

***Begonia* (Begoniaceae) from Limestone Hills  
in the Kuching Division, Sarawak, Borneo,  
including nine new species**

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**Abstract**

Fifteen *Begonia* species are described from limestone hills in the Kuching Division, Sarawak, Borneo, of which nine are new: *B. andersonii* Kiew & S.Julia, *B. burttii* Kiew & S.Julia, *B. chaiana* Kiew & S.Julia, *B. corrugata* Kiew & S.Julia, *B. kiamfeeii* Kiew & S.Julia, *B. paoana* Kiew & S.Julia, *B. penrissenensis* Kiew & S.Julia, *B. punchak* Kiew & S.Julia and *B. serapatensis* Kiew & S.Julia. The distribution of these begonias confirms that the Bau limestone flora is phytogeographically distinct and shows that the Padawan-Serian and Penrissen limestone areas also form two distinct phytogeographic areas and that there are few species shared between the three areas.

**Introduction**

In common with limestone elsewhere in Sabah and Sarawak, the limestone hills in the Kuching Division are tower karst formations with sheer cliffs. They occur as isolated hills and in the Kuching Division are now surrounded by cultivation. Geologically, limestone in the Kuching Division has been subdivided into three areas: the Bau, Padawan-Serian and Penrissen limestone areas (Banda *et al.*, 2004).

The Bau limestone is best known botanically (Kiew *et al.*, 2004) and includes both the well-known tourist caves, Wind Cave (formerly called Gunung Lubang Angin) and Fairy Cave (Gunung Kapur). Being closest to Kuching town, it was explored botanically as early as 1845 when Hugh Low collected there (Kiew *et al.*, 2004). Other 19<sup>th</sup> century collectors include G.D. Haviland (1891-1895) and H.N. Ridley (1893, 1903), who wrote an account of Bornean begonias (Ridley, 1906).

In the 20th century, major collectors include J.A.R. Anderson (1950-1970), one of whose special interests was the Sarawak limestone flora (Anderson, 1965) and B.L. Burtt (1978), who specialized in the Gesneriaceae. Many collections were added to the Sarawak Forest Department Herbarium (SAR) by local staff.

The most recent survey was carried out in 2001-2003 when 20 hills in the Bau area were inventoried (Kiew *et al.*, 2004), as part of Kuching Limestone Biodiversity Project by the Sarawak Biodiversity Centre and the ASEAN Regional Center for Biodiversity Conservation, with the result that six begonias, including one new species, *Begonia lailana* Kiew & Geri, were documented from the Bau limestone (Kiew & Geri, 2003).

In contrast, the botany, including begonias, of the Padawan-Serian and Penrissen limestone remained unstudied. The Padawan-Serian area was better collected before our survey with begonias collected from the Tebedu area (Teng Bekap, Gua Baju and Gunung Mentawa), Bukit Pait, Bukit Angob, Gunung Bra'ang (the highest limestone hill in the Kuching Division reaching 729 m and first climbed by Haviland), Gunung Manok, Gunung Mas, Gunung Sebakap, Gunung Sebengkam, Gunung Selabor, Gunung Seburan and 21<sup>st</sup> Mile Serian Road.

The Penrissen area was even more poorly known previous to our study with only Bukit Serapat (also known as 13th Mile Kuching-Simanggan Road or 16th Mile Penrissen Road), Gunung Bah (G. Bar on the herbarium specimens) and G. Berloban being represented by herbarium specimens. Our exploration of these hills, as well as of Gunung Burau and Gunung Rimo, show that the Penrissen area is particularly high in endemics.

This study was undertaken to document and describe the begonia species found on limestone in the Kuching Division (nine new species are described below) and in particular to map their distribution. It is likely that as more hills are explored in the Padawan-Serian and Penrissen areas further new species will come to light.

### **Distribution of Begonias in the Kuching Division**

Among species of the limestone flora in Borneo, begonias exhibit one of the highest levels of endemism with many being restricted to a single

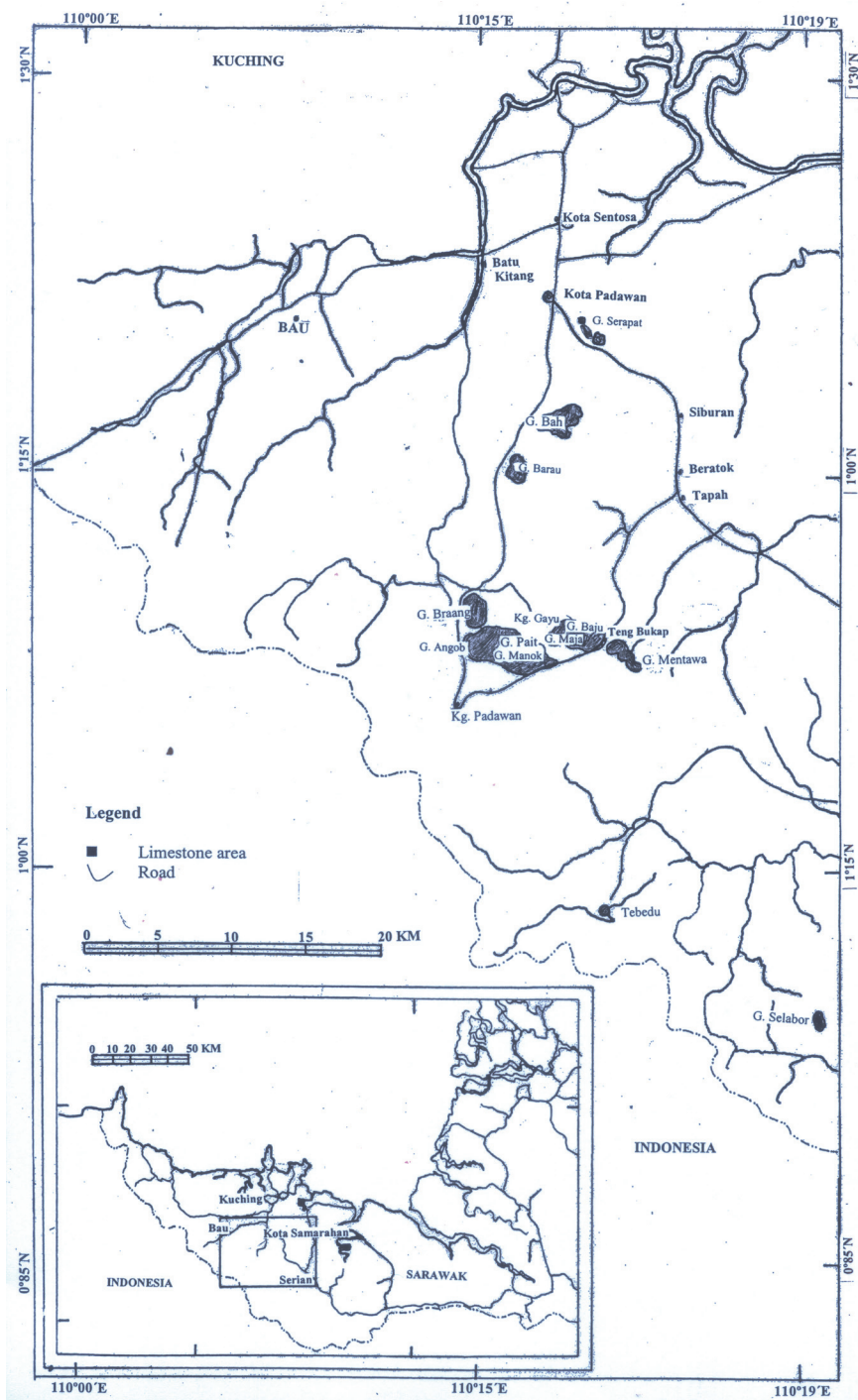


Figure 1. Limestone hills in the Kuching Division, Sarawak.

hill (Kiew, 2001; Pearce, 2003). The distribution of these narrow endemics is therefore useful in delineating phytogeographic areas (Kiew, 2001). Indeed, Burtt (1978) did just this for *Monophyllaea* (Gesneriaceae) in the Kuching Division and was the first to recognise that there were in fact two distinct phytogeographic areas: the Bau hills versus the rest based on the distribution of *Monophyllaea* species and varieties. This distribution pattern is also exhibited by other limestone endemics, such as species of *Begonia* and *Schismatoglottis* (Araceae), and led Kiew *et al.* (2004) to distinguish the Bau limestone as separate from the Padawan-Serian limestone. Our study not only confirms that the Bau limestone is a distinct phytogeographic area but also shows for the first time that the Penrissen limestone is distinct from the Padawan-Serian limestone in which it had previously been included (Burtt, 1978, and Kiew *et al.*, 2004) so that in fact there are three distinct limestone areas in the Kuching Division.

All three areas are equally diverse with six, seven and six begonia species occurring in the Bau, Padawan-Serian and Penrissen areas, respectively. Each area is home to its own endemic species: two in the Bau area (*Begonia congesta* Ridl. and *B. lailana* Kiew & Geri); three in the Padawan-Serian area (*B. andersonii* Kiew & S.Julia, *B. chaiana* Kiew & S.Julia and *B. paoana* Kiew & S.Julia); and four in the Penrissen area (*B. burttii* Kiew & S.Julia, *B. kiamfeeii* Kiew & S.Julia, *B. penrissenensis* Kiew & S.Julia, *B. punchak* Kiew & S.Julia and *B. serapatensis* Kiew & S.Julia).

In addition, although the Penrissen area geographically lies between those of the Bau and Padawan-Serian areas, it shares fewer species with the two other areas: only *B. speluncae* Ridl. occurs in all three areas; the Padawan-Serian and Bau areas share three species (*B. calcarea* Ridl., *B. pendula* Ridl. and *B. rubida* Ridl.), while only *B. corrugata* Kiew & S.Julia is found in both the Penrissen and Padawan-Serian areas.

**Key to Limestone *Begonia* Species in the Kuching Division**

- 1a. Stems erect and cane-like ..... 2
- 1b. Stems rhizomatous or creeping ..... 10
  
- 2a. Leaves with veins prominently forked and narrowly diverging. Fruits oblong ..... 3
- 2b. Leaves with veins widely diverging where they fork. Fruits wider than long or much wider distally ..... 4

- 3a. Leaves glabrous. Female flowers and fruits in a compact cluster; pedicels 4–5 mm long ..... 5. ***B. congesta***
- 3b. Leaves hairy. Female flowers and fruits well-spaced on the inflorescence; pedicels 7–13 mm long..... 6. ***B. corrugata***
- 4a. Leaves lanceolate or oblanceolate; petioles straight or at a slight angle with the midrib ..... 5
- 4b. Leaves ovate; petioles at a pronounced angle with the midrib ..... 7
- 5a. Laminas lanceolate, 8–12 cm long. Inflorescences 6–9.5 cm long. Female flowers with 3 tepals ..... 4. ***B. chaiana***
- 5b. Laminas oblanceolate, 12–23 cm long. Inflorescences 10–25 cm long. Female flowers with 5 tepals ..... 6
- 6a. Laminas 12–17 cm long. Inflorescences 10–16 cm long. Female flowers in a single pair ..... 8. ***B. lailana***
- 6b. Laminas 15–24 cm long. Inflorescences 12–25 cm long. Female flowers in 2 pairs (one pair in the leaf axil and one above) ..... 9. ***B. paoana***
- 7a. Basal lobes up to a third of the lamina length. Inflorescences shorter than the leaves (to 6.5 cm long) ..... 8
- 7b. Basal lobes about half the lamina length. Inflorescences longer than the leaves (9+ cm long) ..... 9
- 8a. Leaves with petioles to 4.5 cm on the lower leaves and blades 9.5–12 by 5–6 cm. Inflorescences with female flowers at the base. Male flowers with 2 tepals ..... 11. ***B. penrissenensis***
- 8b. Leaves with petioles to 2.5 cm long and blades to 7 by 4 cm. Female flowers in separate axils from the male inflorescences. Male flowers with 4 tepals ..... 12. ***B. punchak***
- 9a. Laminas more than 9 x 5 cm. Flowers white. Fruit wings 6–9 mm wide ..... 14. ***B. serapatensis***
- 9b. Laminas up to 8 x 5.5 cm. Flowers ruby red. Fruit wings 4–5 mm wide ..... 13. ***B. rubida***
- 10a. Stems thin and creeping. Leaves widely spaced, longer than wide .... 11
- 10b. Stems thick and rhizomatous. Leaves tufted, as wide as long ..... 12
- 11a. Leaves hairy, plain green, ovate, basal lobes 2–4.5 cm long. Inflorescences with several female flowers and fruits. Flowers white. Male flowers with

- 4 tepals ..... 7. ***B. kiamfeeii***
- 11b. Leaves glabrous, with silver spots, basal lobes 1.2–2 cm long. Inflorescences with one female flower or fruit. Flowers deep pink or red. Male flowers with 2 tepals ..... 10. ***B. pendula***
- 12a. Leaves peltate ..... 13
- 12b. Leaf bases cordate ..... 14
- 13a. Leaf strongly oblique, laminas broader than long, 1.2–3.5(-12) cm long, apex rounded ..... 15. ***B. speluncae***
- 13b. Leaf scarcely oblique, laminas longer than broad, 4.5–7 cm long, apex acuminate ..... 2. ***B. burttii***
- 14a. Laminas round; petioles shorter than the laminas, 2–10 cm long. Inflorescences among the leaves, erect and longer than the petioles. Flowers pink or white ..... 1. ***B. andersonii***
- 14b. Laminas ovate; petioles longer than the laminas, 14–35 cm long. Inflorescences developing on the bare prostrate rhizome, shorter than the petioles. Flowers peachy orange ..... 3. ***B. calcarea***

*Begonia* specimens from the Bau limestone are listed in Kiew & Geri (2003).

