bracteoles pale green, reddish at base, ovate 4–6 × 4–8 mm, margin ciliate or irregularly serrate, apex emarginate, persistent. *Male flowers*: pedicel white, 8–10 mm long, glabrescent; tepals 4, pink, deep pink near base, glabrous, margin entire, apex broadly acute to rounded, outer two tepals elliptic, 9–11 × 5–6 mm, inner two tepals lanceolate, 7–9.5 × 1.5–2 mm; stamens 15–20, cluster conical, sessile; filaments pale yellow, c.1 mm long; anthers pale yellow, obovate, c.1.5 × 1 mm, apex emarginate. *Female flowers*: sessile, enclosed by 2 or 3 bracteoles; ovary white or pale green, obovate, ovary including the wings 4–5 × 5–6.5 mm, glabrous, wings 3, unequal, locules 3, placentas 2 per locule; tepals 5, pinkish, glabrous, margin entire, apex acute, outer three tepals elliptic, 8–8.5 × 4–5 mm, inner two tepals narrowly elliptic to lanceolate, 8–9 × 2–2.5 mm; styles 3, pale yellow, c.3 mm long, divided to base; stigma pale yellow, anchor-shaped, papillose forming a continuous twisted band. *Capsule* not seen.

Distribution. Malaysia (Sarawak). To date, known only from Kapit District (see Figure 1).

Habitat. Riparian forest on rocks and stream banks, at elevations to 313 m.

Etymology. Latin, *lati-* ('broad') and *folius* ('leaf'), referring to its lamina broader than long.

Begonia latifolia is uncommon where it occurs. Compared with *Begonia bosuangiana* from Sabah, this species is larger, with stem 4–8 cm long (versus low herb to 4 cm tall); longer internodes, 2–5.5 cm (versus 1–1.5 cm long); larger lamina, 5.5–9.5 × 6.5–12 cm (versus c.5 × 5.3 cm); and conspicuously larger lower bracteoles, 4–12 × 6–10 mm (versus 1–2.5 × 1–2 mm).

9. Begonia mentiens S.Julia & Kiew, **sp. nov.**

Similar to *Begonia jamilahanuiana* S.Julia in its habit and leaf characters, but *B. mentiens* can be distinguished by its wider lamina, 4.5–9 cm (versus 2.5–5 cm wide); inflorescence a compound cyme, 1–4 cm long, produced from leaf axils from base to stem apex (versus paniculate inflorescence 7–15 cm long produced from upper leaf axils); bracts narrowly ovate to linear, c.3 × 1 mm, and bracteoles c.2 × 1 mm, margin entire (versus bracts ovate, 6–7 × 3–4 mm, bractoles 2–6 × 2–5 mm, margin studded with glandular knobs); smaller ovary, 9–10 × 13–15 mm, with equal wings (versus ovary 17–20 × 13–15 mm, with unequal wings); and capsule wider than long, 8–10 × 12–16 mm, with longer pedicel, 11–12 mm long (versus longer capsule, 11–17 × 11–15 mm, with pedicel 5–10 mm). – Type: Malaysia, Borneo, Sarawak, Julau District, Lanjak Entimau Wildlife Sanctuary, Sungai Igan, 1°44'13"N, 112°05'59"E, 25 v 2016, *Ling & Dino* SFC 5966 (holotype SAR!, isotype KEP!). Figure 10.

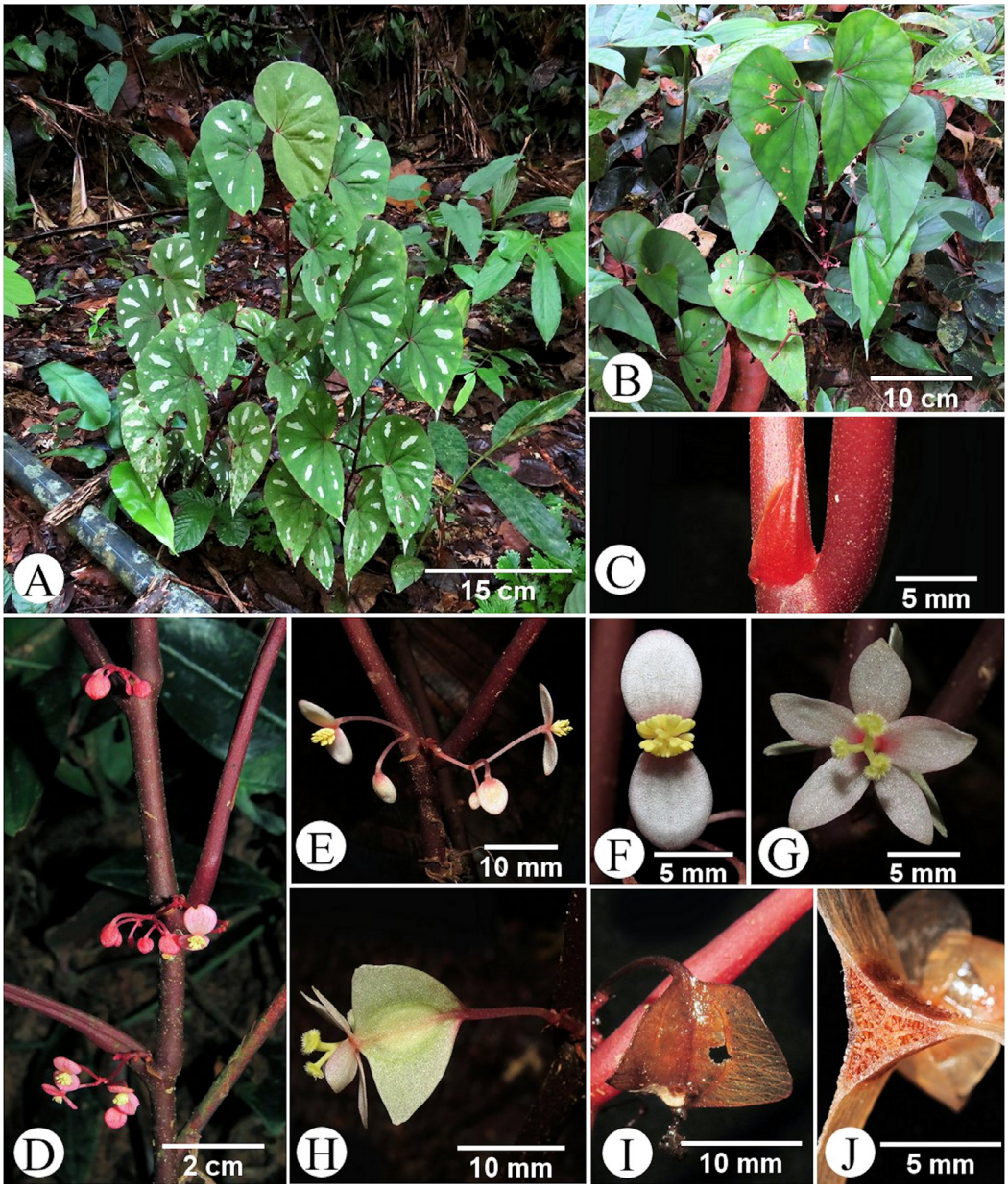

Figure 10. *Begonia mentiens* S.Julia & Kiew, sp. nov. A, Habit, showing spotted leaves; B, habit, showing individual with plain leaves; C, stipule; D, inflorescence on lower part of stem; E, male inflorescence; F, male flower; G and H, female flower; I, old capsule; J, cross-section of female flower. All photographs taken by C. Y. Ling: A, C and G–J, *Ling & Dino* SFC 5918; B and E–G, *Ling & Dino* SFC 5949; D, *Ling & Dino* SFC 5966 (the type specimen).

Cane-like herb to 75 cm tall; whole plant glabrous. *Stems* dark magenta, 4–5 mm thick, internodes 2–5 cm, slightly thicker at the nodes. *Stipules* magenta, ovate, 7–10 × 5–7 mm, margin entire, keeled, apex setose, seta 1–2 mm long, caducous. *Leaves* alternate, distant, oblique, asymmetrical, held more or less horizontally, sometimes held at a 45° angle; petioles magenta, 6–10.5 cm long, grooved above; lamina glabrous with silvery elongated spots in between veins, sometimes with silvery spots along the margin and at the leaf apex or sometimes plain green above, pale green beneath, juvenile plants usually with pinkish spots, in life succulent, matt, ovate, 10–13 × 4.5–9 cm, broad side 4–8 cm wide, base shallowly cordate, basal lobes 3–8.5 cm long, margin almost entire, apex acuminate to caudate, acumen 1.5–2 cm long; venation palmate-pinnate, above veins green except near base, magenta beneath, slightly impressed above except near leaf base, prominent beneath, 6–8 veins radiating from the base of leaf, 7 or 8 along the midrib on the broad side, 3–5 veins in basal lobe. *Inflorescences* protogynous, in the upper leaf axils, compound cyme, 1–4 cm long, up to 7 female inflorescences in the lower part of the leafless stem; male inflorescence towards the apex; bracts reddish, narrowly ovate to linear, c.3 × 1 mm, margin entire, apex setose, seta c.1 mm long, caducous; bracteoles similar to bracts but smaller, c.2 × 1 mm, caducous. *Male flowers*: pedicel pink, 7–10 mm long; tepals 2, white or pale pink tinged reddish towards base, ovate, 6–7.5 × 4–6.5 mm, margin entire, apex rounded; stamens 19–26, cluster subsessile, globose, filaments pale yellow, c.0.5–1 mm long; anthers pale yellow, obovate, c.0.8–1 × 0.8–1 mm, apex emarginate. *Female flowers*: pedicel pinkish, 9–10 mm long, glabrous; ovary pale green, ovate to triangular in outline, ovary including the wings 9–10 × 13–15 mm, wings 3, equal, sometimes tinged pink, locules 3, placenta 1 per locule; tepals 5, pale pink, deeper pinkish at base, outer four tepals elliptic, 6–9 × 3–4 mm, margin entire, apex rounded, inner tepal narrowly elliptic, 6 × 2.5–3 mm; styles 3, pale yellow green, 2–3 mm long, deeply divided to base, widely Y-shaped; stigma pale yellow, papillose cells large and pale yellow forming a continuous twisted band. *Capsules* glabrous, 8–10 × 12–16 mm, locules 3, wings 3, equal, rounded proximally, truncate distally, 4–6 mm wide, thinly fibrous, dehiscing between locule and wing; pedicel pendent, 11–12 mm long, reddish towards the base.

