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Communications address The Editor (Sandakania), Forest Research Centre, Forestry Department, P.O. Box 1407, 90715 Sandakan, Sabah, Malaysia.

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A revision of *Fagraea* (*Loganiaceae*) in Borneo, with notes on related Malesian species and 21 new species

K.M. Wong & John B. Sugau

Forest Research Centre, Sepilok,
P.O.Box 1407, 90715 Sandakan,
Sabah, Malaysia

Summary. *Fagraea* is revised for Borneo, where it is represented by 42 species, including 20 new species, one new combination and one apparently unnamed species, of which only vegetative material is known. Of the species in Borneo, 24 are endemic and *Fagraea* is here considered a Malesia-centred speciose genus which has evolved many species adapted to a large variety of habitats and soils. Notes are provided on infrageneric divisions within *Fagraea*, as well as on nomenclature and typification for these species and eight others (including one new species) not found in Borneo but related to the present study.

The latest account of *Fagraea* for Malesia (including Borneo) is that by Leenhouts in Flora Malesiana (Leenhouts 1962). Leenhouts (1962, 1984) enumerated 15 species in Borneo, and placed the genus together with *Potalia* (South American) and *Anthocleista* (African) in the same tribe, Potalieae. *Fagraea* (as understood, an Asiatic genus) is distinct by its 5-lobed calyx and corolla from these two genera, which have a 4-lobed calyx and multiples of a 4–5-lobed corolla.

Recent reviews of the Loganiaceae *sensu lato* suggest that the tribe Potalieae (which includes *Fagraea*) might be better placed in the Gentianaceae (Struwe, pers. comm.) Although we have followed the existing concept in regarding *Fagraea* as part of the Loganiaceae here, we accept that this question remains to be further resolved. Our revision is relevant to the genus *Fagraea* only, and the impression gained from this study is that the various groups of species reviewed are quite reasonably considered congeneric, and do not represent diverse generic elements.

In our work to revise the genus for the Tree Flora of Sabah and Sarawak, we have sought to review the material from Borneo against that found in the Malesian region and elsewhere

generally. Two problems were immediately obvious. One was an accumulation of recent material which could not be named satisfactorily with Leenhout's scheme. The other was taxonomic in nature, as for a number of species he listed, Leenhouts included a wide range of material in each, to the extent that taxa with very different corolla types have been regarded as the same species. A striking example of this is seen in the material he included in *F. ceilanica*. Whereas the original description and drawing of Thunberg (1782), as well as specimens (example *Konig s.n.*, at Leiden, sheet no. 908.127-92) from Galle (a locality in Sri Lanka mentioned by Thunberg), clearly show the corolla as a long funnel-shaped structure with a 8–9 cm long tube, Leenhouts identified material from India and Malesia that had very small corollas (tube length not more than 3 cm long) as the same species. These two types are correlated with a number of other characters, including differences in the form of the inflorescence; no intermediates or gradation in characters can be found to link these extremes. Leenhouts had confounded *F. ceilanica* (here found absent from the Malesian region) with several distinct species in Malesia and elsewhere, including Blume's *F. littoralis* and several unnamed species. Leenhout's extremely broad species concepts were applied to many groups or clusters of taxa.

The present account recognizes 42 species in Borneo, including 20 new species, one new combination and one apparently unnamed species, and provides notes on a further eight species (including one new species) not known in Borneo.

Of the 42 Bornean species known, 24 (slightly more than half) are endemic to Borneo. Among the Bornean endemics, four (*F. kinabaluensis, F. kuminii, F. oreophila* and *F. tuyukii*) appear restricted to Sabah, ten (*F. acutibracteata, F. caudata, F. dulitensis, F. floribunda, F. havilandii, F. iliasii, F. longipetiolata, F. megalantha, F. rarissima* and *F.* sp. indet.) to Sarawak and Brunei, and ten (*F. collina, F. rugulosa, F. stenophylla, F. stonei, F. teysmannii, F. montana, F. cuspidata, F. resinosa, F. macroscypha* and *F. involucrata*) are more widespread on the island, occurring in Sabah, Sarawak, Brunei and usually also Kalimantan. *F. kalimantanensis* appears restricted to Kalimantan.

These endemic Bornean species are recorded from and probably restricted to the following habitat types: peat swamp forest (1 species), mixed dipterocarp forest (10 species), lowland riverbank (1 species), montane forests (9 species), and special rock types or substrates, such as ultramafic, basaltic or podsolic soils (3 species). This paper accepts *Fagraea* as a speciose genus which has evolved species adapted to a large variety of habitats and soils. Although a few species in Borneo also occur on limestone, they are not restricted to it; *F. kuminii*, however, appears to be restricted to ultramafic soils in Sabah.

Of the 18 species found in Borneo but which are not endemic, three are shared only with the Philippines, ten species are shared only with the immediate Sundaland territories, Malaya, Sumatra, and Java, one is shared with east Malesian territories and does not occur in other west Malesian territories, and four occur in both west and east Malesia. Only three species (*F. fragrans, F. auriculata* and *F. crenulata*) occurring in Borneo also reach Indo-

China, outside the Malesian region. Although our studies (recording 42 species for Borneo) contrast with that of Leenhouts (1962, 1984) (recording 15 species for Borneo) and we are unable at this stage to provide updated figures for the other islands in Malesia, it is fairly certain from even the highly conservative figures available from Leenhouts (1962) that Borneo, Malaya, Sumatra and New Guinea have the most number of species, and that *Fagraea* is properly a Malesia-centred genus.

Infrageneric groups in *Fagraea*

The characters employed by Leenhouts (1962) in delimiting the three sections of the genus (*Fagraea* section *Fagraea*, section *Cyrtophyllum* and section *Racemosae*) have been reviewed in the present work, and further characters that augment the very few used by Leenhouts have also been established here.

In passing, it is well to comment on several morphological terms used by Leenhouts. We do not use the term "stipule" for the appendage found at leaf-stalk bases, but instead describe this as a nodal ochrea formed by elaboration of the leaf-stalk bases, which fuse as a cup-like structure that embraces the stem at each node. Each of the two component basal structures of the leaf stalks that form the ochrea is called an "axillary scale" and those auricular structures that develop on the sides of the axillary scale or the base of the leaf stalk are simply referred to as "leaf-stalk auricles" here (Fig. 1). We find that the axillary scale

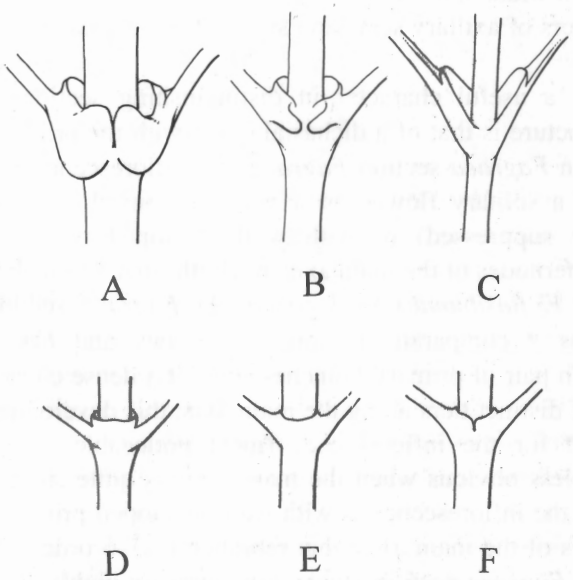

Fig. 1. Leaf-stalk appendages in *Fagraea*. **A & B.** With conspicuous axillary scales bearing reflexed auricles. **C.** With conspicuous axillary scale but no auricles. **D, E & F.** With axillary scales fused to form cup-shaped nodal ochreas, loosely clasping the node in D, tightly clasping the node in E and F, and splitting with age in F.

develops above the base of the leaf stalk (and loosely clasps the stem) only in *Fagraea* section *Fagraea* whereas in the other two sections it develops from the very base of the leaf stalk and clasps the stem tightly.

Leenhouts (1962) observed that he found ovaries that were 2-locular (with axile placentation) or 1-locular (with two parietal placentas) occurring together in some species, whereas in others only 1-locular ovaries occurred. He dismissed the taxonomic value of this character in the genus, but admitted that further observations should be made. We have looked at the ovary structure of very many species in all three sections of the genus, and find that the ovary always has only one locule with two parietal placentas.

The form of the stigma, whether 2-lobed or not, was also suggested as being a potentially useful character in the infrageneric classification of *Fagraea*. We examined stigmas from young and mature open flowers of representative species from each of the three sections and discovered that in all the stigma is basically a capitate structure where the uppermost receptive portion is a slightly 2-lobed shallow dome. This receptive dome is demarcated from the base of the stigmatic head by a transverse line. In *Fagraea* section *Fagraea* and section *Racemosae*, the stigmatic head is at first capitate, but its lower cup-like portion develops a rim that then confers a peltate structure. In *Fagraea* section *Cyrtophyllum*, this does not happen and the stigma remains simply capitate.

The principal characters of importance in the definition of these three sections are inflorescence form and branching, seed form, and the nature of the fruit epidermis, in addition to the characters of axillary scale and stigma form discussed above.

Inflorescence form is a useful character in distinguishing sections within the genus, although the basic structure is that of a dichasial cyme with the primary branches in pairs along the main axis. In *Fagraea* section *Fagraea*, the inflorescence is either without any branching (with only a solitary flower on a very condensed inflorescence axis where branches are entirely suppressed) or with well-developed primary branches (which resembles the lower internodes of the main axis in length) that rebranch typically only once but exceptionally (in *F. floribunda*) to 3 orders. In *Fagraea* section *Racemosae*, the inflorescence develops a comparatively long main axis and has all branches very condensed, so that each pair of primary branches support a dense cluster of flowers which give the appearance of distinct tiers along the main axis; this development is accompanied by a pendulous habit for the inflorescence (most noticeable in the field when the inflorescence is long, less obvious when the mains axis is quite short itself). In *Fagraea* section *Cyrtophyllum*, the inflorescence is with well-developed primary branches (as long as the lower internodes of the main axis) that rebranch to 3–6 orders (Fig. 2). Hence, the inflorescence form in *Fagraea* section *Racemosae* appears highly distinctive. The basic cymose nature of the inflorescence is more easily perceived in *Fagraea* section *Fagraea*, except that very reduced forms (with only a solitary flower) and highly branched forms (with many flowers) also occur in very few of the species. The highly branched

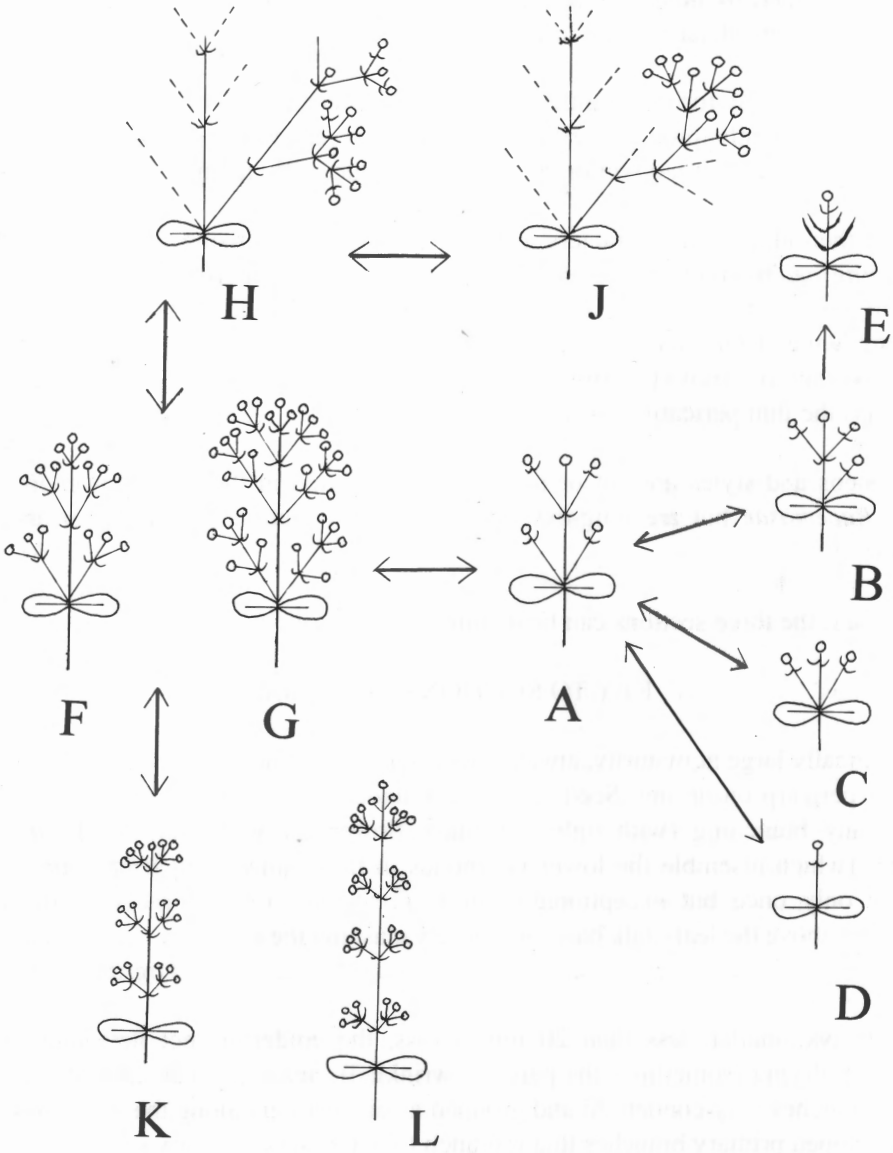

Fig. 2. Inflorescence structure in *Fagraea*. **A.** The basic dichasial structure of the compound cyme in sect. *Fagraea* (primary branches not further rebranching). **B, C, D.** Reduction of the basic cyme structure in some species of sect. *Fagraea*. **E.** Similar to B, but side branches not developed and bracts occasionally developing to form an involucre at the base of the solitary terminal flower, in some species of sect. *Fagraea*. **F, G.** Rebranching (to one order only) of primary branches on the main cyme axis, in some species of sect. *Fagraea*. **H.** Rebranching (to 3 orders) of primary branches on the main cyme axis in *F. floribunda* of sect. *Fagraea*. **J.** Rebranching (to 3–6 orders) of primary branches on the main cyme axis in sect. *Cyrtophyllum*. **K, L.** Development of a long main axis and condensation of all branches, in sect. *Racemosae*. Arrows used are for relating different conditions and do not imply particular evolutionary directions.

inflorescence condition is, among Bornean species of this section, known only in *F. floribunda* (which by other characters clearly relates it to *Fagraea* section *Fagraea*) and resembles the typical state of the inflorescence in *Fagraea* section *Cyrtophyllum*.

There are two seed forms (angular or ellipsoid-rounded) in *Fagraea*. *Fagraea* section *Fagraea* consistently produces ellipsoid-rounded seeds, whereas both *Fagraea* section *Cyrtophyllum* and *Fagraea* section *Racemosae* produce only angular seeds.

Several other supporting characters are also useful in recognizing the sections. *Fagraea* section *Fagraea* has typically large fruits at maturity (always more than 25 mm across) with the fruit epidermis detaching from the pericarp on drying. In both *Fagraea* section *Cyrtophyllum* and *Fagraea* section *Racemosae*, the fruits are always smaller, less than 20 mm across, and the fruit epidermis does not detach from the pericarp on drying (although sometimes the thin pericarp is wrinkled).

The stamens and styles are not or only slightly exserted in the open flower in *Fagraea* section *Racemosae* but are long-exserted in *Fagraea* section *Cyrtophyllum* and section *Fagraea*.

In summary, the three sections can be distinguished as follows.

KEY TO SECTIONS OF *FAGRAEA*

Fruits typically large at maturity, always more than 25 mm across, the epidermis detaching from the pericarp on drying. Seeds ellipsoid-rounded, never angular. Inflorescence either without any branching (with only a solitary flower) or with well-developed primary branches (which resemble the lower internodes of the main axis in length) that rebranch typically only once but exceptionally (in *F. floribunda*) to 3 orders. Axillary scales developing above the leaf-stalk base and loosely clasping the stem. .... *Fagraea* sect. *Fagraea*

Fruits always smaller, less than 20 mm across, the epidermis not detaching from the pericarp on drying (sometimes the pericarp wrinkled). Seeds angular. Inflorescence either with all branches very condensed and grouped as distinct tiers along the main axis, or with well-developed primary branches that rebranch to 3–6 orders. Axillary scales developing at the very base of the leaf stalk and tightly clasping the stem.

> Inflorescence with all branches very condensed and grouped in distinct tiers along the main axis. Stigma capitate but at maturity developing an expanded rim that gives it a peltate structure. Stamens and style not or only slightly exsert in the open flower. ..... *Fagraea* sect. *Racemosae*

Inflorescence with well-developed primary branches (as long as the lower internodes of the main axis) that rebranch to 3–6 orders. Stigma capitate throughout, an expanded rim not developing. Stamens and style long-exsert in the open flower. ..... *Fagraea* sect. *Cyrtophyllum*

The climbing, epiphytic or strangling habit is only common among species of *Fagraea* sect. *Fagraea*.

Characters shared by the sections

Although the three sections in *Fagraea* are by the characters above quite distinct, there are still many characters in common among them which in our opinion do not easily allow their potential segregation as distinct genera.

Similarity in inflorescence form exists between the sections *Fagraea* and *Cyrtophyllum*, where the primary branches are well-developed and rebranch to several orders (typically 3–6 orders in section *Cyrtophyllum*, and 3 orders in section *Fagraea* as represented by *F. floribunda*). On the other hand, sections *Fagraea* and *Racemosae* have a similar stigmatic development and structure in the flower. Yet section *Fagraea* has a rather unique seed type (elliptic-rounded) that contrast with that in sections *Racemosae* and *Cyrtophyllum* (angular seeds). The latter two also share a form of the nodal ochrea slightly different from that in section *Fagraea*.

Other characters which may in some instances be important in generic or sectional distinction do not occur in mutually exclusive states among the sections of *Fagraea.* For instance, infundibular corollas occur in all three sections, whereas salverform corollas in only two (section *Fagraea* and *Cyrtophyllum*), and tubular corollas are found in only a few species in section *Fagraea*. All three sections are also basically characterised by terminal inflorescences, but only in a few species within section *Cyrtophyllum* are the inflorescences axillary.

Fagraea section *Cyrtophyllum* in Borneo and related species

In Borneo, Leenhouts (1962) recorded only two species for this section, *F. fragrans* and *F. elliptica*. Both these species in Leenhouts' sense represent (nomenclatural, not biological) complexes of distinct species, with good characters to distinguish them.

The *Fagraea fragrans* complex

This complex consists of four species (*F. caudata* Ridl., *F. fragrans* Roxb., *F. gigantea* Ridl.

and *F. wallichiana* Benth.) that share some common characters, such as exauriculate leaf stalks, much-branched and many-flowered cymes that are exclusively axillary, small flowers (total corolla length 1–2 cm), and long-exsert styles and stamens.

In his treatment of *Fagraea fragrans* for the revision in Flora Malesiana, Leenhouts (1962) took an extreme view and included as synonyms a number of names that represent these four taxa that are here considered distinct. These taxa are keyed out as follows.

KEY TO THE *FAGRAEA FRAGRANS* COMPLEX

1a. Inflorescence a many-branched, many-flowered cyme. Corolla tube 6–8 mm long. Leaves chartaceous with wavy margins, or leaves (sub)coriaceous with secondary veins 9–12 pairs.

2a. Inflorescence peduncle 4–6 cm long. Open flowers with calyx diameter 2–2.5 mm, corolla lobes (5–)6–7 mm long and 3–4 mm wide, and styles exsert for 8–10 mm. Leaves with 9–12 pairs of secondary veins which are flat on the upper surface, and plane margins when fresh ..... *F. fragrans*

2b. Inflorescence peduncle 2–3.5 cm long. Open flowers with calyx diameter 1.5–2 mm, corolla lobes 4–5 mm long and 2.5–3 mm wide, and styles exsert for 14–16 mm. Leaves with 3–8 pairs of secondary veins which are often depressed on the upper surface, and wavy margins when fresh ..... *F. gigantea*

1b. Inflorescence a 3-branched cyme, or (sometimes) reduced unbranched inflorescence, (1–)3-flowered. Corolla tube 10 mm or longer. Leaves coriaceous, the margins never wavy, with secondary veins 3–6 pairs.

3a. Branches of the cyme, when present, 1.8–3 cm long. Flower with pedicel 5–10 mm long, calyx 2.5–3 mm across, corolla tube 10–12 mm long, and style exsert for 8–12 mm. Leaf apex caudate. (Endemic to Borneo) ..... *F. caudata*

3b. Branches of the cyme, when present, 0.8–1 cm long. Flower with pedicel 3–4 mm long, calyx 3.5–4 mm across, corolla tube 18–24 mm long, and style exsert for 20–25 mm. Leaf apex acuminate, not caudate. (Endemic to the Malay Peninsula.) .... *F. wallichiana*

Notes on the species

1. Fagraea caudata Ridl. (Figs. 3C & D; 4)

J. Str. Br. R. As. Soc. 79 (1918) 97-98. Type: *Lobb, s.n.*, 1853, "Borneo" (Sarawak) (K).

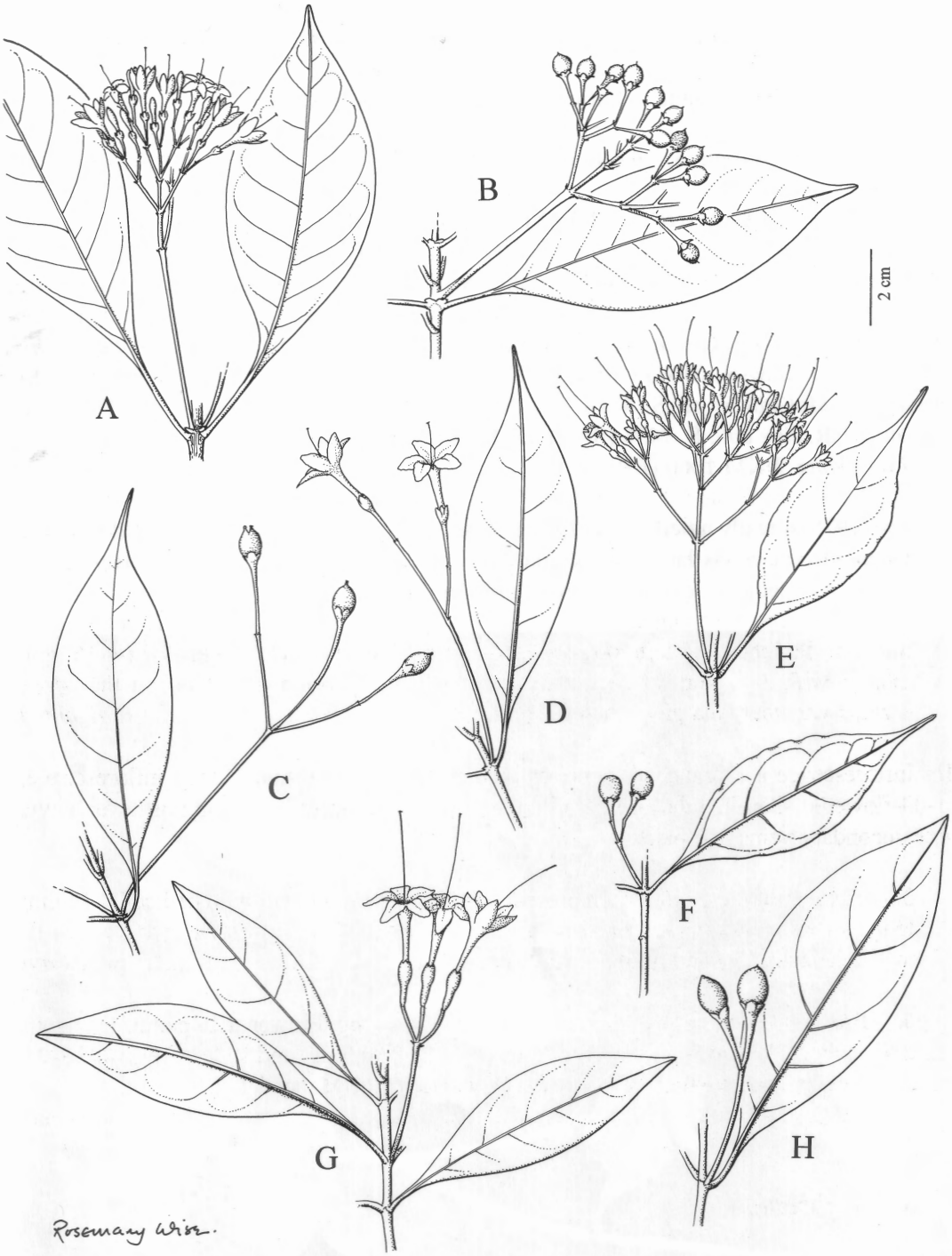

Fig. 3. The *Fagraea fragrans* complex: inflorescences, flowers and fruits of the different species. **A, B.** *F. fragrans*. **C, D.** *F. caudata.* **E, F.** *F. gigantea.* **G, H.** *F. wallichiana*. **A** from SAN 87993, **B** from A 2102, **C** from *Wong* WKM 1060, **D** from S. 19707, **E** from S. 21394, **F** from SAN 89218, **G** from *Curtis* 375, **H** from *Maingay, s.n.*

F. fragrans sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte*, *non* Roxb.

DISTRIBUTION. Endemic to Sarawak and Brunei in Borneo.

HABITAT. Mixed dipterocarp forest.

SPECIMENS EXAMINED—BORNEO. SARAWAK: *Beccari* 2956 (K); 1st Div. Gunung Santubong South, *Bujang* S. 12999 (K, L, SING); Bako N.P., Lintang path, *Chai* S. 19707 (A, BO, K, KEP, L, MEL, MOSC, SAN, SING); Bako N.P., Bukit Gondol, *Ilias* S 17908 (A, BO, K, KEP, L, SAN, SING); *Lobb s.n.* (type K); 1st Div. Mt. Matang, near Valombrosa, *M. & J. Clemens* 7783 (K); 1st Div. Bako N.P., Bukit Gondol, *Mohd. Shah* P. 5647 (A, K, L, SAR, SING); Bintulu, Nyabau F.R., *Brunig* S. 12050; Lambir N.P., Sg. Jangkang, *Mokhtar et al.* S. 47187 (K, KEP, L, MO, SAN); Kuching, No.7716 (SAR); Kelaung F.R. *sine coll.* S. 7431 (SAR). **BRUNEI:** Belait, Batu Patam, along ridge north of summit, *Wong* WKM 1060 (BRUN, K).

Ridley (1918) already noted: "This species is allied to *F. wallichii* of Penang Hill, differing in the more coriaceous lanceolate cordate [*sic!* = caudate] leaves, and extremely slender peduncles and pedicels, cylindric corolla tube and shorter stamens."

