Three new species of Crypteronia (Crypteroniaceae) from Borneo

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Summary. Three new species of Crypteronia, C. borneensis, C. elegans and C. glabriflora are described. C. borneensis is represented by material from Borneo previously thought to be C. cumingii, a species now found to be absent from Borneo and typified by a Philippine collection. Keys to the genera of Crypteroniaceae and Crypteronia species occurring in Borneo are provided.

The Crypteroniaceae, a pantropical family which belongs undoubtedly to the Myrtales, was regarded by van Beusekom-Osinga & van Beusekom (1975) as comprising two subfamilies, viz. Crypteronioideae, which consists of 3 genera, Axinandra, Crypteronia and Dactylocladus, and Alzateoideae which includes Alzatea and Rhynchocalyx. Axinandra and Dactylocladus were once placed under Melastomataceae as they share similar vegetative anatomical features. Based on evidence from multidisciplinary studies which include wood anatomy, palynology and embrylogy, Dahlgren & Thorne (1984) accepted Axinandra, Crypteronia and Dactylocladus under the Crypteroniaceae and recognized Alzatea and Rhynchocalyx as separate families. Both Alzatea and Rhynchocalyx, monotypic genera of Central-South America and eastern parts of South Africa, are respectively isolated into distinct and new families. Alzateaceae (Graham, 1984) and Rhynchocalycaceae (Johnson & Briggs, 1984). Keating (1984) found that Crypteroniaceae is most similar to Lythraceae in leaf histology although findings on wood anatomy suggest it should be placed with Melastomataceae (van Vliet & Baas, 1984).

The three genera accepted within the Crypteroniaceae are distinguished as follows:
Leaf apex typically obtuse, rarely acute. Intercostal veins on both leaf surfaces almost invisible. Functional stamens very short, 0.5–1 mm long. Plants typically of peat swamp forest ............................................................ Dactylocladus

Leaf apex acute, acuminate to caudate or cuspidate. Intercostal veins typically prominent on one or both sides of the leaf. Functional stamens longer, 1.5–4 mm long. Plants of other habitats.

Flower subtended by 1 bract. Petals absent. Stamens as many as sepals, persistent. Ovary superior, 2–4-celled, ovules many per cell. Capsules small, chartaceous, typically with persistent style and stigma; seeds many ....................... Crypteronia

Flower subtended by 3 bracts, the two lateral ones often tiny. Petals present. Stamens twice as many as sepals or petals, not persistent. Ovary inferior, (4–)6-celled, ovules 1 or 2 per cell. Capsules large, woody, style and stigma caducous (falling away at an early stage); seeds few ........................................... Axinandra

Crypteronia as recognized by van Beusekom-Osinga (1977) includes four species and two varieties, viz. C. cumingii, C. griffithii, C. macrophylla, C. paniculata var. paniculata and C. paniculata var. affinis, all occurring in Borneo except for C. paniculata var. affinis.

Through a revision of the genus for the Tree Flora of Sabah and Sarawak, three new species are recognized. They are endemic to Borneo and found from lowland to highland primary forest although C. glabriflora is recorded mainly in hilly areas. C. borneensis is known to occur in Sabah, Sarawak and Brunei while C. elyzans and C. glabriflora are known from Sarawak and Brunei only.

A note on flower sexuality and inflorescence form

Whereas Dahlgren & Thorne (1984) have recorded that most of the species of Crypteronia are unisexual, Beusekom-Osinga (1977) claimed that only C. paniculata is unisexual. However, in the present study only C. paniculata appears to have genuinely unisexual flowers and a dioecious habit.

It is observed that in male flowers of C. paniculata the anthers are normally well formed and exceed four times the length of the short, non-functional pistil (pistillode). However, in the female flowers the stamens are tiny, barely exceeding the sepals, with anthers that are minute compared to the well-developed ovary, long styles and capitate stigmas. The other taxa have bisexual flowers with a protandrous habit, as various stages of the maturation of the female and male organs are observed. The stamens
appear to mature prior to the pistil and are fully elongated with shrivelled anthers that have released pollen when the pistil is still much shorter with undeveloped stigmatic lobes. However, at a later stage, longer styles with well developed stigmatic lobes and which exceed the sepals are found.