Distribution. Malaysia (Sarawak). To date, known only from Lanjak Entimau Wildlife Sanctuary (see **Figure 1**), where the species is widely distributed.

Habitat. Riparian forest along stream bank with large sandstone or mudstone boulders, on alluvial soils, at elevations 124–140 m.

Etymology. Latin, *mentiens* ('imitating'), referring to the sterile plant resembling those of *Begonia jamilahanuiana*.

Additional specimens examined. Malaysia. **Sarawak**: Julau District – Ulu Mujok, Sungai Sunpan, 1°42'20"N, 112°04'48"E, 20 v 2016, *Ling & Dino* SFC 5918 (KEP, SAR); Mujok, Lanjak Entimau Wildlife

Sanctuary, Sungai Segak, 1°40'53"N, 112°09'40"E, 21 v 2016, *Ling & Dino* SFC 5929 (KEP, SAR); Sungai Nyamuk, tributary of Sungai Mujok, 1°41'24"N, 112°07'01"E, 23 v 2016, *Ling & Dino* SFC 5949 (KEP, SAR); Sungai Mujok, Sungai Sugai, 1°44'04"N, 112°05'59"E, 24 v 2016, *Ling & Dino* SFC 5958 (KEP, SAR).

Begonia mentiens is rather common and occurs in a few river systems in Ulu Mujok. In the field, individual plants are scattered (not growing in clumps or close together). In comparison, plants of *Begonia jamilahanuana* usually grow close together to form a large clump. The irregular spots on the upper leaf surface of *Begonia mentiens* are pink in the juvenile stage but turn white with age or sometimes completely disappear, whereas the spots on *B. jamilahanuana* leaves are persistent in adult plants.

Begonia jamilahanuana and *B. mentiens* seem to occupy different microhabitats. *Begonia jamilahanuana* is usually found along shade ridges of hill mixed dipterocarp forest with a thick layer of leaf litter, in contrast to *B. mentiens*, which usually grows by stream banks.

10. Begonia petrensis C.Y.Ling & S.Julia, **sp. nov.**

Similar to *Begonia xiphophylloides* Kiew in its narrow, almost non-oblique leaves, and 2-tepaled male flowers, but *B. petrensis* differs in being little branched, to 50 cm tall (versus bushy and much branched, to 30 cm tall); and having leaf width:length ratio of 1:3–4.8 (versus 1:5.5–7); male flowers with larger tepals, 4–5.5 × 3.5–4 mm (versus 2.2–3.5 × 1.5–2.5 mm); fewer stamens, 20–22 (versus 30–35); female flower with longer pedicel, c.7 mm (versus 2 mm long); ovary including the wings c.13 × 20.5 mm (versus c.10 × 8 mm); and larger tepals, 14–15 × 5–7 mm (versus c.5 × 2.5 mm). – Type: Malaysia, Borneo, Sarawak, Belaga District, Linau Forest Management Unit, Gua Layang-layang, Tributary of Sungai Bahau, 2°18'42"N, 114°40'56"E, 27 ix 2016, *Ling* et al. SFC 7042 (holotype SAR!, isotype KEP!). Figure 11.

Slender herb to 50 cm long, little branched; whole plant glabrous. *Stems* greenish or reddish, erect when young, becoming pendent, internodes (1–)2.5–7 cm long, 2–4 mm thick. *Stipules* pale green or reddish, narrowly ovate, 4–7 × 2–4 mm, margin entire, apex acute, caducous. *Leaves* alternate, distant, slightly asymmetrical, held more or less horizontally; petioles reddish or greenish, 0.3–1 cm long, slightly grooved above or terete; lamina glabrous, plain dark green above, reddish beneath, slightly falcate, in life succulent, glossy, narrowly lanceolate, 6–13.5 × 1.5–2.8 cm, broad side 0.7–1.4 cm wide, base slightly cordate, slightly unequal, basal lobes not well developed, margin broadly dentate, more prominent towards the apex, vein endings sometimes toothed, apex acuminate, acumen 1–2.5 cm long; venation pinnate, veins concolorous above, pale green beneath, slightly impressed above, prominent beneath, 4 or 5 on either side of the midrib. *Inflorescences* protogynous, terminal, opposite the uppermost leaf, a single female flower at the base of the inflorescence, above with male flower, sparsely branched; bracts pale green, ovate, c.6 × 2 mm, margin entire, apex acute, caducous; bracteoles, similar to bracts but smaller, c.3 × 1.5 mm, caducous. *Male flowers*: pedicel pale green or whitish, 3–6 mm long, tepals 2, white

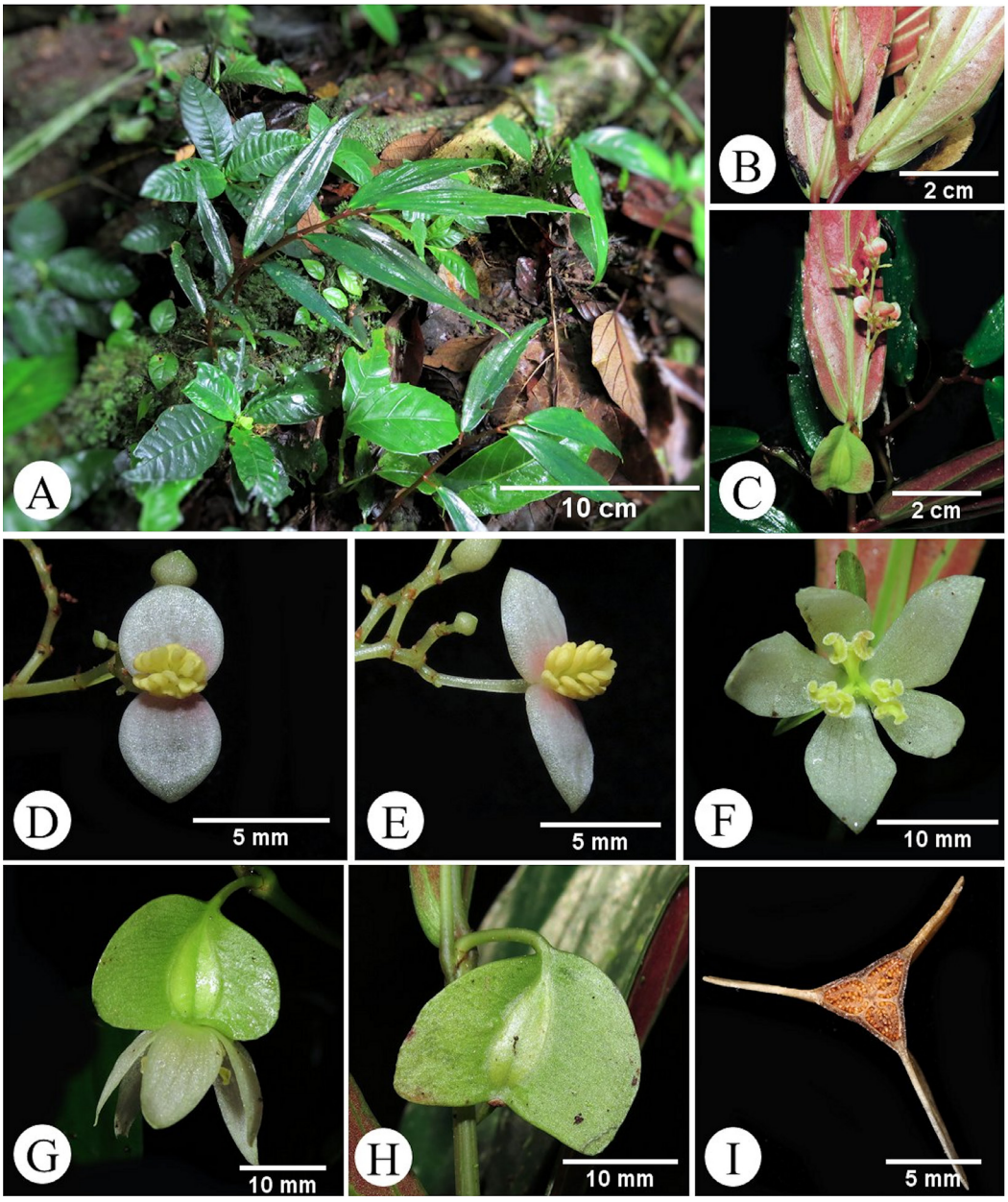

Figure 11. *Begonia petrensis* C.Y.Ling & S.Julia, sp. nov. A, Habit; B, stipule, stem and lower surface of lamina; C, male inflorescence and capsule; D and E, male flower; F and G, female flower; H, capsule; I, cross-section of capsule. All photographs of the type specimen, *Ling* et al. SFC 7042, taken by C. Y. Ling.

or white tinged pink at base, ovate, 4–5.5 × 3.5–4 mm; stamens 20–22, cluster globose, subsessile; filament pale yellow green, 0.2–0.5 mm long; anther pale yellow, obovate, 0.8–1 × 0.5–1 mm, apex emarginate. *Female flowers*: pedicel pale green, c.7 mm long; ovary pale green sometimes tinged pink, ovate, ovary including the wings c.13 × 20.5 mm, wings 3, equal, locules 3, placentas 2 per locule; tepals 5, white, sometimes tinged pink outside, white inside, outer two tepals narrowly elliptic, c.14 × 5 mm, inner three tepals elliptic, c.15 × 7; styles 3, pale yellow green, 2–3 mm long, divided to base, anchor-shaped; stigma pale yellow, papillose with continuous twisted band. *Capsules* pale green, sometimes tinged pink at wings, ovate, 12–14 × 14–20 mm, locules 3, wings 3, equal, acute proximally rounded to truncate distally, 5–9 mm wide, thinly fibrous, dehiscing between locule and wing, pedicels pendent, pale green, sometimes tinged pink, 4–9 mm long.

Distribution. Malaysia (Sarawak). To date, known only from Belaga District (see Figure 1).

Habitat. On mossy sandstone boulders in mixed dipterocarp forest at elevations to 825 m.

Etymology. Latin, *petrensis* ('growing among rocks').

This species resembles *Begonia amidalae* C.W.Lin & C.I Peng and *B. bayae* S.Julia & Kiew in having lanceolate leaves with petiole in line with the midrib, but it has much narrower and more elongate leaves.