Fig. 4. *Fagraea caudata*, on the Batu Patam ridge in Brunei (*Wong* WKM 1060). (Photo by K.M. Wong.)

2. Fagraea fragrans Roxb. (Fig. 3A, B)

[Hort. Beng. (1814) 84, *nom. nud.*] Fl. Ind. ed. Wall., 2 (1824) 32. Type: *Wallich*, Cat. no. 1597E (Coll. Hunter), "Pullo Penang" (K).

Cyrtophyllum peregrinum Reinw., Syll. Pl. nov Soc. bot. Ratisb. 2 (1826) 9; Blume, Bijdr. (1826) 1022. Syntypes: *Blume*, Java (L: sheets 908.127-244 & 908.127-126); *Korthals*, Java (L: sheet 908.127-236).

F. peregrina Bl., Rumphia 2 (1838) 34, t. 80; Mus. Bot. 1 (1850) 172.

F. cochinchinensis A. Chevalier, Cat. Pl. Jard. Bot. Saigon (1919) 65, *pro specim., excl. basionym.*

F. fragrans sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte* (*excl. F. caudata* Ridl., *F. gigantea* Ridl., *F. speciosa sensu* Ridl. *non* Bl., *F. sororia* J.J. Sm., *F. wallichiana* Benth., *F. lanceolata* Wall. *in syn.*).

DISTRIBUTION. Bengal, Indo-China, Malaya, Sumatra, Java, Borneo, Mindoro, Balabac, Palawan, Celebes.

HABITAT. Lowland forest, especially secondary or disturbed forest, sometimes in coastal or beach forest, or *kerangas* (tropical heath) forest.

SELECTED REPRESENTATIVE SPECIMENS—BORNEO. SABAH: Kota Kinabalu, Gaya island (south), *Aban* SAN 57839 (SAN); Sandakan, Elopura, Darby Road, *Cuadra* NBFD 3197 (K); Bangawan, Mempakul, *Abubakar* NBFD 4111 (K); Kimanis, *Bayak* NBFD 2114 (K); Beaufort, *Caudra* NBFD A 1377 (K). **SARAWAK:** *Beccari* 3428 (K); Balai Ringin P.F., *Stipni* 1705 (SAR); Kuching, Taman Budaya, *Yahud et al* S. 57555 (K, KEP, L, MO, SAN); Kuching, Museum Garden, *Mamit* S. 33492 (SAR). **BRUNEI:** Anduki F.R., *Anderson* S. 4941 (SAR). **KALIMANTAN:** Sentarum Wildlife Reserve, far north-west corner of Danau, Sungei Seriang, *Giesen* 140 (K); Sentarum Wildlife reserve, western border of Danau, Nanga Kenelang, *Giesen* 148 (K).

Blume's figure in his *Rumphia* (Blume 1838) leaves no doubt that the taxon depicted is the same as Roxburgh's *F. fragrans*.

3. Fagraea gigantea Ridl. (Fig. 3E, F)

J. Str. Br. R. As. Soc. 79 (1918) 98. Syntypes: *Derry* 272, Malacca, Bt. Sebukor (SING), *Ridley* 5818, Singapore, Garden Jungle (SING); *Ridley* 8921, Singapore, Garden Jungle (SING). Lectotype (here chosen): *Ridley* 8921, Singapore, Garden Jungle (SING).

F. speciosa (*non* Blume) *sensu* Ridley, J. Str. Br. R. As. Soc. 50 (1908) 122.

F. sororia J.J.Smith ex Cammerl., Bull. Jard. Bot. Buitz. 3,5 (1923) 319, pl. 5. Syntypes: *Bruinsma* 12, Lampongs, Tandj-Penang (BO); *Endert* 44E 1P 429 (BO, L); 44E 1P 515 (BO, K, L); 44E 2P 673 (BO, L); 44E 2P 706 (BO, K, L), Sumatra, Palembang, Banjoeasin en Koeboestreken; *Grashoff* 400, Sumatra, Moeara Doea Sh. (BO); *Grashoff* 1060, Sumatra, Rawas (BO, L); *Houtvester*, Sumatra, Medan 19, Bengkalis (BO); *Teysmann* 3796, Sumatra, Moeara Enim (BO, L); *Teysmann* 4210, Sumatra, Lampongs Kebang (BO, L); *Buurman van Vreeden* 77, Sumatra, Palembang (BO). Lectotype (here chosen): *Endert* 44E 1P 515, Sumatra, Palembang (L; isolectotypes BO, K).

F. fragrans sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Roxb.

DISTRIBUTION. Malaya, Sumatra, Borneo.

HABITAT. Lowland and mixed dipterocarp forest.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau, Kawa road, *Jaswir & Aban* SAN 26277 (BO, K, KEP, L, SAN, SING); Keningau, Nabawan, coupe 1973, Rasha Co., *Dewol & Karim* SAN 78059 (K, L, SAR, SING); Sandakan, Batu Sapi road, *Meijer* SAN 24942 (K, KEP, L, SAR). **SARAWAK:** Baram, Melinau Gorge, *Chew* CWL 444 (K); Baram, Ulu Sg. Melinau Paku, foot of G. Mulu, *Anderson* no. 4085 (K, L, SAN, SAR, SING); 5th. Div. Limbang, Ulu Medamit, *Chai, Wright & Othman* S 32335 (K, L, SAR, SING); Kuching, Siol, Bukit Unjam, *Omar* 353 (K); Miri, Sg. Ukong, *Othman* S 21394 (K, L, SAN, SING). **BRUNEI:** Ulu Tutong, Rumah Sigat, *Ashton* BRUN 908 (K); Ulu Ropan-Belalong watershed, *Ashton* BRUN 5275 (K); Lawas, Mt. Bugoh ridge, *Smythies* BRUN 0812 (K). **KALIMANTAN:** E. Kutei, Sangkulirang Distr. Kerajaan R. region, *Kostermans* 34793 (BO, K, L); Sanggau, ne Bindaag, *Neth. Ind. For. Service* bb. 28143 (BO, K); E Kutei, Sg. Susuk region, *Kostermans* 5693 (BO, K). **SUMATRA.** Palembang, Rawas, *Dumas* 1550 (BO, K); Palembang, Banjoeasin en Koeboestreken, *Endert* 44 E. 1P. 515 (K); Upper Riauw, Pakanbaru, Tenajan R., *Soepadmo* 232 (BO, K).

Leenhouts (1962) was not the first one to confuse this taxon with *F. fragrans*. In the synonymy of his treatment of *F. sororia*, Smith (in Cammerloher 1923) points out that Scheffler (Flora (1869) 309) has mistaken this species for Roxburgh's *F. fragrans*. Kochummen (1973) has already reinstated the species, citing also consistent differences in the wood anatomy between this species and *F. fragrans*.

4. Fagraea wallichiana Benth. (Fig. 3G, H)

J. Linn. Soc., Bot., 1 (1856) 98. Type: *Wall.*, Cat. no. 1599, Penang (K).

F. lanceolata Wall. [Cat. (1829) no. 1599, *nom. nud.*] Schnizl., Iconogr. 2 (1851) t. 131, fig. 1, *nom. illeg.*, *non* Blume (1826); Miquel, Fl. Ind. Bat. 2 (1857) 376.

Cyrtophyllum lanceolatum (Wall.) DC., Prod. 9 (1845) 31; Ridley, Fl. Mal. Pen. 2 (1923) 421.

F. fragrans sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Roxb.

DISTRIBUTION. Endemic to Malaya.

HABITAT. Hills and ridges in lowland forest.

SPECIMENS EXAMINED—MALAYA. Penang Hill, *Corner* SFN 31597 (K); Penang, Moniots road, *Curtis* 375 (K); Penang, *Maingay* 1029 (K); Penang Hill, *Symington* KEP 38043 (K, KEP); Penang, *Wallich* 1599 (K); Penang, *Wallich s.n.* (K).

The use of the epithet *lanceolata* for this species is preempted by Blume's use of it for a different taxon. The species has been reinstated by Wong *et al.* (1987), who also point out that whereas *F. fragrans* is a lowland species common in secondary forests, *F. wallichiana* occurs only on hills and ridges.

The *Fagraea elliptica* complex

Generally this complex can be recognized by leaves that lack auricles, axillary scales that develop at the very base of the leaf stalks and that tightly clasp the stem; many-flowered cymes with 3–6 orders of branching; small flowers (total corolla length 0.8–1.9 cm); salverform corollas; and relatively longer styles (up to twice the corolla tube length).

Leenhouts (1962) included under *F. elliptica* (distributed in the Moluccas, Celebes, New Guinea, Borneo, Java, and Sumatra, and of which the type is a Moluccan specimen) three other distinct Bornean species which are here formally recognized. These species are *F. belukar* Wong & Sugau, *F. collina* Wong & Sugau and *F. rugulosa* Wong & Sugau.

KEY TO THE *FAGRAEA ELLIPTICA* COMPLEX
(based mainly on inflorescences and flowers)

1a. Cymes with main axis branching to 4–6 orders. Corolla lobes ovate, 2.5–3 mm long. Leaf apex typically obtuse-rounded to emarginate. Tree mostly of lowland secondary forest and open sites, and forest gaps ..... *F. belukar*

1b. Cymes with main axis typically branching to only 3–4 orders (very exceptionally an occasional 5th order of branching present). Corolla lobes lanceolate, 3.5 mm long or more.

Leaf apex acuminate to cuspidate-caudate. Trees typically of primary forest in the lowlands or mountains.

2a. Calyx in flower 3–4 mm long. Corolla lobes 5–8 mm long. Filament in open flowers 15–18 mm long. Mature fruits (6–)9–10 mm across. Leaf surfaces drying very coarsely wrinkled and very coarse to the touch ..... *F. rugulosa*

2b. Calyx in flower 2–3 mm long. Corolla lobes 3.5–6 mm long. Filaments in open flowers 7–11 mm long. Mature fruits smaller, only 3.5–5(–6) mm across. Leaf surfaces drying smooth.

3a. Flowers sessile to subsessile, the pedicels (if developed) to 1 mm long. Leaf apex acuminate. Leaf secondary veins obscure to only very faintly visible, never elevated on the lower side. (Leaves coriaceous. Corolla tube 6–7 mm long.) .... *F. collina*

3b. Flowers with distinct pedicels 1–3 mm long. Leaf apex cuspidate to caudate. Leaf secondary veins distinct and raised on the lower side. (Leaves chartaceous to coriaceous. Corolla tube 6–11 mm long.) ..... *F. elliptica*

KEY TO THE *FAGRAEA ELLIPTICA* COMPLEX
(based mainly on vegetative characters)

1a. Leaf surface drying very coarsely wrinkled (resembling a coarsely pitted surface) and very coarse to the touch. Filaments in open flowers 15–18 mm long. Fruits larger, (6–)9–10 mm across ..... *F. rugulosa*

1b. Leaf surface drying smooth or only finely shagreen. Filaments in open flowers 6–11 mm long. Fruits smaller, 3.5–5(–6) mm across.

2a. Leaf secondary veins distinct and elevated on the lower side. Corolla lobes lanceolate, 3.5–6 mm long, and flowers with distinct pedicels 1–3 mm long .... *F. elliptica*

2b. Leaf secondary veins obscure or only faintly visible on the lower side, never elevated. Corolla lobes ovate, 2.5–3 mm long, or if lanceolate and longer then flowers subsessile to sessile.

3a. Leaves typically larger, to 22 x 13 cm, with obtuse-rounded to emarginate apex; stalk 3–4.5 cm long. Cyme with main axis branching to 5–6 orders. Flowers with distinct 3–4-mm-long pedicels. Corolla lobes ovate, 2.5–3 mm long ..... *F. belukar*

3b. Leaves typically smaller, to 15 x 7 cm, with acuminate apex; stalk 1.5–2 cm long. Cyme with main axis branching to only 3–4 orders. Flowers sessile to subsessile, the pedicels (if developed) to 1 mm long. Corolla lobes lanceolate, 4–5 mm long ..... *F. collina*

Notes on the species

5. Fagraea belukar *Wong & Sugau* **sp. nov**. *F. ellipticae Roxb. similis, sed lobis corollae ovatis brevioribusque (2.5–3 mm longis) differt. Typus: Saikeh SAN 72151, Sabah, Beaufort, Beaufort Hill (holotypus SAN)* (Figs. 5 & 6)

F. elliptica auctt. non Roxburgh: Leenhouts, Fl. Males. 1, 6 (1962), *pro parte*; Cockburn, Trees of Sabah 1 (1976) 210 *pro parte*; Ashton, Manual of the Non-Dipterocarp Trees of Sarawak 2 (1988) 314 *pro parte*; Anderson, Check List of the Trees of Sarawak (1980) *pro parte*.

Tree up to 32 m tall; bole 1.3 m diameter, fluted-cylindric. Bark fissured, blackish grey; inner bark reddish-yellowish; sapwood yellowish white. Leaves obovate to broad-elliptic, 7–22 x 4–13 cm, coriaceous, upper and lower surfaces finely shagreen or smooth; base cuneate, margin plane to recurved, apex obtuse-rounded to emarginate, midrib prominent, rounded to ridged; lateral veins 10–12 pairs, lower side faintly visible, immersed (never raised), upper side faintly visible, flat, immersed or slightly sunken; reticulations obscure; leaf stalks 3–4.5 cm long, stout. Inflorescence a many-flowered branched cyme, 13 cm long, 15–19 cm wide, main axis branching 4–6 orders, terminal; peduncle 2–3.5 cm long, first branch 3–5.5 cm long; pedicel 3–4 mm long. Calyx campanulate, 1–2 mm long, calyx 1–2 mm diameter, divided to the middle. Corolla salverform, tube 7–10.5 mm long, 1–1.5 mm wide, corolla lobes ovate, 2.5–3 mm long, 1.5 mm wide. Stamens 8–10 mm long, filament 6–8 mm long inserted at the mouth of corolla, exserted for 8–9 mm; anther oblong, 1 mm long; style exsert for 4–9 mm, stigma small, capitate, very obscurely 2-lobed. Fruit a berry, globose, 3.5–5 mm across, tipped with a minute circular scar of fallen style, fruit calyx lobes 1–1.5 mm long, 1–1.5 mm wide. Seeds smallish, *c.* 1 mm diameter, numerous, brownish black.

DISTRIBUTION. Borneo, in all districts including Sabah and Sarawak, and Banka island.

HABITAT. Lowland secondary forests and open sites, and forest gaps.

SPECIMENS EXAMINED—BORNEO. SABAH: Beaufort, Beaufort hill, *Saikeh* SAN 72151 (holotype SAN); Jesselton, Pulau Gaya, near Ulu Soyong river, *Aban* SAN 57828 (KEP, L); Sandakan, Leila F.R., *Ahwing* SAN 39033 (K, L); Sipitang, SFI area, *Amin* SAN 126518 (SAN); Weston, Hutan Simpan Sianggau, *Amin* SAN 126720 (SAN); Weston, Hutan Simpan Sianggau, *Amin* SAN 132146 (SAN); Sandakan, Leila F.R., Pum station

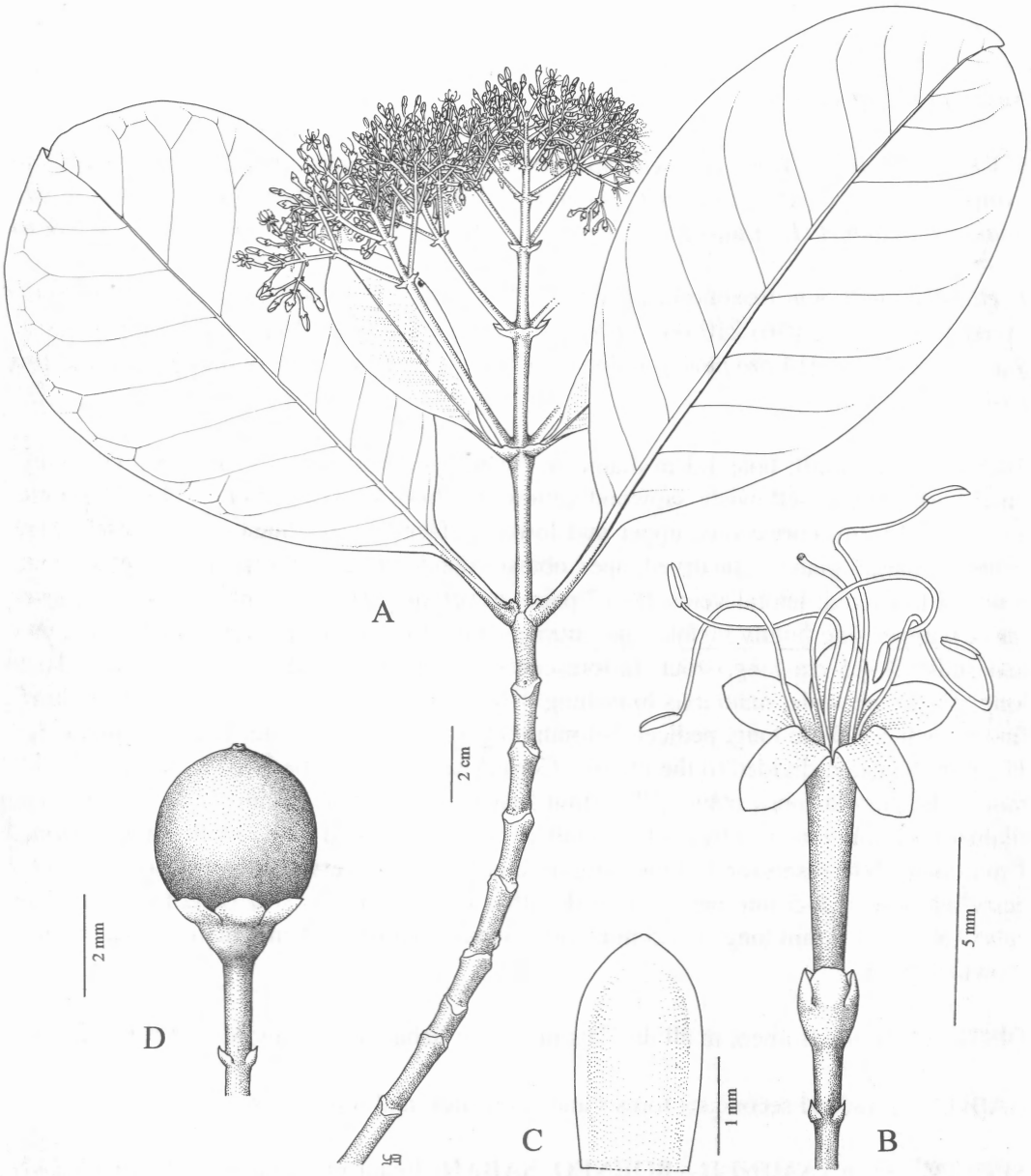

Fig. 5. *Fagraea belukar*. **A.** Leafy flowering branch. **B.** Flower. **C.** Corolla lobe. **D.** Fruit. All from SAN 72151 except **D**, from SAN 72256.

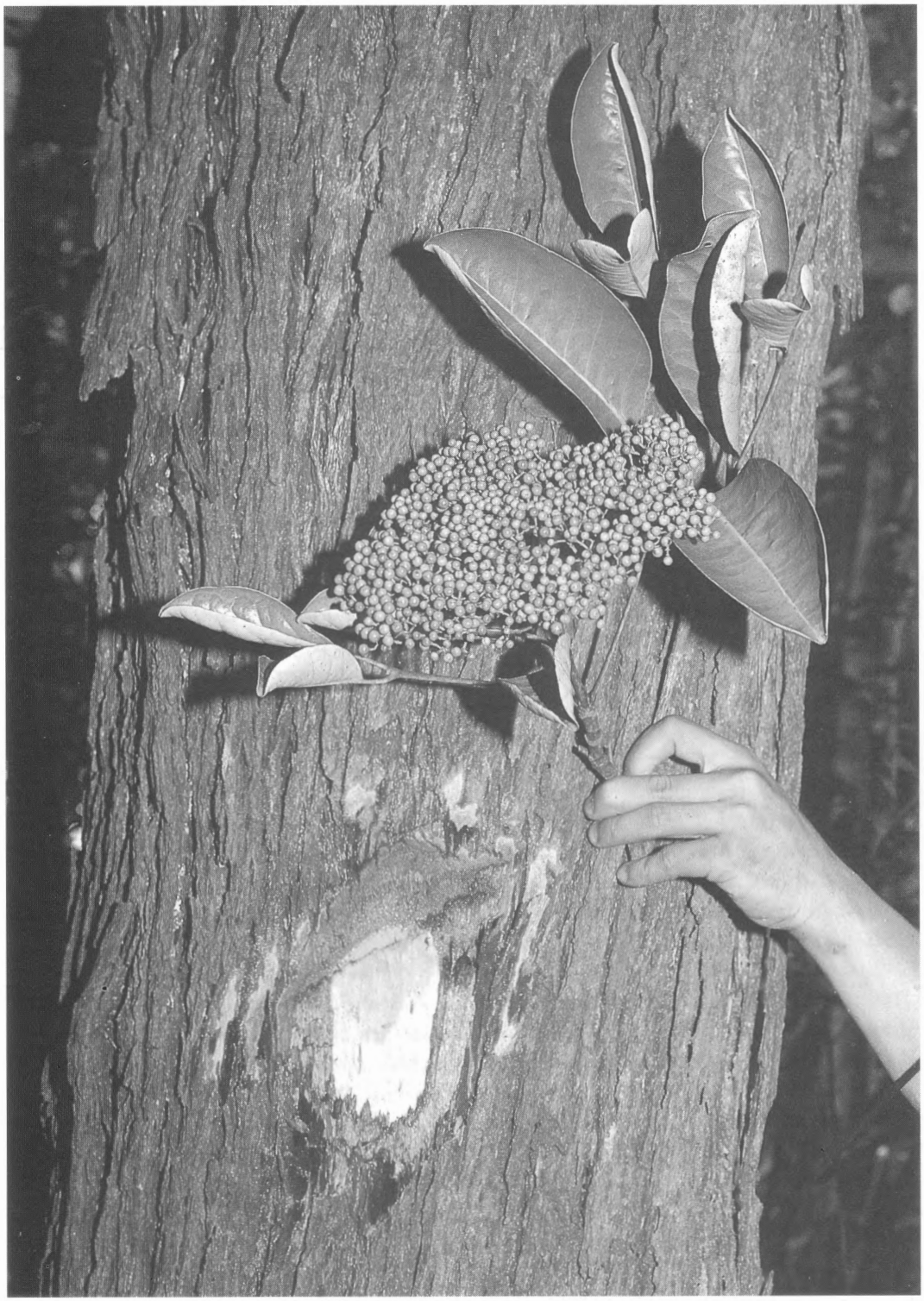

Fig. 6. *Fagraea belukar*, at the Bukit Beruang area in Brunei. (Photo by K.M. Wong)

mainline, *Ampon & Madani* SAN 47347 (SAN); Sandakan, Leila F.R., *Ampuria* SAN 32601 (K, L, SAR, SING); Kota Kinabalu, Bt. Padang, *Beaman* 10822 (K, MSC); Sandakan, junction of Ernetina road, *Brand* SAN 34698 (BO, K, KEP, L, PHIL, SAR, SING); Sipitang, *Caudra* A 3293 (K); Sandakan, mile 4, Leila F.R., *Dewol & Chow* SAN 74258 (K, KEP, L); Weston, Lubok Darat, *Dewol & Karim* SAN 78358 (SAN); Sipitang, Bkt. Ulu Sipitang, *Dewol & Termiji,* SAN 78358 (K, KEP, L, SAR, SING); Tawau, Padang Golf, *Ismail* SAN 107761 (SAN); Sandakan, Leila F.R., *Kanis & Ding Hou* SAN 57451 (K, L); Sandakan, Leila F.R., *Kumin* SAN 74160 (K, L, SAR, SING); Jesselton, Gaya island F.R., *Lajangah* SAN 28776 (BO, K, KEP, L, SAR, SING); Sipitang, forest behind SFI Qrs., *Madani & Amin* SAN 86236 (SAN); Beaufort, Beaufort Hill, *Madani* SAN 36770 (K, L, SAR); Beaufort, Beaufort Hill, *Meijer* NT 172 (SAN); Sandakan, town, *Meijer* SAN 20945 (SAN); Beaufort, Kg. Inuman, *Mikil* SAN 30215 (K, L, SAR); Beaufort, mile 52, Mesapul road, *Mikil* SAN 34569 (SAN); Beaufort, Beaufort hill, *Saikeh* SAN 72259 (K, L, SAR, SING); Sandakan, mile 3/4 north road below Sabah Hotel, *Sam & Ernesto* SAN 26522 (SAN); Jesselton, Pulau Gaya, *Sinanggul* SAN 40136 (KEP); Beaufort, Mantanior, *Talib & Marsal* SAN 84772 (SAN); Labuan, Botanic Garden, Natural Arboretum, *Talip* SAN 55629 (SAN); Beaufort, Weston, Bkt, Siungau, *Talip* SAN 80618 (K, KEP, L, SAR, SING); Sandakan, Sepilok Laut, *Tamin* SAN 131250 (SAN); Jesselton, near hospital, *Tandom* NBFD 2810 (SAN); Sandakan, Sepilok Laut F.R., *Termiji & Paul* SAN 85500 (SAN); Sandakan, Leila F. R., *Wong* SAN 22901 (K, KEP, L, SAR); Jesselton, Gaya F.R., *Wyatt-Smith* KEP 80298 (K). **SARAWAK:** Tarum, *Rehal* 1750 (SAR); Bukit Lan, *Wright* 631 (SAR); Serian, Sg. Sabal Tapang, *Sinclair* SFN 10266 (E, K, L, SAR, SING); Kuching, sg. Pair Silag, tepi laut, *MRihal* 2251 (SAR); Kuching, *Corner & Brunig* 10444 (SAR); *Anderson* S. 4921. **KALIMANTAN:** Long Bagun, *Wiriadinata* 602 (BO, K); Bangarmassing, *Motley, s.n.* 1857 (K).

F. belukar most resembles *F. rugulosa* Wong & Sugau in having small flowers and fruits (calyx 2–4 mm long, corolla tube 3.5–8 mm long, fruits 5–8 mm diameter) and many-flowered cymes. However, it differs in its cymes in which the main axis typically branches to only 4–6 orders, ovate corolla lobes (2.5–3 mm long) and typically obtuse-rounded to emarginate leaf apex. A photograph of this species appears on page 304 of Leenhouts (1962), in his Fig. 4 (as *F. elliptica*).

This is the common secondary forest (*belukar* in Malay) and open-area *Fagraea* tree of Borneo. At Kew is a Korthals collection of this species taken from Borneo and labelled in Blume's hand "*Fagraea picrophloea*", but under his *Picrophloeus javanensis* (the basis of Blume's *Fagraea picrophloea*) Blume noted "*in sylvis altioribus montis Salak*", indicating that the type should be a Javanese specimen (L). The Korthals specimen from Borneo cannot be the type, and Blume probably misidentified this specimen as *Fagraea picrophloea*.