One supporting character here found useful in distinguishing among the species is the extent of branching of the inflorescence. Inflorescences which branch to only the 1st or 2nd order occur in *C. cumingii*, *C. elegans*, *C. glabriflora*, *C. griffithii* and *C. paniculata*, whereas those branching to the 2nd or 3rd order are typical of *C. borneensis* and *C. macrophylla*. This is illustrated diagrammatically in Fig. 1.

The *C. cumingii* complex

The Bornean specimens identified by Beusekom-Osinga as *C. cumingii* in fact differ from the typical Philippine material of *C. cumingii* in having a sunken midrib on the upper leaf surface, raised secondary veins that are distinctly looping towards the margin on the lower leaf surface, inflorescences branching to the 2nd or 3rd order and seed wings that are broadly obtuse apically. They represent a distinct species here named *C. borneensis* (see below).

*C. cumingii* has a flattened midrib on the upper leaf surface, flat secondary veins that do not form any distinct loops towards the margin on the lower leaf surface, inflorescences branching to the 1st or 2nd order and seed wings that are tapered apically. It is known from the Philippines, Celebes, Moluccas and Papua New Guinea and appears to be quite uniform in flower and fruit characters, with two exceptions. The Papuan and Moluccan material has shorter petioles while the Celebes material has slightly shorter pedicels. Otherwise, the material from these islands closely match the Philippine material of *C. cumingii*.

Key to *Crypteronia* species in Borneo

1a. Leaves chartaceous. Intercostal veins obscure on both sides. Plant dioecious. Flowers unisexual: ovary 2-celled. Seeds inserted on the septum, the membranous seed wing with a broadly rectangular base and a tapered or acute apex .......................... *C. paniculata* (var. *paniculata*)

1b. Leaves coriaceous to subcoriaceous. Intercostal veins prominent on one or both sides. Plant monoecious. Flowers bisexual; ovary 3–4-celled. Seeds inserted at the base of the septum; the membranous seed wing with a tapered or acute to narrowly rectangular or obtuse base and a broadly obtuse to acute apex.

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Fig. 1. Inflorescence form and branching in Crypteronia species. A, to 1st order. B, to 2nd order. C, to 3rd order.  
A2. C. elegans, C. cumingii and C. paniculata.  
B2. C. cumingii.  
B3. C. glabriflora, C. griffithii.  
B4. C. macrophylla.  
B5. C. cumingii.  
C1. C. macrophylla.  
C2. C. borneensis.
2a. Midrib on upper leaf surface distinctly sunken. Inflorescence bracts 2.5–9 mm long .................................................. C. borneensis, sp. nov.

2b. Midrib on upper leaf surface flat. Inflorescence bracts shorter. 0.5–1.5 mm long.

3a. Leaves oblong to ovate-oblong. Lateral veins 10–20 pairs. Inflorescences branching to the 3rd order, rarely to only 2nd order; main axis very thick, 3–5 mm thick ..................................................................... C. macrophylla

3b. Leaves narrowly elliptic, elliptic to ovate-elliptic. Lateral veins typically not more than 10 pairs. Inflorescences branching to the 1st or 2nd order (typically to the 1st order); main axis 1–3 mm thick.

4a. Leaf apex acuminate to caudate. Acumen 0.5–1.8 cm long. Leaf base distinctly cuneate. Intercostal veins distinctly reticulate to tessellate. Petioles slender, only 1–1.5 mm thick. Ovary glabrous. Capsules ellipsoid ................................................................. C. elegans, sp. nov.

4b. Leaf apex shortly acute, acumen if present shorter. 0.1–0.4 cm long. Leaf base cordate to rounded. Intercostal veins sparsely reticulate. Petioles thicker, 2–7 mm thick. Ovary densely to sparsely minutely papillate to pubescent. Capsules subglobose to ovoid.