### Limestone Begonias in the Kuching Division

#### 1. *Begonia andersonii* Kiew & S. Julia, *sp. nov.*

Sect: *Reichenheimia*

*A Begonia speluncae* Ridl. *laminis latioribus 8–15 latis (nec usque 5(-12) cm latis), petiolis lanatis (nec glabris) et foliis basi cordatis (nec peltatis) differt.*

**Typus:** Borneo, Sarawak, Kuching Division, Teng Bekap, Gua Baju, 8 August 2004, Kiew, Julia & Tan S 93269 (holo, SAR; iso, E, KEP, SING). Figure 2

Rosette begonia; **stems** rhizomatous, creeping and rooting at nodes, up to 7 cm long, woody, hairy, not branched, stout, 6–7 mm thick; without a tuber. Stipules densely hairy, narrowly lanceolate, ca 2 x 5 mm, pale green to pale brown, margin entire, apex entire, persistent. **Leaves** tufted and splayed out against the rock face; petiole woolly with pale brown hairs, (2–)5(–10) cm long, slightly succulent, reddish in young leaves, reddish brown in older leaves; lamina oblique, young leaves bronzy, adult leaves plain pale green above with slightly paler green veins, beneath paler and scintillating with brown veins, thinly succulent, drying papery, slightly asymmetric, orbicular,

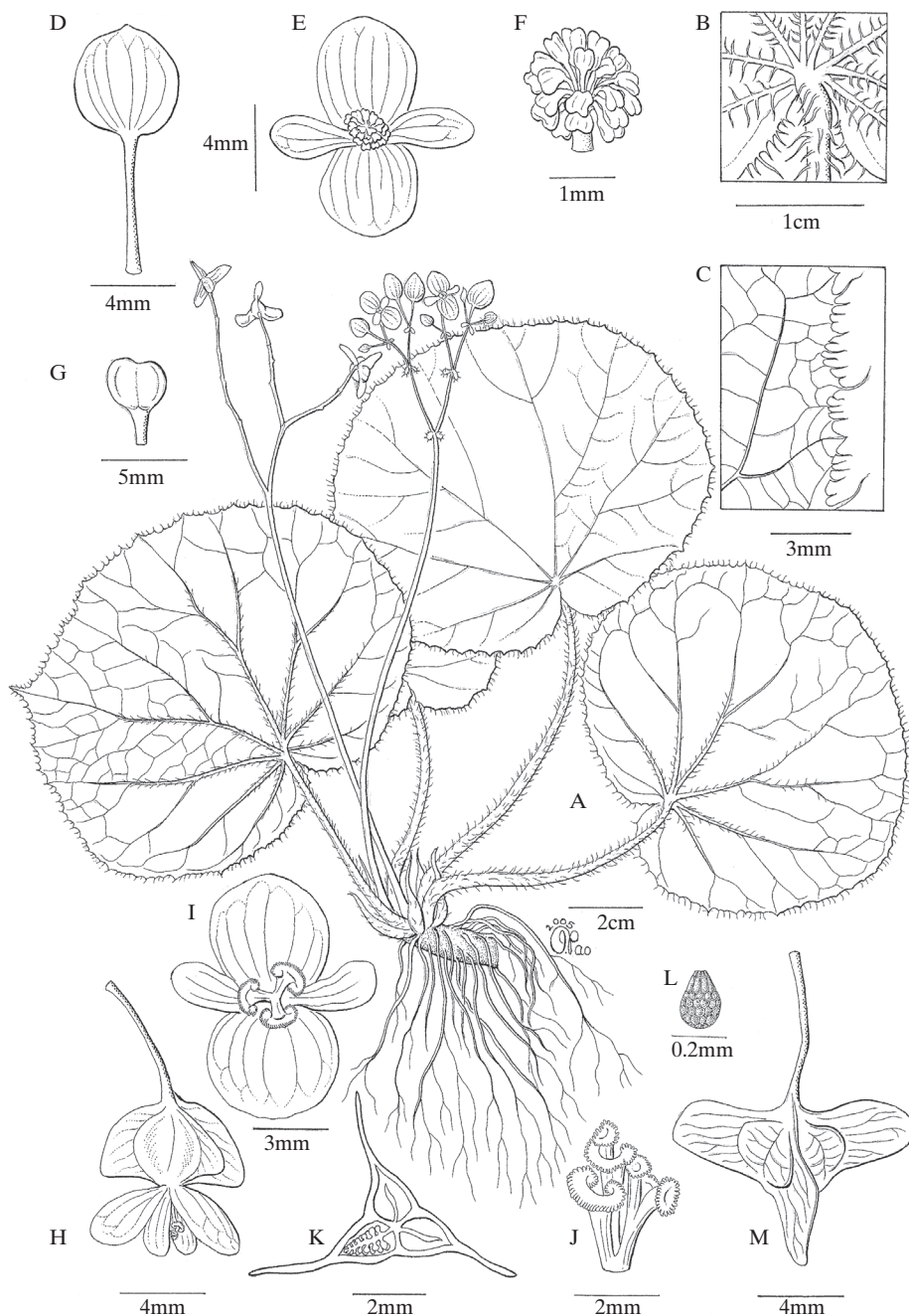


Figure 2. *Begonia andersonii* Kiew & S. Julia

A. habit; B. lower leaf surface near the midrib; C. leaf margin; D. male bud; E. open male flower; F. stamen cluster; G. stamens; H. female flower; I. open male flower; J. styles and stigmas; K. TS ovary; L. seed; M. fruit. (A from CWL 1308; B-M from S 93269).

6.2–11.5 x 8.3–15.75 cm, broad side 4.5–6.5(–9.5) cm wide, base deeply cordate sometimes overlapping, basal lobes 0.75–2(–3.5) cm, margin hairy, crenate, apex rounded or shortly acute; venation palmate with 3–4 pairs of veins branching less than half way to the margin, midrib often branching more or less dichotomously, veins slightly impressed above, beneath prominent and densely hairy, hairs brown. **Inflorescences** terminal, pale red, glabrous, erect, dichasial cyme, longer than the leaves, 9–31 cm long, peduncle 2.5–9 cm long, branches 2 or more, 2.5–9 cm long, male flowers many, female flowers 2–3, protogynous. Bracts obovate, pale green, with long dense hairs, 1–2 mm long, margin entire; bracteoles similar but smaller. Male flowers with a pale pink pedicel 15 mm long; tepals 4, pale pink, margin entire, apex rounded, glabrous, outer two broadly rounded, 6 x 4–6 mm, inner two narrowly oval, 4 x 1.5–2 mm; stamens many, cluster globose, *ca* 2 mm diam., sessile; filaments 1–2 mm long; anthers yellow, narrowly oblong, 1 mm long, apex slightly notched, opening by lateral slits. Female flowers with a pedicel *ca* 20 mm long; ovary *ca* 3 x 4 mm, reddish, wings 3, more or less equal, *ca* 3 mm wide, locules 3, placenta one per locule; tepals 4, pale pink, glabrous, margin entire, apex rounded, outer two rounded, *ca* 3 x 3 mm, inner two smaller 2 x 1 mm; styles 3, styles and stigma yellow, *ca* 1 mm long. **Fruits** pendent on a fine stalk *ca* 9–11 mm long; capsule 4–5 x 11–13 mm, glabrous, wings 3, equal, thinly fibrous, 3–4 mm wide, splitting between the locules and wings. **Seeds** barrel-shaped, *ca* 0.5 mm long, collar cells less than half the seed length.

*Distribution:* Endemic in Kuching Division, Sarawak; known only from the Padawan-Serian limestone.

*Habitat:* Locally common, it is restricted to limestone and grows on dry vertical limestone cliffs in light shade.

*Specimens examined:* Padawan-Serian limestone - Teng Bekap [Tiang Bekap], Anderson S 12345 (SAR); Gunung Mentawa, Burt B 8112 (SAR), Chew CWL 656 (SAR), CWL 1308 (SAR); Kampung Gayu, Mohizah & Jegong S 66838 (SAR); 21st Mile Serian Road, Anderson S 20999 (SAR), Murthy & Chai S 24699 (SAR); Tebedu, Bukit Kajing, Abang Mohtar S 48287 (SAR).

*Notes:* *Begonia andersonii*, like *B. speluncae*, belongs to sect. *Reichenheimia* in its ovary having three locules, each locule with one placenta. They are also similar in their circular leaves and female flowers that are very like the male flowers in having four tepals, the outer pair large and round and the inner pair narrowly oblong. Otherwise, they are different in size - *B. speluncae* is a small plant with leaves 1.4–5.5 cm across (exceptionally up to 12 cm wide), which are almost glabrous (the leaf margin is minutely ciliate) and its leaves are peltate (not cordate as described by Ridley, 1906).

*Begonia andersonii* has a very local distribution centred on Teng Bekap. Interestingly, although *B. speluncae* Ridl. has a wide distribution in the Kuching Division, and occupies the same habitat as *B. andersonii*, these two species are not found growing on the same hill.

It is named in honour of J.A.R. Anderson, who pioneered the exploration of the limestone flora in Sarawak (Anderson, 1965). His collections include this species.