6. Fagraea collina *Wong & Sugau* **sp. nov**. *F. ellipticae Roxb. similis, sed floribus sessilibus (pedicellis usque ad 1 mm longis) differt. Typus: Aban SAN 50747, Sabah, Ranau, copper mining area (holotypus SAN).* (Fig. 7)

F. elliptica sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Roxburgh; Cockburn, Tree of Sabah 1 (1976) 210, *pro parte*; Ashton, Manual of the Non-Dipterocarp Trees of Sarawak 2 (1988) 314, *pro parte*; Anderson, Check List of the Trees of Sarawak (1980), *pro parte*.

Medium-sized tree or shrub, up to 5 m tall; bole *c.* 25 cm diameter. Bark fissured, blackish; sapwood yellowish. Leaves elliptic, oblanceolate-obovate, 4–15 x 2–7 cm, coriaceous, upper and lower surfaces finely shagreen; base cuneate, margin plane to slightly recurved, apex acute, midrib prominent, ridged, lateral veins 7–9 pairs, visible, lower side obscure, upper side faint to obscure; reticulations obscure; leaf stalks 1.5–2 cm long, axillary scale inconspicuous, developing above the leaf-stalk base and tightly clasping the stem. Inflorescence a many-flowered terminal cyme, 6–9 cm long, 11–18 cm long, main axis branching 3–4 orders; peduncle 1–3.5 cm long, first branch 2.5–7 cm long; pedicel 0–1 mm long. Calyx campanulate, 2–3 mm long, calyx 1.5–2 mm diameter, divided to almost halfway or further down. Corolla salverform, tube 6–7 mm long, 1–1.5 mm wide, corolla lobes ovate to lanceolate, 2–2.5 mm long, 1–1.5 mm wide. Stamen-filament 8–11 mm long, inserted at the corolla mouth; anthers 1 mm long, exsert for 6–7 mm. Style exsert for 5–7 mm, stigma capitate. Fruit a berry, globose, 3.5–5 mm across, fruit calyx 1 mm long. Seeds small, *c.* 1 mm diameter, brownish black.

DISTRIBUTION. Known thus far only from Sabah and Sarawak in Borneo.

HABITAT. Mostly in montane forests, sometimes lowland (Gaya island, near Kota Kinabalu, Sabah); also white-sand forests, from 20 to 1700 m.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, Mamut, copper mining area, *Aban* SAN 50747 (holotype SAN); Ranau, Kinabalu N.P., Bundu Tuhan view trail, *Aban* SAN 49430 (SAN); Ranau, Mamut copper mine, *Beaman* 9962 (K, MSC); M. Kinabalu, *Puasa* 3506 (K). **SARAWAK:** Base camp at Bt. Sadok, *Banyeng & Ilias* S. 45043 (K, KEP, L, MO, SAN, SAR); Summit of Bt. Sadok, *Banyeng & Ilias* S.45059 (K, KEP, L, MO, SAN); Anap, (Kana) trig point, Bt. Naoung, *Banyeng* S. 19401 (A, BO, K, KEP, L, MEL, SAN, SAR, SING); Bintulu, Merurong plateau, *Brunig* S. 8791 (K, SAR); Kuching, Matang, G. Serapi, *Lee* S. 54146 (K, SAR); Mt. Dulit, *Richards* 1735 (K); Mt. Dulit, Ulu Koyan, *Synge* 1874 (K).

F. collina has been confused with *F. elliptica* Roxb. in having a calyx (in flower) 2–3 mm long, corolla lobes 3.5–6 mm long; filaments in open flowers 7–11 mm long; mature fruits only 3.5–5(–6) mm across; and leaves elliptic or oblanceolate-obovate, in which the surfaces dry smooth. However, it is distinct from *F. elliptica* in having sessile to subsessile

flowers, the pedicels (if developed) to 1 mm long; acuminate leaf apices and obscure to only very faintly visible leaf lateral veins that are never elevated on the lower side.

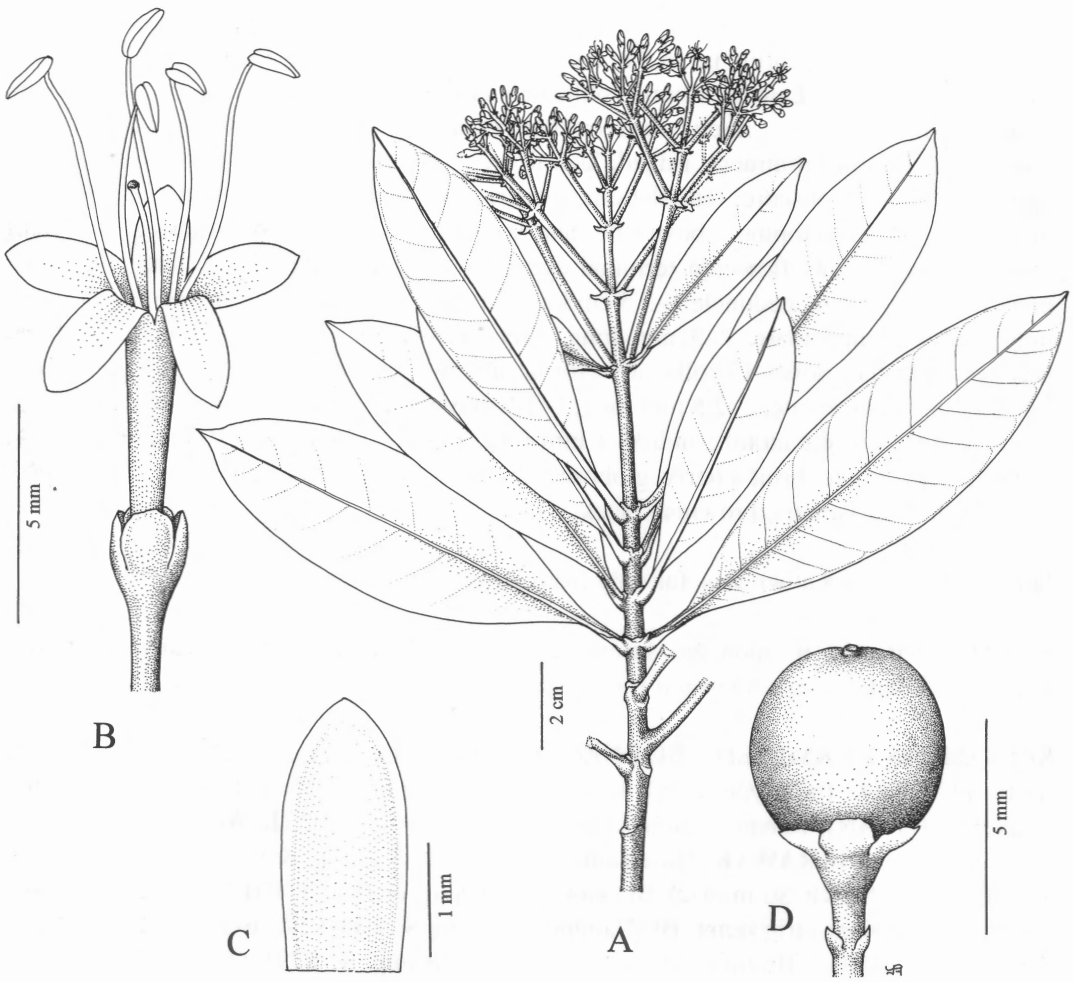

Fig. 7. *Fagraea collina*. **A.** Leafy flowering branch. **B.** Flower. **C.** Corolla lobe. **D.** Fruit. All from SAN 50747 except **D**, from S. 45043.

7. F. elliptica Roxb.

[Hort. Beng. (1814) 84, *nom. nud.*] Fl. Ind. ed. Wall. 2 (1824) 32.

Picrophloeus javanensis Bl., Bijdr. (1826) 1020, *nom. nud.* Type: see *Fagraea javensis* (Bl.) Bakh. *f.*

Cyrtophyllum speciosum Bl., Bijdr. (1826) 1022. Type: *Blume* 1867, Java (L: sheet no. 908.127–210).

Willughbeia elliptica (Roxb.) Spreng., Syst. Veg. 4 (1827) Cur. Post. 71.

Fagraea speciosa (Bl.) Bl., Rumphia 2 (1838) 35, t. 81: Mus. Bot. 1 (1850) 172.

F. picrophloea Bl., Rumphia 2 (1838) 36, *nom. illeg.* (based on *Picrophloeus javanensis*); Mus. Bot. 1 (1850) 173. Type: see *F. javensis* (Bl.) Bakh. *f.*

F. kimangu Bl., Mus. Bot. 1 (1850) 173. Type: *Blume*, Java, kimangle, kimangu (L, sheet no. 908.127-507).

F. valida Miq., Fl. Ind. Bat. 2 (1857) 376. Type: *Junghuhn*, Sumatra, "Panoadjih et Koeta tinggi" (L: sheet no. 908.127-625).

F. sumatrana Miq., Fl. Ind. Bat. 2 (1857) 377. Type: *Teysmann*, Sumatra, Payakombo, "kajoe sobo" (L: sheet no. 908.127-628).

F. aurantiodora S. Moore, J. Bot. 66 (1928) 105. Type: *Brass* 642, Papua New Guinea, Sogere (BM, K).

F. pseudoelliptica Kanehira & Hatusima, Bot. Mag. Tokyo 56 (1942) 161, f. 5. Type: *Kanehira-Hatusima* 12577, New Guinea, Ayerjat, along Boemi River, about 40 km inland from Geelvink (TKU).

F. javensis (Bl.) Bakh. *f.* in Backer, Bekn. Fl. Java 7 (1948) fam. 170, p. 12, *nom. illeg.* (based on *Picrophloeus* javensis Bl.); Blumea 6 (1950) 382. Type: *Blume*, Java (L: sheet no. 908.127-201).

F. pusilliflora Bakh. *f.* in Backer, Bekn. Fl. Java 7 (1948) fam. 170, p. 13, *nom. nud*; Blumea 6 (1950) 383. Type: *Endert* 77E.1P.746, Sumatra, Palembang (L: sheet no. 923.157-1391).

F. elliptica sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte.*

DISTRIBUTION. Sumatra, Java, Borneo, Celebes, Moluccas, New Guinea.

HABITAT. Lowland, occasionally montane forest.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, Mt. Kinabalu, Eastern Shoulder, alt. 3400 ft., *Chew, Corner & Stainton* RSNB 3 (SAN); Penampang, 4th mile from Kg. Babagon to Ulu Terian, alt. 2100 ft., *Cockburn, Chow & Aban* SAN 68423 (SAN); Ranau, Kinabalu N.P., road side to Power Station, alt. 5800 ft., *Meijer et al.* SAN 94214 (SAN); Ranau, Kinabalu N.P., above Hot Spring, alt. 3500 ft., *Meijer* SAN 24093 (SAN). **SARAWAK:** 3rd. Div. Kapit, Ulu Balleh, Bt. Tibang, *Ilias* S. 28573 (A, K, L, MEL, SAR, SING); Baram, Melinau Gorge, *Chew* CWL 442 (SAR); Miri, Lambir proposed N.P, *Awang* S 24094 (K, L, SAR, SING). **BRUNEI:** route from Kg. Mendarau to Bukit Teraja F.R, *Hotta* 12682 (BRUN). **SUMATRA.** eil Simaloer, Landschap Tapah (Defajan), *Achmad* 1515 (BO, K); Atjeh, G. Leuser Nature Res. G. Mamas, *de Wilde & Wilde-Duyfjes* 16639 (K, L); Palembang, ond. afd. Banjoeasin en Koeboestreken, *Endert* 77E, 1P. 933 (BO, K). **PAPUA NEW GUINEA.** Morobe, Gurakor, *Brass* 29385 (K); Sogeri, *Brass* 642 (A, K); Sepik distr. Aitape subdistr, along Bliri River near Wantipi village, *Darbyshire & Hoogland* 8338 (CSIRO, K). **MOLUCCAS.** E. Ceram, Kp. Kiandarat, G. Kilia, *Buwalda* 5592 (BO, K); Bacan Is., Tuara near Amasing Kali, *de Vogel* 3958 (BO, K); Obi Is., Anggai, G. Batu Putih, *de Vogel* 4013 (K, L).

In the *Hortus Bengalensis*, Roxburgh provides only a listing of the name, mentioning Moluccas. There is a short description in Wallich's edition of the Flora Indica, with no further details except mention of Moluccas again. There is also no drawing of the species among the Roxburgh Flora Indica Drawings at Kew, and we have not found in K or L such specimen from Moluccas that could be directly related to Roxburgh. Although we are not certain if the type or such specimens are at the Calcutta herbarium, it was evident to us that the Moluccas specimens seen by us are of this species, and none of the other three species in this complex occur in Moluccas.

The name *F. elliptica* has also been used in previous Bornean accounts by Cockburn (Trees of Sabah (1976), Vol. 1) and Ashton (Manual of Non-Dipterocarp Trees of Sarawak (1988), Vol. 2) for the species here accepted as *F. belukar* and *F. collina*.

8. Fagraea rugulosa *Wong & Sugau* **sp. nov**. *F. ellipticae Roxb. similis, sed foliis superficiebus grosse rugosis in sicco differt. Typus: Chai & Ilias S. 27929, Sarawak, 5th Div., Ulu Lawas, Telau, Kota F.R. near Sg. Telau (holotypus SAN; isotypi SAR, L, K, SING, A, BO, KEP).* (Fig. 8)

F. elliptica sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Roxburgh; Cockburn, Trees of Sabah 1 (1976) 210, *pro parte*; Ashton, Manual of the Non-Dipterocarp Trees of Sarawak 2 (1988) 314, *pro parte;* Anderson, Check list of the Trees of Sarawak (1980), *pro parte.*

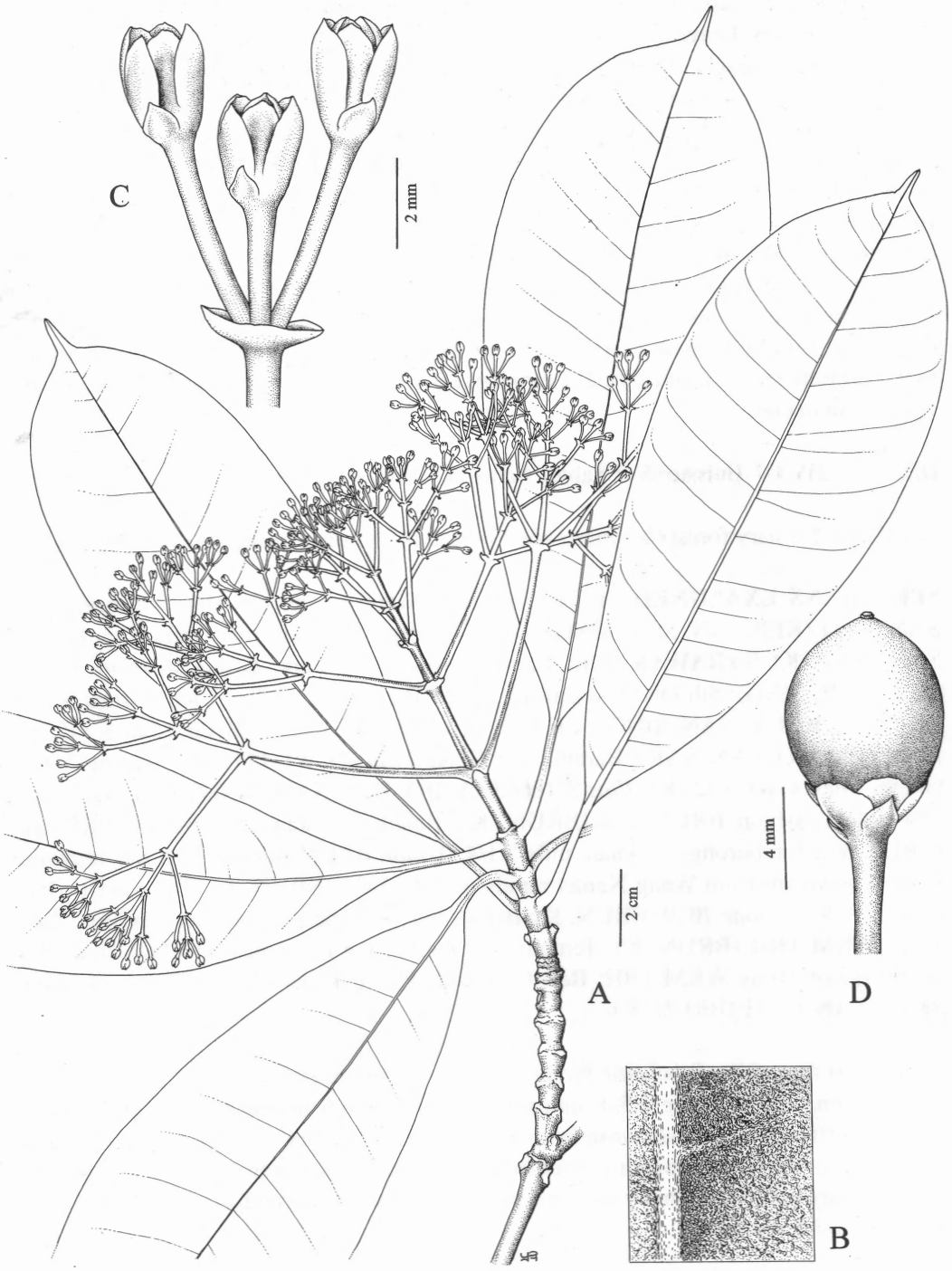

Fig. 8. *Fagraea rugulosa*. **A.** Flowering leafy branch. **B.** Detail of rough lower leaf surface. **C.** Ultimate cyme-like unit of the inflorescence, in bud. **D.** Fruit. All from S. 27929, except **D**, from S. 16603.

Tree, up to 15 m tall; bole up to 25 cm diameter. Bark lightly fissured, dark brown; inner bark dark brown. Leaves elliptic-obovate, 11–21 x 5–9 cm, coriaceous, upper and lower surfaces very coarsely shagreen; base cuneate, margin recurved when dry, apex obtuse-cuspidate, midrib prominent, rounded or ridged; lateral veins 9–12 pairs, lower and upper side faint to obscure; reticulations obscure; leaf stalks 2–3.5 cm long, axillary scale developing above the leaf-stalk base and tightly clasping the stem. Inflorescence terminal, a many-flowered branched cyme, 6 cm long, 15 cm wide, main axis branching 3–4 orders, first branch 2.5–6 cm long; peduncle 1–2 cm long; pedicel 2–3 mm long. Calyx campanulate, 3–4 mm long, 2–3.5 mm diameter, divided to almost to its base. Corolla salverform, tube 10–11 mm long, 1–1.5 mm wide, corolla lobes lanceolate, 5–8 mm long, 2–2.5 mm wide. Stamen-filament 15–18 mm long, inserted at corolla mouth; anthers on filament, 1 mm long. Style exsert for 10–11 mm; stigma unknown. Fruit a berry, globose, 6–9(–10) mm across, fruit calyx 2–3 mm long, 2–3 cm wide. Seeds variable in shape, small, *c.* 1 mm diameter.

DISTRIBUTION. Borneo: SW Sabah, Sarawak (Lawas and Baram areas only) and Brunei.

HABITAT. Primary forest (*kerangas* and lowland mixed dipterocarp forest, up to *c.* 450 m).

SPECIMENS EXAMINED—BORNEO. SABAH: Sipitang, Sri Beaufort Area, *Dewol* SAN 80111 (KEP, SAN, SAR, SING); Beaufort, Papar-Beaufort road, mile 16.5, *Lajangah* SAN 32270 (K). **SARAWAK:** Miri, Lambir, proposed N. Park, *Awang Morshidi* S. 24094 (K, L, SAR, SING); 5th Div. Ulu Lawas, Kota F.R., near Sg. Telau, *Chai & Ilias* S 27929 (A, BO, K, KEP, L, SAN, SING); 4th. Div. G. Mulu N. P., Ulu Sg. Berar, *Chai* S 39595 (A, K, KEP, L, MO, SAN, SAR): Baram, near G. Api, *Chew* CWL 1172 (K); Baram, Melinau Gorge, *Chew* CWL 442 (K); *Ilias* S 16603 (A, BO, K, L, SAN, SING). **BRUNEI:** Belait, Ulu Belait, Ashton BRUN 214 (BRUN, K); Belait, Andalau F.R., *Ashton* BRUN 628 (BRUN, K); Temburong, Bt. Puan, mile 5 1/4, *Ashton* BRUN 637 (BRUN, K); Temburong R., just upstream from Wong Nguan rapids, *Coode* 6539 (BRUN, K); Tutong, Bt. Bahak, near LP 338A, *Coode* 7029 (BRUN, K); Belait, source of the Sg. Ingei north of Batu Patam, *Wong* WKM 1104 (BRUN, K); Temburong, Temburong river, just upstream from Wong Nguan gorge, *Wong* WKM 1702; Belait, Andalau F.R. Compartment 9, *Wood, Smythies & Ashton* SAN 17521 (BRUN, K).

F. rugulosa resembles *F. belukar* Wong & Sugau in having small flowers and fruits (calyx 2–4 mm long, corolla tube 3.5–8 mm long, fruits 5–8 mm diameter) and many-flowered cymes. It differs from *F. belukar* in having leaf surfaces that dry very coarsely wrinkled and that are very coarse to the touch; cymes in which the main axis branches to 3–4 orders (very exceptionally and occasionally to 5 orders), and lanceolate corolla lobes that are 5–8 mm long and 2–2.5 mm wide.

Fagraea section *Racemosae* in Borneo and related species

Generally this section can be recognized by its leaves without auricles; nodal ochreas that develop at the very base of the leaf stalk and that tightly clasp the stem; an inflorescence with all branches very condensed and grouped in distinct tiers along the main axis; large flowers (total corolla length 1.65–5.9 cm); infundibular corollas; and relatively short styles less than twice the corolla tube length. It consists of ten species, *F. cuspidata* Bl., *F. maingayi* Clarke (not in Borneo), *F. montana* Wong & Sugau, *F. peninsularis* Wong & Sugau (not in Borneo), *F. philippinensis* Wong & Sugau, *F. racemosa* Jack ex Wall. (not in Borneo), *F. teysmannii* Commerl., *F. spicata* Baker, *F. stenophylla* Becc. ex Merr., and *F. volubilis* Wall. (var. *volubilis* and var. *microcalyx* Wong & Sugau).

In his account of the Loganiaceae of the Netherlands Indies, Commerloher (1923) confused *F. racemosa* Jack ex Wall. (typified by a specimen from Penang in the Malay Peninsula, which lay outside the scope of that study) with another species that is more widespread in the region (here identified as *F. volubilis*). These two species have a similar corolla form, but can be consistently distinguished (see notes under *F. volubilis*).

Leenhouts' revision for the Flora Malesiana (Leenhouts 1962) has, in our review, further confounded the situation by including other species (including several recognized by Commerloher) that have characteristically different inflorescence structure, flower size, corolla form, and fruit calyx-lobe habit under the name *F. racemosa*. The leaf form of many of these species is undoubtedly variable and difficult to distinguish, but Leenhouts (1962) has even regarded the characteristic long, linear leaves of the rheophytic *F. stenophylla* Becc. ex Merr. as insufficiently distinctive.

Below we provide keys to the species of this section in Borneo, as well as other (non-Bornean) species related to them.

KEY TO *FAGRAEA* SECT. *RACEMOSAE* IN BORNEO AND RELATED SPECIES
(based mainly on flowers and fruits)

1a. Narrowed basal tubular part of corolla very short, much less than a third the length of the corolla tube, and mostly hidden by the calyx in the open flower.

2a. Calyx larger, 9–12 mm long, 9–12 mm wide, the lobes 7–9 mm long. Narrowed basal tubular part of the corolla only 2 mm long; corolla lobes larger, 15–18 mm long. Anthers 3.5–4 mm long. (Malaya and Sumatra) ..... *F. maingayi*

2b. Calyx smaller, 7–9 mm long, 7–8 mm wide, the lobes 4–5 mm long. Narrowed basal tubular part of the corolla 5–6 mm long; corolla lobes smaller, 7–11 mm long. (Borneo and Balabac islands) ..... *F. cuspidata*

1b. Narrowed basal tubular part of the corolla longer, more than a third or half the corolla tube, and clearly extending beyond the calyx in the open flower.

3a. Corolla lobes in the open flower relatively short, at most up to about a third the length of the expanded upper part of the corolla tube.

4a. Flower smaller, the calyx 3.5–4 mm long, the corolla 18–21 mm long and 5.5–7 mm wide at the uppermost part of the tube. Calyx lobes tightly clasping the base of the mature fruits. Leaves generally small (4–13 × 1.8–6 cm), with cuneate to rounded base, never cordate, distinctly stalked. (Malaya and Banka) .... *F. peninsularis*

4b. Flower larger, the calyx 5–6 mm long, the corolla 32–41 mm long and 12–17 mm wide at the uppermost part of the tube. Calyx lobes spreading out away from the base of mature fruits. Leaves generally larger (10–30 × 5–14 cm), with cordate base, subsessile. (Borneo and the Philippines) ..... *F. spicata*

3b. Corolla lobes in the open flower relatively longer, about half or more the length of the expanded upper part of the corolla tube.

5a. Corolla of open flowers relatively narrow (the uppermost part of the tube only 6–8 mm wide).

6a. Corolla of open flowers 20–27 mm long (the narrowed basal tubular part 8–10 mm long, the inflated upper part 10–11 mm long). Anthers 2–2.5 mm long. Leaves linear, 12–27 cm long, with 7–14 pairs of secondary veins faintly visible. (Rheophytic plants of the lowlands) ..... *F. stenophylla*

6b. Corolla of open flowers 18–20 mm long (the narrowed basal tubular part 7–8 mm long, the inflated upper part 5–6 mm long). Anthers 1 mm long. Leaves elliptic-obovate, 3.5–13.5 cm long, with 4–5 pairs of secondary veins faintly visible. (Montane plants) ..... *F. montana*

5b. Corolla of open flowers wider (the uppermost part of the tube 10 mm or wider).

7a. Mature flowers with calyx 7–9 mm long; inflated upper part of corolla tube 12–16 mm long, much longer than the basal tubular part.

8a. Uppermost part of the corolla tube only 10–12 mm wide; corolla lobes 7–8 mm long. Anthers 1.5 mm long. (Leaves typically smallish, the length at least 3 times the width.) ..... *F. teysmannii*

8b. Uppermost part of the corolla tube 20–22 mm wide; corolla lobes 10–12 mm long. Anthers 3.5–4 mm long. (Leaves typically large, sometimes small, the length typically less than 3 times the width.) .... *F. philippinensis*

7b. Mature flowers with calyx 4–6 mm long; inflated upper part of the corolla tube 7–10 mm long, shorter than or about as long as the basal tubular part.