5a. Inflorescences with ultimate branches typically longer, (15–)20–40 cm. Main axis thicker, 2–3 mm. Pedicels very short. 0.1–0.5 mm long. Densely pubescent. Sepals broadly spread open in the mature flower. Sparsely to densely pubescent outside. Styles sparsely pubescent at base, glabrous at upper part. Seed wing tapered at apex .................................................. C. griffithii

5b. Inflorescences with ultimate branches not more than 20 cm long; main axis slender, 1–2 mm thick. Pedicels distinct, 1–1.5 mm long. Glabrous. Sepals connate, forming a dome-like structure even in the mature flower, glabrous outside. Styles glabrous throughout. Seed wing broadly obtuse at apex ............................................. C. glabriflora, sp. nov.

The new species

Crypteronia borneensis J.T. Pereira & K.M. Wong sp. nov. C. macrophylla Beusekom-Osinga similis sed inter alia, foliis late ovatis, ovatis-ellipticis vel ellipticis
inflorescentisque brevioribus (usque ad 25 cm longis) differt. Typus: Tarmiji & Talib SAN 90941, Sabah, Beaufort (holotypus SAN).

Tree to 25 m and 45 cm diameter. Bark greyish brown, smooth; inner bark brown to greyish. Sapwood yellowish white to brown. Twigs glabrous. Leaves broadly ovate, ovate-elliptic to elliptic, 10–26 × 4–20 cm; apex acute to acuminate, acumen 0.5–1.0 cm long; base cordate, rounded to cuneate; coriaceous to subcoriaceous, drying dark brown to green-brown on both sides, glabrous; midrib distinctly sunken on the upper surface, distinctly raised below; lateral veins 8–15 pairs, distinctly looping towards the margin, sunken to flat above, distinctly raised below; intercostal veins obscure above and prominent below, sparsely reticulate; petioles 0.5–2 cm long, 2–5 mm thick, glabrous. Inflorescences terminal or in the axils of fallen leaves on older branches, 14–25 cm long, branching to the 2nd or 3rd order, main axis 2–4 mm thick, ultimate branches 5–15 cm long, rachis pubescent; bracts 2.5–9 mm long, triangular, subglabrous, persistent. Flowers bisexual, bracteoles (0.5–)1–2 mm long, narrowly triangular to subulate, sparsely hairy, persistent; pedicels 0.5–2 mm long, c. 0.5 mm thick, minutely papillate to pubescent; sepals deltoid to triangular, thickly tomentose inside, minutely papillate to tomentose outside, 0.5–1.5 × 0.5–1.5 mm; stamens 1.5–2.5 mm long, filaments 2–4 mm long, anthers 0.25–0.5 × 0.2–0.8 mm; pistils 2–4 mm long, styles 1–3.5 mm long, densely minutely papillate to tomentose, stigmas capitate; ovary 1–2 mm across, 3–(4)-celled, minutely thickly papillate to tomentose. Capsules subglobose, impressed at the septum, papillate to densely tomentose. Seeds inserted at the base of the septum; seed wing apically broadly obtuse, tapered or acute at base.

VERNACULAR NAME. Sabah—tampasu (Dusun).

DISTRIBUTION. Endemic to Borneo (Sabah, Sarawak and Brunei).

HABITAT. Occurring from lowland to highland reaching c. 600 m. primary forest, frequently near river banks. Recorded on clay-rich, well-drained alluvium to sandy soils.