## 2. *Begonia burtii* Kiew & S. Julia, *sp. nov.*

Sect: *Reichenheimia*

*A Begonia speluncae* Ridl. *laminis foliorum majoribus longitudine latitudinem aequanti 4.5–6.8 x 5.6–6.4 cm (nec latioribus quam longioribus, 1.2–5(-10) x 1.4–5.7(-12) cm) apice acuminatis (nec rotundatis) differt.* **Typus:** Borneo, Sarawak, Kuching Division, Gunung Serapat, 8 August 2004, Kiew, Julia & Tan S 93266 (holo, SAR; iso, E, KEP, SING). Figure 3

Rosette begonia; **stems** rhizomatous, creeping and rooting at nodes, up to 4 cm long, succulent, hairy, not branched, stout, *ca* 4 mm thick; without a tuber. Stipules reddish, hairy, narrowly lanceolate, 3–4 x 1–1.5 mm, margin entire, apex setose, caducous. Leaves tufted, oblique; petiole greenish, glabrous, 4.7–9 cm long, succulent, slightly glaucous; lamina of young leaves rosy red above and beneath, mature **leaves** plain matt, dark green above with paler green veins, beneath reddish green or rosy red, thickly succulent, drying papery and with the tertiary veins slightly raised, slightly asymmetric, peltate, broadly oval, sometimes angular, 4.5–6.8 x 5.6–6.4 cm, broad side *c.* 3.7 cm wide, base rounded, 1.5–1.8 cm from junction with the petiole to the base of the lamina, margin fringed by short hairs, entire to minutely dentate, apex shortly acute; venation palmate with *ca* 4 pairs, veins branching half to one third of the way to the margin, plane above, beneath prominent and glabrous. **Inflorescences** terminal, red, glabrous, erect, dichasial cyme, longer than the leaves, *ca* 9.5–15 cm long, peduncle 9–13 cm long, branches two 0.5–2 cm long, male flowers many, female flowers 2 or more, protandrous. Bracts caducous. Male flowers with a white pedicel 15–17 mm long; tepals 4, red in bud, pale pink when open, margin entire, apex rounded, glabrous, outer two broadly oval to rotund, 4–7 x 5–6 mm, inner two narrowly oval, 3–4 x 1–1.5 mm; stamens many, cluster fan-shaped, stalked; filaments *c.* 2 mm long; anthers pale yellow, oblanceolate, 2 mm long, apex slightly notched, opening by lateral slits. Female flowers with a pedicel *ca* 5 mm long; ovary *ca* 9 x 12 mm, locules light red and wings pale green, wings 3, more or less equal, *ca* 3 mm wide, locules 3, placenta one per locule; tepals 5, rosy pink, glabrous, margin entire, apex rounded, outer two obovate, *ca* 6 x 3 mm, inner

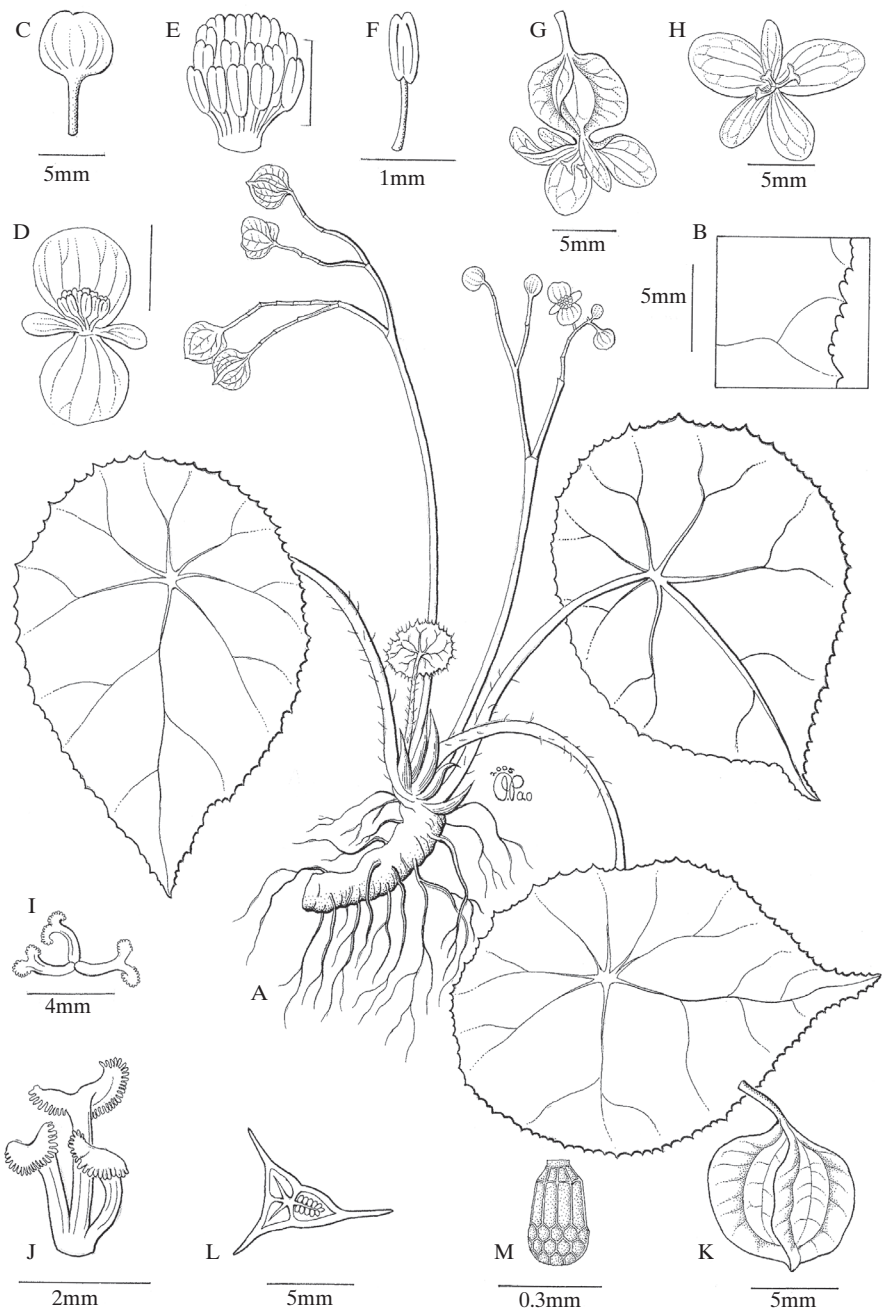


Figure 3. *Begonia burtii* Kiew & S. Julia  
 A. habit; B. lower leaf surface; C. male bud; D. open male flower; E. stamen cluster; F. stamens;  
 G. female flower; H. open male flower; I & J. styles and stigmas; K. fruit; L. TS ovary; M. seed.  
 (All from S 93266).

three smaller *ca* 3 x 1 mm; styles 3, styles and stigmas pale yellow, *ca* 2 mm long. **Fruits** pendent on a fine stalk 4–8 mm long; capsule 6–8(–10) x 7–10(–13) mm, glabrous, wings 3, equal, rounded, thinly fibrous, 2–3(–5) mm wide, splitting between the locules and wings. **Seeds** barrel-shaped, *ca* 0.3–0.4 mm long, collar cells *ca* half the seed length.

*Distribution*: Endemic in the Kuching Division, Sarawak; known only from a single hill in the Penrissen limestone.

*Habitat*: Restricted to limestone, it grows on deeply shaded vertical limestone rock faces near the base of the hill.

*Specimen examined*: Penrissen limestone - Bukit Serapat, 13th Mile Kuching-Simanggan Road, *Burt & Martin B 4746* (SAR).

*Notes*: This is the second peltate begonia to be recorded for the Penrissen limestone. The other is the widespread *Begonia speluncae* collected from Gunung Burau. Compared with *B. speluncae*, *B. burtii* is a larger plant, has a slightly angular lamina with a distinct midrib and an acuminate apex, which is longer or as broad as long, whereas laminae of *B. speluncae* are broader than long and rounded at the apex and the veins appear to branch dichotomously so that there is no distinct midrib. In addition, *B. burtii* has female flowers with five tepals, while those of *B. speluncae* have four.

This species is as yet known from a single hill. It is named in honour of B.L. Burt, who was one of the early explorers of the Kuching limestone and who first collected this species, in recognition of his work on *Monophyllaea* (Gesneriaceae) that first drew attention to the distinction between the limestone floras of the Bau and Padawan-Serian/Penrissen areas.

### 3. *Begonia calcarea* Ridl.

J. Str. Br. Roy. As. Soc. 46 (1906) 260; Kiew & Geri, Gard. Bull. Singapore 55 (2003) 115.

*Distribution*: Endemic in the Kuching Division, Sarawak; known only from the Bau (Gunung Kawa, G. Lanyang, G. Tabai) and Padawan-Serian limestone.

*Specimens examined*: Padawan-Serian Limestone – Gunung Angob, *Anderson S 27513* (SAR); Gunung Bra'ang, *Haviland s.n. (n.v.)*; Gunung Manok, *Burt B8134* (SAR).

*Notes*: Although quite widespread on the Kuching limestone, it is a rare begonia that on the Bau limestone grows in deeply shaded forest on the

base of the hills (Kiew & Geri, 2003). Ridley (1906) first described this species from Gunung Bra'ang, from where Haviland had collected it from the summit.

It is an outstandingly decorative begonia - its petioles are densely clothed in long magenta hairs and its bunches of flowers produced from the prostrate rhizome are peach-coloured.

4. *Begonia chaiana* Kiew & S. Julia, *sp. nov.*

Sect. *Petermannia*

*A Begonia subisensis* K. G. Pearce *tepals femineis 3 (nec 5), fructibus pedicellis brevibus usque 7 mm longis (nec usque 30 mm) et alis angustioribus c. 6 mm latis (nec 10-11 mm) differt.* **Typus:** Borneo, Sarawak, Kuching Division, Gunung Mentawa, Kiew, Julia & Pearce S93270, 8 August 2004 (holo, SAR; iso, E, KEP, L, SING). Figure 4

Cane-like begonia, whole plant glabrous; **stems** erect, 30–50 cm long, young stem reddish and succulent, mature stem green and woody, slender, 3–4 mm thick, nodes swollen, branching to form a spreading crown; without a tuber. Stipules narrowly lanceolate, *ca* 5 x 2 mm, reddish, margin entire, apex glabrous, persistent. **Leaves** distant, 2–4.5 cm apart, slightly oblique; petiole 1.5–2.2 cm long, succulent, pale red; lamina plain glossy dark green above, beneath deep red with green or deep red veins, succulent, drying thinly papery, asymmetric, lanceolate, 8–12 x 2.2–3.5 cm, broad side 1.2–2.5 cm wide, base unequal, basal lobes rounded 5–10 mm long, margin dentate, scalloped between the teeth, apex caudate; venation palmate-pinnate with 1 pair at the base and 2 pairs along the margin branching towards the margin, and with 1 vein in the basal lobe, veins slightly impressed above in life, raised when dry, beneath prominent. **Inflorescences** axillary, pale red, erect, cymose panicle, shorter than the leaves, 6–9.5 cm long, peduncle 2–3 cm long, branches two 2.5–4 cm long, male flowers many, female flowers 1 at the base, protogynous. Bracts obovate 1–2 mm long, margin entire, caducous; bracteoles similar but smaller. Male flowers with a pale red pedicel 5–7 mm long; tepals 2, in bud green or tinged red outside, greenish white or pale reddish green when open, broadly oval, 5 x 4–6 mm, margin entire, apex rounded, glabrous; stamens many, cluster flattened laterally, *ca* 2.5 mm across, stalked; filaments *c.* 1 mm long; anthers pale yellow, almost rounded, 1 mm long, apex slightly notched, opening by lateral slits. Female flowers with a pedicel *ca* 6 mm long; ovary deep red, 5–13 x 6–15 mm, wings 3, more or less equal, *ca* 7 mm wide, locules 3, placentas 2 per locule; tepals 3, deep red, isomorphic, *ca* 9 x 6 mm, obovate, glabrous, margin entire, apex rounded; styles 3, styles and stigma pale yellow, *ca* 4 mm long. **Fruits** pendent on a stiff