9a. Inflorescence short, 4–13 cm long, without distinct branches, the flowers or flower-groups closely arranged together (the rachis mostly hidden by flowers). Calyx lobes tightly clasping the base of mature fruits. (Corolla lobes generally slightly shorter, 6–7 mm long; Indo-China to Malaya, rare in Sumatra.) ..... *F. racemosa*

9b. Inflorescence of variable length, 2–30 cm long, indistinctly to conspicuously branched, the flowers or flower-groups relatively well spaced (the rachis clearly visible). Calyx lobes spreading out away from the base of mature fruits. (Corolla lobes generally longer, 7–12 mm long; widespread throughout Malesia.) ..... *F. volubilis*

10a. Calyx lobes 3–3.5 mm long ..... *F. volubilis* var. *volubilis*

10. Calyx lobes 1.5–2.5 mm long ..... *F. volubilis* var. *microcalyx*

KEY TO *FAGRAEA* SECT. *RACEMOSAE* IN BORNEO AND RELATED SPECIES
(based mainly on vegetative characters)

1a. Leaves linear, the length more than 10 times the width ..... *F. stenophylla*

1b. Leaves ovate to elliptic to lanceolate, the length less than 6 times the width.

2a. Leaves subsessile, cordate at the base, turned upside down on the distal pendulous parts of branches on mature trees ..... *F. spicata*

2b. Leaves distinctly stalked, the base cuneate to rounded or subcordate, never turned upside down on the branches, the distal parts of which never become pendulous.

3a. Leaf margins recurved when dry.

4a. Leaves typically oblong-lanceolate, sometimes elliptic to obovate. (Malaya and Sumatra) ..... *F. maingayi*

4b. Leaves typically elliptic to ovate. (Borneo and Philippines)

5a. Leaf secondary veins quite obscure. (Mountain plants with smallish leaves; Borneo only.)

6a. Corolla 18–20 mm long ..... *F. montana*

6b. Corolla 27–31 mm long ..... *F. teysmannii*

5b. Leaf secondary veins prominent and distinct. (Typically lowland, rarely mountain, plants with usually large leaves; Philippines and Borneo.) .... *F. philippinensis*

3b. Leaf margins plane, not recurved, when dry.

7a. Leaf secondary veins 4–5 pairs, rather obscure. (Malay Peninsula) .... *F. peninsularis*

7b. Leaf secondary veins 5 pairs or more, typically more than 5 pairs, prominent and distinct.

8a. Mature corolla 33–40 mm long ..... *F. cuspidata*

8b. Mature corolla 18–28 mm long

9a. Inflorescence short, 4–13 cm long, without distinct branches, the flowers or flower-groups closely arranged together (the rachis mostly hidden by flowers). Calyx lobes tightly clasping the base of mature fruits. (Corolla lobes generally slightly shorter, 6–7 mm long; Indo-China to Malaya, rare in Sumatra.) ..... *F. racemosa*

9b. Inflorescence of variable length, 2–30 cm long, indistinctly to conspicuously branched, the flowers or flower-groups relatively well spaced (the rachis clearly visible). Calyx lobes spreading out away from the base of mature fruits. (Corolla lobes generally longer, 7–12 mm long; widespread throughout Malesia.) ..... *F. volubilis*

Notes on the species

9. Fagraea cuspidata Bl. (Fig. 9)

Mus. Bot. 1 (1850) 170. Type: *Blume*, Borneo, Tanjong Java (isotype L).

Fig. 9. *Fagraea cuspidata*. (Photo by K.M. Wong.)

F. robusta Bl., Mus. Bot. 1 (1850) 170. Type: *Zippelius*, "Nova Guinea" (L: sheet no. 908.127-729) (the locality is most likely a mistake; it is perhaps a Bornean specimen to which a New Guinean label has been attached, which even made Blume specially record "*nec non in insula Borneo*".)

F. crassipes Bentham J. Linn. Soc. Bot. 1 (1856) 99. Type: *Motley* 343, Labuan (holotype K).

F. cymosa Merr., J. Str. Br. R. As. Soc. 77 (1917) 234. Syntypes: Native Coll. 383, Sarawak (A); Native Coll. 776, Sarawak (A, K, L); *M.S. Clemens* 9627, British North Borneo, Jesselton, on hills near the seashore (BM).

F. pendula Merr., Pl. Elm. Born. (1929) 251. Type: *Elmer* 20141, North Borneo, near Tawao (isotype K, L).

F. racemosa sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Jack ex Wall. (1824).

DISTRIBUTION. Known only from Borneo (all districts) and Balabac islands.

HABITAT. Mixed dipterocarp forest, also lowland secondary forests and forest gaps and fringes.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, S.E. of Matupang, *Dewol & Amin* SAN 100105 (L); Weston, *Kabul* NBFD 5463 (K); Kabili-Sepilok F.R., *Enggoh* NBFD 7231 (K); Kimanis, *Kwanting* NBFD A 359 (K); Mt. Kinabalu, *Puasa* 3579 (K); Tambunan, Apin-Apin, *Puasa* NBFD 3835 (K). **SARAWAK:** 4th Div., Bintulu, Nyabau, *Hou* 337 (K); Kuching, Selang F.R. *Ilias* 8456 (K); Miri, *Wyatt-Smith* KEP 80075 (K); Bintulu, Longreen road, *Yii* S 37871 (K); Upper Rejang river, *J. & M.S. Clemens* 21546 (K); Kuching, Penrissen road, mile 6, *Purseglove & Shah* P 4408 (K). **BRUNEI:** Temburong, Selapon, *Kirkup* 318 (BRUN, K). **KALIMANTAN:** Pontianak, Bentiang, Gunung Nap, *Shea* 26759 (L); Sangkoelirang, Sampajan, *Aet* 673 (BO, K); Berau, Mt. Njapa on Kelai River, *Kostermans* 21331 (L). **BALABAC.** Balabac, *Vidal* 3318 (K).

A small tree, this is one of the commonest lowland and hill secondary forest and forest-gap species of *Fagraea* in Borneo. Its pendulous inflorescences with conspicuously large flowers make it instantly recognizable from the other common secondary forest *Fagraea*, *F. belukar*, which is a larger tree developing a sizeable trunk and with erect, small-flowered inflorescences.

10. Fagraea maingayi Clarke

in Hook. *f.*, Fl. Brit. Ind. 4 (1883) 84. Type: *Maingay* 1033 (holotype K).

F. racemosa sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Jack ex Wall. (1824).

DISTRIBUTION. Malay Peninsula and Sumatra.

HABITAT. Lowland dipterocarp forest and secondary forest.

SPECIMENS EXAMINED—MALAYA. Kedah, Koh Mai Forest Reserve, *Kiah* SFN 35105 (K); Perak, near Ulu Selangor, *King's Coll.* 8671 (K); *Maingay* 1033 (type, K); Pahang, Mentakab, Kemasul F.R., *Mohzan* KEP 99591 (K); Selangor, Kuang, *Raman* KEP 24881 (K); Pahang, Aur F.R., Compt. 34, *Whitmore* FRI 3630 (K); Negeri Sembilan, Senawang F.R., *Yakim* KEP 1986 (K); Pahang, Ulu Krau, G. Benom Game Reserve, *Zahir* KEP 99108 (K); Pahang, Sg. Telom, Bt. Cheraga, *Zainuddin* FRI 14737 (K). **SUMATRA.** Atjeh, G. Leuser Nature Reserve, *de Wilde & de Wilde-Duyfjes* 12685 (K) (new record for Sumatra).

This has the largest flowers among this group of species.

11. Fagraea montana *Wong & Sugau* **sp. nov.** *F.teysmannii Cammerl. similis, sed corolla breviore (18–20 mm longa), lobis 4.5–5 mm longis et antheris typice brevioribus (1 mm longis) differt. Typus: Aban SAN 50722, Sabah, Ranau, Mamut, copper mining area (holotypus SAN, isotypi K, L).* (Fig. 10)

F. racemosa sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Jack ex Wall. (1824).

Small tree, up to 6 m tall (but recorded to 40 m tall with buttresses 1.3 m high). Bark fissured, brown; inner bark laminated, reddish. Wood pale. Leaves elliptic-oblong, 3.5–13.5 x 1.5–5.5 cm, coriaceous, upper and lower surfaces smooth; base cuneate, margin plane to slightly recurved, apex abruptly caudate, midrib prominent, rounded; lateral veins 4–5 pairs, upper side faint to obscure, lower side faint to obscure; reticulations obscure; leaf stalks 0.7–2 cm long, axillary scale developing above the leaf-stalk base and tightly clasping the stem. Inflorescence a many-flowered panicle, 4.5–14 cm long; peduncle 1.5–5.5 cm long; branch clusters well-spaced, first order branches indistinct, 5 mm long, secondary order branches indistinct, tertiary order branches absent; pedicel 6–12 mm long. Calyx 4–4.5 mm long, 4–6.5 wide, calyx lobes 2.5–3 mm long. Corolla cup-shaped, 16–19 mm long, narrowed basal part 7–8 mm long, expanded upper part 5–6 mm long, 6–7.5 mm wide, corolla lobes ovate, 4.5–5 mm long, 3–3.5 mm wide. Stamens inserted at the base of the inflated part; anthers included or just visible at the throat, 1 mm long. Style exsert for 4–5 mm, stigma capitate. Fruit ovoid-globose, 9–15 mm long, 8–11 mm wide, fruit calyx patent to clasping fruit base. Seeds small, *c.* 1 mm diameter, brownish black.

DISTRIBUTION. Endemic to Borneo (Sabah, Sarawak).

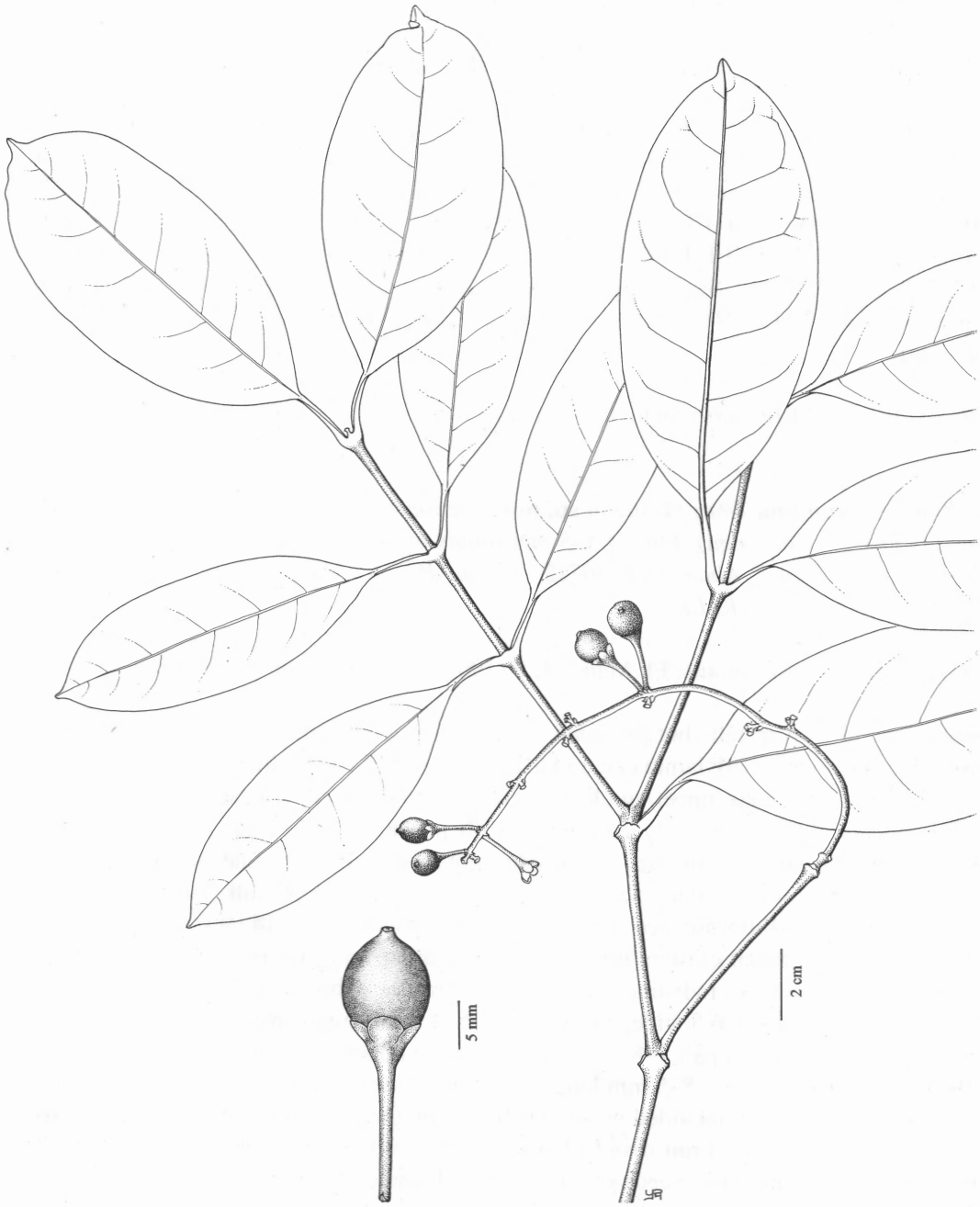

Fig. 10. *Fagraea montana*: Leafy fruiting branch, and detail of single fruit. From SAN 50722.

HABITAT. Mostly in montane forests, up to 1500 m.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, Mamut, copper mining area, *Aban* SAN 50722 (holotype SAN, isotypes K, L); *Ahmad & Ejan* SAN 86952 (SAN); *Asik* SAN 125587 (SAN); Ranau, Mile 5, Paginatan-Ranau road, *Dangi* SAN 15801 (SAN); *Fidilis* SAN 115792 (SAN); *Fidilis* SAN 125462 (SAN); Mt. Kinabalu, Dallas, Tinompok spur, *J & M.S. Clemens* 27711 (K); Tambunan, Rafflesia Forest Reserve, *Wong* WKM 2602 (SAN); Jalan Trusmadi, *Mikil* SAN 31859 (K, L, SAN); Ranau, Tenompok, *Sario* SAN 28506 (K, L, SAN, SAR, SING); Ranau, Kinabalu, *Sinanggol* SAN 51402 (SAN); Keningau, Highland plantation, mile 11, *Talip & Ejan* SAN 86952 (K, SAN). **SARAWAK:** 4th Div., Baram, Kelabit Highland, Bkt. Aru Damoh, *Chai* S 35417 (A, K, L, MO, SAR); 7th Div., Kapit, Melinau, Ulu Sampurau, Bukit Sampadai, *Ilias* S 40722 (SAR); 7th Div., Kapit, Melianu, Bkt. Sampadai, *Ilias* S 40881 (K, KEP, L, MO, MW, SAN, SAR).

F. montana resembles *F. teysmannii* Commerl. in having relatively longer corolla lobes in the open flower (about half or more the length of the expanded upper part of the corolla tube) and elliptic to oblong, typically small coriaceous leaves. However, it can be distinguished by its relatively narrow corolla in open flowers (the uppermost part of the tube only 6–8 mm wide), shorter corolla lobes (only 4.5–5 mm long), and shorter anthers (to 1 mm long).

Heine, in his "*Pflanzen der Sammlung J. & M.S. Clemens vom Mount Kinabalu*" (1953: 91), enumerated *Clemens* 27711 as "*F. cf. minor* Reinw.". As this epithet is preempted by Blume's use of it for a different species it cannot be applied to the species here.

12. Fagraea peninsularis Wong & Sugau, sp. nov. *F. spicata Baker affinis sed calyce 3.5–4 mm longo, corolla 18–21 mm longa, folio base cuneatovel rotundato et petiolo distincto differt. Typus: Loh FRI 17131, Peninsular Malaysia, Johore, Segamat Wildlife Reserve, eastern boundary (holotypus KEP, isotypus K).* (Fig. 11)

F. ligustrina sensu King & Gamble, J. As. Soc. Beng. 74, 2 (1908) 609; *sensu* Ridley, Fl. Malay Pen. 2 (1923) 420; *non* Blume (1838).

F. racemosa sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Jack ex Wall. (1824).

Treelet, up to 7 m tall. Leaves elliptic-ovate, 4–13 × 1.8–6 cm , thin coriaceous, upper and lower surfaces smooth; base cuneate-rounded, margin plane, apex abruptly caudate; midrib prominent beneath, rounded to flattened; lateral veins 4–5(–7) pairs, upper side faint, lower side prominent to faint; reticulations obscure or faint; leaf stalk 0.4–1.5 cm long, axillary scale developing above the leaf-stalk base and tightly clasping the stem. Inflorescence a many-flowered cyme, 3–8.5 cm long; peduncle 1.8–4.8, branch clusters well-spaced; first and second order branches indistinct, third order branching absent; pedicel 2–3 mm long.

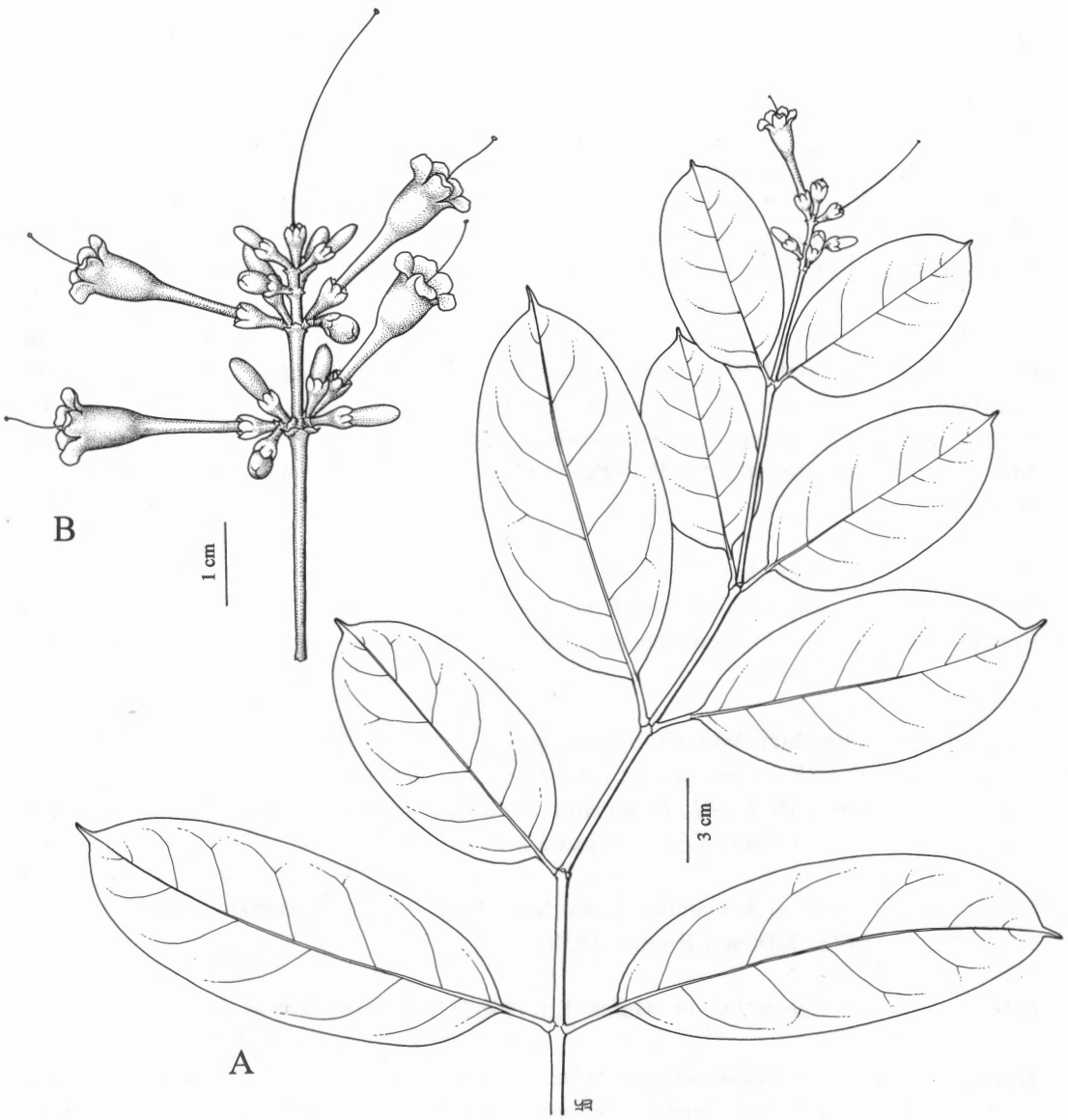

Fig. 11. *Fagraea peninsularis.* **A.** Leafy flowering branch. **B.** Part of inflorescence. From FRI 17131.

Calyx 3.5–4 mm long, 3–5 mm wide; calyx lobes 1.5–2 mm long. Corolla infundibular, 1.8–3 cm long, narrowed basal part 1–1.2 cm long, expanded upper part 0.8–1 cm long, 5.5–7 mm wide, corolla lobes semi-orbicular, 2.5–3.5 mm long, 3–3.5 mm wide. Stamen-filament inserted at base of the inflated part; anther 1 mm long, included or just visible at throat; style exsert for 3–4 mm, 3–3.2 cm long; stigma peltate. Fruit ovoid, 8–10 × 7–9 mm, fruit calyx clasping to patent. Seeds small, angular, brownish black.

DISTRIBUTION. Endemic to the southern half of the Malay Peninsula and Banka Island to its south.

HABITAT. Lowland dipterocarp forest.

SPECIMENS EXAMINED—MALAYA. Singapore, *Lobb* no. 4 (K); Singapore, *Lobb s.n.* (K); Johore, Segamat Wildlife Reserve, eastern boundary, *Loh* FRI 17131 (K); Singapore, Changi, *Ridley* 2783 (K); *Ridley* 8453 (K); Pahang, Rompin, *Soh* KEP 15425 (K); Selangor, Klang, Olar Limpit, *Symington* KEP 43681 (K). **BANKA.** Herb. T. Horsfield (purchased 1859) (K).

King & Gamble (1908) and Ridley (1923) incorrectly applied Blume's name *F. ligustrina* (a synonym of *F. volubilis* var. *microcalyx*) to this species, which has hitherto not been named.

13. Fagraea philippinensis *Wong & Sugau* **sp. nov**. *F. teysmannii Cammerl. similis, sed tubo corollae superne latiore (20–22 mm) et parte basale tubi angustate 7–12 mm longa differt. Typus: Ahern's Coll., For. Bur. 3270, Philippines, Luzon, Rizal (holotypus K).* (Fig. 12)

F. racemosa sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Jack ex Wall. (1824).

Small tree, up to 3 m tall; bole *c.* 13 cm diameter. Bark fissured, grey. Leaves elliptic-oblong, 8–23 × 3.5–10.5 cm, coriaceous, upper and lower surfaces smooth; base cuneate rounded to cordate, margin plane to recurved, apex acuminate-short caudate, midrib prominent, rounded; lateral veins 4–8 pairs, upper side faint to obscure; reticulations obscure; leaf stalks 0.6–1.5 cm long, axillary scale developing above the leaf-stalk base and tightly clasping the stem. Inflorescence a many-flowered panicle, 4.5–19 cm long, peduncle 2.5–8.5 cm long, branch clusters well-spaced to close, first order branches indistinct, second order branches indistinct; pedicel 2–6 mm long. Calyx 7–9 mm long, 5–8 mm wide, calyx lobes 4–6 mm long. Corolla salverform, 34–46 mm long, narrowed basal part 7–12 mm long, expanded upper part 12–16 mm long, 20–22 mm wide, corolla lobes ovate, 15–18 cm long, 9–10 mm wide. Stamen-filament inserted at the base of the inflated part; anthers included, 3.5–4 mm long. Style exsert for 5–7 mm. Fruit ellipsoid, 9–11 mm long, 7–9 mm wide, fruit calyx clasping fruit base.

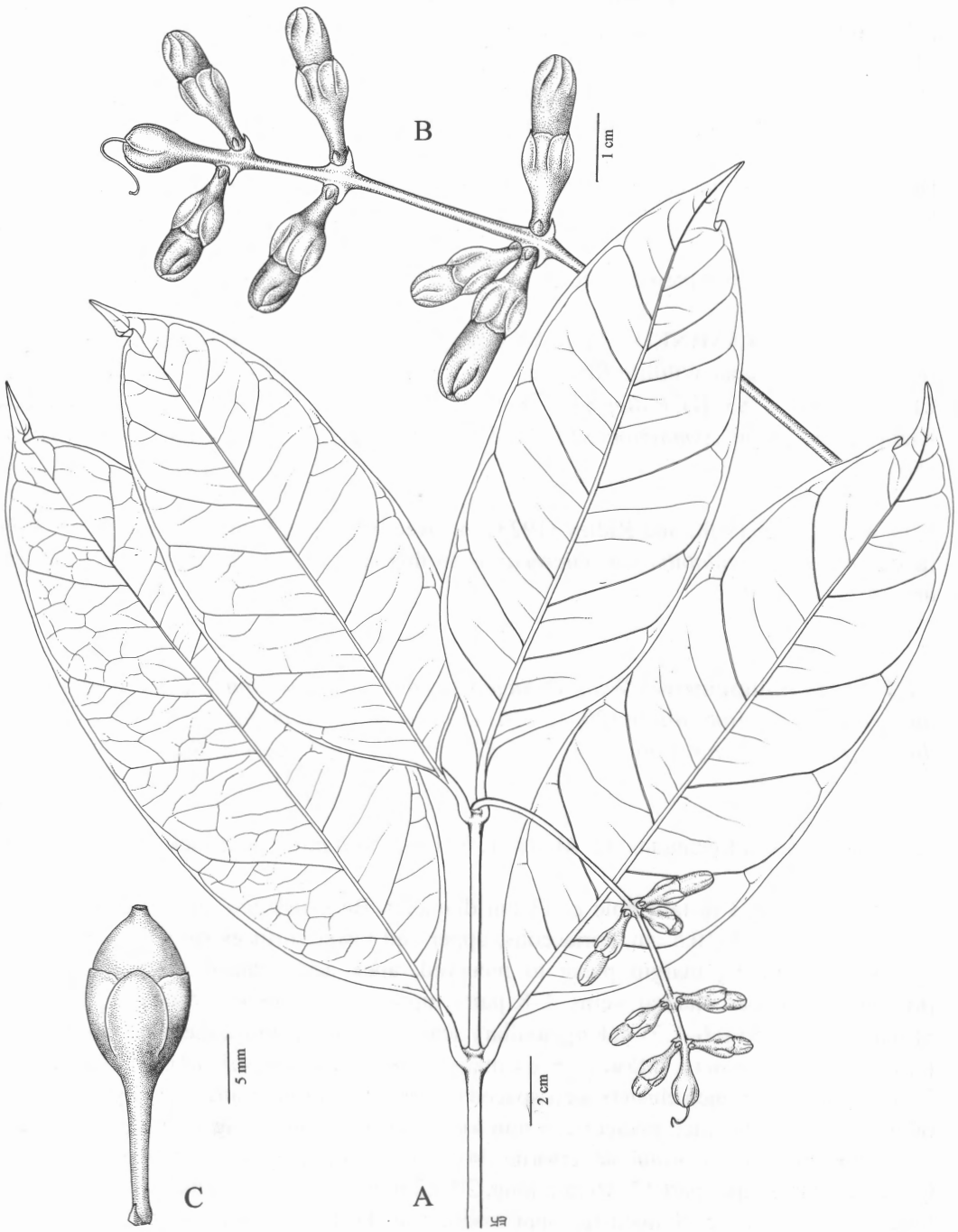

Fig. 12. *Fagraea philippinensis*. **A.** Leafy flowering branch. **B.** Detail of inflorescence. **C.** Fruit. **A, B** from S. 42239; **C** from S. 37022.