Begonia petrensis is also similar to *B. chaiana* Kiew & S.Julia in its erect, slender, glabrous stems with narrow, almost non-oblique leaves, and 2-tepaled male flowers, but it differs in its scarcely developed basal lobe (versus rounded basal lobe 5–10 mm long); female flowers with 5 large tepals, 14–15 × 5–7 mm (versus 3 tepals c.9 × 6 mm); and fruits with a rounded wing tip (versus a truncate or pointed wing tip). *Begonia chaiana* is restricted to limestone rocks, whereas this new species grows among sandstone boulders.

11. Begonia segerakensis C.Y.Ling & Kiew, **sp. nov.**

Similar to *Begonia jenginensis* S.Julia & Kiew in its habit, large hairy leaves with long petioles, and male flowers with 4 tepals but differs in its conspicuously hispid petioles (versus minutely pubescent petioles); lower lamina surface sprinkled with bristles (versus lower surface glabrous between the veins); dichasium 2–3 cm long (versus racemose inflorescence, usually 10–15 cm long); smaller ovate bracts, 4–6 × 2–3 mm (versus lanceolate, 12–17 × 4–5 mm); smaller bracteoles, 3–5 × 2–5 mm, with glandular knobs on the margin (versus non-glandular bracteoles, 4–10 × c.4 mm); male flowers with broadly ovate outer tepals 6–7 × 7–8 mm, outer surface densely covered by red bristles (versus outer tepals ovate, glabrous, 8–10 × 5–8 mm); female flower with shorter pedicel, c.1.5 mm long (versus pedicel 4–8 mm long); ovary, particularly the locules, covered in red bristles (versus ovary glabrous); and capsules single, 8–10 mm long (versus 2–4 capsules along the rachis, each 12–14 mm long) with shorter pedicel to c.2 mm long (versus 6–15 mm long). – Type: Malaysia, Borneo, Sarawak, Lubok Antu District, Lanjak

Entimau Wildlife Sanctuary, Nanga Segerak, Along Segerak trail, 1°23'51"N, 112°01'39"E, 21 x 2016, *Ling* et al. SFC 7064 (holotype SAR!, isotype KEP!). **Figure 12.**

Cane-like herb, when young lax and occasionally appearing creeping when the stem base roots at ground level, when mature erect to 1 m tall. Stem, stipule, petiole and both leaf surfaces with hispid hairs to 7 mm long, whitish or reddish. *Stems* unbranched, brownish to green brown or red brown, internodes (1.5–)3–7.5 cm long, 4–6 mm thick, slightly thicker at nodes. *Stipules* greenish or reddish, tinged red on the keel, ovate, 10–18 × 6–8 mm, margin entire, keeled, apex setose, seta to 5 mm long, caducous. *Leaves* distant, alternate, oblique; petioles reddish or red brown, 4.5–10 cm long, succulent, terete or slightly grooved above, held more or less horizontally; lamina hispid, plain green above, paler beneath, in life succulent, shiny, asymmetrical, ovate, 10–14.5 × 6.5–12 cm, broad side 5–8 cm wide, base cordate, overlapping, unequal, basal lobe 5.5–8.5 cm long, margin minutely dentate and ciliate, apex acuminate, acumen 1–2 cm long; venation palmate-pinnate, veins greenish above except reddish at base, paler green beneath, prominent on both surfaces, 2 or 3 veins radiating from the base, branching 2 or 3 times towards the margin, 5 or 6 veins in basal lobe, 2 or 3 on either side of the midrib. *Inflorescences* protogynous, in upper leaf axils, simple dichasium 2–3 cm long, peduncle reddish; bracts reddish, ovate, 4–6 × 2–3 mm, margin entire, keeled, apex setose, seta c.1 mm long, caducous; bracteoles pale green tinged red at base, ovate, 3–5 × 2–5 mm, margin with prominent glandular knobs, apex rounded to emarginate, persistent. *Male flowers*: pedicel pinkish, 8–10 mm long; tepals 4, outer two tepals white and glabrous inside, tinged pink, outside densely covered by red bristles, margin entire, apex acute, broadly ovate, 6–7 × 7–8 mm, inner two tepals white, glabrous, margin entire, apex acute lanceolate, 4–6.5 × 2–2.5 mm; stamens c.35, cluster loosely globose, subsessile, filaments c.1 mm long; anthers yellow, obovate, c.1 × 0.5 mm, apex emarginate. *Female flowers*: pedicel pale green, glabrous, c.1.5 mm long, ovary pale green, hispid, bristles red, particularly dense on the locules, wings 3, unequal, ovate, ovary including the wings c.7 × 16 mm, locules 3, placentas 2 per locule; tepals 5, white tinged pink at base; outer three tepals ovate, c.9 × 9 mm, sparsely hairy outside, margin entire, apex acute, inner two tepals narrowly ovate, c.8 × 4 mm, glabrous, margin entire, apex acute; styles 3, yellow green, 2–2.5 mm long; stigma yellow, anchor-shaped, papillose. *Capsules* single, ovate, 8–10 × 14–16 mm, locules 3, hairy outside, wings 3, unequal, 3–5 mm wide, rounded proximally, rounded to truncate distally, dehiscing between the locules and wings; pedicel pendent, c.2 mm long.

Distribution. Malaysia (Sarawak). To date, known only from Nanga Segerak in Lanjak Entimau Wildlife Sanctuary (see **Figure 1**).

Habitat. On steep slopes below the ridge in mixed dipterocarp forest occasionally with sandstone boulders, at elevations to 925 m.

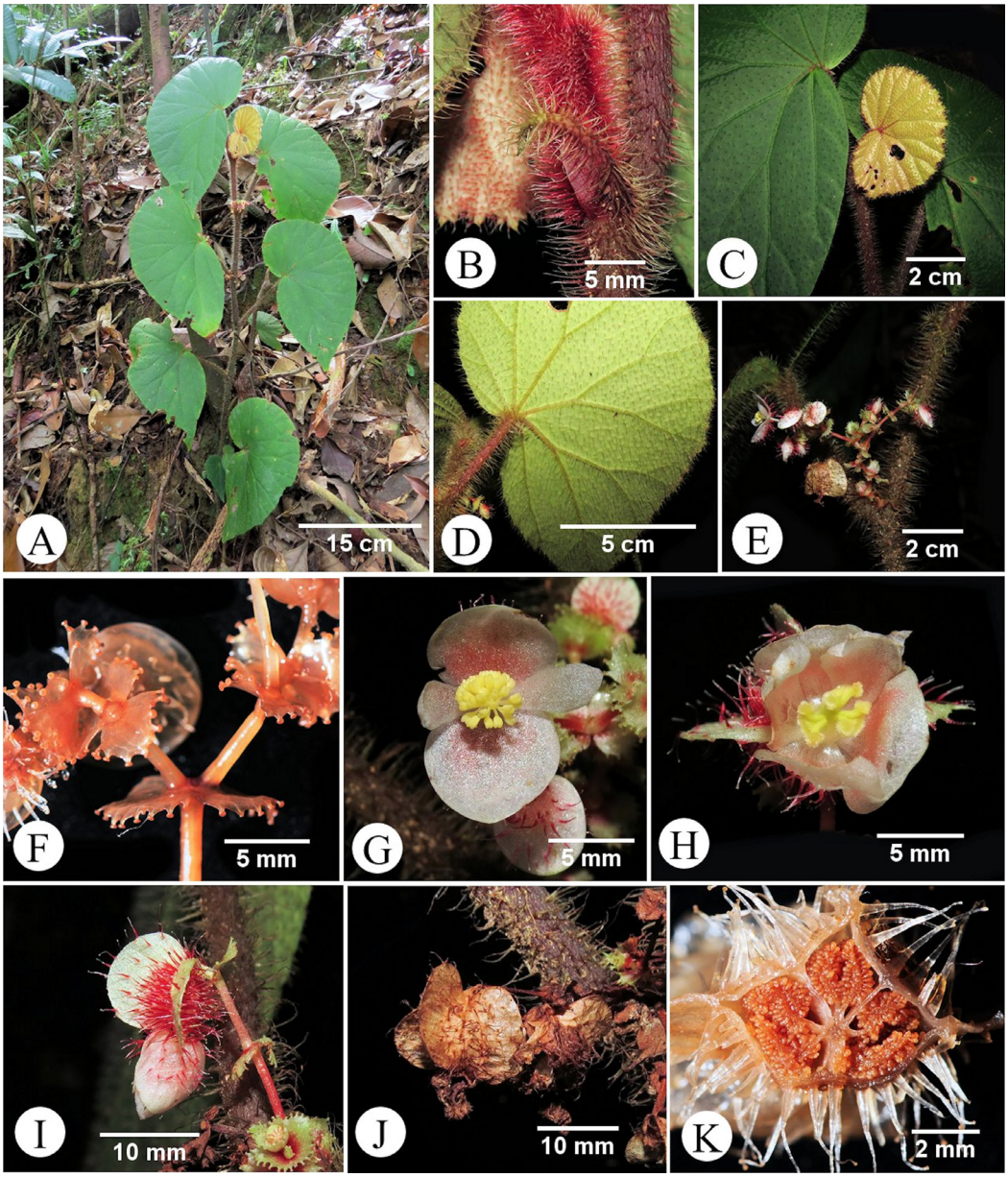

Figure 12. *Begonia segerakensis* C.Y.Ling & Kiew, sp. nov. A, Habit; B, stipule; C, upper leaf surface; D, lower leaf surface; E, inflorescence; F, bracteoles; G, male flower; H and I, female flower; J, dry capsule; K, cross-section of female flower. All photographs of the type specimen, *Ling* et al. SFC 7064, taken by C. Y. Ling.

Etymology. Named after the locality, Nanga Segerak, where the species was discovered.

When sterile, *Begonia segerakensis* can easily be confused with *B. jenginensis*, but it differs in its hairy lower lamina surface, flowers and fruits (see diagnosis above).

12. Begonia sessilifructa S.Julia & Kiew, **sp. nov.**

Similar to *Begonia kiamfeei* Kiew & S.Julia in its creeping habit, hirsute petioles and long inflorescences but differs in having smaller stipules, 3–5 × 2–3 mm (versus 8–13 × 4–6 mm); uppermost bracteoles persistent and studded with glandular knobs (versus caducous bracteoles with entire margins); fewer stamens, c.14 (versus 26–30); subsessile female flowers with hispid ovary (versus female flower with a pedicel to 8 mm long and a glabrous ovary); and fruit subsessile (versus fruit stalk 6–13 mm long). – Type: Malaysia, Borneo, Sarawak, Julau District, Sungai Mujok, Sungai Sugai (near boundary of Lanjak Entimau Wildlife Sanctuary), 1°44'03"N, 112°05'53"E, 24 v 2016, *Ling & Dino* SFC 5953 (holotype SAR!, isotype KEP!). **Figure 13**.