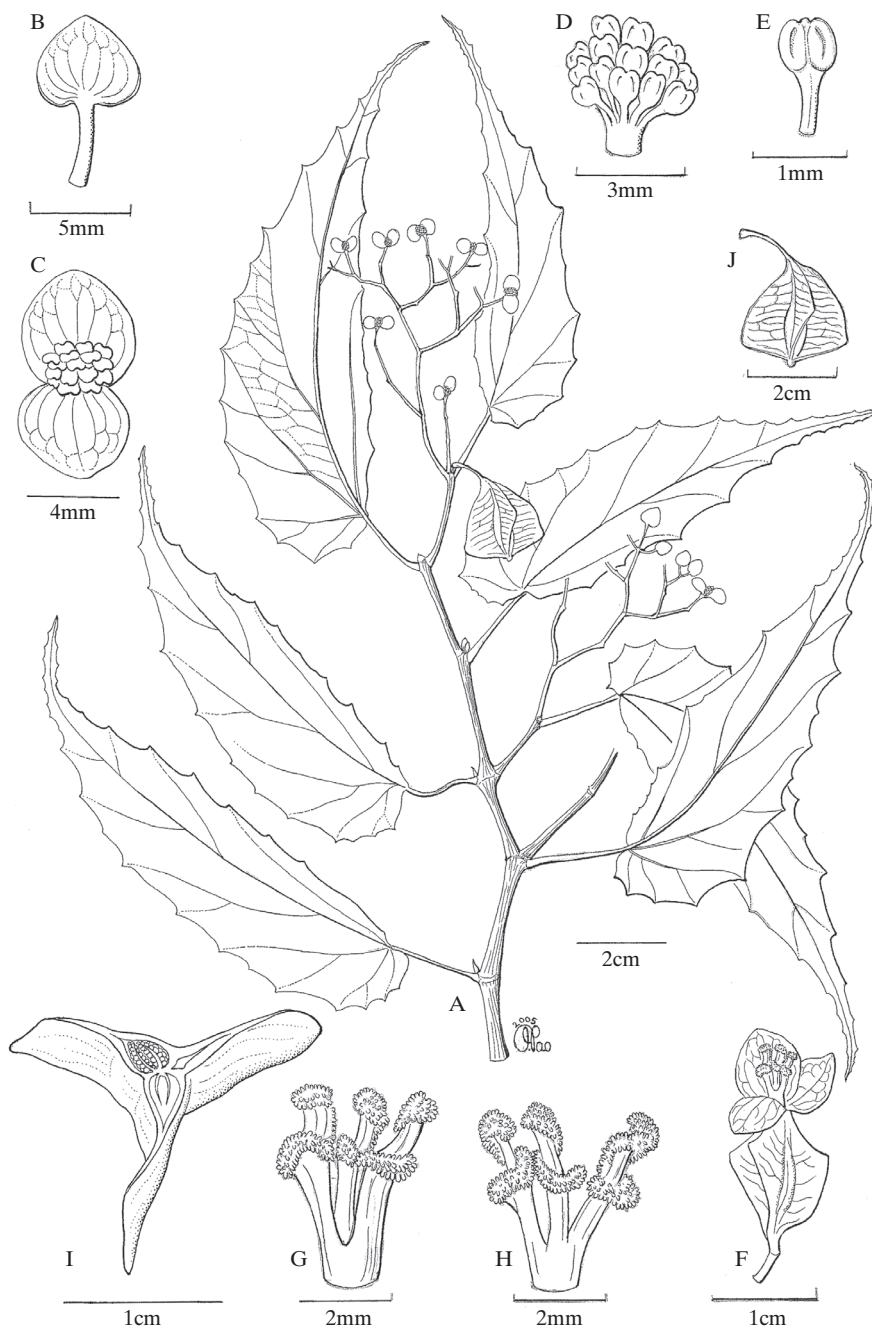


Figure 4. *Begonia chaiana* Kiew & S. Julia

A. habit; B. male bud; C. open male flower; D. stamen cluster; E. stamen; F. female flower; G & H. styles and stigmas; I. TS ovary; J. fruit. (A-E from S 27424; F-J from S 93270).

stalk *ca* 7 mm long; capsule *ca* 15 x 20 mm, hairless, locules 2 (one locule not developing), wings 3, subequal, the longer *ca* 8 mm wide and the shorter two *ca* 6 mm wide, thinly fibrous, splitting between the locules and wings.

*Distribution:* Endemic in Kuching Division, Sarawak; known from two limestone hills in the Padawan-Serian area.

*Habitat:* It grows on limestone rocks or jagged cliffs deep in shade below the tree canopy.

*Specimens examined:* Padawan-Serian limestone - Bukit Pait, *Erwin & Paul Chai S 27424* (SAR), *Julia & Kiew S 95686* (KEP, SAR); Gunung Mentawa, *Anderson 12346* (SAR), *Burt B 8111* (SAR).

*Notes:* This is a dainty cane-like begonia with slender stems and rather narrow, glossy dark green leaves that are strikingly deep red underneath. In habit, it is similar to *Begonia subisensis* but differs from this species not only in its female flowers having three tepals (those of *B. subisensis* have 5) but the fruit is also quite different in having a short stiff stalk (whereas that of *B. subisensis* is flexuose, dangling and up to 30 mm long) and the capsule is both smaller and has relatively narrower wings (the fruits of *B. subisensis* are about 14 x 23 mm with wings 10–11.5 mm wide).

It shares the inflorescence type (cymose panicle), two tepals in the male flower and the capsule shape with slightly unequal wings with *Begonia lailana* but differs in its smaller size (*Begonia lailana* grows to 1 m tall, has larger laminas 12.5–17 x 8–10 cm and longer panicles 10–16 cm long) and tepal number in the female flower (5 in *B. lailana*).

In its cane-like habit, its protogynous inflorescences and female flowers with three locules each with two placentas, it conforms to sect. *Petermannia*. However, its fruit wings are slightly unequal and one locule does not develop in the fruit and is empty of placentas and seeds. In addition, the slightly longer wing is not thickened (as it is in sect. *Platycentrum*) and apart from size is identical to the other two wings.

It is an extremely local species known from just two localities.

It is named in honour of Dr Paul Chai Piang Kong, the first Sarawakian appointed as botanist (1971–1986) in the Sarawak Forest Department.

##### 5. *Begonia congesta* Ridl.

J. Str. Br. Roy. As. Soc. 46 (1906) 253; Kiew & Geri, Gard. Bull. Singapore 55 (2003) 116.

*Distribution:* Endemic in the Kuching Division, Sarawak; restricted to the *Bau limestone* (Bidi, Fairy Cave (Bukit Kapur), Bukit Krian, G. Batu, G.

Doya, G. Jebong, G. Kawa, G. Krian, G. lanyang, G. Pambur, G. Ropih, G. Seburan, G. Tai Ton and G. Tongga).

*Habitat:* In shade on limestone boulders or on damp rock-faces near the cliff base.

*Notes:* *Begonia congesta* belongs to a group of limestone begonias that are characteristic in their relatively thick stems, often swollen at the nodes, and their leaves that have narrowly bifurcating veins that are impressed above giving the lamina a corrugated surface. It is confined to the Bau limestone where it is common and widespread.

#### 6. *Begonia corrugata* Kiew & S. Julia, *sp. nov.*

##### Section *Petermannia*.

*A Begonia congesta* Ridl. *foliis pubescentibus (nec glabris) et floribus femineis remotis pedicellis longioribus 7–13 mm longis (nec 4–5 mm) differt.* **Typus:** Borneo, Sarawak, Gunung Manok, 6 Sept 2005, *Julia & Kiew S 95689* (holo, SAR; iso, E, KEP, L, SING).

Cane-like begonia, **stems** greenish or reddish brown, woody, matted ferruginous, sometimes bristly with translucent/white hairs 3–4 mm long, particularly dense on the uppermost internodes, erect, little branched, to 60 cm tall but flowering at *ca* 10 cm tall, 6–7 mm thick, nodes swollen with a conspicuous stipular scar, internodes 2–6.5 cm long; without a tuber. Stipules narrowly triangular, 7–20 x 4–15 mm, pale green, glabrous, margin entire, apex setose, caducous. **Leaves** oblique, distant, pendent and held flat against the rock surface, petioles (2.5–)4.5–6–5(–7.5) cm long, glabrous and glossy, sometimes densely bristly and bristles 2–3 mm long, narrowly grooved above; laminae plain deep green above, sometimes with a bluish tinge, paler beneath with dense translucent erect bristly hairs 1–2 mm long on the upper surface; thin in life, papery when dry, asymmetric, broadly ovate, 14–22(–25) x 9–16 cm, broad side 7–11 cm wide, base unequally cordate, basal lobes rounded, not overlapping, the larger 1.5–4 cm long, margin ciliate usually almost entire with minute teeth, sometimes serrate, apex shortly acuminate, acumen to 2.25 cm long; venation palmate-pinnate with (1–)2 basal pairs of veins, with 3–5 pairs along the midrib and 3 veins in the basal lobes, veins narrowly parallel and deeply impressed above giving a corrugate appearance, branching once or twice before the margin, beneath prominent, in young leaves red, in mature leaves red and minutely pubescent, sometimes brown and ferruginous with hairs 1–2 mm long, reticulation of tertiary veins prominent on both surface in dried leaves. **Inflorescences** light green, densely bristly, bristles *ca* 3 mm long, racemose, erect, shorter than

the leaves, 13.5–23 cm long, protogynous, female flowers produced singly in the lower part of the inflorescence with up to 5 female flowers *ca* 3.5–5 cm apart, above branches distant and bearing 2–3 cymules of male flowers with one male flower opening at a time. Bracts green, 15–23 x 10–16 mm, minutely hairy especially along the raised midrib, margin entire; bracteoles green, *ca* 8 x 6 mm, decreasing in size towards the apex. Male flowers with a light green pedicel *ca* 4–5 mm long with dense glandular hairs, tepals 2, greenish yellow, broadly oval, margin entire and recurved, apex rounded, on the outer surface densely hairy with short glandular hairs, stamen cluster globose, *ca* 2–3 mm across, sessile, stamens 40–50, filament *ca* 0.75 mm long, anther light yellow, broadly oblanceolate, *ca* 0.75 mm long, apex slightly emarginate, opening by lateral slits. Female flowers with reddish or pale green pedicel and ovary densely covered in short glandular hairs, pedicel 4–10 mm long, ovary oblong 15–19 x 10–12 mm, locules 3, placentas two per locule, wings subequal 2.5–4.5 mm wide, tepals (4 or) 5, ovate, 10–12 x 5–7 mm, toothed towards the apex, teeth tipped by a glandular hair, apex acute, outside glabrous or with dense glandular hairs, greenish yellow or whitish pink, style and stigma greenish yellow *ca* 4 mm long, styles 3, bifid, stigma a papillose spiral band. **Fruit** pendent on a stiff, minutely hairy pedicel (7-)10–13 mm long, capsules 15–20 x 12–15 mm, locules 3, wings 3, subequal, thin, longer wing 4–5 mm wide, narrower wing *ca* 3 mm wide, splitting between the ovules and wing, stigma caducous. **Seeds** barrel-shaped, brown, *ca* 0.25 mm long, collar cells *ca* half the seed length.

*Distribution:* Endemic in the Kuching Division, Sarawak; known only from the Padawan-Serian and Penrissen limestone.

*Habitat:* On steep rock-strewn slopes and on limestone screes in shade under the tree canopy.

*Specimens examined:* Padawan-Serian limestone - Bukit Angob, *Anderson S 27493* (SAR, SING); Bukit Paya Payung, Tebedu, *Jamree et al. S 73270* (SAR); Gunung Manok, *Burt B 8133* (SAR); Gunung Mentawa, *Burt B 8109* (SAR); Gunung Sabu, *Jamree et al. S 75866* (SAR); Gunung Sebakab, *Jamree et al. S75804* (SAR); Gunung Sebengkam, *Jamree et al. S75896* (SAR). Penrissen limestone - Gunung Bah, *Julia et al. S 95699* (E, KEP, L, SAR, SING); 16th Mile Penrissen Road, *Anderson S 15274* (SAR).

*Notes:* Similar to *Begonia congesta* in habit and in its corrugated leaves and in its small male flowers with two tepals that are hairy outside, like *B. congesta* it belongs to sect. *Petermannia* on account of its three-locular ovary, each locule of which has a bilamellate placenta. It differs from *B. congesta* in its densely hairy leaf surface and inflorescences that bear well-spaced single

female flowers with long pedicels in the lower part of the inflorescences. (*B. congesta* has two pairs of female flowers with short 4–7 mm-long pedicels that are congested (2–3 mm apart) at the base of the inflorescence).

It is named for its characteristic corrugated leaf surface.