DISTRIBUTION. Philippines, Borneo (Sarawak and Kalimantan).

HABITAT. Mixed dipterocarp forest and *kerangas* forest, up to 600 m.

SPECIMENS EXAMINED—BORNEO. SARAWAK: 1st Div., Semenggoh, *Brunig* 4804 (K); 1st Div., Kuching, Semenggoh Arboretum, *Gary et al.* S 37022 (K); Lawas, sg. Belaban, *Ilias* S. 26313 (K, SAR); 1st Div., Bako N.P., Telok Gador, *Yii* S. 42239 (K, SAR). **KALIMANTAN:** Mt. Simbas, Pak Sanggak, *Prawiroatmodjo* 258 (BO, K, L). **PHILIPPINES.** Luzon, Rizal, *Ahem's coll.*, For. Bur. 3270 (holotype K); Luzon, Limutan, *Loher* 4119 (K); Luzon, Rizal, Montalban, *Loher* 6504 (K).

F. philippinensis most resembles *F. teysmannii* Commerl. in having wider corollas in the open flower (the uppermost part of the tube 10 mm or wider), mature flowers with calyx 7–9 mm long; an inflated upper part of corolla tube 12–16 mm long, much longer than the basal tubular part. However, it is distinct from *F. teysmannii* in having a wider uppermost part of the corolla tube (20–22 mm), longer corolla lobes (10–12 mm) and longer anthers (3.5–4 mm).

14. Fagraea racemosa Jack ex Wall.

in Roxb., Fl. Ind. 2 (1824) 35. Type: *Jack*, Penang (Wallich, Cat. 1601.1) (holotype K).

F. racemosa var. *grandis* DC. Prod. 9 (1845) 29. Type: *Porter*, Penang (Wallich, Cat. 1601.2) (holotype K).

F. racemosa sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte*.

DISTRIBUTION. Indo-China, Malay Peninsula, Sumatra.

HABITAT. Lowland forest, including secondary forest.

SPECIMENS EXAMINED—MALAYA. Johore, Kota Tinggi, riverine swamp, *Burkill* HMB 4555 (K); Selangor, Puchong, *Carrick* JC 1501 (K, L, SING); Johore, Sedili river, *Corner* SFN 25949 (K); Pahang, Labong Endau, *Evan s.n.* (K); Johore, Biserat, *Gwynne-Vaughan* 610 (K); Kedah, Selama, Sungai Terap , *Henderson* SFN 35437 (K); Selangor, Rantau Panjang, *Kloss s.n.* (K); Negeri Sembilan, Tampin, *Md Nur* SFN 1313 (K); Penang (Wall., Cat. 1601(2), prob. 1822), *Porter s.n.* (K); Penang, Peneng Hill, *Ridley* 9354 (K). **SUMATRA.** Asahan, Silo Maradja, *Bartlett* 8702 (K); Upper Riauw, Pakanbaru, Tenajan R., freshwater swamp, *Soepadmo* 38 (BO, K).

See comments under *F. volubilis* (species no. 18) here.

15. Fagraea spicata Baker

Kew Bull. (1896) 25. Type: *Creagh, s.n.*, British North Borneo, east coast (holotype K).

F. congestiflora Elmer, Leafl. Philip. Bot. 8 (1915) 2741. Type: *Elmer* 13169, Palawan, Puerto Princesa, Mt. Pulgar (holotype PNH, probably destroyed in the war; isotype A).

F. racemosa sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Jack ex Wall. (1824).

DISTRIBUTION. Borneo, Palawan, Luzon (Philippines).

HABITAT. Lowland to lower montane forest, frequently in gaps and also secondary forests.

SPECIMENS EXAMINED—BORNEO. SABAH: Ulu Segama, near Kuala Beruang, *Cockburn* SAN 70921 (K); Myburgh Province, Sandakan, *Elmer* 20178 (K); "British North Borneo", *Gibbs* 2871 (K); Sapagaya, *Puasa* 1393 (K); Sandakan, Kabili For. Res., *Puasa* NBFD no. 4882 (K). **SARAWAK:** Baram, Tutoh, Ulu Sungei Melinau Paku, *Anderson* 4038 (K); Bintulu, Nyabau F.R., *Ashton* S 15914 (A, K, L); 4th Div., Dulit Range, *Awa & Yii* S 46627 (K, KEP, L); 3rd Div., Kapit, Belaga, 10 km below Belaga on the Rejang, Segaham range, near Belaga airfield, *Jacobs* 5458 (K, L); 3rd Div. Mujong, Batang Balleh, *Williams* S 17137 (K, L, SING). **BRUNEI:** Belait, Sungei Liang Arboretum, *Forman* 1085 (BRUN, K); Belait, Sungei Liang Arboretum, *Haslani* HA 48 (BRUN, K); Belait, Labi, Bukit Teraja, *Niga* NN 293 (BRUN, K); Tutong, Sungei Medit, *Simpson* 2521 (BRUN, K); Temburong, Bukit Patoi, *Wong* WKM 1299 (BRUN, K). **KALIMANTAN:** W. Koetai, *Endert* 5054 (BO, K); E. Kutai Reserve, vicinity of Sengata and Mentoko rivers, *Leighton* 362 (L); Nunukan, N of Tarakan, *Meijer* 2098 (BO, K); Sungai Wain Protected Forest, km 15, Balikpapan-Samarinda road, *Sidiyasa* 787 (K). **PALAWAN.** St Paul's Bay, Cabayugan village, *Ridsdale* SMHI 1650 (K). **PHILIPPINES.** Luzon, Tayabas, Lucban, *Elmer* 7834 (K).

The relatively short triangular corolla lobes, short inflorescences with densely packed flowers on them, and subsessile cordate leaves are distinctive of this species.

16. Fagraea stenophylla Becc. ex Merr. (Fig. 13)

J. Str. Br. R. As. Soc. 77 (1917) 236. Type: Native Coll., Bur. Sci. no. 2828, Sarawak, Upper Baram, Selungo (holotype PNH, probably destroyed in the war; isotypes A, UC).

F. eucalyptifolia Cammerl., Bull. Jard. Bot. Btzg. 3, 5 (1923) 312, f. 2. Syntypes: *Amdjah* 552, Borneo, Soengei Parii (L); Jaheri, Exp. Nieuwenhuis 1896-87 (L).

F. racemosa sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Jack ex Wall. (1824)

DISTRIBUTION. Endemic to Borneo.

HABITAT. Beside fast-flowing, bouldery lowland streams and rivers.

SPECIMENS EXAMINED—BORNEO. SABAH: *Dewol* SAN 80131 (SAN); *Madani* SAN 134026 (SAN); *Mikil* SAN 37779 (SAN); *Sumbing* SAN 110201 (SAN); *Omar* SAN 106924 (SAN). **SARAWAK:** Baram, Sungei Tutoh, *Chew* CEL 1088 (K); *Beccari* 3863 (K); *Chai & Ilias* S. 31108 (SAR); *Chai* S. 39728 (SAR). **BRUNEI:** Temburong river, *Wong* WKM 1287 (BRUN, K); Kuala Belalong, *Dransfield* JD 6665 (BRUN, K); Temburong river, upstream from Wong Nguan, *Coode* 6559 (K); along Temburong and Belalong rivers, *Jacobs* 5639 (K, L).

Beccari cited his collection no. 3863 in For. Born. (1902) 524, fig. 65 (1), with the name *F. stenophylla*, but gave no description; Merrill validated this name, basing his description on a different specimen. The long, linear leaves (as shown in Cammerloher's figure) and rheophytic habit of this species are unmistakable.

Fig. 13. *Fagraea stenophylla*, collected along the Temburong River in Brunei (*Wong* WKM 1287). (Photo by K.M. Wong.)

17. Fagraea teysmannii Commerl.

Bull. Jard. Bot. Btzg. 3, 5 (1923) 314, f. 3. Syntypes: *Jaheri* 1430, Exp. Nieuwenhuis 1896-97, Kalimantan, Bloe-oe (L); *Teysmann* s.n., Karimata, Soengei Tajan (L); *Jaheri s.n.*, 1893, Borneo (L); *Teysmann s.n.*, Landak Ngabang (L). Lectotype (here chosen): *Teysmann s.n.*, Karimata, Soengei Tajan (L).

F. racemosa sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Jack ex Wall. (1824).

DISTRIBUTION. Endemic to Borneo.

HABITAT. Apparently restricted to mountains.

SPECIMENS EXAMINED—BORNEO. SABAH: Keningau, path to Tambunan, 3.5 mile W of Kaingaran village, *Wood & Wyatt-Smith* SAN A 4382 (L). **SARAWAK:** Mount Dulit, Native Coll. *Richards* 1961 (K); Mount Dulit, *Richards* 1712 (K); Mount Dulit, *Richards* 1887 (K); Mount Dulit, Ulu Koyan, *Synge* S 489 (K). **KALIMANTAN:** Bloe-oe. Exp. Niewenhuis, *Jaheri* 1430 (syntype, L); Karimata, Soengei Tajan, *Teysmann s.n.* (syntype, L, here chosen as lectotype).

Two syntypes cited by Cammerloher, *Jaheri s.n.*, 1893 (L) and *Teysmann s.n.*, Landak Ngabang (L) are *F. volubilis* var. *microcalyx* Wong & Sugau. The lectotype chosen here matches the figure accompanying Cammerloher's original description.

18. Fagraea volubilis Wall.

in Roxb., Fl. Ind. 2 (1824) 36. Type: *Jack*, E. Bencoolen (Herb. Wallich, sheet marked "1600. E. Bencoolen" on bottom left) (holotype K).

var. **volubilis**

F. morindaefolia Bl., Rumphia 2 (1838) 32, t. 73 f. 2, t. 79. Type: *Blume*, Java (holotype L: sheets 908.127-731 and 908.127-721; isotype K).

F. coarctata Bl., Rumphia 2 (1838) 33. Type: *Zippelius, s.n.* (L: sheet no. 908.127-620).

F. scholaris Blco., Fl. Filip. ed. 2 (1845) 93; ed. 3, 1 (1877) 171. Type: *Merrill*: Species Blancoanae no. 163, Luzon, Rizal, Antipolo (isotype K).

F. appendiculata Bl., Mus. Bot. 1 (1850) 169. Type: *Zippelius*, Nov. Guinea (L: sheets 908.127-701 and 908.127-702).

F. subreticulata Bl., Mus. Bot. 1 (1850). Type: *Blume*, Java (L: sheet no. 908.127-608).

F. latifolia Miq., Fl. Ind. Bat. 2 (1857) 369. Type: *Teysmann*, Sumatra, bij Sadjoendjoeng (L).

F. rodatzii Laut. & Schum., Fl. Schutzgeb. (1900) 499. Syntypes: *Hollrung* 628, New Guinea, "Kaiser Wilhelmsland, Constantinhafen" (K); *Hollrung*, "Augustafluss, erste Station" (L); Rodatz u. Klink 118, "Ramufluss" (L).

F. grandifolia Merr., J. Str. Br. R. As. Soc. 77 (1917) 231. Type: *Hose* 742, Sarawak, Baram, Miri river (holotype K, isotype L).

F. racemosa var. *pauciflora* K. & G. J. As. Soc. Beng. 74, 2 (1908) 609. Syntypes: King's Coll. 707, 1926, 3016, 3242 (K), Perak; Scortechini 112, Perak (K); Ridley 6315 (K), 8917, Singapore (K).

F. pauciflora (K. & G.) Ridl., Fl. Malay Pen. 2 (1923) 419, f. 110. Types as for *F. racemosa* var. *pauciflora*.

F. racemosa sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Jack ex Wall. (1824).

DISTRIBUTION. Malaya, the Andaman and Nicobar Islands, Sumatra, Java, Borneo, Celebes, Moluccas, Philippines, New Guinea.

HABITAT. Lowland forest, including secondary forest and forest fringes.

SPECIMENS EXAMINED—BORNEO. SABAH: Kota Belud, Ambong, *Kandali* NBFD 7117 (K); Labuk Bay, Linkabo, *Ridley* 9082 (K); Weston, Kg. Huasai, *Suleiman* NBFD 2188 (K). **SARAWAK:** 1st Div., Tebakang, Bkt. Rawan, *Awa & Ilias* S 45563 (K); Bako N.P., Lintang Patah, *Carrick* 3306 (K); Bako N.P., Telok Asam, *Chai & Ilias* S 17830 (K); Miri river, *Hose* 742 (K); 1st Div., Bau/Lundu road, 17th mile, G. Undan, *Yii* S 45934 (K). **KALIMANTAN:** Sei Sampit, Kec. Mantaya Hilir Utara, Banendang, *Afriastini* 307 (BO, K); Danau Sentarum Wildlife Reserve, Belitung River, *Giesen* 85 (BO, K); Bangarmassing, *Motley* 1163 (K). **PALAWAN.** Palawan, Pagdanan Range, Ibangley Brookeside Hill, *Podzorski* SMHI 888 (K); Palawan, St. Paul's Bay, mining road from Cabayungan to Marapati beach, *Ridsdale* SMHI 1635 (K). **PHILIPPINES.** Luzon, Batangas Prov., *Cuming* 1506 (K); Bohol Is., *Cuming* 1814 (K); Mindanao, Agusan Prov. Cabadbaran, *Elmer* 13979 (K); Leyte, Palo, *Elmer* 7160 (K); Panay, Capiz Prov., Jamindan, *Ramos & Edano* Bur. Sci 31194 (K); Mindoro, Calapan, Mangubat Bur. Sci. No. 922 (K); Biliran Is. Mt. Suiro, *Sulit* PNH 21611 (K).

This rather variable species assumes forms with short or long inflorescences that are not obviously branched or have distinct branches, and which have flowers that are subsessile to

long-pedicelled, but these character states intergrade and all are united by the consistent size of the flower, a rather constant corolla form and calyx lobes that spread out from (rather than tightly clasp) the base of mature fruits.

F. racemosa has shorter inflorescences (1–7 cm) that are never distinctly branched and which have very closely arranged flowers or flower-groups (nearly touching), whereas the more variable *F. volubilis* has inflorescences that vary in length (2.5–17 cm) and branching (from elaborately to indistinctly branched), with flowers or flower-groups that are relatively well spaced (the inflorescence rachis always clearly visible). Moreover, the habit of the calyx lobes in the mature fruit is distinctive, that in *F. racemosa* tightly clasping the base of the fruit, whereas they spread out away from the fruit base in *F. volubilis*. This habit of the calyx lobes clasping the fruit base correlates with different corolla forms that in other species help distinguish them from *F. racemosa*. As far as can be ascertained, *F. racemosa* occurs in Indo-China and the Malay Peninsula, and also Sumatra (where it is apparently rare; the two collections, *Bartlett* 8702 and *Soepadmo* 38, of this species were collected after Cammerloher's account, in 1927 and 1960, respectively). The variability of *F. volubilis* is reflected by a somewhat large synonymy that has also been correctly grouped with this name by Leenhouts (1962), albeit under the name *F. racemosa.*

Perhaps some confusion in the typification of Wallich's *F. volubilis* could have contributed to its being equated with *F. racemosa.* In the Wallich herbarium at Kew, there are two sheets labelled "Fagraea volubilis Jack". The one marked "1600.E Bencoolen" on the bottom left is to be regarded as the type of *F. volubilis* Wall., as it fits Wallich's description: "A native of Bencoolen, from whence Mr Jack indulged me with beautiful fruit-bearing specimens...raceme...a foot or more in length...of numerous, opposite, twice dichotomous, spreading racemuli..." The other sheet, on which is marked "1600 Herb. Finl. [= Finlayson]" at the bottom left, is *F. racemosa* Jack ex Wall.; it is to be dismissed from the typification of *F. volubilis* Wall. Although Ridley (1894: 164) points out that it is possible some of Jack's specimens distributed by Wallich as from Penang were really collected in Sumatra, it cannot be ascertained if the reverse has not occurred with specimen "1600 Herb. Finl.". Although *F. racemosa* Jack ex Wall. is common in Penang (and, indeed, the next number in Wallich's catalogue, 1601, is its type, collected from Penang by Porter), it also occurs in Sumatra. Both sheets marked "Fagraea volubilis" in Wallich's herbarium could represent an originally mixed collection presented as one species, or it could have been that specimens from Bencoolen (Sumatra) and Penang were confused during distribution.

It is unfortunate that we are resigned to using *F. volubilis* for a species that has the habit of an erect shrub or tree. Wallich must have coined the epithet *volubilis* (Latin, "twining") because of the likeness of the long, slender, pendulous infructescence in Jack's Bencoolen specimen to those of many garden vines.

Fagraea volubilis var. **microcalyx** *Wong & Sugau* **var. nov.** *a var. volubili lobis calycis brevioribus (1.5–2.5 mm longis) differt. Typus: Burley, Tukirin et al. 372, Kalimantan, 5 km, NE of Haruwu village (holotypus KEP).* (Fig. 14)

F. ligustrina Bl., Rumphia 2 (1838) 33. Type: *Blume*, Moluccis (L: sheets no. 908.127-525, 908.127-540, 908.127-550). Including var. *disparifolia* Bl., type: L: sheet no. 908.127-520.

F. cordifolia Bl., Rumphia 2 (1838) 33. Type: *Zippelius*, Molucc. (L: sheet no. 908.127-453).

F. gracilis Cammerl., Bull. Jard. Bot. Btzg. 3, 5 (1923) 316, f. 4. Type: *Jaheri* 169, Exp. Nieuwenhuis 1896-97 (L).

F. racemosa sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Jack ex Wall. (1824).

Small tree, up to 7 m tall; bole 12 cm diameter. Leaves elliptic, ovate to lanceolate, 8–12 × 2–10, coriaceous, upper and lower surfaces smooth, base cuneate, rounded to cordate, margin plane, apex acuminate to short caudate; midrib prominent, rounded; lateral veins 5–10 pairs, upper side faint to obscure, lower side prominent to faint; reticulations obscure; leaf stalks 0.6–2 cm long, axillary scale developing above the leaf-stalk base and tightly clasping the stem. Inflorescence a many-flowered panicle, 2–15 cm long, peduncle 1.5–5.5 cm long, branch clusters well-spaced to close, first order indistinct, 2 mm long, second order indistinct, third order absent; pedicel 2–4 mm long. Calyx 4–5 mm long, 3.5–4.5 mm wide, calyx lobes 1.5–2.5 mm long. Corolla broadly infundibular, 25–30 mm long, narrowed basal part 10–12 mm long, expanded upper part 8–10 mm long, 11–12 mm wide, corolla lobes semi-orbicular to ovate, 7–8 cm long. Stamen-filaments inserted at the base of the inflated part of the corolla; anthers included, 1.5–2 mm long. Style 0.8–2.3 cm long; stigma capitate. Fruit ovoid to ellipsoid, 10–14 mm long, 7–11 mm wide, fruit calyx patent. Seeds minute, blackish brown, numerous.

DISTRIBUTION. Borneo (Sarawak, Brunei, Kalimantan) and the Moluccas.

HABITAT. Lowlands: peat swamp, mixed dipterocarp forest and *kerangas* forest.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Sibu, path from Rantau Panjang to sg. Teku, *Anderson* 9869 (K); Rejang, Lepah P.F., *Anderson* 8082 (K); Sibu, Naman F.R., Sg. Assam, *Bujang* S. 9170 (K); Kuching, *Haviland* 592 (K), 933 (K), 1780 (K), 2275 (K), 3065 (K); Matang, *Haviland* 678 (K); *Hewitt series* 1083 (K), 1084 (K), 1086 (K); *Hullett* 358 (K); 1st Div., Simunjan, Gunung Gaharu, *Ilias & Azahari* S 35683 (K, SAR); 1st Div., Bau/Lundu road, 25 mile, Sampadi F.R., *Ilias* S 25270 (A, E, K, L, SAR, SING); 1st Div., Bau/Lundu road, 26 mile, Sampadi F.R., *Ilias* S 26196 (K, SAR); 1st Div., Bau/Lundu road, 25th mile, Sampadi F.R., *Ilias* S 26995 (K, SAR); 4th Div., Bintulu, Nanga Saplow, Segan F.R., *Ding Hou* 468 (K, L); Serian, Sabal F.R., *Nahar* 12717 (K); Matang, *Ridley s.n.* (K);

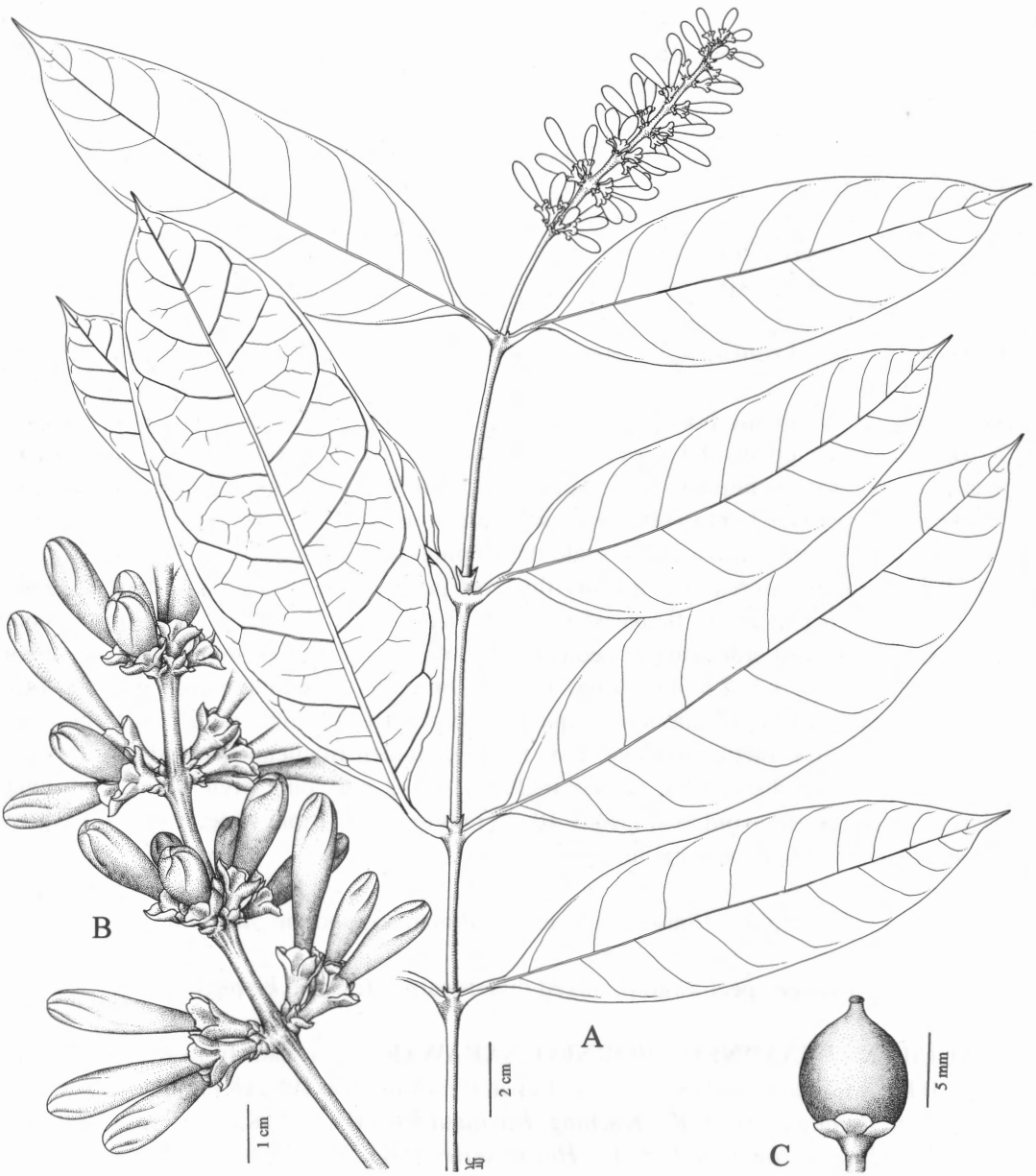

Fig. 14. *Fagraea volubilis* var. *microcalyx*. **A.** Leafy flowering branch. **B.** Detail of inflorescence. **C.** Fruit. All from S. 35683.

Sibu, Naman F.R., *Sanusi* S 9179 (K); Binatang, Pulau Bruit, *Sanusi* S 9237 (K); Binatang, Pulau Bruit, *Sanusi* S 9267 (K); Sibu, Naman F.R., *Sanusi* S 9756 (K); Kuching, *Sarawak Museum series* 300 (K). **BRUNEI:** Belait, Badas sawmill, *Brunig* S. 1118 (K). **KALIMANTAN:** *Burley, Tukirin et al.* NGS 372 (BO, SAN); headwaters of Sg. Kayahan, 5 km NE of Haruwu Village, *Burley, Tukirin et al.* 450 (K); Bt. Badinging, KCT 47 km, *Veldkamp* 8516 (BO, L, SAR). *Jaheri s.n.* (L); Landak Ngabang, *Teysmann s.n.* (L).

This distinct variety has been diagnosed to be different from *F. volubilis* var. *volubilis* in having a smaller calyx (4–5 mm long, 3.5–4.5 mm wide) with lobes 1.5–2.5 mm long.

Fagraea section *Fagraea* in Borneo and related species

The main distinguishing characters of this section include large fruits (always exceeding 25 mm across, often larger) with the epidermis pustulating and peeling off on drying, ellipsoid-rounded seeds, and inflorescences of only a solitary flower or with well developed primary branches that rebranch typically only once (and exceptionally to 3 orders in one species, *F. floribunda*). The axillary scales found in members of this section develop above the leaf-stalk base and loosely clasp the stem.

By far, this is the most speciose section of the genus, and various life forms in addition to trees, such as climbers, epiphytes and stranglers have evolved in this section. In the following key, only species occurring in Borneo are dealt with, although in the enumeration that follows, further species that do not occur in Borneo but which are related are included.

KEY TO *FAGRAEA* SECT. *FAGRAEA* IN BORNEO

1a. Trunk and branches armed with prickles. Leaf margin minutely crenulate .. *F. crenulata*

1b. Trunk (stems) and branches unarmed. Leaf margin not crenulate, at most slightly and irregularly wavy.

2a. Leaf-stalk bases typically developing distinct, rim-like or large lobe-like auricles that are usually reflexed.