Fig. 2. *Crypteronia borneensis*. A. Fruiting leafy branch. B. Flower. C. Fruit. A and C from SAN 90941, B from SAN 80470.
C. borneensis resembles C. macrophylla in the inflorescence branching habit (to the 3rd order) and floral dimensions. It differs from C. macrophylla in having broadly ovate, ovate-elliptic to elliptic leaves, a sunken midrib on the upper leaf surface, sparsely reticulate intercostal venation, shorter inflorescences (to 25 cm long) and longer inflorescence bracts. C. macrophylla has oblong to ovate-oblong leaves, a flattened midrib on the upper surface, prominent and distinct reticulate or tessellate intercostal veins, longer inflorescences (30–40 cm long) and shorter bracts. It was originally identified by Beusekom-Osinga as C. cumingii, which it approaches in leaf morphology and floral dimensions but differs from in the features mentioned in the discussion of the C. cumingii complex (above). From its congeners in Borneo, C. borneensis is generally distinguishable by the comparatively sunken midrib on the upper leaf surface and long inflorescence bracts.

Crypteronia elegans J.T. Pereira & K.M. Wong sp. nov. C. macrophylla Beusekom-Osinga similis sed inter alia, folis parvioribus anguste ellipticis apicibus acuminatis vel caudatis inflorescentiisque brevioribus (usque ad 24 cm longis) differt. Typus: Ilias Paie S. 36393. Sarawak. 7th Division. Kapit. Bukit Bakar (holotypus SAN. isotypi K. KEP. L. MO. SAR). (Fig 3)

Tree to 27 m tall and 75 cm diameter. Bark reddish brown to blackish, flaky; inner bark red with deep yellow. Sapwood orange straw. Buttress to 1.5 m high and 1.5 m wide. Twigs glabrous. Leaves narrowly elliptic, 7–12 × 2–5 cm; apex acuminate to caudate. acumen 0.5–1.8 cm long; base cuneate; subcoriaceous. drying dark brown to brown on both sides; glabrous; midrib flattened on the upper surface but raised below; lateral veins 8–10 pairs, looping towards the margin, flattened on both sides; intercostal veins prominent on both sides, distinctly reticulate or tessellate on both sides; petioles 1–2 cm long, 1–1.5 mm thick, glabrous. Inflorescence terminal and axillary, up to 24 cm long, branching to the 1st or 2nd order, main axis 1–2 mm thick, ultimate branches 7–18 cm long, rachis puberulent, bracts 0.5–1 mm long, early caducous. Flowers bisexual, bracteoles 0.5–1.5 mm long, narrowly triangular, usually caducous on mature flowers; pedicels 0.5–1.5 mm long, c. 0.5 mm thick, puberulent; sepals deltoid, sparsely puberulent outside but densely puberulent inside, 0.5–1 × 0.75–1 mm; stamens 1.5–2.5 mm long, filaments 1–2 mm long, anthers 0.5 × 0.5 mm; pistils 2–3.5 mm long, styles 1–3 mm long, glabrous. stigma punctate; ovary 1.5–2 mm across, 3-celled, glabrous. Capsules ellipsoid, impressed at the septum, glabrous to subglabrous. Seeds inserted at the base of the septum; seed wing apically and basally tapered.

DISTRIBUTION. Endemic to Borneo (Sarawak and Brunei); not yet recorded for Sabah.

HABITAT. Hills and ridges of lowland mixed dipterocarp forest and secondary forest, to 1100 m high.
Fig. 3. *Crypteronia elegans*. A. Flowering leafy branch. B. Flower. C. Young fruit. A and C from Nooteboom & Chai 2114, B from S. 36393.
Crypteronia elegans resembles *C. macrophylla* chiefly in its floral characters, especially flower size. Vegetatively, both have prominent and distinctly reticulate, tessellate intercostal veins on both sides of the leaves. Nevertheless, the most distinct characteristics which differentiate it from *C. macrophylla* are its narrowly elliptic leaf shape, distinctly cuneate leaf base with acuminate to caudate apex, and smaller leaves (7–12 cm long and 2–5 cm wide). These characters also set it apart from all other Bornean species of *Crypteronia*. In addition, it has a more slender leaf petiole (1–2 mm thick), fewer lateral veins (8–10 pairs), a shorter inflorescence (up to 24 cm only) with more slender main axis (1–2 mm thick), and inflorescence branching to the 2nd order, and capsules which are ellipsoid, impressed at the septum and subglabrous to glabrous. *C. macrophylla* has an ovate-oblong to oblong leaf shape with cordate to rounded leaf base and acute apex, larger leaves (18–45 cm long and 8–18 cm wide), thicker leaf petiole (2–5 mm), more lateral veins (10–20 pairs), inflorescences that branch to the 3rd order and with a thicker main axis (3–5 mm thick), and capsules that are subglobose and distinctly hairy. Therefore, *C. elegans* is remarkably distinct from all other Bornean *Crypteronia* species.