7. *Begonia kiamfeeii* Kiew & S. Julia, *sp. nov.*

Section: *Petermannia*

*A Begonia pendula* Ridl. *foliis dense hirsutis (nec glabris) et tepalis masculis 4 (nec 2) differt.* **Typus:** Borneo, Sarawak, Kuching Division, Gunung Bah, Julia, Kiew & Leong S 95698, 17 Nov 2005 (holo, SAR; iso, E, KEP, L, SING). Figure 5

Creeping begonia rooting at the nodes, climbing vertically up rocks and cliffs. **Stems** slender, reddish, unbranched, 23–50 cm long, internodes 2.5–4.5 cm long, succulent and in life *ca* 3 mm thick; without a tuber. Indumentum of uniseriate, translucent or white hairs, scattered and 3 mm long on the stems and petioles; 3–4 mm long on upper and lower surfaces of veins and lamina margin. Stipules broadly ovate, 8–13 x 4–6 mm, membranous, reddish, margin entire, apex setose, rapidly decaying on the plant. **Leaves** alternate, distant, pendent; petioles reddish, succulent, 2.5–6 cm long, terete; laminae oblique, young leaves pale green, adult leaves mid-green with pale green veins, paler beneath, succulent, drying papery, asymmetric, ovate, 6.5–8.5 x 5–8.5 cm, broad side 3.5–5.5 cm wide, base cordate, basal lobes 2–4.5 cm long, margin minutely dentate, teeth tipped by a hair, apex acuminate, acumen 1–1.7 cm long; venation palmate with 2 pairs of veins at the base, 1 pair along the midrib and 2 veins in the basal lobe, branching towards the margin, midrib and veins impressed above, slightly prominent beneath. **Inflorescences** axillary, erect, cymose panicle, pale green, sparsely hairy, 13–23 cm long, longer than the leaves, peduncle 6.5–10 cm long, branches 10–15 mm long, male flowers many, female flowers 1 per branch with up to 6 branches bearing female flowers, protogynous. Bracteole pairs subtending the male flowers white, lanceolate, 4–6 x 3–4 mm, glabrous, margin entire. Male flowers with pedicels 6–10 mm long; tepals 4, pure white, margin entire, apex rounded, glabrous, outer two obovate, 6.5–8 x 6–7 mm, inner two narrowly oblong, 5–7 x 2–3 mm; stamens 26–30, cluster globose, 2–3 mm diam., sessile; filaments *ca* 0.5 mm long; anthers yellow, obovate, 0.75–1 mm long, apex emarginate, opening by lateral slits. Female flowers with white pedicels *ca* 8 mm long; ovary white, *ca* 7 x 14 mm, wings 3, more or less equal, *ca* 5 mm wide, locules 3, placentas two per locule; tepals 4 or 5, white, glabrous margin entire, apex acute, outer ovate, *ca* 4 x 2 mm, inner smaller 3 x 2 mm; styles 3, yellow, *ca* 2 mm long, joined for *ca* half its length, ultimate

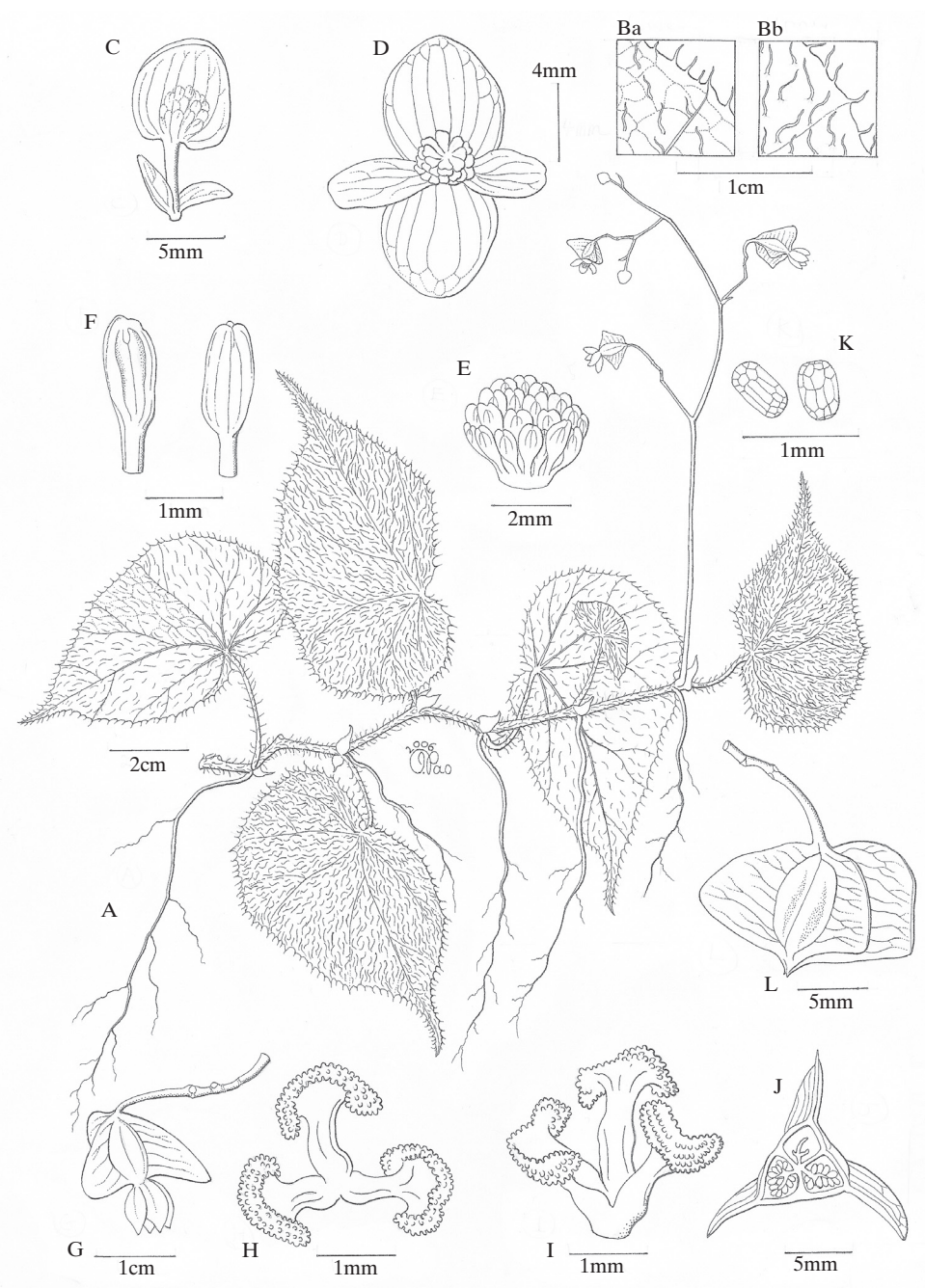


Figure 5. *Begonia kiamfuei* Kiew & S. Julia

A. habit; B. leaf surface (a) lower side, (b) upper side; C. male bud; D. male flower; E. stamen cluster; F. stamens; G. female flower; H & I. styles and stigmas; J. TS ovary; K. seed; L. fruit. (All from S 95698).

branches broadly U-shaped. **Fruits** pendent on fine stalks *ca* 6–13 mm long; capsules 6–8 x 13–15 mm, glabrous, wings 3, equal, thinly fibrous, (3–)5–6 mm wide, splitting between the locules and wings. **Seeds** barrel-shaped, *ca* 0.5 mm long, collar cells *ca* half the seed length.

*Distribution:* Endemic in the Kuching Division, Sarawak; on Penrissen limestone, known from a single hill.

*Habitat:* Growing directly on limestone rocks where there is a deep moss layer in light shade.

*Notes:* The very pale green leaves and pure white flowers make it a striking begonia. (Most Bornean begonias have pink flowers). It grows on shaded damp mossy vertical cliff faces, the same micro habitat as *Begonia pendula* with which it shares the creeping habit with slender stems that root at the node. However, it is very different from *B. pendula* that is glabrous, has variegated leaves, deep pink or red flowers and male flowers with two tepals. It has been collected from a single hill.

It is named for Leong Kiam Fee, botanist with the Singapore Botanic Gardens, and one of the discoverers of this new species

8. *Begonia lailana* Kiew & Geri  
Gard. Bull. Singapore 55 (2003) 117.

*Distribution:* Endemic in the Kuching Division, Sarawak; known only from the Bau limestone (Gunung Aup, G. Batu, G. Doya, G. Kawa, G. Lanyang, G. Podam, G. Poing, G. Tabai).

*Habitat:* On soil at the base of limestone hills, in light shade.

*Notes:* It is a cane-like begonia with large, glossy green leaves sometimes with scattered dark red bristles on the upper surface. Its attractive red, toothed tepals in the female flowers are unusual among Bornean begonias.

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

Sect. *Petermannia*.

*A Begonia lailana* Kiew & Geri *laminis longioribus* 17–23 cm *longis* (nec 12–17 cm) *inflorescentis longioribus* 12–25 cm *longis* (nec 10–16 cm *longis*) *et paribus florum femineorum* 2 (nec 1) *differt*. **Typus:** Borneo, Sarawak, Gunung Rimo, *Julia*, Kiew & Geri S91390, 29 April 2005 (holo, SAR; iso, KEP, E, L, SING). Figure 6

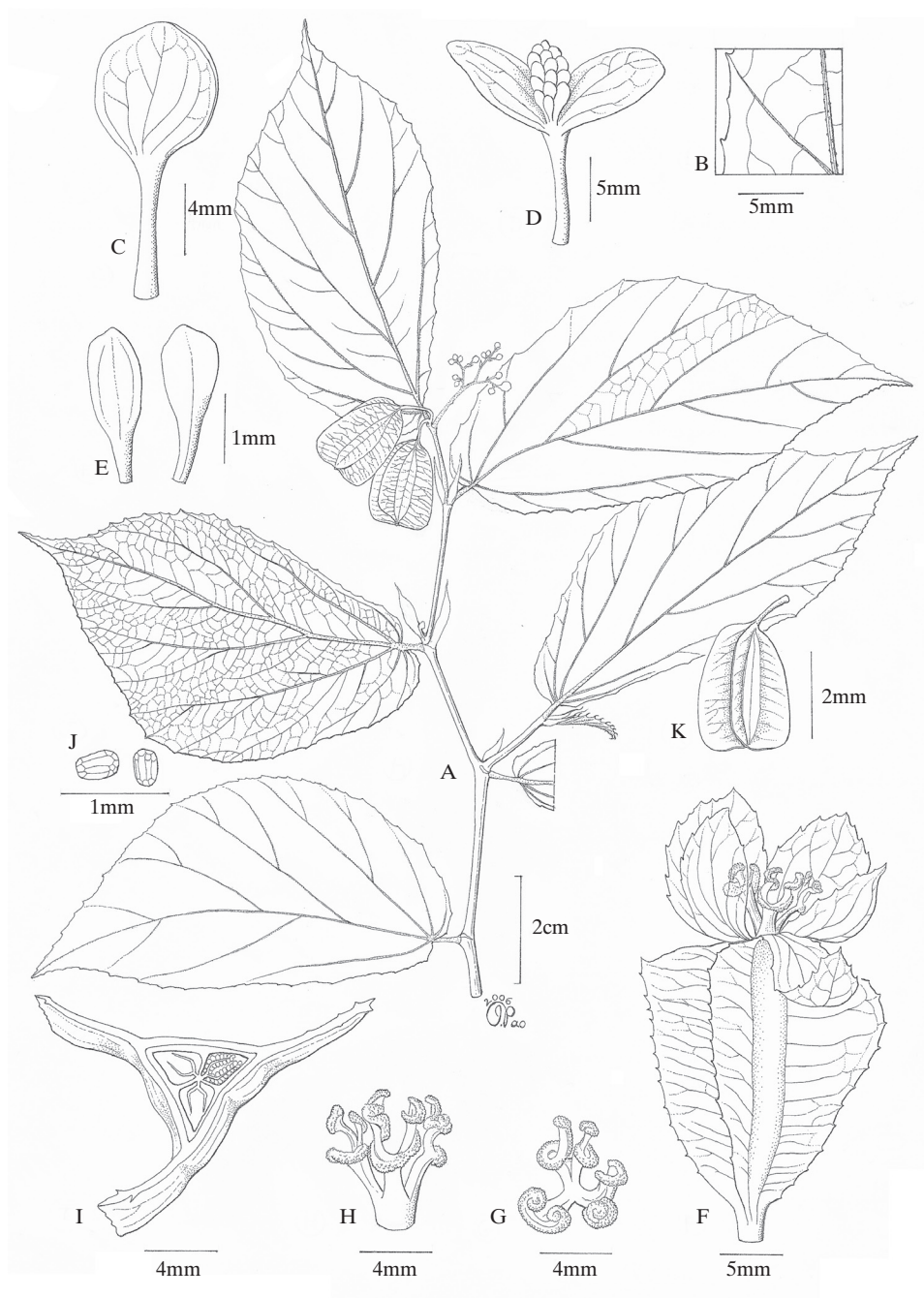


Figure 6. *Begonia paoana* Kiew & S. Julia

A. habit; B. lower leaf surface; C. male bud; D. male flower; E. stamens; F. female flower; G & H. styles and stigmas; I. TS ovary; J. seed; K. fruit. (All from S 91390).