3a. Leaf blade decurrent along the stalk, forming distinct wings several mm wide all along the stalk, and continuing into the leaf-stalk auricle. (Flowers not known) .... *Fagraea* sp. A

3b. Leaf blade not decurrent along the stalks, or only very slightly so and never more than 1 mm wide, distinct from the leaf-stalk auricle.

4a. Lateral veins on the lower leaf surface distinct and prominent. Flower subtended by an involucre of large bracts. Corolla tube inside pale floccose at the middle part ..... *F. macroscypha*

4b. Lateral veins on the lower leaf surface obscure or only very slightly distinct. Flowers not subtended by any involucre or (in *F. involucrata*) with such an involucre. Corolla tube inside completely glabrous or (in *F. involucrata*) pale floccose at the middle part.

5a. Leaf apex obtuse, rounded or with only an inconspicuous tip.

6a. Flowers solitary or only 3–5 per inflorescence. Corolla tube at least 5 cm long.

7a. Flowers solitary. Corolla tube 13–14 cm long. Calyx lobes 3.5–4 cm long. Leaf blades typically very large, 28–29 × 12–13 cm. ..... *F. megalantha*

7b. Flowers 3–5 in a cyme. Corolla tube 6–9 cm long. Calyx lobes 2.5–3 cm long. Leaf blades typically smaller, 12–19 × 6–10 cm. ..... *F. auriculata*

6b. Flowers many (up to *c.* 40) per inflorescence. Corolla tube not exceeding 3 cm long ..... *F. kalimantanensis*

5b. Leaf apex acute, caudate or distinctly cuspidate.

8a. Flowers solitary, subtended by an involucre of bracts. Corolla tube inside pale floccose at the middle part. Inflated upper part of corolla tube bell-shaped. Leaf-stalk auricles large and conspicuous, resembling lobes ..... *F. involucrata*

8b. Flowers 3–5 in a cyme, without any involucre. Corolla tube inside completely glabrous. Inflated upperpart of corolla tube trumpet-shaped. Leaf-stalk auricles 1–2 mm wide only, resembling rims ..... *F. borneensis* (typically)

2b. Leaf-stalk bases without auricles, or these auricles very indistinct and easily overlooked (*F. resinosa*).

9a. Lateral veins on lower leaf surface distinct and prominent on drying.

10a. Cyme subsessile, the flowers individually subtended by bracts 1–1.5 cm long forming a loose involucre. ..... *F. iliasii*

10b. Cyme distinctly stalked, the flowers not subtended by any unusually large bracts.

11a. Inflorescence a laxly branched cyme 14–16 cm long, the primary branches rebranching to 3 orders. ..... *F. floribunda*

11b. Inflorescence with condensed branches or laxly branched but never exceeding 10 cm long, the primary branches rebranching only once.

12a. Leaves thick-coriaceous, the stalks massive (5–8 mm thick). Inflorescence with condensed branches. Calyx lobes in flower 10–12 mm long. ..... *F. ridleyi*

12b. Leaves thin-coriaceous, the stalks slender (2–3 mm thick). Inflorescence with distinct elongate branches. Calyx lobes in flower 5–8 mm long. ..... *F. renae*

9b. Lateral veins on lower leaf surface indistinct, or sunken on drying.

13a. Flowers subtended by an involucre of enlarged bracts.

14a. Calyx and most of the involucre bracts ellipsoid with rounded apices. Leaf-stalk bases developing small, inconspicuous auricles. ..... *F. resinosa*

14b. Calyx and most of the involucre bracts with acute-pointed apices. Leaf-stalk bases clearly without auricles.

15a. Leaf blades narrowly elliptic, the apex acute-caudate. Leaf stalks longer, 2.2–4 cm long. Flowers 1–3, each on a short but distinct and thick stalk; involucre bracts typically keeled. ..... *F. kuminii*

15b. Leaf blades obovate, the apex cuspidate. Leaf stalks shorter, 0.5–2 cm long. Flowers solitary, the stalk hidden by the bracts and inconspicuous; involucre bracts without distinct keels. ..... *F. acutibracteata*

13b. Flowers without any involucre at their base.

16a. Flowers solitary.

17a. Corolla tubular to narrowly infundibular, the tube 8.5–15 cm long. .... *F. carnosa*

17b. Corolla short-infundibular, the tube 3–4.5 cm long.

18a. Corolla lobes larger, 3.5–4 cm long, 2–2.5 cm broad. Leaf stalks 1.2–3 cm long and leaves elliptic. ..... *F. stonei*

18b. Corolla lobes smaller, 1.8–2.2 cm long, 1.5–2 cm broad. Leaf stalks less than 1 cm long if leaves elliptic (*F. kinabaluensis*), or when longer (1–2.2 cm) then leaves distinctly obovate.

19a. Leaves obovate, the stalks 1–2.2 cm long. Upper part of corolla tube at most 1 cm across at the mouth. ..... *F. dulitensis*

19b. Leaves elliptic or only very slightly obovate, the stalks less than 1 cm long. Upper part of corolla tube more flared, 2–2.5 cm across at the mouth. ..... *F. kinabaluensis*

16b. Flowers (2–)several in a cyme.

20a. Inflorescence a tight cluster of many flowers, the branches condensed and hidden by the flowers themselves (in fruit the axes visible but still short, supporting many fruits). ..... *F. splendens*

20b. Inflorescence a few-flowered cyme or, if many-flowered, the branches distinct and not hidden by the flowers.

21a. Leaf apex obtuse-rounded. Leaves drying black or dark brown. .... *F. tuyukii*

21b. Leaf apex acute or shortly cuspidate or caudate. Leaves drying pale to dark greenish brown.

22a. Corolla tube more than 10 cm long ..... *F. borneensis* (in part; occasional specimens with weakly developed or indistinct leaf-stalk auricles)

22b. Corolla tube less than 8 cm long.

23a. Corolla tubular, the tube more than twice as long as the lobes. .... *F. havilandii*

23b. Corolla infundibular, the tube less than twice as long as the lobes.

24a. Corolla throat 5–8 mm across.

25a. Leaf blades decurrent to the base of their stalks, which are broadly winged. Ultimate branches developing broadened, somewhat corky and very short internodes that form a series of coarse cicatrices along the branches. ..... *F. oreophila*

25b. Leaf blades not completely decurrent along their stalks, which are always slender and distinct. Ultimate branches not as above: such nodal cicatrices if developing always far apart.

26a. Leaves small, to 9 × 2.5 cm, the apex caudate. Corolla tube 18–20 mm long. ..... *F. rarissima*

26b.Leaves typically larger, 8–15 × 3–6.5 cm, the apex acute to shortly cuspidate. Corolla tube 20–30 mm long. ..... *F. blumei*

24b. Corolla throat 10–20 mm across.

27a. Corolla tube with a base 5–7 mm across, gradually flared upwards. Leaves smaller typically, at most 3 cm wide. .... *F. longipetiolata*

27b. Corolla tube with a base only 1–2 mm across, abruptly flared upwards. Leaves larger typically, 3–10 cm wide.

28a. Flower calyx lobes small, 2–4 mm long. Leaves narrowly obovate-elliptic to oblong. Upper leaf surface parchment-like when dry. ..... *F. oblonga*

28b. Flower calyx lobes larger, 7–8 mm long. Leaves broadly ovate to elliptic. Upper leaf surface coarsely shagreen when dry. ..... *F. littoralis* (var. *borneensis*)

Notes on the species

19. Fagraea acutibracteata *Wong & Sugau* **sp. nov**. *F. gardenioidi Ridl. similis, sed foliis venis lateralibus obscuris differt. Typus: Lee S. 44032, Sarawak, 2nd. Div., Lingga, Bukit Senyandang (holotypus SAN, isotypi K, KEP, L).* (Fig. 15)

Woody climber up to 6.5 m tall (sometimes erroneously recorded as a tree); bole *c.* 20 cm diameter. Bark reddish brown. Leaves obovate, 9–14.5 × 3.5–5 cm, thin coriaceous, upper and lower surfaces smooth; base attenuate, margins plane, apex obtuse with 1–1.5 cm acumen; midrib prominent, faint towards the apex; lateral veins obscure; reticulations invisible to obscure; leaf stalks 0.5–2 cm long, axillary scale slightly conspicuous, adnate to leaf stalk base. Flower solitary, subsessile; bracteoles 2–3 pairs, closely attached to calyx cup base, longer than the calyx, 20–30 mm long. Calyx 1.5–2 cm long, 1–1.2 cm diameter, divided to near the base, sepals lanceolate, apex acute-acuminate. Corolla unknown. Fruit ovoid (young), *c.* 2 cm long, 1.5 cm wide, fruit calyx lobes patent. Seeds rounded, dark brown.

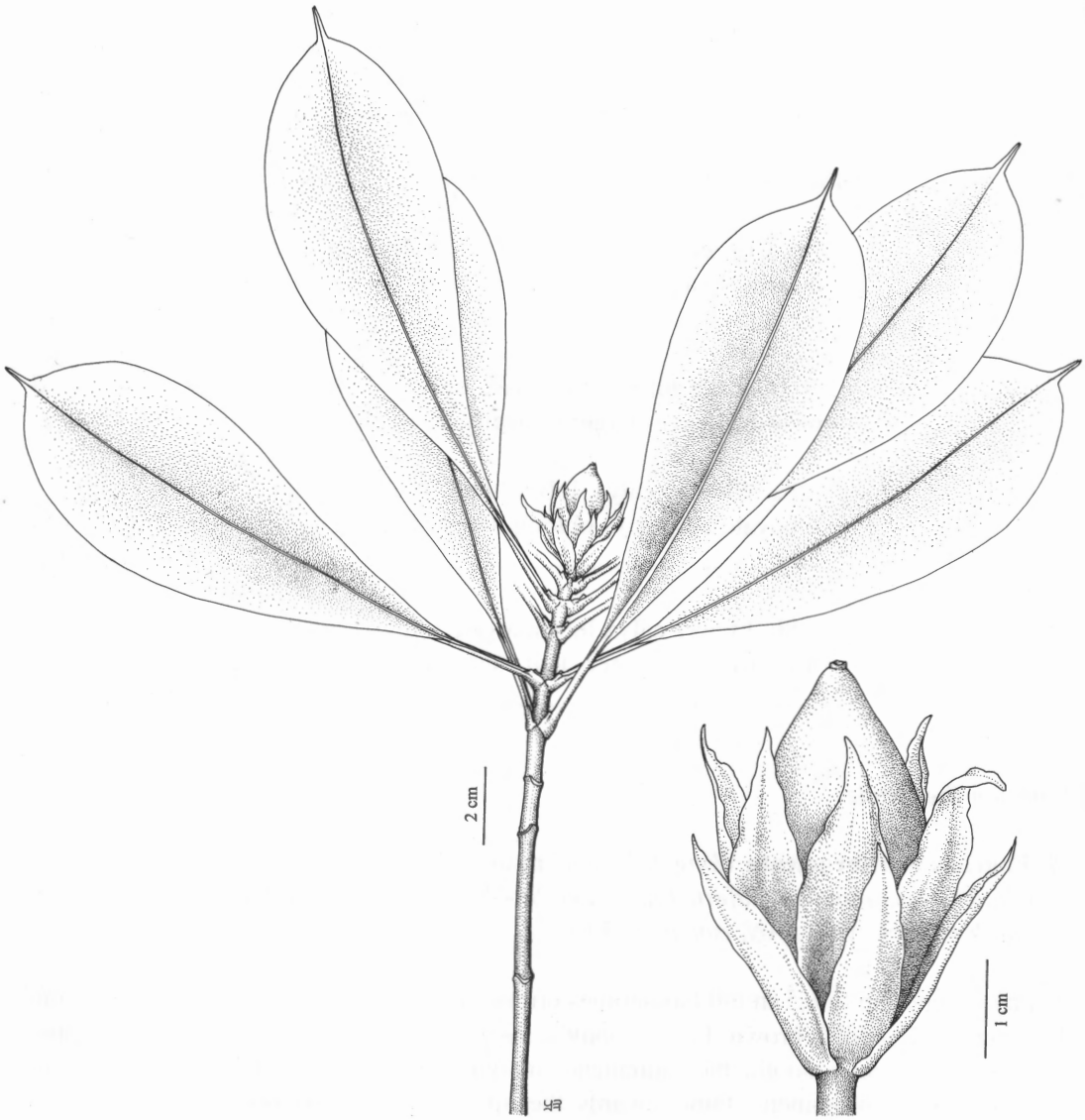

Fig. 15. *Fagraea acutibracteata*. Fruiting specimen and detail of fruit. From S. 44032.

DISTRIBUTION. Borneo (Sarawak), so far known only from the type.

HABITAT. On sandstone rocks at 550 m.

Vegetatively, *F. acutibracteata* most resembles *F. dulitensis* Wong & Sugau in being a small tree with obovate and thin coriaceous leaves whose margins are plane. However it is distinct from *F. dulitensis* by its 2–3 pairs of bracteoles, closely attached to calyx cup base, very conspicuous (25–30 mm long) and longer than the calyx. This distinct species also vegetatively resembles *F. oreophila* Wong & Sugau except that it has 2–3 pairs of bracteoles. It differs from *F. kuminii* Wong & Sugau in its obovate leaves with shorter stalks (0.5–2 cm long), and solitary flowers where the peduncle is hidden by the bracts.

20. Fagraea auriculata Jack (Fig. 16)

Mal. Misc. 2, n. 7 (1822) 82. Neotype (here chosen): *Wray* 2913, Perak (L).

F. auriculata sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte*.

DISTRIBUTION. Borneo, Malaya Peninsula, Java and Indo-China.

HABITAT. Lowlands and hills, up to 1930 m.

SPECIMENS EXAMINED—BORNEO. SARAWAK: No locality, *Hewitt* series 1132 (SAR); Gat, Upper Rejang River, *Clemens* 21597 (SAR); Bidi, August 1907, *Hewitt* series 720 (SAR); Kuching, Telok Asam, sea level, *Anderson* S 8979 (SAR). **KALIMANTAN:** Bangarmassing, *Motley* 704 (K). **MALAYA.** *sine loc.* (? Malacca), *Maingay* 1025 (L); Pahang/Selangor, Ulu Kali, *Whitmore* FRI 12214 (L), FRI 15551 (L); Perak, Goping, *King's Coll.* 8125 (L); Perak, *Wray* 2913 (L, neotype); Pahang, Cameron Highlands, *Symington* KEP 36092 (L); Singapore, Pulau Pawai, *Sinclair s.n.* (L). **JAVA.** Udjung Kulon Nature Reserve, *Wirawan* 270 (K).

The treatment of this species by Leenhouts (1962) is not followed here. His *F. auriculata* subsp. *borneensis* and subsp. *parviflora* are to be abandoned, as they represent the distinct species, *F. borneensis* and *F. euneura* (see there), respectively.

At the Leiden herbarium a number of flowering specimens of *F. resinosa* were determined by Leenhouts as *F. auriculata* subsp. *borneensis*. Leenhouts (1962), in noting that his *F. resinosa* was only known by specimens in fruit and flower-bud stages, had clearly overlooked that these flowering specimens (marked with an asterisk under *F. resinosa* in this account) were montane, as were other collections he had placed under the species; whereas *F. borneensis* (which he considered *F. auriculata* subsp. *borneensis*) is a lowland

Fig. 16. *Fagraea auriculata*, at the Genting Highlands in Peninsular Malaysia. (Photo by K.M. Wong.)

taxon. The corolla in *F. resinosa* is merely half the length of that in *F. borneensis*, although both taxa have tiny leaf-stalk auricles.

In his *F. auriculata* subsp. *auriculata* we find the following four distinct components: *F. auriculata* Jack (south Thailand, Malaya, Java, Borneo), *F. imperialis* Miq. (Sumatra, Java), *F. epiphytica* Elmer (Philippines) and a species here named *F. megalantha* Wong & Sugau (known only from Sarawak in Borneo). A partial key to distinguish these species is given below, where corolla characters used are those of the dried state (making allowance for shrinkage of the corolla during drying).

1a. Flower very large (corolla tube 13–14 cm long when dry). ..... *F. megalantha*
(see species no. 39 here)

1b. Flower smaller (corolla tube less than 12 cm long when dry).

2a. Leaves with 8–9 pairs of lateral veins; leaf-stalk auricles indistinct, resembling a thickened ridge only about 2 mm high; basal cylindrical part of corolla tube as long as upper inflated part. ..... *F. epiphytica*
(see species no. 26 here)

2b. Leaves with 5–7 pairs of lateral veins; leaf-stalk auricles large and patent to reflexed, to 10 mm across; basal cylindrical part of corolla tube shorter than upper inflated part.

3a. Branch internodes without ridges or with only a weak median longitudinal ridge on each side; flowers solitary or 3–5 in a cyme; bracteoles at base of flower acute ..... *F. auriculata*

3b. Branch internodes with 2 ridges running downwards from the leaf-stalk bases on each side; flowers solitary; bracteoles at base of flower rounded. .... *F. imperialis*
(see species no. 31 here)

We have seen no specimen that can be considered the type of Jack's species *F. auriculata*, but it is clear that the taxon distributed in Malaya (including Singapore) is what Jack intended as this species; none of the other three species in this complex is known so far from Malaya. Judging from collectors' notes, this species is most likely a strangler or large epiphyte.

Apparently Jack (1822) provides no type for his species *Fagraea auriculata*. In his account, he only mentioned that the species was first found by him in Singapore and again in the West Coast of Sumatra at Tapanuly. Also, Merrill (1952) showed clearly that there is no type provided for Jack's *F. auriculata*.

21. Fagraea blumei G. Don

Gard. Dict. 4 (1837) 69 (as "*blumii*"). Type: *Blume, s.n.,* Java (L: sheet no. 908.127-758).

F. obovata Bl., Bijdr. (1826) 1021, *nom. illeg., non* Wall. (1824). Type: *Blume, s.n.*, Java (L: sheet no. 908.127-758).

F. obovato-javana Bl., Rumphia 2 (1838) 29, t. 75, incl. var. *bebeak* Bl. Type (as for *F. obovata* Bl.): *Blume, s.n.*, Java (L: sheet no. 908.127-758).

F. vaginata King & Gamble, J. As. Soc. Beng. 74, 2 (1908) 610, *pro parte* (syntypes from Java only; syntypes from Malaya = *F. renae* Wong & Sugau). Lectotype (here chosen): *Forbes* 827, Java (L).

F. obovata sensu Bakh. *f.* in Backer, Bekn. Fl. Java 7 (1948) fam. 170: 11, incl. var. *brevicalyx* Bakh. *f.*, Blumea 6 (1950) 382: lectotype (here chosen): *Leeuwen, s.n.*, Oct. 1921, Java, Tjibodas (L).

F. blumei sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte*.

DISTRIBUTION. Borneo, Malaya Peninsula, Java and Sumatra.

HABITAT. Primary forest, mostly in highland areas.

SPECIMENS EXAMINED—BORNEO. SABAH: Kinabalu, Tenompok, *J & M.S. Clemens* 26177-26888 (K), *s.n.* 4 March 1932 (L); Ranau, Mt. Kinabalu, Liwagu Trail, *Aban* SAN 60597 (L); Kinabalu, Mosilau Trail, *Sinanggol* SAN 48023 (L); Kinabalu, Mesilau River, *Chew & Corner* RSNB 4121 (K, L); Kinabalu, Marai Parai, *Wong et al.* SAN 134755 (SAN). Ranau, Kundasang, *Anderson* S. 25591 (K, SAR); Gunong Alab, 1500 m, *Nooteboom* 964 (L, SAN). **SARAWAK:** Kalabit Highlands, G. Murud, *Nooteboom & Chai* 1974 (L); Baram, G. Mulu, path from Sg. Melinau Paku, *Anderson* 4243 (L); Kapit, ridge between Sungai Balang and Sg. Balleh, *Anderson & Ilias* S. 28272 (L); Lundu, G. Gading, *Anderson* 15387 (L). **JAVA.** *Blume, s.n.* (Leiden sheet no. 908.127-758)(L, type); *Junghuhn, s.n.*, (Leiden sheet no. 908.127-1213) (L); Cibodas, *Aya Nitta* 15145 (L); Poentjak, *Buwalda* 8078 (L); *de Vriese, s.n.*, (Leiden sheet no. 908.127-495) (L); Preanger, Pangentjongan, Telaga Bodas, *Kooders* 4321B (L); Tjobodas, *Drs. v. Leeuwen s.n.* (Leiden sheet no. 923.157.1259) (L).

The principal diagnostic characters of *F. blumei* are leaves with only 2–3 pairs of secondary veins that are obscure to only rather faintly visible on the lower side; the lack of leaf auricles; and a typically well-branched (4–7-cm-long) inflorescence. The flowers are smaller than those of *F. ridleyi* King & Gamble (as based on Leenhouts' lectotypification of

this species), and the character of whether or not the fruit stalks and calyces, and inflorescence axes are lenticellate cannot be used to distinguish between *F. blumei* and *F. ridleyi*.

Leenhouts (1962) also erroneously included in his concept of *F. blumei* a number of specimens from Malaya (including some of the syntypes of King and Gamble's *F. vaginata*, which he reduced to synonymy under *F. blumei*) and from Borneo which represent an undescribed taxon named *F. renae* Wong & Sugau in the present account. The Philippine material ascribed to *F. blumei* subsp. *blumei* by Leenhouts has leaves with very thick, short stalks and decurrent blades, and should be excluded on this evidence; the flowering material on these is poor and does not lend itself to proper interpretation. Leenhouts' *F. blumei* subsp. *plumeriaeflora*, from the Philippines, is a distinct species: it has bigger leaves with more and clearer veins, larger flowers and distinctive narrowly ellipsoid (not obovoid-globose) fruits. On this account, *F. plumeriaeflora* DC. should be reinstated. True *F. blumei* does not appear to occur in Malaya and the Philippines, and as here understood is distributed in Java, Sumatra and Borneo. Material from Celebes included under this species by Leenhouts is heterospecific, none corresponding to true *F. blumei*.

In addition, Leenhouts (1962) also included some true *F. blumei* material under the name *F. ceilanica*.

22. *Fagraea borneensis* Scheff. (Fig. 17)

in Hassk. Flora 52 (1869) 309. Type: *Lobb*, s.n., "Sarawak" (K).

F. nonok Elmer, Leafl. Philip. Bot. 3 (1910) 858. Lectotype (here chosen): *Elmer* 12285, Sibuyan Island (L).

F. auriculata ssp. *borneensis* (Scheff.) Leenh., Fl. Males., 1, 6 (1962), *pro parte.*

F. resinosa sensu Leenhouts, Fl. Males, 1, 6 (1962), *pro parte.*

DISTRIBUTION. Borneo and Philippines.

HABITAT. Lowlands and highland areas, also in swampy areas and on limestone. Once recorded from "rocks near seaside".

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau, Quoin Hill road, *Aban* SAN 32436 (L); Sipitang, Hutan Simpan Kuala Mengalong, *Amin* SAN 106015 (SAN), Mengalong F.R., seaside, *Talib* SAN 84375 (L, SAN); Sandakan, Sg. Kapur, *Meijer* SAN 22617 (K); Ranau, mile 55, Lohan, *Sadau* SAN 49234 (K); Tawao, *Elmer* 20623 (K, L). **SARAWAK:** 3rd Div., Daro F.R., Tanjong Belatok, sample plot 17, *Anderson* S 29378 (K);

Fig. 17. *Fagraea borneensis*, at the Tutong white sands in Brunei (*Dransfield* JD 6516). (Photo by K.M. Wong.)

Baram, Tutoh, Ulu Melinau, Gunung Api, *Anderson* S 30889 (L); Bako N.P., Telok Paku, *Chai* S 18017 (K, L, SAN, SING), Pulau Lakei, *Carrick & Enoch* JC 383 (K, L); Miri, Kebaleh, in swamp forest near stream, *Dan* S 4394 (A, B, K, L, NB, S); Kuching, *Haviland* 3066 (K); Serian, Gunong Penrissen, *Ilias* S 16399 (SAR). **BRUNEI:** Tutong, Pasir Putih, *Dransfield* JD 6516 (K); Kuala Belait-Kuala Baram road, *Corner* BRUN 5362 (BRUN, K, L); Ranggau area and Brunei river, mangrove swamp, *Ashton* BRUN 5120 (K, L). **KALIMANTAN:** E. Borneo, along Mahakam River, *Kostermans* 9540 (K, L), *Endert* 1441 (K, L), Sangkulirang Island, *Kostermans* 4914 (K, L); headwaters of Kahayan River, *Burley, Tukirin et al.* 760 (K, L). **PHILIPPINES.** Mindoro, San Teodoro, 750 m alt., *Ridsdale* 1260 (L); Sibuyan Island, Capiz, Mt. Giting-Giting, *Elmer* 12285 (L).

In his account of the Loganiaceae of Malesia, Leenhouts recognized three subspecies in *Fagraea auriculata* Jack, *F auriculata* ssp. *auriculata*, *F. auriculata* ssp. *parviflora* and *F. auriculata* ssp. *borneensis*. Here we reinstate the last as a distinct species, *F. borneensis* Scheff. *F. borneensis* is distinct from *F. auriculata* Jack in having narrowly funnel-shaped corolla; auricles not well developed to distinct, not very large, 0.8–1.5 cm diameter; lateral veins 6–8(–11) pairs, indistinct to slightly distinct. The species is distributed throughout Borneo, in primary lowland as well as *kerangas* forest, and is an epiphytic climber or strangler.

23. F. carnosa Jack (Fig. 18A)

Malay. Misc. 2, n. 7 (1822) 81. Type: The type specimen of Jack's *F. carnosa* is apparently not available but the type-locality is cited as "In the neighbourhood of Bencoolen".

F. flavidula Ridl., Fl. Mal. Pen. 5 (1925) 322. Type: *Henderson* SFN 11673, Pahang, Cameron Highlands (L, isotype).

F. monantha Miq., Fl. Ind. Bat. 2 (1857) 373. Type: *Teysmann* HB 998, Sumatra, Sibogo (L, isotype).

F. uniflora Merr., J. Str. Br. R. As. Soc. 77 (1917) 235.

F. rotundifolia Ridl., J. Str. Br. R. As. Soc. 50 (1908) 117.

DISTRIBUTION. Borneo (Sarawak), Malay Peninsula, Lower Burma and Sumatra.

HABITAT. On sandstone soils in Mixed Dipterocarp Forest.