Creeping herb. Stem and petioles hirsute, stipules and lamina hispid, hairs reddish, sometimes whitish, 1.5–2 mm long. *Stems* 5–18 cm long, little branched, red brown, internodes 1–3.5 cm long, 2–3 mm thick, slightly thicker at nodes, rooting at nodes. *Stipules* pale green or brownish, ovate, 3–5 × 2–3 mm, margin entire, apex setose, seta to 2 mm long, caducous. *Leaves* oblique, held horizontally; petioles reddish or greenish, 2–5.5 cm long, terete; lamina plane, sparsely bristled, plain green above, pale green beneath, in life slightly succulent, asymmetrical, ovate, 4–7.5 × 4–6.5 cm, broad side 2.5–4.5 cm wide, base unequal, cordate, overlapping (when dry appearing peltate), basal lobe 1.5–2.5 cm long, margin dentate, apex acuminate, acumen 0.5–0.8 cm long; venation palmate-pinnate, pale green, above reddish towards the base, 3–5 veins on either side of the midrib, branching twice towards the margin, 2 or 3 veins in basal lobe, slightly impressed above, prominent beneath. *Inflorescences* erect, axillary, opposite the leaf, cymose paniculate, 7–19 cm long, red brown with sparse reddish hairs, peduncle 3.5–7 cm long, first branch with a single female flower, upper branches with a row of up to 17 pairs of bracteoles, each subtending 1 or 2 male flowers; bracts pale green, ovate, 5–6 × 3–4 mm, margin entire, apex acuminate, acumen to 1 mm long, persistent; lower bracteoles similar to bracts but smaller, 2–4 pairs, margin entire, pale green or reddish, 2–4 × 2 mm, apex setose, seta to 1 mm long, reddish, pinkish or greenish, ovate, 1–3 × 1–4 mm, margin studded with glandular knobs, persistent. *Male flowers*: pedicel 5–10 mm long white or pinkish, tepals 4, white or pinkish outside, white inside, glabrous, margin entire, apex broadly acute or rounded, outer two tepals broadly ovate, 5–7 × 4–5 mm, inner two tepals oblanceolate, 3–5 × 2 mm, stamens c.14, cluster globose, subsessile, filaments 1–1.2 mm long; anthers lemon yellow, obovate, c.0.8 × 0.5 mm, apex emarginate. *Female flowers*: subsessile, ovary white or pale green, broadly ovate, 4–5.5 × 12–16 mm, densely hispid on the locules, hairs red, 1–2 mm long, wings 3,

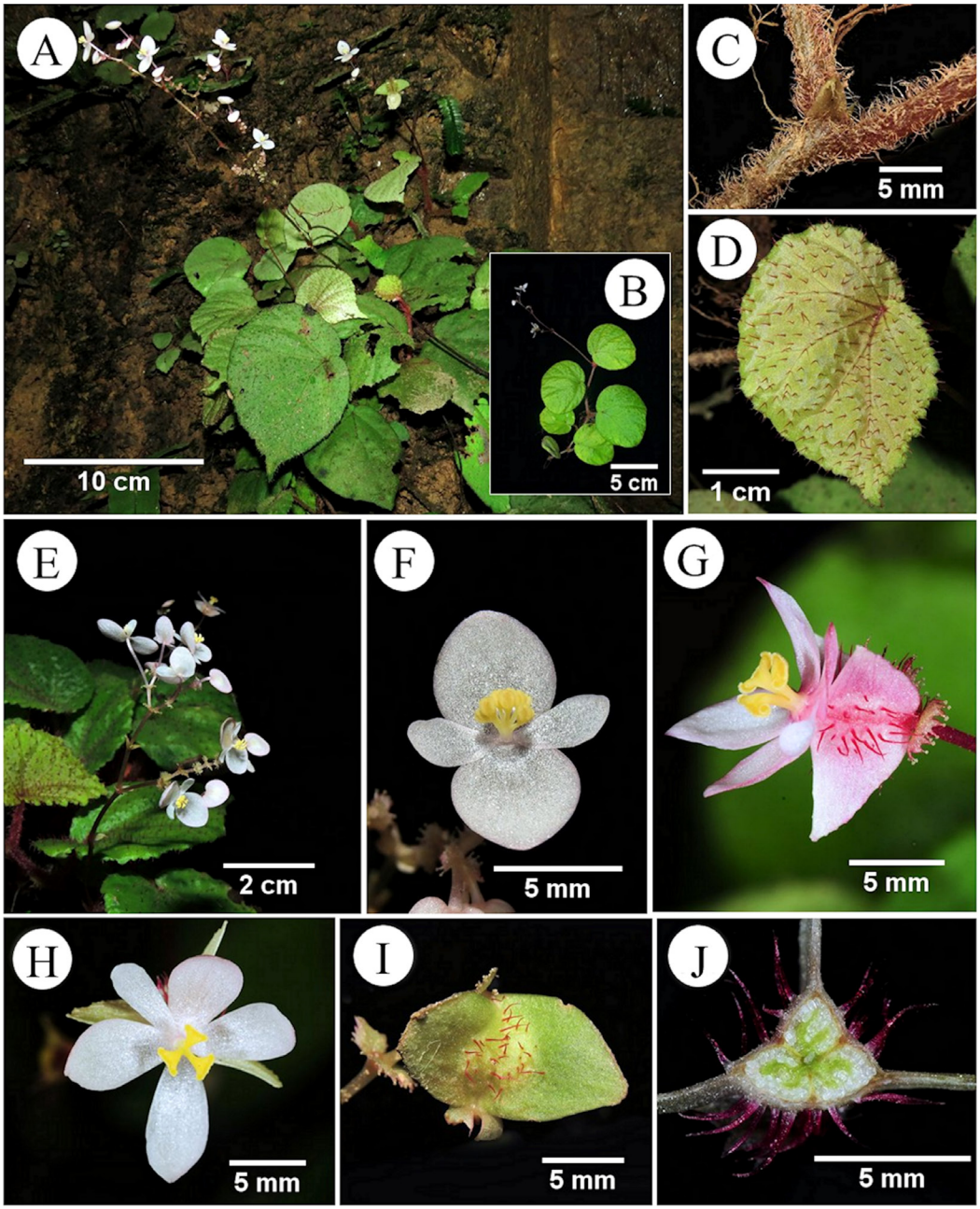

Figure 13. *Begonia sessilifructa* S.Julia & Kiew, sp. nov. A and B, Habit; C, stipule and stem; D, juvenile leaf upper surface; E, inflorescence; F, male flower; G and H, female flowers; I, capsule; J, cross-section of ovary. All photographs taken by C. Y. Ling: A–F and I, *Ling & Dino* SFC 5953 (the type specimen); G–H and J, *Ling & Dino* SFC 5968.

equal, 4–6 mm wide, locules 3, placentas 2 per locule, tepals 5, white, pinkish or pale green outside, white or pinkish inside, glabrous outside and inside, margin entire, apex rounded, outer four tepals obovate, 5–7 × 4 mm, inner tepal oblanceolate, 5–7 × 2 mm, styles 3, yellow, c.1 mm long; stigma lemon yellow, anchor-shaped, papillose. *Capsules* subsessile, single, pale green with red hispid hairs on locules, 6–7 × 15–17 mm, locules 3, placentas 2 per locule, wings 3, equal, broadly acute proximally and distally, 5–6 mm wide, dehiscing between the locules and wings.

Distribution. Malaysia (Sarawak). To date, known only from Lanjak Entimau Wildlife Sanctuary (see **Figure 1**), where the species is widely distributed. This species occurs both within and outside the boundaries of the TPA of Lanjak Entimau Wildlife Sanctuary.

Habitat. Riparian forest along the main river at elevation to 131 m; growing on steep slopes with clayey soil.

Etymology. Latin, *sessilis* ('stalkless'), *fructus* ('fruit').

Additional specimen examined. Malaysia. **Sarawak**: Julau District – Lanjak Entimau Wildlife Sanctuary, Sungai Igan, 25 v 2016, *Ling & Dino* SFC 5968 (KEP!, SAR!).

Subsessile female flowers and capsules are seldom encountered in Bornean begonias. Also striking in *Begonia sessilifructa* are the regular row of upper bracteoles with male flowers that are produced on the upper branches of the inflorescence.

In its creeping habit, this species resembles *Begonia dinosauria* C.W.Lin & C.I Peng, but *B. sessilifructa* differs in its plane lamina surface, shorter stem, 5–18 cm long (versus conspicuously bullate lamina surface, longer stem, 15–40 cm long); ovate stipules, 3–5 × 2–3 mm, with an entire margin (versus ovate-triangular larger stipules, 7–12 × 3.5–8 mm with a denticulate margin); shorter petioles, 2–5.5 cm (versus 4.5–8 cm); bracts with entire margin (versus ciliate margin); tepals of male flower smaller, outer two tepals 5–7 × 4–5 mm and inner two tepals 3–5 × 2 mm (versus tepals of male flower larger, outer two tepals 13–17 × 7–10 mm and inner two tepals 11–16 × 2–4 mm); fewer stamens, c.14 (versus 30–40); and subsessile female flowers (versus stalked female flower with pedicel to 3–5 mm long).

New record

Begonia papyraptera Sands, Checkl. Fl. Pl. Gymnosperms Brunei Darussalam p. 432 (1997 ['1996']); Joffre *et al.*, Sandakania 20: 38 (2015). – Type: Brunei, Temburong District, Amo, Sungai Temburong valley, downstream from helipad LP 286, 28 iv 1992, *Johns* et al. RJ 7422 (holotype K, isotype BRUN).

Distribution. Brunei and Malaysia (Sarawak).

Habitat. In Sarawak, the species grows in riparian forest at elevation 679–739 m.

Specimens examined. Malaysia. **Sarawak**: Marudi District – Long Banga, Ulu Sekuan, 3°10'48"N, 115°28'42"E, 28 viii 2016, *Ling* et al. SFC 7160 (KEP, SAR); Tama Abu Permanent Forest, Sungai Baleh, 3°18'30"N, 115°28'50"E, 17 viii 2017, *Julia* et al. SFC 8117 (KEP!, SAR!).