Cane-like begonia, **stems** up to 1.2 m tall, 3–4 mm diam., reddish brown, woody, minutely pubescent on the uppermost nodes, internodes 3–13.5 cm long, branching; without a tuber. Stipules lanceolate, 16–35 x 6–10 mm, pale green, glabrous, margin entire, midrib ridged, apex attenuate, caducous. **Leaves** alternate, distant, not oblique; petioles 5–10(–18) mm in the lower leaves, 6–10(–20) mm in the upper leaves, slightly thickened, minutely pubescent, brownish red, terete; laminae plain mid-green above, paler below, in most plants leaves glabrous above, a few plants with minute red hairs on a raised hair base, oblanceolate, asymmetric, 15–24 x 4.5–11 cm, broad side 4–8 cm wide, succulent in life, papery when dry, base rounded on the broad side, basal lobe 0.5–1.3 cm long, cuneate or rounded on the narrow side, margin minutely dentate, apex acuminate; venation palmate-pinnate with 1 pair of veins at the base, 4–6 pairs along the midrib and 2–3 veins in the basal lobe, branching twice, impressed above, beneath veins slightly prominent, concolorous and glabrous or minutely pubescent. **Inflorescences** axillary, erect, dull red, (3–)11–25 cm long, longer than the leaves, sessile or with a peduncle *ca* 3 cm long, racemose with cymose branches of male flowers, branches 2–4 cm long, glabrous, protogynous with (rarely 1 or) 2 pairs of female flowers at the base and many male flowers on side branches above. Bracts pale green, *ca* 7 x 3 mm, margin entire, glabrous. Male flowers with glabrous pedicels 6–7 mm long, tepals 2, pale green flushed crimson, round with a recurved margin, 5–7 x 5–7 mm, glabrous, stamen cluster conical, *ca* 2.5 mm across, stamens *ca* 40; filament *c.* 0.75 mm long, anther pale yellow, oblanceolate, *ca* 1 mm long, apex rounded, dehiscing by longitudinal slits. Female flowers with pale red pedicels 7–8 mm long, ovary pale red, glabrous, 15 x 12–14 mm, locules 3, each locule with 2 placentas, wings 3, equal; tepals 5, greenish yellow, isomorphic, oval, 10–11 x 4–6 mm, slightly toothed towards the acute apex; styles 3, 3–4 mm long, bifurcating, stigma a spirally twisted papillose band. **Fruits** on a stiff, decurved stalk, 10–23 mm long, capsules glabrous, oblong, widening towards the apex, 20–28 x 21–25 mm, wings 3, subequal, larger wing 6–10 mm wide and the smaller two 6–8 mm wide, thinly fibrous, dehiscing between the locules and the wings, stigma caducous. **Seeds** barrel-shaped, brown, *ca* 0.25 mm long, collar cells more than half the seed length.

*Distribution:* Endemic in the Kuching Division; known only from the Padawan-Serian and Penrissen limestone.

*Habitat:* Slope of limestone hill or on limestone screes, rubble or rocks at 130–280 m altitude, locally common.

*Specimens examined:* Padawan-Serian limestone - Bukit Peyang, Yui & Othman S 46218 (SAR); Gunung Manok, Mamit S 33476 (SAR); Gunung

Mas, *Julia et al.* S 95693 (E, KEP, SAR, SING); Gunung Selabor, *Anderson* S20827 (SAR), S28053 (SAR); Selabor, 3 Sept 2005, *Julia & Kiew* S 95676 (E, KEP, L, SAR, SING); Seburan, *Anderson* S 12921 (SAR); Teng Bekap, *Mamit* S 32641 (SAR). *Penrissen limestone* – Gunung Rimo (type).

*Vernacular names:* Kura (Bidayuh), riang (Iban).

*Notes:* This cane-like begonia is similar to *Begonia lailana* in habit, size, and the leaves that are not oblique. However, it differs in the petioles not being densely hairy, the juvenile leaves are never spotted, nor are the adult leaves reddish beneath and the leaves are considerably larger, the inflorescences longer, and there are two pairs of female flowers in the inflorescence.

It is more common on the Padawan-Serian limestone; as yet it is known from only one hill (Gunung Rimo) in the Penrissen limestone area.

There are two other specimens collected from Padawan limestone (*S* 27425 from Bukit Pait and *CWL* 1306 from Gunung Mentawa) that are similar in habit to *B. paoana* but they differ in having narrowly oblong fruits (15 x 9 – 25 x 15 mm) that are narrowed towards the apex. These populations have not been refound and the specimens without inflorescences and flowers are insufficient to describe.

This species is named in honour of Joseph Pao, botanical artist in the Sarawak Herbarium.

#### 10. *Begonia pendula* Ridl.

J. Str. Br. Roy. As. Soc. 46 (1906) 257; Kiew & Geri, Gard. Bull. Singapore 55 (2003) 120.

*Distribution:* Endemic in the Kuching Division, Sarawak: known only from the Bau and Padawan-Serian limestone. *Bau limestone* - Bidi, Bukit Boring, Gunung Apin, G. Aup, G. Batu, G. Berloban, G. Doya, G. Jebong, G. Juita, G. Lobang Angin, G. Pambur, G. Podam, G. Poing, G. Ropih, G. Setiak, G. Stulang, G. Tabai, G. Tai Ton, G. Tongga, G. Umbut; *Padawan-Serian limestone* - Gunung Selabor, *Sinclair* SFN 38471 (SING).

*Habitat:* On damp, mossy vertical limestone cliff faces, in shade beneath the tree canopy.

*Notes:* It is a decorative begonia with bright green leaves variegated with silver green spots between the veins. Its flowers too are attractive being deep pink or red. On the Bau limestone, it is common. Ridley (1906) named it 'pendula' from its stems that trail down the cliff faces.

11. *Begonia penrissenensis* Kiew & S. Julia, *sp. nov.*Section: *Petermannia*

*A Begonia rubida* Ridl. *laminis longioribus 9–12 cm longis (nec usque 8 cm longis), lamina folii quam lobo basali 5-plo longiore (nec lamina lobo basali duplo longiore) et tepalis masculis 2 (nec 4) differt.* **Typus:** Borneo, Sarawak, Kuching Division, Gunung Bah, Kiew, Julia & Leong S95700, 17 Nov 2005 (holo, SAR; iso, KEP, E, K, L, SAN, SING). Figure 7

Cane-like begonia, whole plant glabrous; **stems** erect, up to 50 cm long and 5 mm thick, reddish brown, several stems arising from branches from the base, nodes swollen, internodes 2–7 cm long; without a tuber. Stipules lanceolate, pale green, 7–10 x 3.5–6 mm, margin entire, keeled toward the apex, apex apiculate, persistent. **Leaves** distant; petioles deep red, *ca* 2 cm long in the upper leaves, elongating to 4.5 cm in lower leaves, succulent, terete; laminas oblique, deep green above and pale green beneath or bronze green above and purple-red beneath, sometimes with silver-grey spots with a deep green centre in rows between the veins, all colour forms with deep red veins that on the upper surface appear blackish, in life succulent and brittle, drying thinly leathery, asymmetric, narrowly ovate, 9.5–12 x 5–6 cm, broad side 3.2–4 cm wide, base unequal, basal lobe large and rounded, 1.5–2.5 cm long, margin minutely toothed at the vein endings, apex acuminate, acumen *ca* 1–2 cm long; venation palmate-pinnate with 1(-2) pairs at the base and 2-3 pairs along the midrib and with 2(-3) veins in the basal lobe, branching twice, veins slightly prominent above and beneath, red beneath. **Inflorescences** axillary, reddish, glabrous, erect, cymose panicles with up to 4<sup>th</sup> order branching, shorter than the leaves, (1.3-)2–3.6(-5.2) cm long, peduncles 1.3–1.7 cm long, female flowers on short branches at the base, subsessile to 2–7 mm long, upper branches with male flowers (7-)10–15 cm long, male flowers many, female flowers usually 1 or sometimes 2, protogynous. Bracts pale green, lanceolate, 7–10 x 2–4 mm, margin entire, persistent; bracteoles similar but smaller. Male flowers with green pedicels 6–10 mm long; tepals 2, pale greenish yellow, glabrous, broadly ovate, 5–8 x 6–8.5 mm, margin entire, apex acute to rounded; stamens 30-40, cluster broadly conical, 3–5 mm diam., sessile; filaments *ca* 1 mm long; anthers pale yellow, obovate, 0.75 mm long, apex emarginate, opening by lateral slits. Female flowers with reddish pedicels 10–22 mm long; ovary pale green, 5–12 x 10–15 mm, wings 3, equal, 2–6 mm wide, pointed to rounded, locules 3, placentas 2 per locule; tepals 4, pale green, tinged rosy red, glabrous, isomorphic, lanceolate, 6–8 x 4–5 mm, margin entire, apex acute; styles 3, 2–4 mm long, free to the base and bifurcating with ultimate branches broadly U-shaped. **Fruits** pendent on fine stalks 2.2–3 cm long; capsules 8–13 x 20 mm, locules 3, wings 3,

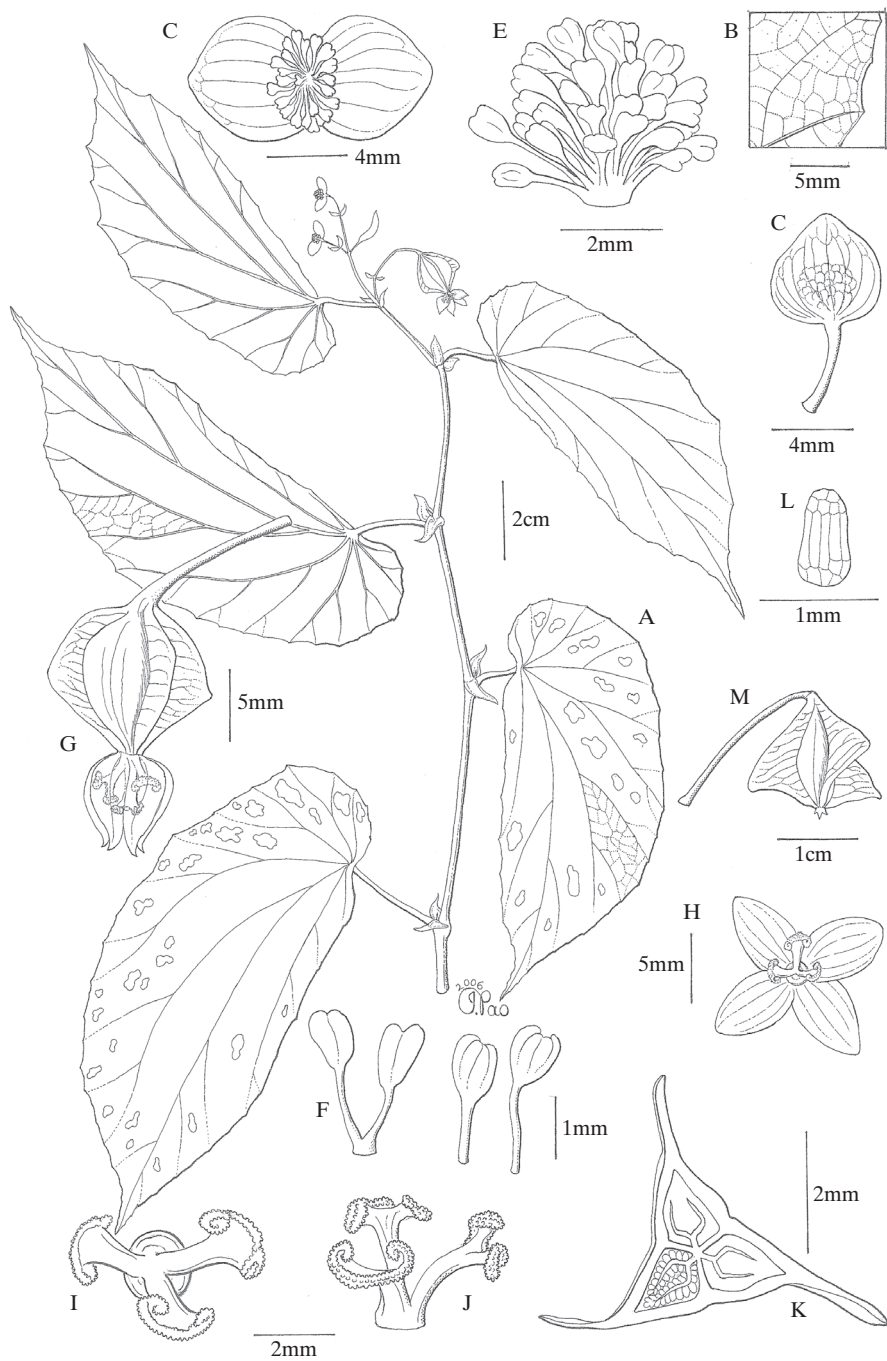


Figure 7. *Begonia penrissenensis* Kiew & S.Julia  
A. habit; B. lower leaf surface; C. male bud; D. male flower; E. stamen cluster; F. stamens; G. female flower; H. open female flower; I & J. styles and stigmas; K. TS ovary; L. seed; M. fruit. (A-L from S 95700; M from S 91389).

rounded to pointed, equal, fibrous, wings 6–7 mm wide, splitting between the locules and wings. **Seeds** barrel-shaped, c. 0.5 mm long, collar cells about  $\frac{3}{4}$  seed length.