SPECIMENS EXAMINED—BORNEO. SABAH: Keningau, N Sinua, Trusmadi logging area, *Meijer* SAN 122605 (SAN). **SARAWAK**: 1st Div., Kuala Sg. Sarawak, *Chai et al.* S 38567 (L, SAR); Telok Belian, Gunong Santubong, 100 ft., *Ilias & Jugah* S. 35976 (L,

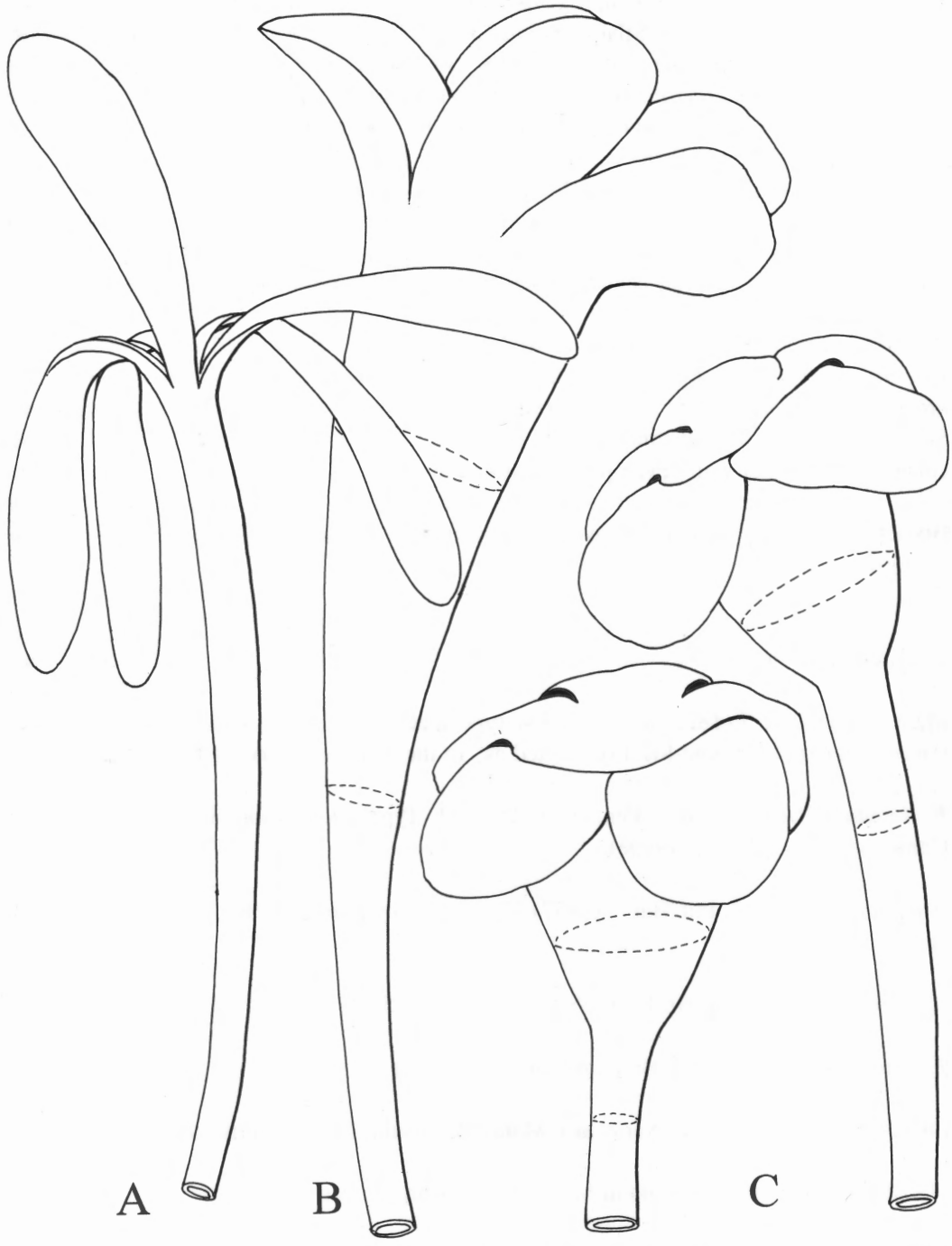

Fig. 18. Corolla form in three long-tubed species of *Fagraea*. **A.** *F. carnosa*. **B.** *F. macroscypha*. **C.** Two corollas of *F. involucrata*. Dashed lines are limits of a middle portion of the corolla tube which is floccose-hairy within; the tube of *F. carnosa* is entirely glabrous within. **A** from SFN 11673, **B** from *Beaman* 8867, **C** from SAN 20305 (left side) and SFN 8996.

SAR); Serian, Gunong Penrissen, *Ilias* S. 16399 (K, L, SAR). **KALIMANTAN:** NE Borneo, Bulungan, along Sebakis River, *Kostermans* 9332 (L). **MALAYA.** Pahang, Cameron Highland, *Henderson* SFN 11673 (L); Selangor, Bukit Takun limestone, 1500 ft., *Chin* 367 (KLU, L). **SUMATRA.** from Pajakumbuh 28 km towards Pakan Baru, Lubu Banka, *Jacobs* 4610 (L); Asahan, Paragambiran, *Rahmat* 6254 (L); Siboga, *Teysmann* HB998 (L).

This species, a shrubby epiphyte or climber, is easily recognized from its rather large slender and spindle-shaped calyx and tubular to long-infundibular corolla (corolla 8.5–15 cm long). The flowers are solitary. The leaves are very stiff when dry and usually have a minutely pointed apex.

24. Fagraea crenulata Maingay ex Clarke

in Hook. *f.* Fl. Br. Ind. 4 (1883) 83. Type: *Maingay*, Malacca (K).

DISTRIBUTION. Borneo (Kalimantan), Malaya, Sumatra and Indo-China.

HABITAT. Swampy forest and along rivers.

SPECIMENS EXAMINED—BORNEO. KALIMANTAN: Sei Bakambit Kapoeas, *Abar bin Adan* nr. 2141 (L); Banjarmasin, Serapat, *Boschproefstation* no. b.b. 10093 (L). **MALAYA.** Kuala Lumpur, Kepong, near FRI, *Yong* KEP 99616 (KEP); Selangor, Kepong, *Chan & Lau* KEP 115733 (KEP); Selangor, Kepong, *Chan & Lau* KEP 115731 (KEP); Selangor, Kepong, *Chan & Lau* KEP 115732 (KEP); Kuala Lumpur, *Carrick* J.C. 1548 (K, L, SING); *Scortechini*, Herbarium Mus. Perak 1642 (L); Singapore, Farrer road, *Hardial* 327 (L). **SUMATRA.** Res Palembang, Palembang by Talang Djava, *Boschproefstation* n. 469 (L); Acheh, *Kooders* N: 10643B (L); Bengkalis, Jalan Djil. heofelplaats, *Beguin* No. 362 (L).

The prickles on the trunk and branches distinguish this species.

25. Fagraea dulitensis *Wong & Sugau* **sp. nov**. *F.gardenioidi Ridl. similis, sed foliis venis lateralibus obscuris differt. Typus: Tong S. 34870, Sarawak, 4th Div., Marudi, Ulu Sg. Tinjar, Dulit Range, near Nanga Koyan (holotypus SAN, isotypi K, KEP, L, MO, SAR).* (Fig. 19)

Tree, up to 5 m tall; bole 5 cm diameter. Bark brown. Leaves obovate, 5–1.5 × 2–4.5 cm, thin coriaceous, upper and lower surfaces smooth; base attenuate to cuneate, margin plane, apex acute or shortly acute-acuminate; midrib prominent, faint towards the apex; lateral veins obscure; reticulations invisible to obscure; leaf stalks 1–1.5 cm long, axillary scale

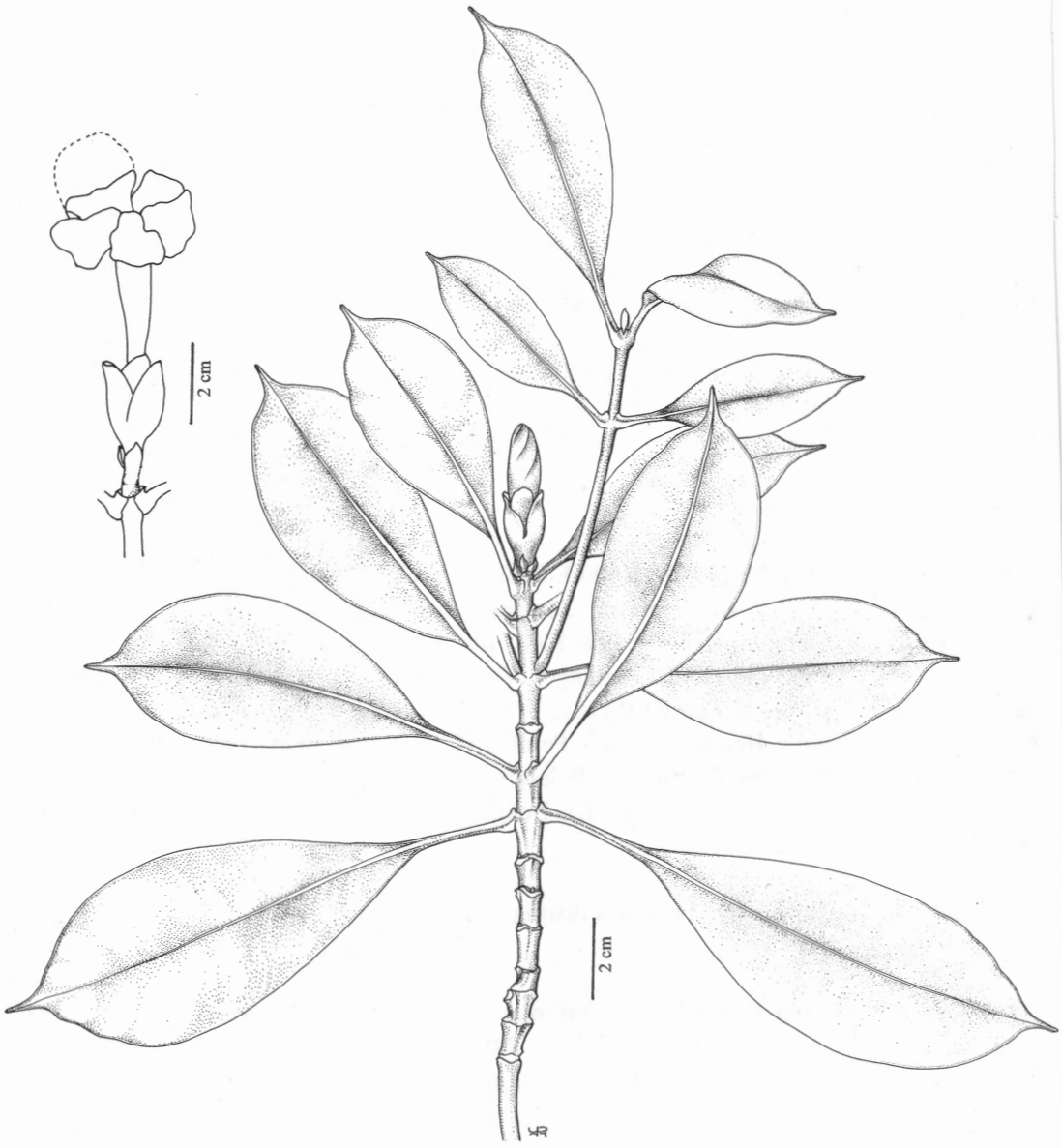

Fig. 19. *Fagraea dulitensis*, leafy flowering branch and open flower. From S. 34870.

conspicuous, adnate to leaf stalk base. Flower solitary, subsessile or pedicel up to 0.5 cm long; bracteoles 1–2 decussate pairs, tiny (only up to 5 mm long), much smaller than the calyx. Calyx 2 cm long, 1–1.3 cm diameter; divided more than halfway down (in bud), green, segments (sepals) ovate, concave, *c.* 1.4 cm long. Corolla tube greenish-yellow, to 5 cm long, the base to 5 mm wide; lobes white, to 1.8 cm long and 1.3 cm wide. Anthers brown. Pistil light green. Fruit unknown.

DISTRIBUTION. Borneo (Sarawak), known only from the type.

HABITAT. In old secondary forests at 113 m.

F. dulitensis resembles *F. acutibracteata* Wong & Sugau in being a small tree with obovate, thin-coriaceous leaves and having subsessile solitary flowers. However, it is distinct from *F. acutibracteata* in having 1–2 tiny (only up to 5 mm long) decussate pairs of bracteoles which are much smaller than the calyx. It also should not be confused with *F. oreophila* Wong & Sugau, which also has oblong leaves and solitary flower but is distinct in having leaves with slightly visible lateral veins.

26. Fagraea epiphytica Elmer

Leafl. Philip. Bot (1915) 2743. Type: *Elmer* 13850, Philippines, Mindanao, Agusan, Cabadbaran (Mt. Urdaneta) (L, isotype).

F. auriculata sensu Leenhouts, Fl. Males., 1, 6 (1962), *pro parte*.

F. curranii Merr., Philip. J. Sc. 13 (1918) Bot. 50. Type: *Curran & Merritt* For. Bur. no. 8043, Philippines, Luzon, Tayabas, Mt. Banajuo (L, isotype).

DISTRIBUTION. Philippines.

HABITAT. Highland areas.

SPECIMENS EXAMINED—PHILIPPINES: Mindanao, Agusan, Cabadbaran (Mt. Urdaneta), *Elmer* 13850 (isotype, L); Luzon, Tayabas, Mt. Banajuo, *Curran & Merritt* For. Bur. no 8043 (L); Mt. Concord, limestone, *Gutierrez et al.* 117164 (L).

Judging from collectors' notes, this species is most likely a large epiphyte or strangler.

27. Fagraea euneura Scheff.

in Hassk. Flora 52 (1869) 308. Lectotype (here chosen): *sine coll.* (*sine date*) Leiden sheet no. 908.127-230, "C.H. Bog." (L).

F. bracteosa Cammerl. Bull. Jard. Bot. Btzg III, 5 (1923) 323, f. 6–7. Lectotype (here chosen): *Rachmat* 723, Celebes, G. Sojo (L).

F. auriculata ssp. *parviflora* Leenh. Fl. Males., 1, 6 (1962). Type: see comments following.

DISTRIBUTION. Moluccas and Celebes.

HABITAT. A number of collectors' notes record it on limestone, at 30–400 m.

SPECIMENS EXAMINED—MOLUCCAS. Morotai, *Main & Aden* 1533 (L); Morotai, *Main* 652 (L); Obi Island, Anggai, Gunung Batu Putih, *de Vogel* 4014 (L); Morotai, Totodoku, *Kostermans* 688a (L); Morotai, Tobelo, *Kostermans* 27 (L). **CELEBES.** Lake Matano, *van Balgooy* 3678 (L); G. Sojo, *Rachmat* 723 (L).

According to our re-examination of Leenhout's *F. auriculata* ssp. *parviflora*, the Moluccan specimens he placed in that taxon represents a species distinct from *F. auriculata* Jack (see key provided in this account), so that the name *F. euneura* Scheff. has to be resurrected for use. Also, Leenhouts (1962) says his "*F. auriculata* ssp. *parviflora*" was based on *F. curranii* Merr. (*Curran & Merritt* 8043, Philippines, Luzon, Tayabas, Mt. Banajuo; isotype L) but that is a synonym of the Philippine *F. epiphytica* Elmer (1915), another distinct species.

This species is evidently a shrubby epiphyte or climber.

28. Fagraea floribunda *Wong & Sugau* **sp. nov**. *F. blumei G. Don similis, sed inflorescentiis typice sessilibus laxe ramosis et calyce breviore (0.9–1.2 cm longo) differt. Typus: Ashton S. 16743, Sarawak, Ulu Anap, Bt. Mersing (holotypus SAN, isotypi BO, K, KEP, L, MEL, SING).* (Fig. 20)

F. blumei sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* G. Don (1837).

Tree, up to 23.3 m tall and 60 cm diameter. Buttress absent but with stilt roots. Bark smooth with white hoop-marked. Leaves broadly oblanceolate, 5–13.5 × 3–6 cm, subcoriaceous, lower surface shagreen, upper surface smooth; base cuneate-attenuate, margins plane, apex broadly acute; midrib prominent, rounded; lateral veins 4–5 pairs, lower side prominent, raised, upper side impressed or sunken; reticulations obscure; leaf stalks 2–3 cm long, axillary scale conspicuous, adnate to leaf stalk base. Inflorescence terminal, a compound cyme, sessile, laxly branched; pedicel 0.8–1 cm long, 3–4 mm thick; bracts subtending inflorescence branches 5–6 mm long; bracteoles 1 pair, small, 1–2 mm long, attached to halfway the pedicel. Calyx campanulate, 0.9–1.2 cm long, 0.3–0.5 cm diameter, calyx lobes rounded, to 5 mm long. Corolla cream yellow, 2.7 cm long, corolla lobes 1–1.4 cm long, 3–4 mm wide. Stamen-filament 1–1.5 cm long, anthers 3–4 mm long; style 0.9–1 cm long, stigma capitate. Fruit oblong, 5 × 4 cm.

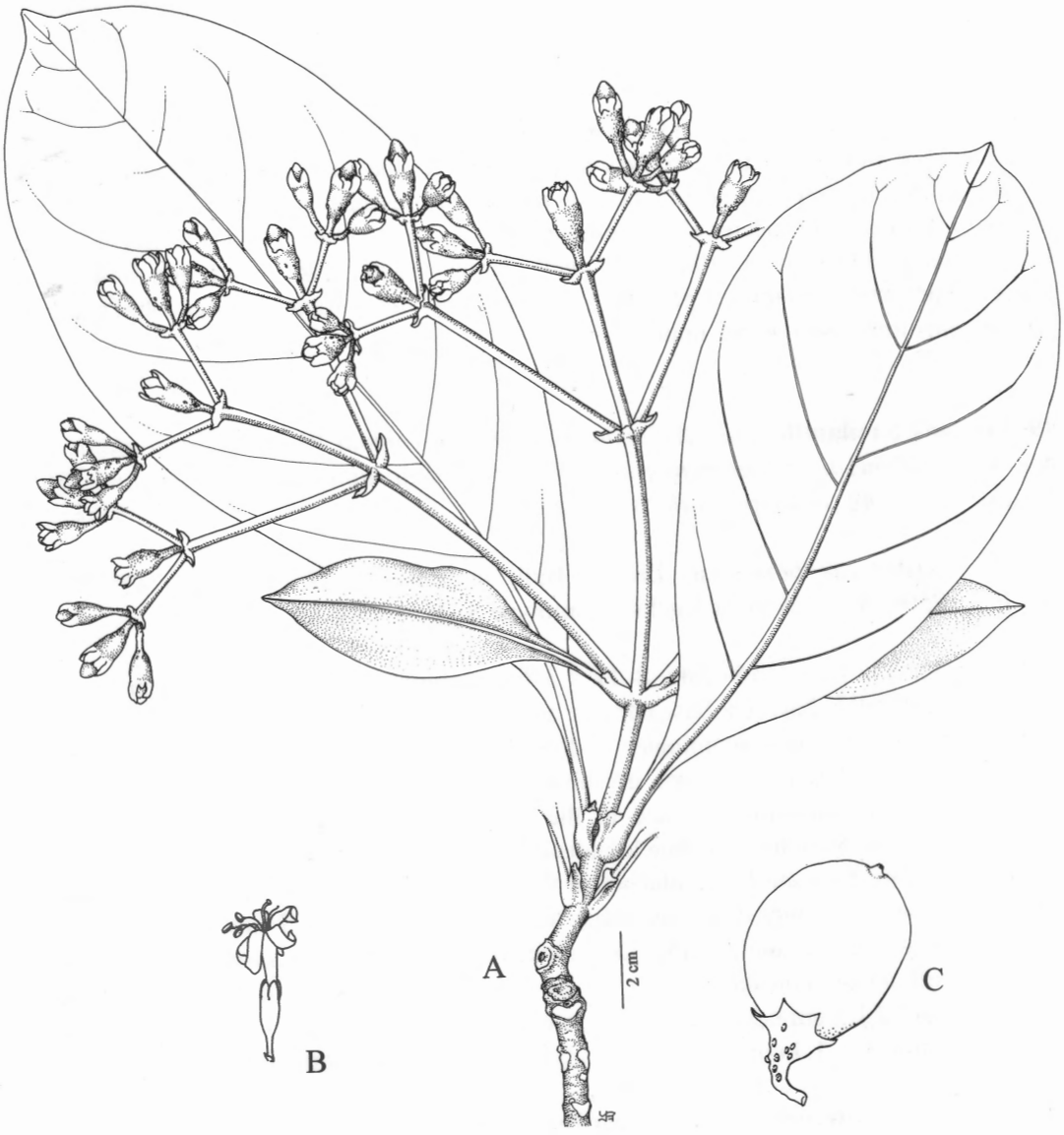

Fig. 20. *Fagraea floribunda*. **A.** Leafy flowering branch. **B.** Flower. **C.** Fruit. **A, B** from S. 16743; **C** from S. 19455.

DISTRIBUTION. Borneo (Sarawak only).

HABITAT. Mixed dipterocarp forests and heath forests, also on basalt boulders, up to 700 m.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Ulu Anap, Bt. Mersing, *Ashton* S. 16743 (holotype SAN, isotype A, BO, K, KEP, L, MEL, SAR, SING); Belingian, Bawan, Begrih, Rumah Temenggong, *Chai* S. 19455 (K, L, SAN, SAR, SING).

F. floribunda resembles *F. blumei* G. Don in having obovate leaves with a smooth, shagreen lower surface and conspicuous axillary scales adnate to the leaf-stalk base. However, it is distinct from *F. blumei* in its sessile, laxly branched inflorescence and shorter calyx (0.9–1.2 cm long). This distinct species also resembles *F. spatiosa* S. Moore, but it is different as that has shorter inflorescences (like *F. blumei*), larger bracts (5–6 mm long) subtending inflorescence branches, thicker pedicels (3–4 mm thick), more rounded calyx lobes and leaf lateral veins impressed on the upper side.

29. Fagraea havilandii *Wong & Sugau* **sp. nov.** *F. oreophila Wong & Sugau affinis sed corolla tubiformè, tubo longitudine lobis duplo excedenti differt. Typus: Haviland 2508, Sarawak, Kuching (holotypus SAR, isotypus L).* (Fig. 21)

F. gardenioides ssp. *borneensis* Leenh., Bull. Jard. Bot. Brux. 32 (1962) 425. Type: *Haviland* 2508, Sarawak, near Kuching (holotype SAR, isotype L).

Habit not known. Leaves obovate, 8–11 × 3–6 cm, coriaceous, upper and lower surfaces smooth to a slightly shagreen; base cuneate and decurrent along leaf stalk, margins slightly recurved when dry, apex acuminate; midrib prominent; lateral veins 6–7 pairs, hardly visible on both sides; reticulations invisible; leaf stalks 1–1.5 cm long, 4–5 mm thick, axillary scale inconspicuous, adnate to the stem, auricle absent. Inflorescence a 2–5-flowered cyme, 4–5 cm long, peduncle indistinct, up to 1 cm long; pedicels 0.5–1 cm long; bracteoles 1 pair, 5–6 mm long, attached at the base of the calyx cup. Calyx campanulate, 1.6–1.7 cm long, 6–7 mm diameter, calyx lobes 6–7 mm long, 5–7 mm wide; calyx cup 9–10 mm long; corolla tubular, tube 5.5 cm long, bottom part 3 mm across, upper part near mouth 5 mm across, corolla lobes 1–1.8 cm long, 4–5 mm wide; style to 5.5 cm long; stamens inserted 1.5 cm below the mouth, anthers included. Fruit 2.5–3 cm long, ellipsoid acute at the top, 1.2–1.3 cm across, fruit calyx patent to clasping the fruit base.

DISTRIBUTION. Borneo (Sarawak, near Kuching).

HABITAT. Unknown.

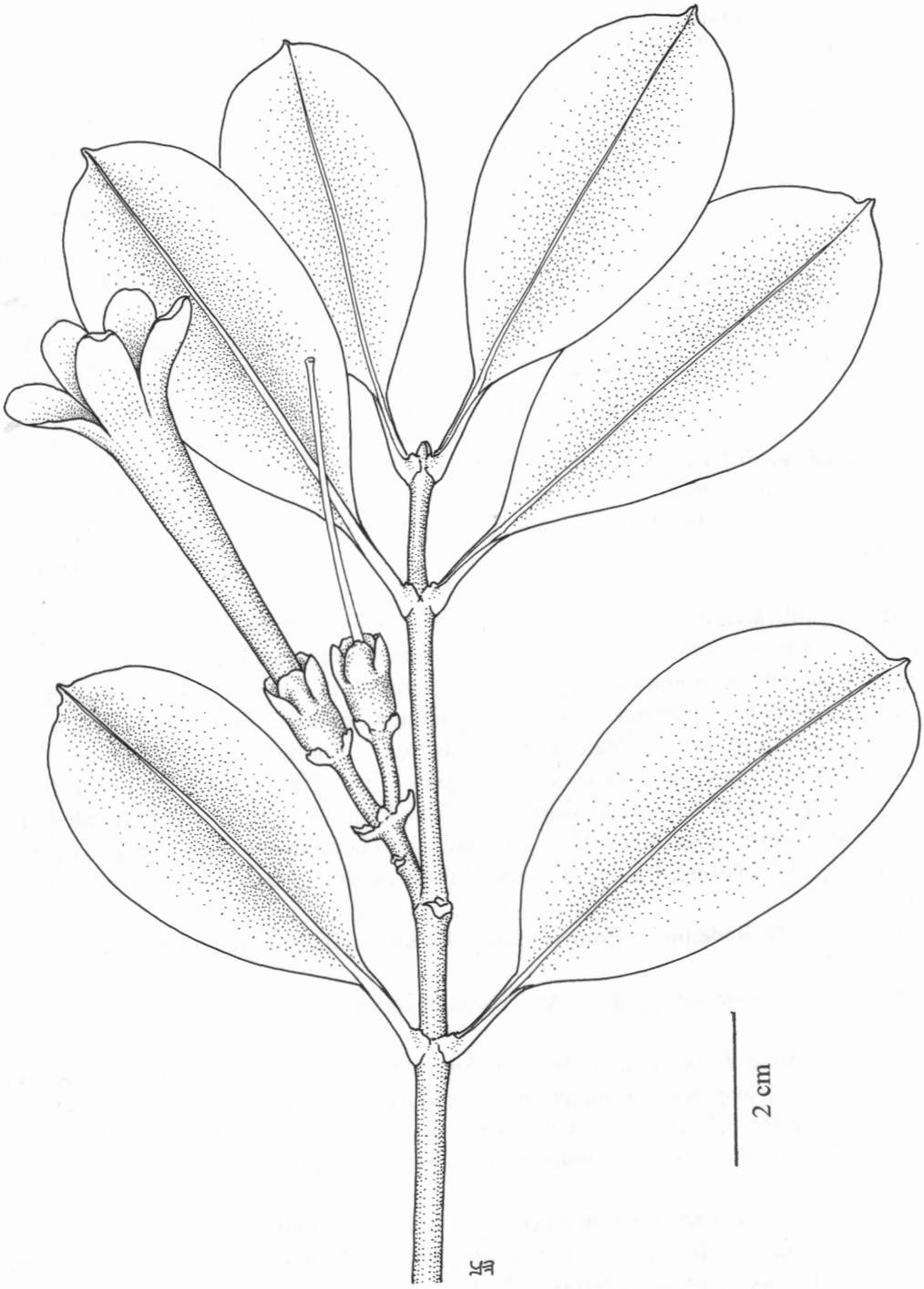

Fig. 21. *Fagraea havilandii*, leafy flowering branch. From *Haviland* 2508.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Kuching, *Haviland* 2508 (holotype SAR, isotype L); Kuching, *Haviland* 2012 (K); Kelabit Highland, Mt. Murud, *Nooteboom & Chai* 2011 (L).