Discussion

Previous reports describing the many new species of *Begonia* from Sarawak have focused mainly on those from limestone areas, Totally Protected Areas (e.g. national parks and wildlife sanctuaries), dam areas and forest areas easily accessible from Kuching city centre. Eight of the 13 species discussed in this article were collected from remote forest areas outside the TPA network in Sarawak. Regarding the species from TPAs, five (including one occurring both within and outside the TPA boundary) were recorded from Lanjak Entimau Wildlife Sanctuary. These five species add to the six previously recorded from Lanjak Entimau Wildlife Sanctuary (Julia & Kiew, 2016b).

The majority of the species described in this article are narrowly endemic and have only been collected once from their type locality. Only two species, *Begonia humifusa* and *B. mentiens*, were collected more than once from different river systems or localities. However, with further botanical exploration in Borneo, the distribution ranges of these species will probably be found to be wider than their currently known ranges, as shown for the many species recently published from Kalimantan; Hughes *et al.* (2020) reported 11 species from Kalimantan that were previously known only from Sabah or Sarawak. Similarly, the distribution of *Begnonia promethea* Ridl. has been extended from Sarawak to Kalimantan (Kiew *et al.*, 2018). *Begonia papyraptera*, formerly known from Brunei, is noted here as a new record from Sarawak, having been discovered in Tama Abu Permanent Forest. Additionally, within Sarawak, the known distribution ranges of two species, *Begonia darthvaderiana* C.W.Lin & C.I Peng and *B. jugamensis* S.Julia & Kiew, which were previously known only from Lubok Antu District and Bintulu District, respectively, have now been extended to Kapit District.

Despite continuous exploration of forests in Borneo, the percentage of hyperendemic and rare species remains high among *Begonia* species (see **Appendix**). In forests of Borneo, more than one species of *Begonia* often coexist, but they nevertheless usually occupy different microhabitats or different elevations. Even species growing closely together have different growth habits and may possibly be reproductively isolated. Indeed, hybrids are extremely rare in the wild. For example, along Sungai Bekakap, at least three species occur along the same river system: *Begonia bekakapensis* and *B. kumangiana* grow together but exhibit different growth habits, whereas *B. latifolia* grows in forest at lower elevations.

A few species described here are very similar in vegetative characters to species previously described from Sarawak but conspicuously different in reproductive characters. Examples include *Begonia mentiens* and *B. kebuhoensis*, which are vegetatively very similar to *B. jamilahanuiana* and *B. sadirensis*, respectively. In such circumstances and without

meticulous observations and complete materials of flowers and fruits, these species superficially appear to be the same species or are wrongly identified or are often overlooked in the field.

The publication of many new species of *Begonia* from Sarawak reflects our gradually expanding knowledge of the diversity and distribution of the genus in Borneo. Furthermore, the continuous discovery of new *Begonia* species shows no sign of levelling off, and specimens already lodged in herbaria, and awaiting naming and description, may represent new species.

Acknowledgements

We gratefully acknowledge financial support from Sarawak Forestry Corporation, which enabled the fieldwork in 2016–2017 resulting in the collections of the species described in this article. We are indebted to all the field staff (Dino anak Jengka, Army anak Kapi, Admon anak Bernier, Angelia anak Muri and Gun anak Sibak) for their invaluable assistance during the fieldwork; and the management and staff of Raplex FMU, Linau FMU and Kakap Camp for providing logistic assistance during field trips to their concession areas. The first and third authors would like to thank the management of Forest Department Sarawak for their encouragement and continuous support for botanical research in Sarawak.

ORCID iDs

S. Julia https://orcid.org/0000-0002-1418-3843
R. Kiew https://orcid.org/0000-0003-2098-9701
C. Y. Ling https://orcid.org/0000-0001-9572-5319

References

Ardi WH, Girmansyah D, Lin CW, Hughes M. 2019. Two new species of *Begonia* (Begoniaceae) from Borneo. Phytotaxa. 407(1):22–28. https://doi.org/10.11646/phytotaxa.407.1.4

Frodin DG. 2004. History and concepts of big plant genera. Taxon. 53(3):753–776. https://doi.org/10.2307/4135449

Girmansyah D. 2017. Two new species of *Begonia* (Begoniaceae) from Long Duhung, Berau Regency, East Kalimantan, Borneo Island, Indonesia. Kew Bulletin. 72:3. https://doi.org/10.1007/s12225-016-9665-2

Girmansyah D, Susanti R. 2015. Two new species of *Begonia* (Begoniaceae) from Borneo. Kew Bulletin. 70:19. https://doi.org/10.1007/s12225-015-9569-6

Hughes M, Moonlight PW, Jara-Muñoz A, Tebbitt MC, Wilson HP, Pullan M. 2015–. Begonia Resource Centre. Online database. https://padme.rbge.org.uk/begonia/

Hughes M, Girmansyah D, Randi A, Ningsih HNR. 2020. Eleven new records, three new species and an updated checklist of *Begonia* from Kalimantan, Indonesia. Gardens' Bulletin Singapore. 72(1):33–58. https://doi.org/10.26492/gbs72(1).2020-05

Julia S, Kiew R. 2014. Diversity of *Begonia* (Begoniaceae) in Borneo – how many species are there? Reinwardtia. 14:233–236. https://doi.org/10.14203/reinwardtia.v14i1.420

Julia S, Kiew R. 2016a. *Begonia* (Begoniaceae) from Batang Ai National Park and vicinity, Sarawak, Borneo, including six new species. Phytotaxa. 252(1):17–30. https://doi.org/10.11646/phytotaxa.252.1.2

Julia S, Kiew R. 2016b. Eight new *Begonia* (Begoniaceae) species from the Lanjak Entimau Wildlife Sanctuary and Batang Ai National Park, Sarawak, Borneo. Gardens' Bulletin Singapore. 68(2):257–277. https://doi.org/10.3850/S238258121600020X

Julia S, Kiew R, Ling CY. 2016. Six new species of *Begonia* (Begoniaceae) from Central Sarawak, Borneo. Phytotaxa. 277(2):171–181. https://doi.org/10.11646/phytotaxa.277.2.4

Julia S, Kiew R, Ling CY. 2018. The *Begonia* flora of Gunung Mulu and Gunung Buda National Parks, Sarawak, Borneo, including five new species. Phytotaxa. 381(1):58–79. https://doi.org/10.11646/phytotaxa.381.1.9

Kiew R, Julia S, Rimi R, Joffre AA. 2015. A Guide to Begonias of Borneo. Kota Kinabalu: Natural History Publications (Borneo). 292 pp.

Kiew R, Julia S, Ling CY. 2016. The Calcarea group of *Begonia* (Begoniaceae) from Borneo, including four new species from Sarawak. Gardens' Bulletin Singapore. 68(2):239–255. https://doi.org/10.3850/S2382581216000193

Kiew R, Julia S, Ling CY, Randi A, Girmansyah D, Hughes M. 2018. Taxonomic status of *Begonia promethea* (sect. *Petermannia*, Begoniaceae) in Borneo. Gardens' Bulletin Singapore. 70(1):153–159. https://doi.org/10.26492/gbs70(1).2018-14

Lin CW, Peng C-I. 2017. Three new species of *Begonia* (Begoniaceae) from Limestone Hills in South western Sarawak, Borneo. Taiwania. 62(2):105–115. https://doi.org/10.6165/tai.2017.62.105

Lin CW, Peng, C-I. 2019. Five new species of *Begonia* (sect. *Petermannia*, Begoniaceae) from western Sarawak, Borneo. Taiwania. 64(2):124–138. https://doi.org/10.6165/tai.2019.64.124

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):219–251. https://doi.org/10.6165/tai.2017.62.219

Ling CY, Julia S, Kiew R. 2018. *Begonia* species (Begoniaceae) from Gunung Penrissen, Sarawak, Borneo, including two new species and a new subspecies. Phytotaxa. 381(1):12–21. https://doi.org/10.11646/phytotaxa.381.1.5

Low YW, Joffre AA, Muhammad Ariffin AK. 2015. Novitates Bruneienses, 2. A remarkable new species of *Begonia* sect. *Petermannia* (Begoniaceae) from Brunei Darussalam. Gardens' Bulletin Singapore. 67(1):61–68. https://doi.org/10.3850/S2382581215000071

Moonlight PW, Ardi WH, Padilla LA, Chung K-F, Fuller D, Girmansyah D, Hollands R, Jara-Muñoz A, Kiew R, Leong W-C, Liu Y, Mahardika A, Marasinghe LDK, O'Connor M, Peng C-I, Pérez AJ, Phutthai T, Pullan M, Rajbhandary S, Reynel C, Rubite RR, Julia S, Scherberich D, Shui Y-M, Tebbitt MC, Thomas DC, Wilson HP, Zaini NH, Hughes M. 2018. Dividing and conquering the fastest-growing genus: towards a natural sectional classification of the mega-diverse genus *Begonia* (Begoniaceae). Taxon. 67(2):267–323. https://doi.org/10.12705/672.3

Appendix

Checklist of Begonia species recorded from Sarawak, and their protologues

***Begonia acidulenta* S.Julia & Kiew**

Julia S, Kiew R. 2016. *Begonia* (Begoniaceae) from Batang Ai National Park and vicinity, Sarawak, Borneo, including six new species. Phytotaxa. 252(1):19. https://doi.org/10.11646/phytotaxa.252.1.2

***Begonia addrinii* S.Julia & Kiew**

Julia S, Kiew R. 2016. Eight new *Begonia* (Begoniaceae) species from the Lanjak Entimau Wildlife Sanctuary and Batang Ai National Park, Sarawak, Borneo. Gardens' Bulletin Singapore. 68(2):258. https://doi.org/10.3850/S238258121600020X

***Begonia adenodes* Irmsch.**

Irmscher E. 1954. Neue Begoniaceen Von O. Beccari in Malesien Gesammelt. Webbia. 9:478.

***Begonia aiensis* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):219. https://doi.org/10.6165/tai.2017.62.219

***Begonia amidalae* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2014. Three new species of *Begonia* (sect. *Petermannia*, Begoniaceae) from Sarawak, Borneo. Phytotaxa. 191(1):129. https://doi.org/10.11646/phytotaxa.191.1.8

***Begonia andersonii* Kiew & S.Julia**

Kiew R, Julia S. 2007. *Begonia* (Begoniaceae) from limestone hills in the Kuching Division, Sarawak, Borneo, including nine new species. Gardens' Bulletin Singapore. 58(2):204.