**Crypteronia glabriflora** J. T. Pereira & K.M. Wong sp. nov. *C. griffithii* Clarke similis sed inter alia pedicellis distinctis glabris (1–1.5 mm longis) ramiisque ultimis inflorescentiarum brevioribus differt. Typus: Dransfield JD 7225. Brunei. Temburong, Amo. Bukit Belalong (holotypus SAN; isotypi BRUN, K, KEP) (Fig. 4)

Tree to 20 m tall and 40 cm diameter. Bark reddish brown, cracking, inner bark reddish. Sapwood pale yellowish brown. Twigs glabrous. Leaves ovate-elliptic to elliptic, 7–20 × 3–8 cm; apex shortly acute, acumen 0.1–0.4 cm long; base cordate to rounded; coriaceous, drying dark brown to brown above and pale brown below, glabrous; midrib flattened on the upper surface, slightly raised below, lateral veins 8–10 pairs, looping towards the margin, flattened above, flattened to slightly raised below; intercostal veins prominent on both sides, sparsely reticulate; petioles 0.4–1 cm long, 2–3 mm thick, glabrous. Inflorescences terminal and in the axils of fallen leaves on older branches, 12–20 cm long, branching to the 1st or 2nd order, main axis 1–2 mm thick, ultimate branches 5–20 cm long, rachis puberulent; bracts 0.5–1 mm long, triangular, glabrous, caducous. Flowers bisexual, bracteoles 0.5–1 mm long, narrowly triangular, pubescent, persistent; pedicels 1–1.5 mm long, c. 0.5 mm thick, glabrous;
Fig. 4. Crypteronia glabriflora. A. Flowering leafy branch. B. Flower. C. Young fruit. All from Dransfield JD 7225.
sepals connate, forming a dome-like structure even in the mature flower. glabrous on both sides but slightly hairy at margin below, 1–1.5 × 1–1.5 mm; stamens 3–4 mm long, filaments 2.5–3.5 mm long, anthers 0.5 × 0.5 mm; pistils (3–)4–5 mm long, styles 2–4.5 mm long, glabrous, stigmas punctate; ovary 1–1.5 mm across, 3-celled, densely powdery hairy or minutely papillate. Capsules subglobose to ovoid, impressed at the septum, minutely papillate. Seeds inserted at the base of the septum, seed wing broadly obtuse at apex, basal narrowly obtuse.

**DISTRIBUTION.** Endemic to Borneo (Sarawak and Brunei only).

**HABITAT.** Hill forest to 820 m. on clay soil overlaying sandstone.


*C. glabriflora* is closely allied to *C. griffithii* in having similar vegetative characters and very long stamens and styles, and an inflorescence with branching to 1st or 2nd order. *C. glabriflora* has glabrous, distinct pedicels (1–1.5 mm long), an inflorescence with slender main axis and shorter (5–20 cm long) ultimate branches, connate sepals which form a dome-like structure even in the mature flower, glabrous sepals and styles, and a broadly obtuse seed-wing apex. On the other hand, *C. griffithii*, has almost sessile flowers, pedicels 0.1–0.5 mm long, an inflorescence with thicker main axis and longer (mostly 20–40 cm) ultimate branches, sepals broadly spread open in the mature flower, sparsely to densely pubescent sepals, sparsely pubescent style base, and a tapered seed-wing apex. *C. glabriflora* is distinguishable from all other Bornean taxa by its glabrous pedicels, sepals and styles, and its connate sepals which form a domed structure even in the mature flower.

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