*Distribution:* Endemic in the Kuching Division, Sarawak, known only from the Penrissen limestone.

*Habitat:* Confined to limestone, it grows on rocky shoulders of the limestone hill c. 250 m high, in light shade.

*Specimen examined:* Penrissen limestone – Gunung Rimo, Julia, Kiew & Malcom S 91389 (E, KEP, SAR).

*Notes:* It is an attractive begonia with the large, pale green pairs of stipules contrasting with its red stems. In addition, some plants have adult leaves with silver-grey spots or are bronze-coloured.

## 12. *Begonia punchak* Kiew & S. Julia, *sp. nov.*

Section: *Petermannia*

*A Begonia rubida* Ridl. *petiolis brevioribus usque 2.5 cm longis (nec 5 cm longis), lamina folii quam lobo basali 3-plo longiore (nec lamina lobo basali duplo longiore) et fructibus alis angustioribus 2-3 mm latis (nec 4-5 mm latis) differt.* **Typus:** Gunung Burau, Penrissen, Julia, Kiew & Malcom S 91392, 30 April 2006 (holo, SAR; iso, E, KEP, L, SING). Figure 8

Cane-like begonia, whole plant glabrous. **Stems** erect, 50–75 cm tall, glossy, crimson, old stem becoming brown and woody, 6–7 mm thick, several stems produced from branching at the base, nodes swollen with a conspicuous stipular scar, internodes 1.5–2.5 cm, upper branches zigzag; without a tuber. Stipules foliaceous, pale green tinged red, 2.2 x 0.8 cm, margin entire, broadly lanceolate, outside keeled, apex acute, soon caducous. **Leaves** distant, alternate, held almost horizontally; petioles 1–2.5 cm long, dark crimson, succulent, terete; lamina oblique, plain mid-green above with a red patch at the base, yellowish green beneath contrasting with deep crimson veins, glossy, in life succulent, asymmetric, ovate, up to 7 x 4.5 cm, decreasing markedly in size towards the apex, broad side to 3 cm wide, base unequal, basal lobe rounded up to 2.75 cm long, margin undulate with minute distant teeth, apex acuminate; venation palmate-pinnate, 3 veins at the base, 1-2 pairs along the midrib and 2 veins in the basal lobe, branching once, impressed above, prominent beneath. **Inflorescences** axillary, deep crimson, unisexual, protogynous; without bracts. Female inflorescences with a peduncle 1.5–3.5

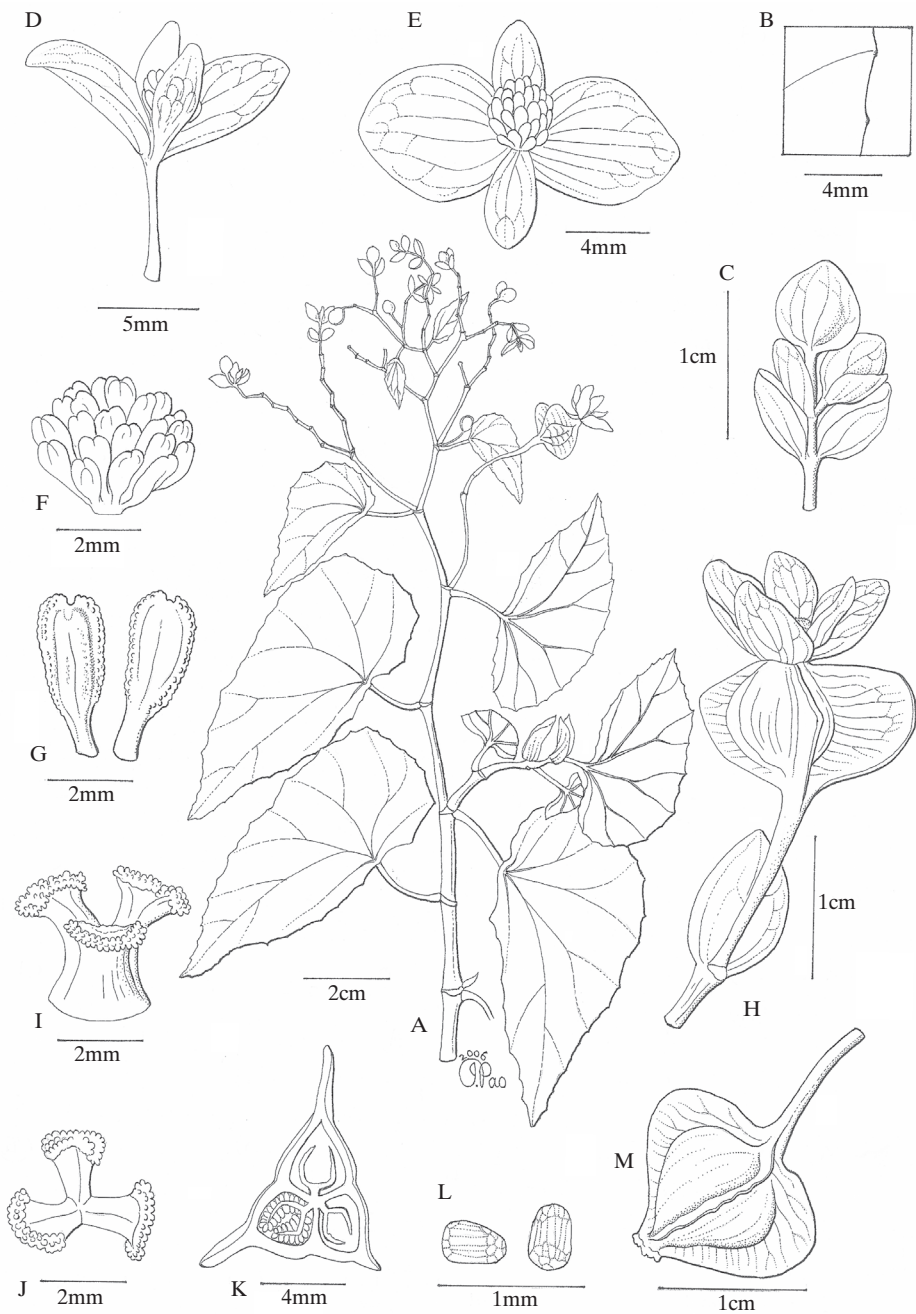


Figure 8. *Begonia punchak* Kiew & S.Julia  
A. habit; B. lower leaf surface; C. male bud with bracteoles; D. male flower; E. open male flower; F. stamen cluster; G. stamens; H. female flower with bracteole; I & J. styles and stigmas; K. TS ovary; L. seed; M. fruit. (All from S 91392).

cm long terminating in 2 pendent female flowers. Male inflorescences with two branches, peduncle 1.5–2.5 cm long, branches up to 4 cm long with 5–10 cymule scars, cymules with 3 male flowers, subtended by foliaceous bracteoles, pale green tinged red, ovate, 5–7 x 6 mm, cucullate, caducous. Male flowers many, pedicels crimson, 2–3 mm long; tepals 4, margin entire, apex rounded, outer two broadly ovate, 5–7 x 7 mm, cream with crimson centre, inner two cream, narrowly lanceolate *ca* 4 x 2 mm; stamens 23–24 in a subsessile, globose cluster, *ca* 2 mm diam., filaments *c.* 1 mm long, anthers yellow, obovate, *ca* 1 mm long, apex emarginate, opening by lateral slits. Female flowers pendent, pedicels crimson, 15–20 mm long; ovary glossy, crimson, *ca* 8 x 12 mm, wings 3, subequal, *ca* 3 mm wide, slightly pointed distally, locules 3, placentas 2 per locule; tepals 5, margin entire, apex acute, outer four isomorphic, elliptic, *ca* 8 x 5 mm, inner one narrow *ca* 4 x 2 mm; styles 3, crimson, widely U-shaped, *ca* 2 mm long. **Fruits** pendent, peduncle and pedicels thin and hair-like, 16–20 mm long; capsules 10–13 x 9–15 mm, wings 3, thinly fibrous, subequal, two rounded, sometimes slightly wider distally, 2–3 mm wide, in some fruits the third wing scarcely developed, dehiscing between the locules and wings. **Seeds** barrel-shaped, *ca* 0.3 mm long, collar cells about  $\frac{3}{4}$  of the seed length.

*Distribution:* Endemic in the Kuching Division, Sarawak; known from a single hill in the Penrissen limestone.

*Habitat:* It grows in soil pockets in an exposed position on the limestone rocks near the summit. The summit of this particular hill had been burned leaving bare exposed rocks and it was in this area that it was found.

*Notes:* This new species is remarkable among Sarawak limestone begonias for its microhabitat. ‘Punchak’ is the Malay word for summit, hence the species epithet. (In the modern Malay spelling system, ‘ch’ is spelt ‘c’, so summit would be written ‘puncak’.) This compares with Sabah, where for example, *Begonia keithii* Kiew, grows in similar exposed conditions. *B. rubida* from the Bau limestone grows near the summit of hills but always on a substrate of thick peat where it is lightly shaded by the straggly trees that grow near the summit.

The new species is distinct from *B. rubida* in its shorter petioles and the basal lobe less than half the length of the lamina and in its capsules that have narrower wings. *B. penrissenensis* also has leaves with a basal lobe about a third the lamina length, but *B. punchak* differs from this species in its smaller leaves with shorter petioles and the male flowers with 4 (not 2) tepals.

*Begonia punchak* is distinctive among limestone begonias in sect. *Petermannia* in that the female flowers are produced in separate leaf axils

from the male inflorescences. The more usual conditions are for the female flowers to be produced from the lower branches of the inflorescence or from the base, but still in the same axil. Unlike typical species in this section, its capsule wings are sometimes unequal, two wings being 2–3 mm wide and the third being reduced to almost being wingless. It is an extremely decorative begonia with glossy bright red stems, ovaries and fruits.

13. *Begonia rubida* Ridl.

J. Str. Br. Roy. As. Soc. 46 (1906) 256; Kiew & Geri, Gard. Bull. Singapore 55 (2003) 121.

*Distribution*: Endemic in the Kuching Division, Sarawak; known only from the Bau and Padawan-Serian limestone. *Bau limestone* - Bidi, Bukit Jebong, Bukit Manok, Bukit Numpang, Gunung Apin, G. Batu, G. Juita, G. Meraja, G. Pambur, G. Ropih, G. Setiak, G. Tai Ton, G. Tongga, G. Umbut.

*Specimens examined*: Padawan-Serian limestone - Bukit Regu, Paul *et al.* S 37392 (SAR); Gunung Manok, Erwin & Paul S 27416 (SAR).

*Notes*: This species is likely to be more widespread on Padawan-Serian limestone but is difficult to collect as it grows on the summit shoulders of the tower karst hills. Erwin & Chai collected it from the summit of Gunung Manok at 330 m altitude.