***Begonia anserina* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2014. Three new species of *Begonia* (sect. *Petermannia*, Begoniaceae) from Sarawak, Borneo. Phytotaxa. 191(1):136. https://doi.org/10.11646/phytotaxa.191.1.8

***Begonia apiensis* Kiew & S.Julia**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):5. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia argentii* Kiew & S.Julia**

Julia S, Kiew R, Ling CY. 2018. The *Begonia* flora of Gunung Mulu and Gunung Buda National Parks, Sarawak, Borneo, including five new species. Phytotaxa. 381(1):61. https://doi.org/10.11646/phytotaxa.381.1.9

***Begonia armykapii* S.Julia & C.Y.Ling**

Julia S, Kiew R, Ling CY. 2016. Six new species of *Begonia* (Begoniaceae) from Central Sarawak, Borneo. Phytotaxa. 277(2):172. https://doi.org/10.11646/phytotaxa.277.2.4

***Begonia articulata* Irmsch.**

Irmscher E. 1954. Neue Begoniaceen Von O. Beccari in Malesien Gesammelt. Webbia. 9:497.

***Begonia artior* Irmsch.**

Irmscher E. 1954. Neue Begoniaceen Von O. Beccari in Malesien Gesammelt. Webbia. 9:484.

***Begonia baik* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2014. *Begonia baik* and *B. padawanensis* spp. nov. (Begoniaceae) from sandstone areas in Sarawak, Malaysia. Nordic Journal of Botany. 33(5):555. https://doi.org/10.1111/njb.00641

***Begonia baikoides* S.Julia & C.Y.Ling**

Julia S, Kiew R, Ling CY. 2016. Six new species of *Begonia* (Begoniaceae) from Central Sarawak, Borneo. Phytotaxa. 277(2):173. https://doi.org/10.11646/phytotaxa.277.2.4

***Begonia bakunensis* S.Julia**

Julia S, Kiew R, Ling CY. 2015. A decade of *Begonia* (Begoniaceae) from Sarawak, Borneo. Sandakania. 20:131.

***Begonia baramensis* Merr.**[a]

Merrill ED. 1928. A collection of plants from Sarawak. Sarawak Museum Journal. 3:529.

***Begonia bayae* S.Julia & Kiew**[b]

Julia S, Kiew R. 2016. *Begonia* (Begoniaceae) from Batang Ai National Park and vicinity, Sarawak, Borneo, including six new species. Phytotaxa. 252(1):22. https://doi.org/10.11646/phytotaxa.252.1.2

***Begonia belagaensis* S.Julia**

Julia S, Kiew R, Ling CY. 2015. A decade of *Begonia* (Begoniaceae) from Sarawak, Borneo. Sandakania. 20:133.

***Begonia benaratensis* S.Julia**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):6. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia bengohensis* S.Julia**

Julia S, Kiew R, Ling CY. 2015. A decade of *Begonia* (Begoniaceae) from Sarawak, Borneo. Sandakania. 20:136.

***Begonia borneensis* A.DC.**[b]

Candolle A de. 1859. *Begonia borneensis*. In: Annales des Sciences Naturelles; Botanique, Series 4, vol. 11, p. 128.

***Begonia burttii* Kiew & S.Julia**

Kiew R, Julia S. 2007. *Begonia* (Begoniaceae) from limestone hills in the Kuching Division, Sarawak, Borneo, including nine new species. Gardens' Bulletin Singapore. 58(2):207.

***Begonia calcarea* Ridl.**[b]

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:260.

***Begonia celata* S.Julia & Kiew**

Julia S, Kiew R. 2016. Eight new *Begonia* (Begoniaceae) species from the Lanjak Entimau Wildlife Sanctuary and Batang Ai National Park, Sarawak, Borneo. Gardens' Bulletin Singapore. 68(2):260. https://doi.org/10.3850/S238258121600020X

***Begonia chaiana* Kiew & S.Julia**

Kiew R, Julia S. 2007. *Begonia* (Begoniaceae) from limestone hills in the Kuching Division, Sarawak, Borneo, including nine new species. Gardens' Bulletin Singapore. 58(2):210.

***Begonia chakensis* S.Julia & C.Y.Ling**

Julia S, Ling CY. 2015. Eight new species of *Begonia* (Begoniaceae) from Murum Dam, Sarawak, Borneo. Sandakania. 20:108.

***Begonia chlorocarpa* Irmsch. ex Sands**

Sands MJS. 2001. Begoniaceae. In: Beaman JH, Anderson C, Beaman RS. The Plants of Mount Kinabalu, vol. 4. Kota Kinabalu: Natural History Publications (Borneo). p. 149.

***Begonia chlorosticta* Sands**

Sands MJS. 1982. *Begonia chlorosticta* (Begoniaceae). Curtis's Botanical Magazine. 183(4):134, t. 827.

***Begonia cincinnifera* Irmsch.**

Irmscher E. 1954. Neue Begoniaceen Von O. Beccari in Malesien Gesammelt. Webbia. 9:494.

***Begonia cognata* Irmsch.**

Irmscher E. 1954. Neue Begoniaceen Von O. Beccari in Malesien Gesammelt. Webbia. 9:477.

***Begonia compacta* S.Julia & Kiew**

Julia S, Kiew R. 2016. *Begonia* (Begoniaceae) from Batang Ai National Park and vicinity, Sarawak, Borneo, including six new species. Phytotaxa. 252(1):23. https://doi.org/10.11646/phytotaxa.252.1.2

***Begonia congesta* Ridl.**[b]

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:253.

***Begonia conipila* Irmsch. ex Kiew**

Kiew R. 2001. *Begonia conipila* Irmsch. ex Kiew (Begoniaceae) from Gunung Mulu National Park, Sarawak, Malaysia. Gardens' Bulletin Singapore. 53(1–2):287.

***Begonia conniegeriae* S.Julia & Kiew**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):10. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia consanguinea* Merr.**

Merrill ED. 1928. A collection of plants from Sarawak. Sarawak Museum Journal. 3:531.

***Begonia corrugata* Kiew & S.Julia**

Kiew R, Julia S. 2007. *Begonia* (Begoniaceae) from limestone hills in the Kuching Division, Sarawak, Borneo, including nine new species. Gardens' Bulletin Singapore. 58(2):213.

***Begonia crassa* S.Julia & Kiew**

Julia S, Kiew R. 2016. Eight new *Begonia* (Begoniaceae) species from the Lanjak Entimau Wildlife Sanctuary and Batang Ai National Park, Sarawak, Borneo. Gardens' Bulletin Singapore 68(2):262. https://doi.org/10.3850/S238258121600020X

***Begonia cruentospirituna* C.W.Lin**

Lin CW, Peng C-I. 2019. Five new species of *Begonia* (sect. *Petermannia*, Begoniaceae) from western Sarawak, Borneo. Taiwania. 64(2):124. https://doi.org/10.6165/tai.2019.64.124

***Begonia cyanescens* Sands**[b]

Sands MJS. 1997 ['1996']. Begoniaceae: In: Coode MJE, Dransfield J, Forman LL, Kirkup DW, Idris MS, editors. A Checklist of the Flowering Plants and Gymnosperms of Brunei Darussalam. Bandar Seri Begawan, Brunei: Forestry Department. Richmond: Royal Botanic Gardens, Kew. p. 433.

***Begonia darthvaderiana* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2014. Three new species of *Begonia* (sect. *Petermannia*, Begoniaceae) from Sarawak, Borneo. Phytotaxa. 191(1):132. https://doi.org/10.11646/phytotaxa.191.1.8

***Begonia dasycaulis* Kiew & C.Y.Ling**

Ling CY, Julia S, Kiew R. 2018. *Begonia* species (Begoniaceae) from Gunung Penrissen, Sarawak, Borneo, including two new species and a new subspecies. Phytotaxa. 381(1):13. https://doi.org/10.11646/phytotaxa.381.1.5

***Begonia densiretis* Irmsch.**

Irmscher E. 1954. Neue Begoniaceen Von O. Beccari in Malesien Gesammelt. Webbia. 9:477–503.

***Begonia devexa* S.Julia & Kiew**

Julia S, Kiew R. 2016. Eight new *Begonia* (Begoniaceae) species from the Lanjak Entimau Wildlife Sanctuary and Batang Ai National Park, Sarawak, Borneo. Gardens' Bulletin Singapore. 68(2):264. https://doi.org/10.11646/phytotaxa.252.1.2

***Begonia dinosauria* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):223. https://doi.org/10.6165/tai.2017.62.219

***Begonia divergens* Kiew & S.Julia**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):12. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia edgariana* S.Julia & Kiew**[b]

Julia S, Kiew R. 2016. *Begonia* (Begoniaceae) from Batang Ai National Park and vicinity, Sarawak, Borneo, including six new species. Phytotaxa. 252(1):25. https://doi.org/10.11646/phytotaxa.252.1.2

***Begonia elatostemma* Ridl.**

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:255.

***Begonia felis* C.W.Lin & C.I Peng**

Lin CW, Peng C-I. 2017. Three new species of *Begonia* (Begoniaceae) from limestone hills in southwestern Sarawak, Borneo. Taiwania. 62(2):105. https://doi.org/10.6165/tai.2017.62.105

***Begonia flavovirens* Kiew & S.Julia**

Julia S, Kiew R, Ling CY. 2015. A decade of *Begonia* (Begoniaceae) from Sarawak, Borneo. Sandakania. 20:138.

***Begonia fractiflexa* S.Julia & Kiew**

Julia S, Kiew R. 2016. Eight new *Begonia* (Begoniaceae) species from the Lanjak Entimau Wildlife Sanctuary and Batang Ai National Park, Sarawak, Borneo. Gardens' Bulletin Singapore. 68(2):266. https://doi.org/10.3850/S238258121600020X

***Begonia fuscisetosa* Sands**[a]

Sands MJS. 1997 ['1996']. Begoniaceae: In: Coode MJE, Dransfield J, Forman LL, Kirkup DW, Idris MS, editors. A Checklist of the Flowering Plants and Gymnosperms of Brunei Darussalam. Bandar Seri Begawan, Brunei: Forestry Department. Richmond: Royal Botanic Gardens, Kew. p. 433.

***Begonia galaxia* C.W.Lin**

Lin CW, Peng C-I. 2019. Five new species of *Begonia* (sect. *Petermannia*, Begoniaceae) from western Sarawak, Borneo. Taiwania. 64(2):127. https://doi.org/10.6165/tai.2019.64.124

***Begonia havilandii* Ridl.**

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:258.

***Begonia hidirii* Tawan, Ipor & Meekiong**

Tawan CS, Ipor IB, Hidir M, Ampeng A, Marzuki B, Meekiong K. 2009. Two new *Begonia* species (Begoniaceae) and notes on extended distribution of *Begonia calcarea* Ridl. from Sarawak, Borneo. Folia Malaysiana. 10(1):48.

***Begonia hirsuticarpa* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):226. https://doi.org/10.6165/tai.2017.62.219

***Begonia hirtitepala* S.Julia & Kiew**

Julia S, Kiew R. 2016. Eight new *Begonia* (Begoniaceae) species from the Lanjak Entimau Wildlife Sanctuary and Batang Ai National Park, Sarawak, Borneo. Gardens' Bulletin Singapore. 68(2):268. https://doi.org/10.3850/S238258121600020X

***Begonia hosensis* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2014. *Begonia hosensis* (sect. *Reichenheimia*, Begoniaceae), a new species from Sarawak, Malaysia. Taiwania. 59(4):326. https://doi.org/10.6165/tai.2014.59.4.326

***Begonia hulletti* Ridl.**

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:255.

***Begonia iridifolia* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):228. https://doi.org/10.6165/tai.2017.62.219

***Begonia jamilahanuiana* S.Julia**

Julia S, Kiew R. 2016. Eight new *Begonia* (Begoniaceae) species from the Lanjak Entimau Wildlife Sanctuary and Batang Ai National Park, Sarawak, Borneo. Gardens' Bulletin Singapore. 68(2):271. https://doi.org/10.3850/S238258121600020X

***Begonia jenginensis* S.Julia & Kiew**

Julia S, Kiew R. 2016. *Begonia* (Begoniaceae) from Batang Ai National Park and vicinity, Sarawak, Borneo, including six new species. Phytotaxa. 252(1):26. https://doi.org/10.11646/phytotaxa.252.1.2

***Begonia johariana* S.Julia & C.Y.Ling**

Julia S, Ling CY. 2015. Eight new species of *Begonia* (Begoniaceae) from Murum Dam, Sarawak, Borneo. Sandakania. 20:110.

***Begonia jokwaniana* C.Y.Ling & S.Julia**

Julia S, Kiew R, Ling CY. 2018. The *Begonia* flora of Gunung Mulu and Gunung Buda National Parks, Sarawak, Borneo, including five new species. Phytotaxa. 381(1):65. https://doi.org/10.11646/phytotaxa.381.1.9

***Begonia jugamensis* S.Julia & Kiew**

Julia S, Kiew R, Ling CY. 2015. A decade of *Begonia* (Begoniaceae) from Sarawak, Borneo. Sandakania. 20:140.

***Begonia julaihiana* S.Julia & C.Y.Ling**

Julia S, Ling CY. 2015. Eight new species of *Begonia* (Begoniaceae) from Murum Dam, Sarawak, Borneo. Sandakania. 20:112.

***Begonia juliasangii* Kiew**

Kiew R, Julia S. 2009. Seven new species of *Begonia* (Begoniaceae) from the Ulu Merirai and Bukit Sarang limestone areas in Sarawak, Borneo. Gardens' Bulletin Singapore. 60(2):354.

***Begonia kachak* K.G.Pearce**

Pearce KG. 2003. Five new *Begonia* species (Begoniaceae) from the Niah National Park, Sarawak, Malaysia. Gardens' Bulletin Singapore. 55(1):74.

***Begonia kanaensis* Kiew & C.Y.Ling**

Kiew R, Julia S, Ling CY. 2016. The Calcarea group of *Begonia* (Begoniaceae) from Borneo, including four new species from Sarawak. Gardens' Bulletin Singapore. 68(2):242. https://doi.org/10.3850/S2382581216000193

***Begonia kasutensis* K.G.Pearce**

Pearce KG. 2003. Five new *Begonia* species (Begoniaceae) from the Niah National Park, Sarawak, Malaysia. Gardens' Bulletin Singapore. 55(1):82.

***Begonia kiamfeei* Kiew & S.Julia**

Kiew R, Julia S. 2007. *Begonia* (Begoniaceae) from limestone hills in the Kuching Division, Sarawak, Borneo, including nine new species. Gardens' Bulletin Singapore. 58(2):215.

***Begonia kuchingensis* C.W.Lin & C.I Peng**

Lin CW, Peng C-I. 2017. Three new species of *Begonia* (Begoniaceae) from limestone hills in southwestern Sarawak, Borneo. Taiwania. 62(2):108. https://doi.org/10.6165/tai.2017.62.105

***Begonia kurakura* Tawan, Ipor & Meekiong**

Tawan CS, Ipor IB, Hidir M, Ampeng A, Marzuki B, Meekiong K. 2009. Two new *Begonia* species (Begoniaceae) and notes on extended distribution of *Begonia calcarea* Ridl. from Sarawak, Borneo. Folia Malaysiana. 10(1):50.

***Begonia lailana* Kiew & Geri**

Kiew R, Geri C. 2003. Begonias from the Bau limestone, Borneo, including a new species. Gardens' Bulletin Singapore. 55(1):117.

***Begonia lambirensis* Kiew & S.Julia**

Julia S, Kiew R & Ling CY. 2015. A decade of *Begonia* (Begoniaceae) from Sarawak, Borneo. Sandakania. 20:142.

***Begonia lansatensis* Kiew & S.Julia**

Julia S, Kiew R, Ling CY. 2018. The *Begonia* flora of Gunung Mulu and Gunung Buda National Parks, Sarawak, Borneo, including five new species. Phytotaxa. 381(1):67. https://doi.org/10.11646/phytotaxa.381.1.9

***Begonia lawii* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):232. https://doi.org/10.6165/tai.2017.62.219

***Begonia lichenora* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):234. https://doi.org/10.6165/tai.2017.62.219

***Begonia linauensis* S.Julia**

Julia S, Kiew R, Ling CY. 2015. A decade of *Begonia* (Begoniaceae) from Sarawak, Borneo. Sandakania. 20:144.

***Begonia lingiae* S.Julia**

Kiew R, Julia S, Ling CY. 2016. The Calcarea group of *Begonia* (Begoniaceae) from Borneo, including four new species from Sarawak. Gardens' Bulletin Singapore. 68(2):244. https://doi.org/10.3850/S2382581216000193

***Begonia longiseta* Irmsch.**

Irmscher E. 1954. Neue Begoniaceen Von O. Beccari in Malesien Gesammelt. Webbia. 9:499.

***Begonia lucychongiana* S.Julia & Kiew**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):14. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia lunatistyla* Irmsch.**

Irmscher E. 1954. Neue Begoniaceen Von O. Beccari in Malesien Gesammelt. Webbia. 9:503.

***Begonia magentifolia* Kiew & S.Julia**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):17. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia magnicarpa* C.W.Lin & C.I Peng**[b]

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):237. https://doi.org/10.6165/tai.2017.62.219

***Begonia matangensis* S.Julia & Kiew**

Julia S, Kiew R, Ling CY, Geri C. 2015. *Begonia* (Begoniaceae) from Kubah National Park and Environs, Sarawak, Borneo, including a new species. Sandakania. 20:95.

***Begonia melinauensis* S.Julia & Kiew**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):19. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia meriraiensis* S.Julia & Kiew**

Kiew R, Julia S. 2009. Seven new species of *Begonia* (Begoniaceae) from the Ulu Merirai and Bukit Sarang limestone areas in Sarawak, Borneo. Gardens' Bulletin Singapore. 60(2):357.

***Begonia metallicolor* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):237. https://doi.org/10.6165/tai.2017.62.219

***Begonia minutitepala* S.Julia & Kiew**

Ling CY, Julia S, Kiew R. 2018. *Begonia* species (Begoniaceae) from Gunung Penrissen, Sarawak, Borneo, including two new species and a new subspecies. Phytotaxa. 381(1):15. https://doi.org/10.11646/phytotaxa.381.1.5

***Begonia muluensis* C.Y.Ling & Kiew**

Julia S, Kiew R, Ling CY. 2018. The *Begonia* flora of Gunung Mulu and Gunung Buda National Parks, Sarawak, Borneo, including five new species. Phytotaxa. 381(1):71. https://doi.org/10.11646/phytotaxa.381.1.9

***Begonia murudensis* Merr.**

Merrill ED. 1928. A collection of plants from Sarawak. Sarawak Museum Journal. 3:530.

***Begonia murumensis* S.Julia & C.Y.Ling**

Julia S, Ling CY. 2015. Eight new species of *Begonia* (Begoniaceae) from Murum Dam, Sarawak, Borneo. Sandakania. 20:115.

***Begonia nagaensis* Kiew & S.Julia**

Kiew R, Julia S. 2009. Seven new species of *Begonia* (Begoniaceae) from the Ulu Merirai and Bukit Sarang limestone areas in Sarawak, Borneo. Gardens' Bulletin Singapore. 60(2):359.

***Begonia natunaensis* C.W.Lin & C.I Peng subsp. *sarawakensis* S.Julia & Kiew**

Ling CY, Julia S, Kiew R. 2018. *Begonia* species (Begoniaceae) from Gunung Penrissen, Sarawak, Borneo, including two new species and a new subspecies. Phytotaxa. 381(1):17. https://doi.org/10.11646/phytotaxa.381.1.5

***Begonia niahensis* K.G.Pearce**

Pearce KG. 2003. Five new *Begonia* species (Begoniaceae) from the Niah National Park, Sarawak, Malaysia. Gardens' Bulletin Singapore. 55(1):77.

***Begonia nix* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):242. https://doi.org/10.6165/tai.2017.62.219

***Begonia opaca* C.W.Lin & C.I Peng**

Lin CW, Peng C-I. 2019. Five new species of *Begonia* (sect. *Petermannia*, Begoniaceae) from western Sarawak, Borneo. Taiwania. 64(2):130. https://doi.org/10.6165/tai.2019.64.124

***Begonia padawanensis* C.W.Lin & C.I Peng**[b]

Lin CW, Chung SW, Peng C-I. 2015. *Begonia baik* and *B. padawanensis* spp. nov. (Begoniaceae) from sandstone areas in Sarawak, Malaysia. Nordic Journal of Botany. 33(5):558. https://doi.org/10.1111/njb.00641 [Validly published online 11 November 2014.]