14. *Begonia serapatensis* Kiew & S. Julia, *sp. nov.*

Sect: *Petermannia*

*A Begonia rubida* Ridl. *laminis majoribus* 9–11 x 7–10 cm (*nec* 4.5–8 x 3–5.5 cm), *floribus albis* (*nec rubris*) *et alis fructus inaequalibus longissima* 6–9 mm *lata* (*nec alis inter se aequalibus et 4–5 mm latis*) *differt*. **Typus**: Borneo, Sarawak, Kuching Division, Bukit Serapat, 8 August 2004, Kiew, Julia & Tan S93267 (holo, SAR; iso, E, KEP, SING). Figure 9

Cane-like begonia, whole plant glabrous; **stems** erect, 20–50 cm long, young stem reddish brown flecked with white, becoming brown and woody at the base, several stems produced from branching at the base, nodes swollen with a conspicuous stipular scar, 6–8 mm thick; without a tuber. Stipules narrowly lanceolate, pale green, 2 x 4–7 mm, margin entire, apex caducous. **Leaves** distant 2.5–3 cm apart; petiole 3.5–5.5 cm long, succulent, reddish brown; lamina oblique, young leaves green with dark red veins and pale green linear spots between the veins, glossy mid-green with a red patch at junction of lamina and petiole, beneath pale green, succulent and brittle, drying papery, asymmetric, broadly lanceolate, 9–11 x 7–10 cm, broad side

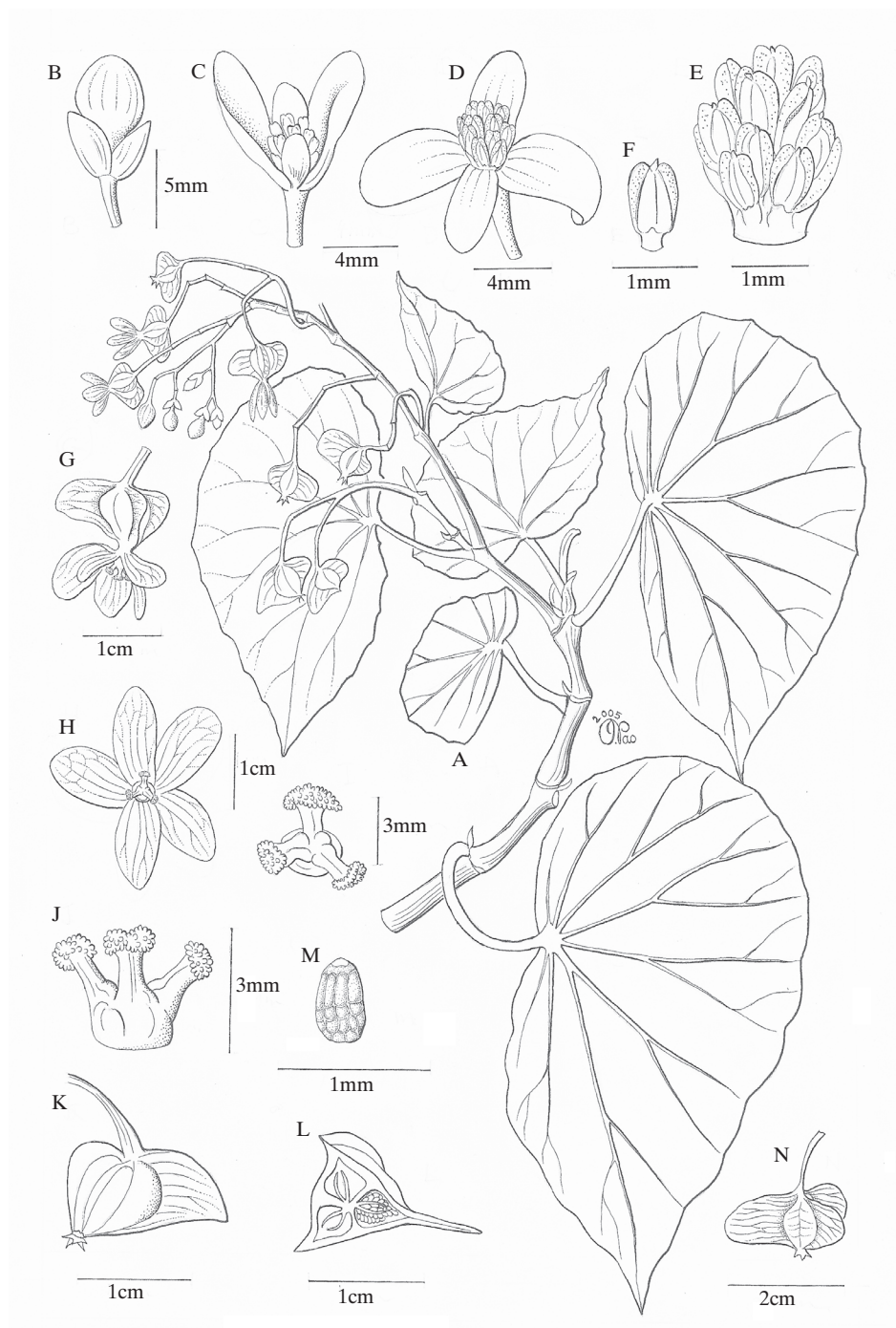


Figure 9. *Begonia serapatensis* Kiew & S. Julia

A. habit; B. male bud with bracteoles; C. male flower; D. open male flower; E. stamen cluster; F. stamens; G. female flower; H. open female flower; I & J. styles and stigmas; K. fruit; L. TS ovary; M. seed; N. fruit. (All from S 93267).

5.5–13 cm wide, base unequal, basal lobe large and rounded, 4.5–6.5 cm long (about half the length of the lamina), margin entire, apex acuminate; venation palmate-pinnate with 2 pairs at the base and 2 pairs along the midrib and with 3 in the basal lobe, branching twice, veins slightly prominent above and beneath, red beneath. **Inflorescences** axillary, reddish, glabrous, erect, cymose panicle, longer than the leaves, 9–15 cm long, peduncle *ca* 6.5 cm long, female flowers on short branches at the base 2.5–3 cm long, upper branches with male flowers 6–8 cm long, male flowers many, female flowers 2 to 10 or more, protogynous. Bracts pale green, broadly ovate, *ca* 5 x 7 mm, margin entire, caducous; bracteoles similar but smaller. Male flowers with a rosy red pedicel 10–15 mm long; tepals 4, white, deep red towards the base, margin entire, apex rounded; outer two oval, 8–10 x 6–8 mm, inner two narrowly oval, 4–6 x 1.5–3 mm; stamens many, cluster globose, 2–3 mm diam., sessile; filaments almost absent; anthers yellow, obovate, *ca* 1 mm long, apex slightly notched, opening by lateral slits. Female flowers with a rosy red pedicel *ca* 5 mm long; ovary pale green, *ca* 12 x 13 mm, wings 3, unequal, longer wing *ca* 8 mm wide, shorter wings *ca* 3 mm wide, locules 3, placenta two per locule; tepals 5, greenish white, outermost reddish at base, margin entire, apex rounded, outer four isomorphic 9–10 x 5–7 mm, inner tepal narrowly oval, 7–8 x 3–4 mm; styles 3, styles and stigmas pale yellow, *ca* 3 mm long. **Fruits** pendent on a thin stiff stalk 11–23 mm long; capsule 9–10 x 14–20 mm, locules 3, wings 3, rounded, unequal, fibrous, longer wing 6–9 mm wide, shorter wings 2–3 mm wide, splitting between the locules and wings. **Seeds** barrel-shaped, *ca* 0.8 mm long, collar cells *ca* half seed length.

*Distribution*: Endemic in the Kuching Division, Sarawak, known only from a single limestone hill in the Penrissen area.

*Habitat*: It grows on rocky shoulders of a limestone hill *ca* 250 m high, in light shade.

*Notes*: In its woody, slightly zig-zag stems and its oblique leaves that are succulent and glabrous and with a large basal lobe almost half the length of the lamina, it resembles *Begonia rubida*. It differs, however, in a number of characters: it does not have the fine ruby coloration of the stems and flowers of *B. rubida* instead the flowers of *B. serapatensis* are white; the leaves are also much larger than those of *B. rubida*. The apparent difference in tepal number in the female flowers between these two species [Ridley (1906) described *B. rubida* as having three tepals] is not supported as the flowers of *B. rubida* we examined had five, three larger and two smaller inner ones.

#### 15. *Begonia speluncae* Ridl.

J. Str. Br. Roy. As. Soc. 46 (1906) 258; Kiew & Geri, Gard. Bull. Singapore. 53

(2003) 122.

*Distribution:* Endemic in the Kuching Division; from the Bau, Padawan-Serian and Penrissen limestone. *Bau* - Bidi, Fairy Cave, Gunung Aup, G. Batu, G. Doya, G. Jebong, G. Kawa, G. Lanyang, G. Meraja, G. Podam, G. Poing, Quop. *Padawan-Serian* - Bukit Pait, Gunung Berloban, G. Manok, G. Mas, G. Sebengkam, G. Selabor, Sungai Serin, Tebedu. *Penrissen* - Gunung Bah, G. Burau.

*Habitat:* On vertical rock faces at the base of limestone cliffs or on the vertical sides of large boulders; in the Bau area frequently on dry rock faces, in the Padawan-Serian and Penrissen areas usually on damp, deeply shaded rock faces.

Notes: This is the most common begonia on limestone in the Kuching Division, being found on most hills, although it is interesting to note that it is not found on those hills where the other begonias with a rosette habit, *Begonia andersonii* and *B. burttii*, occur, both of which occupy the same habitat on sheer, shaded, vertical rock faces.

Ridley (1906) described the leaves of this species as orbicular cordate, but they are without exception peltate. Plants of the Bau limestone uniformly have small laminas (1.2–4.5 x 1.4–5.7 cm), but plants in the Padawan-Serian populations show a much greater range from 3.2 x 4 cm to 5 x 5.5 cm with exceptional plants with laminas up to 10 x 12 cm (*Patsipun et al. S 82156*). They are otherwise typical, for example, in the broad laminas with a rounded apex and the indistinct midrib due to its bifurcating.

*Specimens examined:* Padawan-Serian limestone - Bukit Pait, *Erwin & Paul S 27427* (SAR), *Julia & Kiew S 95687* (KEP, SAR); Gunung Berloban, *Yii S 46142* (SAR); Gunung Manok, *Burt B 8132* (SAR), *Julia & Kiew S 95677* (E, KEP, SAR); Gunung Mas, *Julia et al. S 95691* (KEP, SAR, SING); Gunung Sebengkam, *Jamree et al. S 75900* (SAR); Gunung Selabor, *Anderson S 20836* (SAR), *Ilias Paie S 28044* (SAR); Sungai Serin, *Jacobs 5177* (SAR); Tebedu 15th Mile, *Abg. Mohtar S 49238* (SAR); Bukit Payung, Tebedu, *Patsipun et al. S 82156* (KEP, SAR). Penrissen limestone: Gunung Bah, *Julia et al. S 95694* (SAR), *Rantai et al. S 66034* [Gunung Bar] (SAR); G. Burau, *Julia et al. S 91388* (E, KEP, L, SAN, SAR, SING).

### Incompletely Known

The begonia collected by Yii & Othman (*S 46275*, SAR) from Gunung Selangan (10 km Tebakang/Tebedu Road), Padawan-Serian limestone, is

quite unlike any other limestone begonia in its short petiole, non-oblique, narrowly obovate leaves 10 by 3.5 cm and its short inflorescences. It belongs to the same group of begonias as *Begonia pubescens* Ridl., but is very different in being a larger plant (about 15 cm tall) and in being much less pubescent. It is obviously a new species but it has not been recollected and the material available is too incomplete to describe.

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### References

- Anderson, J.A.R. 1965. Limestone habitat in Sarawak, p. 49–57. In *Symp. Ecol. Res. in Humid Tropical Vegetation*. Sarawak Government & UNESCO.
- Banda, R.M., R. Gendang and A.U. Ambun. 2004. Geology and geochemistry of the limestone in Sarawak. In: H.S. Yong, F.S.P. Ng and E.E.L. Yen (eds.) *Sarawak Bau Limestone Biodiversity*. *Sarawak Museum Journal*. **59**, no. 80; Special issue **6**: 41–61.
- Burtt, B.L. 1978. Studies in Gesneriaceae of the Old World: XLV. A preliminary revision of *Monophyllaea*. *Notes Royal Botanic Gardens Edinburgh* **37**: 1–59.
- Kiew, R. 2001. The limestone begonias of Sabah – flagship species for conservation. *Gardens Bulletin Singapore* **53**: 241–286.
- Kiew, R. and C. Geri. 2003. Begonias from the Bau limestone, Borneo, including a new species. *Gardens Bulletin Singapore* **55**: 113–123.
- Kiew, R., C. Geri, J. Sang and P.C. Boyce. 2004. The understorey flora. In H.S. Yong, F.S.P. Ng and E.E.L. Yen (eds.) *Sarawak Bau Limestone Biodiversity*.

*Sarawak Museum Journal*. **59**, no. 80; Special issue **6**: 105–146.

Pearce, K.G. 2003. Five new *Begonia* species (Begoniaceae) from the Niah National Park, Sarawak, Malaysia. *Gardens Bulletin Singapore* **55**: 73–88.

Ridley, H.N. 1906. Begonias of Borneo. *Journal Straits Branch of Royal Asiatic Society* **46**: 247–261.