***Begonia paoana* Kiew & S.Julia**[b]

Kiew R, Julia S. 2007. *Begonia* (Begoniaceae) from limestone hills in the Kuching Division, Sarawak, Borneo, including nine new species. Gardens' Bulletin Singapore. 58(2):217.

***Begonia papulifolia* S.Julia & C.Y.Ling**

Julia S, Kiew R, Ling CY. 2016. Six new species of *Begonia* (Begoniaceae) from Central Sarawak, Borneo. Phytotaxa. 277(2):175. https://doi.org/10.11646/phytotaxa.277.2.4

***Begonia payung* S.Julia & Kiew**

Kiew R, Julia S. 2009. Seven new species of *Begonia* (Begoniaceae) from the Ulu Merirai and Bukit Sarang limestone areas in Sarawak, Borneo. Gardens' Bulletin Singapore. 60(2):361.

***Begonia pendula* Ridl.**

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:257.

***Begonia penrissenensis* Kiew & S.Julia**

Kiew R, Julia S. 2007. *Begonia* (Begoniaceae) from limestone hills in the Kuching Division, Sarawak, Borneo, including nine new species. Gardens' Bulletin Singapore. 58(2):221.

***Begonia piring* Kiew & S.Julia**

Kiew R, Julia S. 2009. Seven new species of *Begonia* (Begoniaceae) from the Ulu Merirai and Bukit Sarang limestone areas in Sarawak, Borneo. Gardens' Bulletin Singapore. 60(2):364.

***Begonia pleioclada* Irmsch.**

Irmscher E. 1954. Neue Begoniaceen Von O. Beccari in Malesien Gesammelt. Webbia. 9:488.

***Begonia plieranensis* S.Julia & C.Y.Ling**

Julia S, Ling CY. 2015. Eight new species of *Begonia* (Begoniaceae) from Murum Dam, Sarawak, Borneo. Sandakania. 20:117.

***Begonia promethea* Ridl.**

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:259.

***Begonia propinqua* Ridl.**

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:249.

***Begonia pubescens* Ridl.**

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:254.

***Begonia punchak* Kiew & S.Julia**

Kiew R, Julia S. 2007. *Begonia* (Begoniaceae) from limestone hills in the Kuching Division, Sarawak, Borneo, including nine new species. Gardens' Bulletin Singapore. 58(2):223.

***Begonia pyrrha* Ridl.**

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:260.

***Begonia ramosissima* Kiew & S.Julia**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):21. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia rhodochaeta* S.Julia & Kiew**

Kiew R, Julia S. 2009. Seven new species of *Begonia* (Begoniaceae) from the Ulu Merirai and Bukit Sarang limestone areas in Sarawak, Borneo. Gardens' Bulletin Singapore. 60(2):306.

***Begonia rhodoneura* S.Julia**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):23. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia rhodotricha* S.Julia & C.Y.Ling**

Julia S, Ling CY. 2015. Eight new species of *Begonia* (Begoniaceae) from Murum Dam, Sarawak, Borneo. Sandakania. 20:120.

***Begonia rhombipetala* S.Julia & C.Y.Ling**

Julia S, Ling CY. 2015. Eight new species of *Begonia* (Begoniaceae) from Murum Dam, Sarawak, Borneo. Sandakania. 20:122.

***Begonia roseopunctata* Kiew**

Julia S, Kiew R, Ling CY. 2015. A decade of *Begonia* (Begoniaceae) from Sarawak, Borneo. Sandakania. 20:146.

***Begonia rubida* Ridl.**

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:256.

***Begonia rubrobracteolata* S.Julia & C.Y.Ling**

Julia S, Kiew R, Ling CY. 2016. Six new species of *Begonia* (Begoniaceae) from Central Sarawak, Borneo. Phytotaxa. 277(2):176. https://doi.org/10.11646/phytotaxa.277.2.4

***Begonia rubrotepala* S.Julia**

Kiew R, Julia S, Ling CY. 2016. The Calcarea group of *Begonia* (Begoniaceae) from Borneo, including four new species from Sarawak. Gardens' Bulletin Singapore. 68(2):246. https://doi.org/10.3850/S2382581216000193

***Begonia sadirensis* Kiew & S.Julia**

Kiew R, Julia S, Ling CY. 2016. The Calcarea group of *Begonia* (Begoniaceae) from Borneo, including four new species from Sarawak. Gardens' Bulletin Singapore. 68(2):250. https://doi.org/10.3850/S2382581216000193

***Begonia sarangica* Kiew & S.Julia**

Kiew R, Julia S. 2009. Seven new species of *Begonia* (Begoniaceae) from the Ulu Merirai and Bukit Sarang limestone areas in Sarawak, Borneo. Gardens' Bulletin Singapore. 60(2):369.

***Begonia sarawakensis* Ridl.**

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:250.

***Begonia serapatensis* Kiew & S.Julia**

Kiew R, Julia S. 2007. *Begonia* (Begoniaceae) from limestone hills in the Kuching Division, Sarawak, Borneo, including nine new species. Gardens' Bulletin Singapore. 58(2):226.

***Begonia serianensis* C.W.Lin & C.I Peng**

Lin CW, Peng C-I. 2017. Three new species of *Begonia* (Begoniaceae) from limestone hills in southwestern Sarawak, Borneo. Taiwania. 62(2):112. https://doi.org/10.6165/tai.2017.62.105

***Begonia setiamensis* S.Julia & Kiew**

Julia S, Kiew R, Ling CY. 2015. A decade of *Begonia* (Begoniaceae) from Sarawak, Borneo. Sandakania. 20:149.

***Begonia sirukitii* S.Julia & C.Y.Ling**

Julia S, Kiew R, Ling CY. 2015. A decade of *Begonia* (Begoniaceae) from Sarawak, Borneo. Sandakania. 20:151.

***Begonia speluncae* Ridl.**

Ridley HN. 1906. Begonias of Borneo. Journal of the Straits Branch of the Royal Asiatic Society. 46:258.

***Begonia stenogyna* Sands**

Sands MJS. 1997 ['1996']. Begoniaceae: In: Coode MJE, Dransfield J, Forman LL, Kirkup DW & Idris MS (eds.). A Checklist of the Flowering Plants and Gymnosperms of Brunei Darussalam. Forestry Department, Brunei & Royal Botanic Gardens, Kew. p. 432.

***Begonia stichochaete* K.G.Pearce**

Pearce KG. 2003. Five new *Begonia* species (Begoniaceae) from the Niah National Park, Sarawak, Malaysia. Gardens' Bulletin Singapore. 55(1):78.

***Begonia subisensis* K.G.Pearce**

Pearce KG. 2003. Five new *Begonia* species (Begoniaceae) from the Niah National Park, Sarawak, Malaysia. Gardens' Bulletin Singapore. 55(1):85.

***Begonia superciliaris* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):245. https://doi.org/10.6165/tai.2017.62.219

***Begonia suyenii* C.W.Lin**

Lin CW, Peng C-I. 2019. Five new species of *Begonia* (sect. *Petermannia*, Begoniaceae) from western Sarawak, Borneo. Taiwania. 64(2):132. https://doi.org/10.6165/tai.2019.64.124

***Begonia sympodialis* Irmsch.**

Irmscher E. 1954. Neue Begoniaceen Von O. Beccari in Malesien Gesammelt. Webbia 9:495.

***Begonia tebiang* S.Julia & Kiew**

Julia S, Kiew R. 2016. *Begonia* (Begoniaceae) from Batang Ai National Park and vicinity, Sarawak, Borneo, including six new species. Phytotaxa. 252(1):28. https://doi.org/10.11646/phytotaxa.252.1.2

***Begonia tenuissima* S.Julia & C.Y.Ling**

Julia S, Ling CY. 2015. Eight new species of *Begonia* (Begoniaceae) from Murum Dam, Sarawak, Borneo. Sandakania. 20:125.

***Begonia tinjanii* S.Julia**

Julia S, Kiew R, Ling CY. 2016. Six new species of *Begonia* (Begoniaceae) from Central Sarawak, Borneo. Phytotaxa. 277(2):178. https://doi.org/10.11646/phytotaxa.277.2.4

***Begonia triangularis* Kiew & C.Y.Ling**

Julia S, Kiew R, Ling CY. 2016. Six new species of *Begonia* (Begoniaceae) from Central Sarawak, Borneo. Phytotaxa. 277(2):179. https://doi.org/10.11646/phytotaxa.277.2.4

***Begonia ubahribuensis* S.Julia & Kiew**

Julia S, Kiew R. 2016. Eight new *Begonia* (Begoniaceae) species from the Lanjak Entimau Wildlife Sanctuary and Batang Ai National Park, Sarawak, Borneo. Gardens' Bulletin Singapore. 68(2):274. https://doi.org/10.3850/S238258121600020X

***Begonia umbratica* S.Julia**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):24. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia vulgare* S.Julia & Kiew**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):26. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia vulgarioides* S.Julia & Kiew**

Julia S, Kiew R, Ling CY. 2018. The *Begonia* flora of Gunung Mulu and Gunung Buda National Parks, Sarawak, Borneo, including five new species. Phytotaxa. 381(1):74. https://doi.org/10.11646/phytotaxa.381.1.9

***Begonia wallacei* C.W.Lin & C.I Peng**

Lin CW, Chung SW, Peng C-I. 2017. Eleven new species of *Begonia* (Begoniaceae) from Sarawak, Borneo. Taiwania. 62(3):248. https://doi.org/10.6165/tai.2017.62.219

***Begonia xiphophylla* Irmsch.**

Irmscher E. 1953. Systematische Studien über Begoniaceen des tropischen Südamerikas besonders Brasiliens. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie. 76(1):100.

***Begonia xiphophylloides* Kiew**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):31. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia yiii* Kiew & S.Julia**

Julia S, Kiew R, Geri C. 2013. Revision of *Begonia* (Begoniaceae) from the Melinau limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. Phytotaxa. 99(1):28. https://doi.org/10.11646/phytotaxa.99.1.1

***Begonia zygia* C.W.Lin & C.I Peng**[b]

Lin CW, Peng C-I. 2019. Five new species of *Begonia* (sect. *Petermannia*, Begoniaceae) from western Sarawak, Borneo. Taiwania. 64(2):135. https://doi.org/10.6165/tai.2019.64.124

[a] Species that occurs in all regions in Borneo.

[b] Species that occurs in Sarawak and one other region in Borneo.