The type of *F. gardenioides* ssp *borneensis* Leenh. should represent a distinct species. Leenhouts (1962) distinguished *F. gardenioides* from *F. carnosa* by the "linear anthers" of the former and "oblong to elliptic anthers" of the latter. In Sumatran specimens of *F. carnosa* the anthers are linear, as they are in Bornean specimens. This has resulted in Leenhouts wrongly determining a solitary-flowered, large-corolla specimen of *F. carnosa* in L (*Chai et al.* S. 38567) as *F. gardenioides*. Vegetatively the 2 species are indistinguishable, but *F. carnosa* has larger, solitary flowers. *F. gardenioides* ssp. *borneensis* is quite different from *F. gardenioides* ssp. *gardenioides* (Malayan), which has larger flowers, non-decurrent leaf bases, thinner stalks (2–3 mm) and rounded leaf apices.

30. Fagraea iliasii *Wong & Sugau* **sp. nov**. *F. blumei G. Don similis, sed inflorescentiis sessilibus vel subsessilibus (pedunculis usque ad 0.5 cm longis) differt. Typus: Ilias S. 36290, Sarawak, 7th Div., Kapit, Sg. Sut, Ulu Sg. Apah (holotypus SAN, isotypi K, KEP, L, MO, SAR).* (Fig. 22)

Epiphytic shrub. Leaves broadly obovate, 6.5–22 × 7–10.5 cm, thin chartaceous when dry, upper and lower surfaces smooth; base broadly cuneate, margins recurved when dry, apex broadly acute; midrib prominent, sharp-ridged; lateral veins 7–8 pairs, upper side impressed or sunken, lower side prominent, raised; reticulations obscure; leaf stalks 2–3 cm long, axillary scale conspicuous, adnate to leaf stalk base. Inflorescence a 3-flowered cyme, sessile; pedicels hidden by bracteoles; bracteoles 2 pairs, 15–20 mm long, attached at halfway on the pedicel. Calyx cup-shaped, 1–1.5 cm long, 1–1.2 cm diameter, divided more than halfway down, calyx lobes 0.5–1 cm long. Corolla unknown. Fruit a berry, ovoid to ellipsoid, 2.7–3.2 cm long, 1.8–2.2 cm wide, fruit calyx lobes patent. Seeds rounded, brown.

DISTRIBUTION. Endemic to Borneo (Sarawak); known only from the type.

HABITAT. On yellow sandy soil by river bank, at 280 m.

F. iliasii resembles *F. floribunda* Wong & Sugau in having a sessile inflorescence and broadly obovate leaves with prominent lateral veins on the lower side, but is distinct in its short calyx cup (to 0.5 cm only), with 2 pairs of somewhat large bracteoles (15–20 mm long) and thin chartaceous leaves with recurved margins in dry specimens.

Even Leenhouts, in a determination dated 1979 in the Leiden herbarium, observed that this was "possibly new." This is named after Ilias Paie, who had been one of the principal botanical collectors based at the Sarawak herbarium.

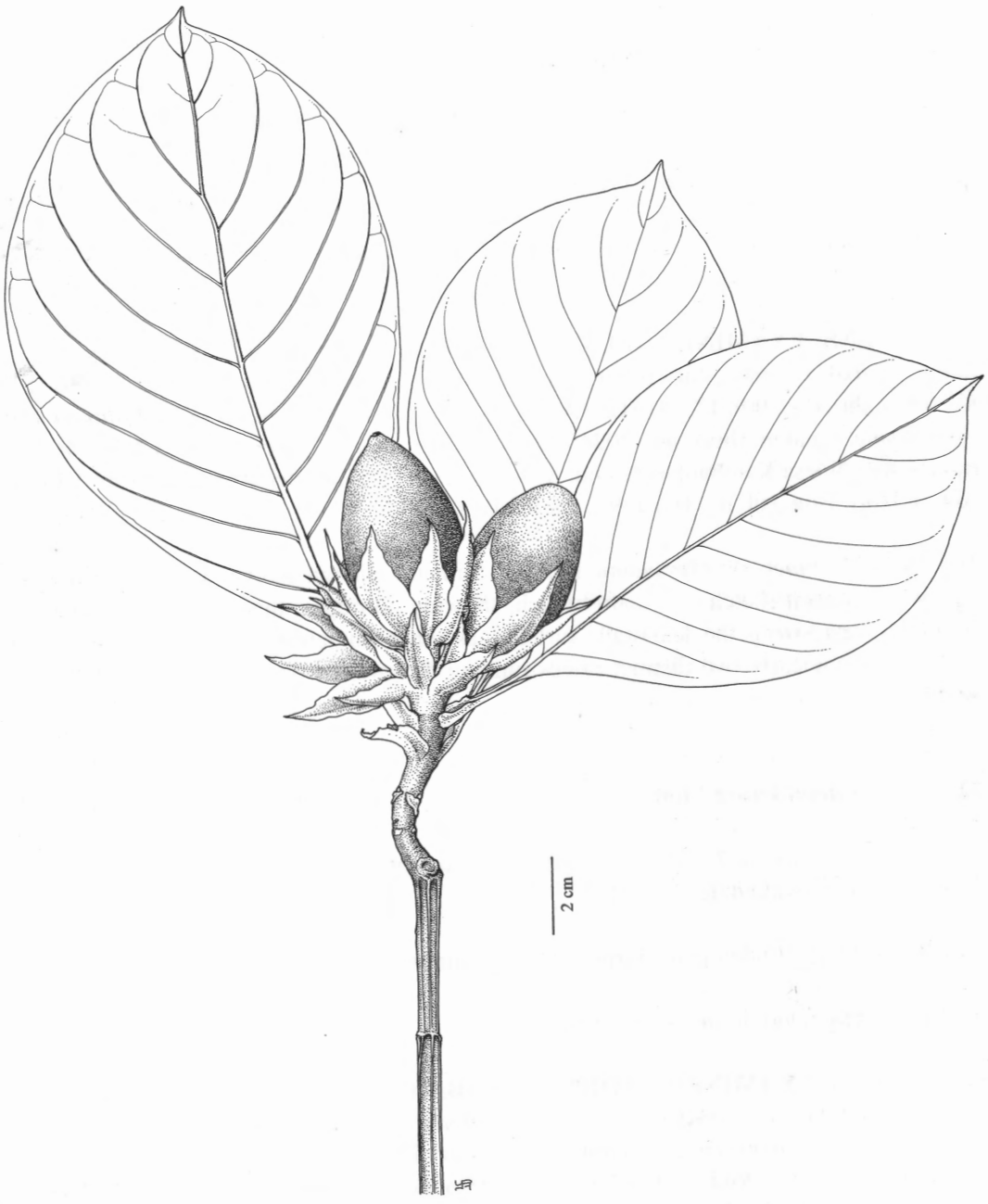

Fig. 22. *Fagraea iliasii*, fruiting leafy branch. From S. 36290.

31. Fagraea imperialis Miq.

Fl. Ind. Bat. 2 (1857) 372. Type: *Teysmann* HB 599, Sumatra, Siboga (L, isotype).

F. javanica Reinw. ex Bl., Cat. (1823) 47, *nom. nud.*

F. auriculata sensu Leenh. Fl. Males., 1, 6 (1962), *pro parte, non* Jack (1822).

DISTRIBUTION. Sumatra and Java.

HABITAT. Recorded both in swamp forest and near the sea, as well as in hill forest at 600 m.

SPECIMENS EXAMINED—SUMATRA. Siboga, *Teysmann* HB 599 (isotype, L); Jambi, Berbak Reserve, Air Hitam Laut, just above sea level, *Franken & Roos* 336 (L); *Korthals*, sheet no. 908.127-91 (L); Gunung Kaba, *Forbes* 2869 (L). **JAVA.** *Zollinger* 199 (K); *Blume*, Leiden sheet no. 202450 (L); *Blume*, Leiden sheet no. 925.250-308 (L); Banjoemas, Noesa Kambangan Island, *Kostermans & van Woerden* 95 (K, L); *Lobb* 78 (K); cult. in Hort. Bog. sub no. II.V.E.91, *Snethlage s.n.* (K).

The type of *F. imperialis* (*Teysmann*, HB 599, Sumatra, Siboga; isotype L) has only a loose leaf, with a pencil sketch of a leafy branch, showing no ridges; this may be an inaccurate drawing emphasizing the leaf-stalk auricles, as other Sumatran specimens with branch portions show clearly two distinct ridges running downwards from between the leaf-stalk bases.

32. Fagraea involucrata Merr. (Fig. 18C)

J. Str. Br. R. As. Soc. n. 77 (1917) 233. Type: *Native coll.* 2083 (Bur. Sci.), Sarawak, Mount Sudan (PNH, presumed destroyed).

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

HABITAT. Highland, in montane forests.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, Bundu Tuhan, *Wood & Charrington* SAN 16380 (KEP, SAN); Mt. Kinabalu, Tenompok, *J & M.S. Clemens* 26813 (K, L); Ranau, Bundu Tuhan, Tenompok, *Meijer* SAN 20305 (K, L, SAN); Kinabalu, Tenompok, *Sinclair, Kadim & Kapis* SFN 8996 (L); Kinabalu, Penibukan, *J. & M.S. Clemens* 31661 (K, L); Mt. Kinabalu, Bundu Tuhan, *Caguiela* BNB F.D. No. 2938 (K, L); Mt. Kinabalu, Tenompok, *J. & M.S. Clemens* 30072 (K). **SARAWAK:** Baram, Main Geneh

river, 4 miles upriver from Long Selatong Ulu, *Chin* 2716 (L). **KALIMANTAN:** W. Koetai, *Endert* 4613 (K, L).

33. Fagraea kalimantanensis (Leenh.) Wong & Sugau, **comb. nov.**

F. tacapala ssp. *kalimantanensis* Leenhouts, Blumea 29 (1984) 423–424. Type: *Nooteboom* 4234, Borneo, Bukit Raya (holotype L).

DISTRIBUTION. Borneo, so far known only from Bukit Raya, Kalimantan.

HABITAT. Highland mixed dipterocarp forest.

SPECIMENS EXAMINED—BORNEO. KALIMANTAN: Bukit Raya, *Nooteboom* 4234 (type, L), *Nooteboom* 4284 (L).

The type of *F. tacapala* (*Bunnemeijer* 12100 at L, from SW Celebes) has a distinctly peduncled inflorescence 13 cm long with very robust peduncles (7–8 mm thick) and inflorescence branches, a 2.5–3-cm-long calyx and a 2.5–3-cm-long corolla. In contrast, Leenhouts' *F. tacapala* ssp. *kalimantanensis* has a shorter inflorescence (4–5 cm long) without a distinct peduncle, and slender inflorescence branches (only 2–2.5 mm thick), shorter calyx (only 7–8 mm long) and shorter corolla (1.5–1.8 cm long). Also, *F. tacapala* ssp. *kalimantanensis* has somewhat distinct leaf stalks (manifest as a definite constriction between the base of the leaf blade and the small auricles), whereas typical *F. tacapala* has the base of the leaf blade continuous with the rather large, reflexed auricles. The two are not conspecific and here we make the combination *F. kalimantanensis.*

34. Fagraea kinabaluensis *Wong & Sugau* **sp. nov**. *F. blumei G. Don similis, sed foliis parvis ellipticis venis lateralibus invisibilibus differt. Typus: Aban & Meijer SAN 93260, Sabah, Keningau, Crocker Range F.R., mile 16 (holotypus SAN, isotypus L).* (Fig. 23)

F. ceilanica sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Thunb. (1782).

Treelet or climbing shrub. Leaves smallish, narrowly elliptic, 5–11 × 2–3.5 cm, thin coriaceous, upper and lower surfaces shagreen, base acute to attenuate, margin slightly recurved when dry, apex acuminate to caudate, midrib prominent, sharp-ridged; lateral veins obscure; reticulations invisible to obscure; leaf stalks 0.8–2.5 cm long, axillary scale inconspicuous, adnate to leaf stalk base. Flower solitary, terminal; pedicel 2–3 mm long; bracteoles two pairs, small, 2–3 mm long, upper pair attached to calyx cup base and another to halfway the pedicel. Calyx cup-shaped, 2.2–2.6 cm long, 1.2–1.3 cm diameter, divided to the middle, calyx lobes 1.7–1.8 cm long. Corolla funnel-shaped, 3.5–4 cm long, divided more than halfway down, corolla lobes 2.5–3 cm long, 1.5–2.5 cm wide. Fruit a berry,

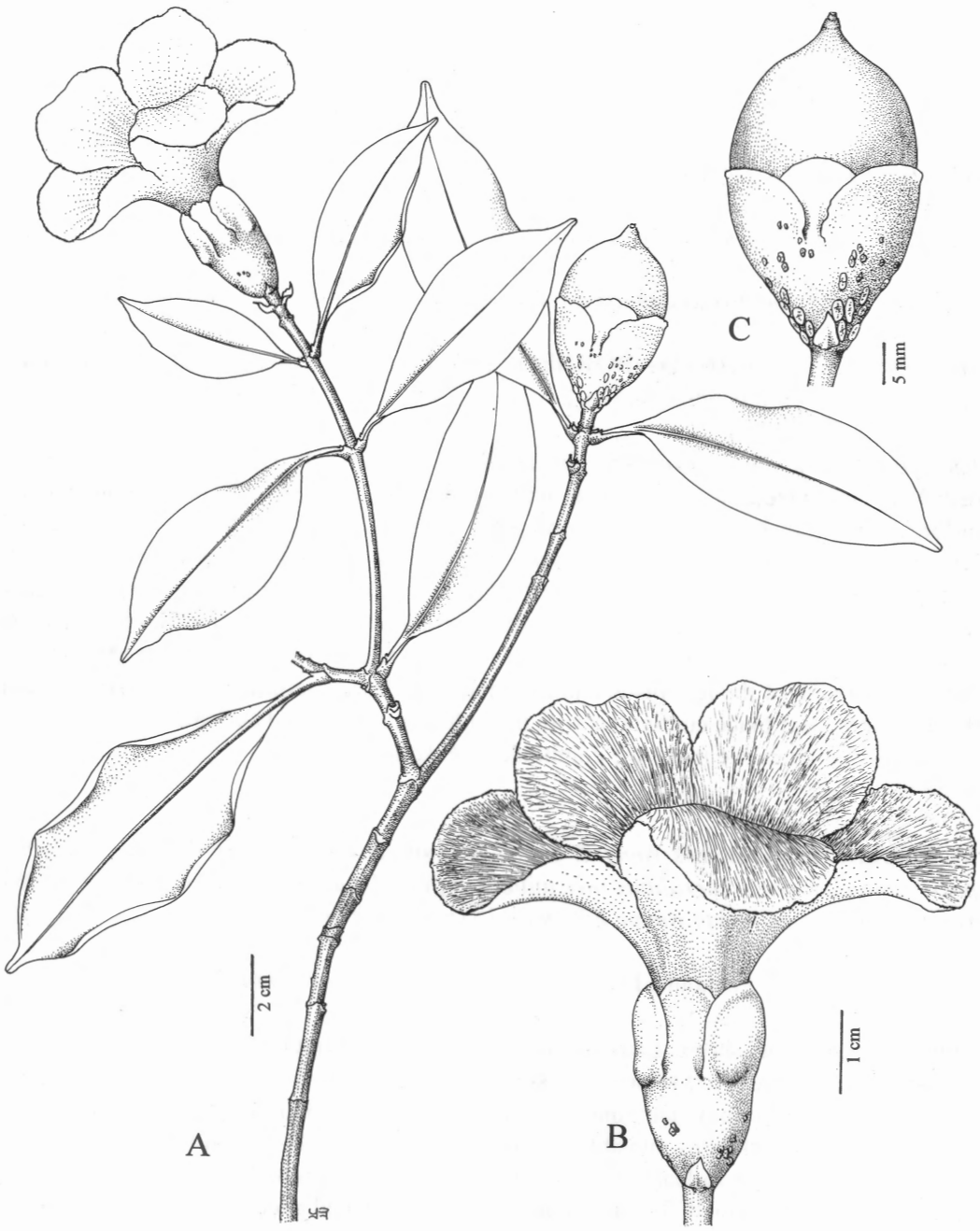

Fig. 23. *Fagraea kinabaluensis*. **A.** Leafy flowering branch. **B.** Detail of flower. **C.** Fruit. All from SAN 93260.

ellipsoid, mucronate apically, 3–3.5 cm long, 2.5–2.7 cm long, fruit calyx patent. Seeds rounded, brown.

DISTRIBUTION. Endemic to Borneo (Sabah and Brunei).

HABITAT. Mostly in highland areas.

SPECIMENS EXAMINED—BORNEO. SABAH: Keningau district, Crocker Range, mile 16, *Aban & Meijer* SAN 93260 (holotype SAN, isotype L); Crocker Range, 19 km west of Keningau at mile 13.5 on Kimanis road, *Beaman* 7045 (L, SAN); Kinabalu, Mesilau river, *Chew & Corner* RSNB 4110 (K); Kinabalu, Mesilau river, *Chew & Corner* RSNB 4278 (L); Kinabalu, Penibukan ridge, *Clemens* 30319 (L); Kinabalu, Penibukan, *Clemens* 30836 (L); Kinabalu, Mount Nunok, *Clemens* 32730 (L); Kinabalu, Colombon basin, *Clemens* 40127 (L); Kinabalu, Penibukan ridge, *Clemens* 40508 (K); Kinabalu, Penibukan ridge, *Clemens s.n.* (L); Mesilau, *Mikil* SAN 38476 (K, L); Kinabalu, path from Mesilau, *Mikil* SAN 38476 (K, L); Ranau district, Kundasang, Corner's path, *Singh* SAN 28274 (K, KEP, L, SAR, SING); Lahad Datu district, Ulu Segama, Gunong Danum, *Dewol* SAN 129500 (SAN); Penampang district, Togudon/Tungol Km 50 Jalan Tambunan/Penampang, *Fidilis* SAN 127788 (SAN); Tambunan district, Mount Trusmadi, *Joseph & Lideh* SAN 110090 (SAN); Lahad Datu district, Mount Silam, *Joseph & Matin* SAN 118095 (SAN); Sipitang, Meligan, highland forest, *Julius* SAN 132905 (SAN); Penampang district, Mount Alab, *Kokawa & Hotta* 2087 (L); *Madani & Amin* SAN 75355 (SAN); Sipitang district, Meligan, *Madani* SAN 132715 (SAN), Meligan, *Madani* SAN 132724 (SAN); Ranau district, Mamut, *Meijer* SAN 62736 (SAN). **BRUNEI:** Temburong District, Kuala Belalong, *Ashton* 5204 (BRUN, L, SAN).

F. kinabaluensis most resembles *F. rarissima* Wong & Sugau in having slightly conspicuous axillary scales which are adnate to the leaf-stalk base, narrowly elliptic leaves with obscure or invisible lateral veins and recurved margins when dry. However, it differs from *F. rarissima* in having typically solitary flowers, 2 pairs of bracteoles, longer calyx cups (0.5–0.8 cm long), and leaves that dry pale brown.

35. Fagraea kuminii *Wong & Sugau* **sp. nov.** *F. resinosae Leenh. similis, sed inflorescentiis typice uni- usque ad trifloris et calyce longiore (3.5–4 cm longo) differt. Typus: Madani et al. SAN 130637, Beluran, Bidu-Bidu F. Res. (holotypus SAN).* (Fig. 24)

F. resinosa sensu Leenh. Fl. Males., 1, 6 (1962), *pro parte*.

Epiphytic shrub or woody climber. Leaves narrowly obovate to oblanceolate, 7.5–15.0 × 3–5.5 cm, coriaceous, upper and lower surfaces smooth; base cuneate to attenuate, margin plane, apex acute to acuminate, midrib prominent; lateral veins faint to obscure; reticulations obscure; leaf stalks 1.5–4.5 cm long, axillary scale conspicuous, adnate to leaf

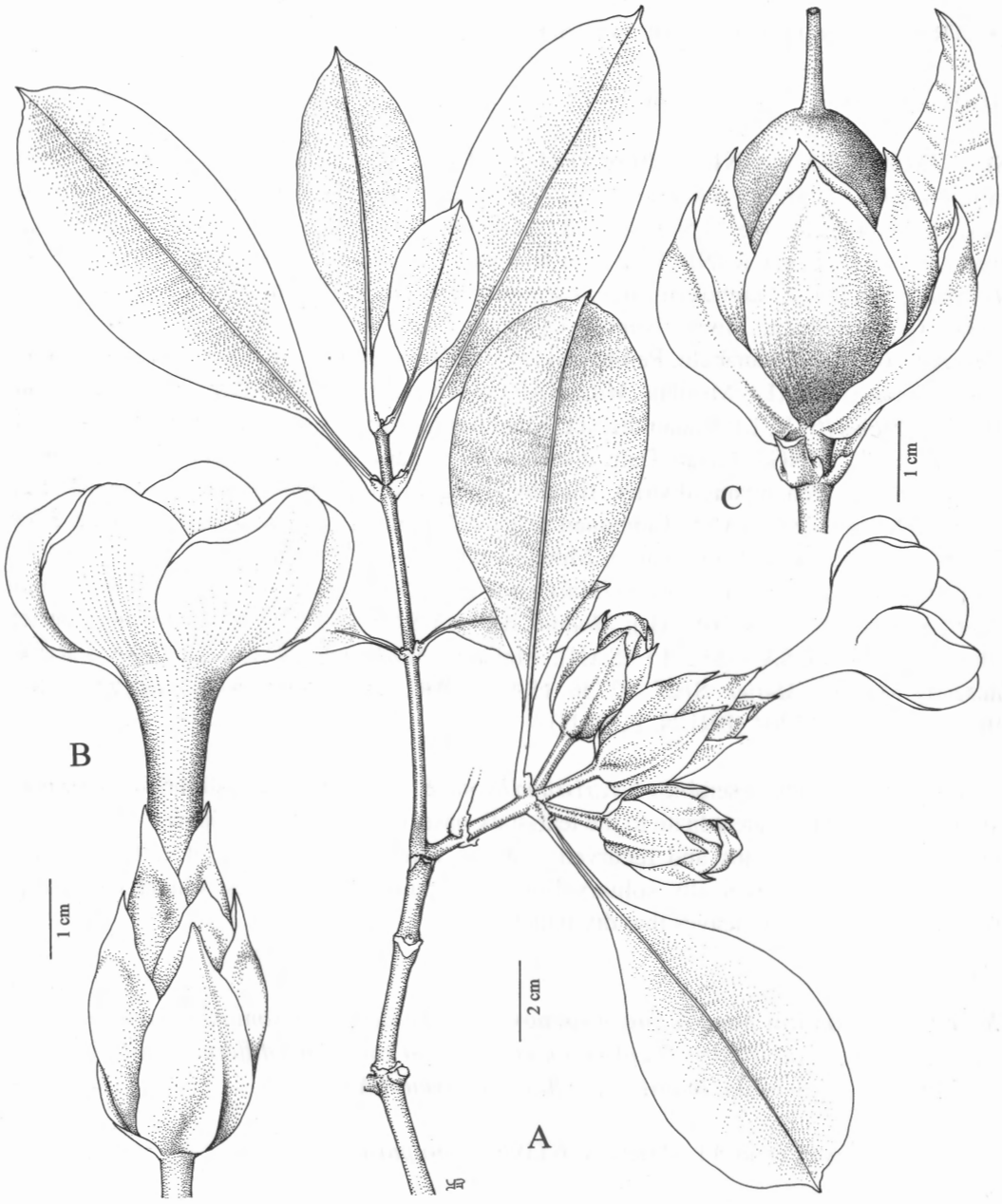

Fig. 24. *Fagraea kuminii*. **A.** Leafy flowering branch. **B.** Detail of flower. **C.** Fruit. All from SAN 130637.

stalk base. Inflorescence a 1–3-flowered cyme; pedicel 1–2 cm long; bracteoles in 2–3 decussate pairs, 2–3.5 cm long, ovate-lanceolate, enclosing the lower part of the calyx, the inner or innermost pair(s) larger than the outer ones. Calyx 3.5–4 cm long, cm diameter, divided to near its base, lobes oblong with acute to acuminate apex, concave, 2.5–3.5 cm long. Corolla greenish white, tubular at base, gradually widened upwards; tube 3.5–4.5 cm long, lobes ovate, 2.5–3 cm long, 2–2.5 cm wide; anthers just visible at throat. Fruit ovoid to ellipsoid 3–3.5 cm long, *c.* 1.5 cm wide, greenish white, fruit calyx clasping. Seeds rounded, brown.

DISTRIBUTION. Borneo (Sabah).

HABITAT. On undulating land, river banks, in disturbed forest on ultramafic soil.

SPECIMENS EXAMINED—BORNEO. SABAH: Sandakan, Telupid, *Leopold & Taha* SAN 83587 (AA, K, KEP, L, SAN, SAR, SING); Labuk/Sugut, Ulu Tungud, *Matin, Joseph & Pius* SAN 117002 (K, L, SAN); Sandakan, Telupid, Bt. Tawai, *Soepadmo et al.* FRI 41317 (KEP, SAN, SAR); Beluran, Bidu-Bidu F. Res., *Madani et al.* SAN 130637 (holotype SAN); Sandakan, Telupid, Ruku-Ruku, *Kumin* SAN 60100 (SAN); Sandakan, Telupid, Ruku-Ruku, *Aban* SAN 94027 (K, SAN); Telupid, Tangkulap, Sg. Kun-Kun, *Pius & Lideh* SAN 124656 (SAN).

F. kuminii most resembles *F. resinosa* Leenh. in having the calyx enveloped by an involucrum consisting typically of two pairs of large bracteoles. It is distinct, however in its narrowly elliptic leaves, faint and obscure lateral veins and slender leaf stalks (less than 3 mm thick).

This is named in memory of Kumin Muroh, late tree-climber who had served the Sandakan herbarium for many years.

36. Fagraea littoralis Bl.

Bijdr. (1826) 1021; Rumphia 2 (1838) 28, t. 74. Type: *Blume*, Java, Nusa Kambangang (Leiden sheet no. 908.127-530) (L).

F. forstenii Bl., Mus. Bot. 1 (1850) 166. Type: *Forsten, s.n.*, Celebes (L, holotype).

F. ceilanica sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Thunb. (1782).

var. **borneensis** *Wong & Sugau* **var. nov.**, *a varietate littorale foliis coriaceis, base rotundatis, pedunculo inflorescentiae 2–6 cm longo differt. Typus: Dewol & Karim SAN 77795, Sabah, Beaufort, Klias Forest Reserve (holotypus SAN, isotypus L).* (Fig. 25)

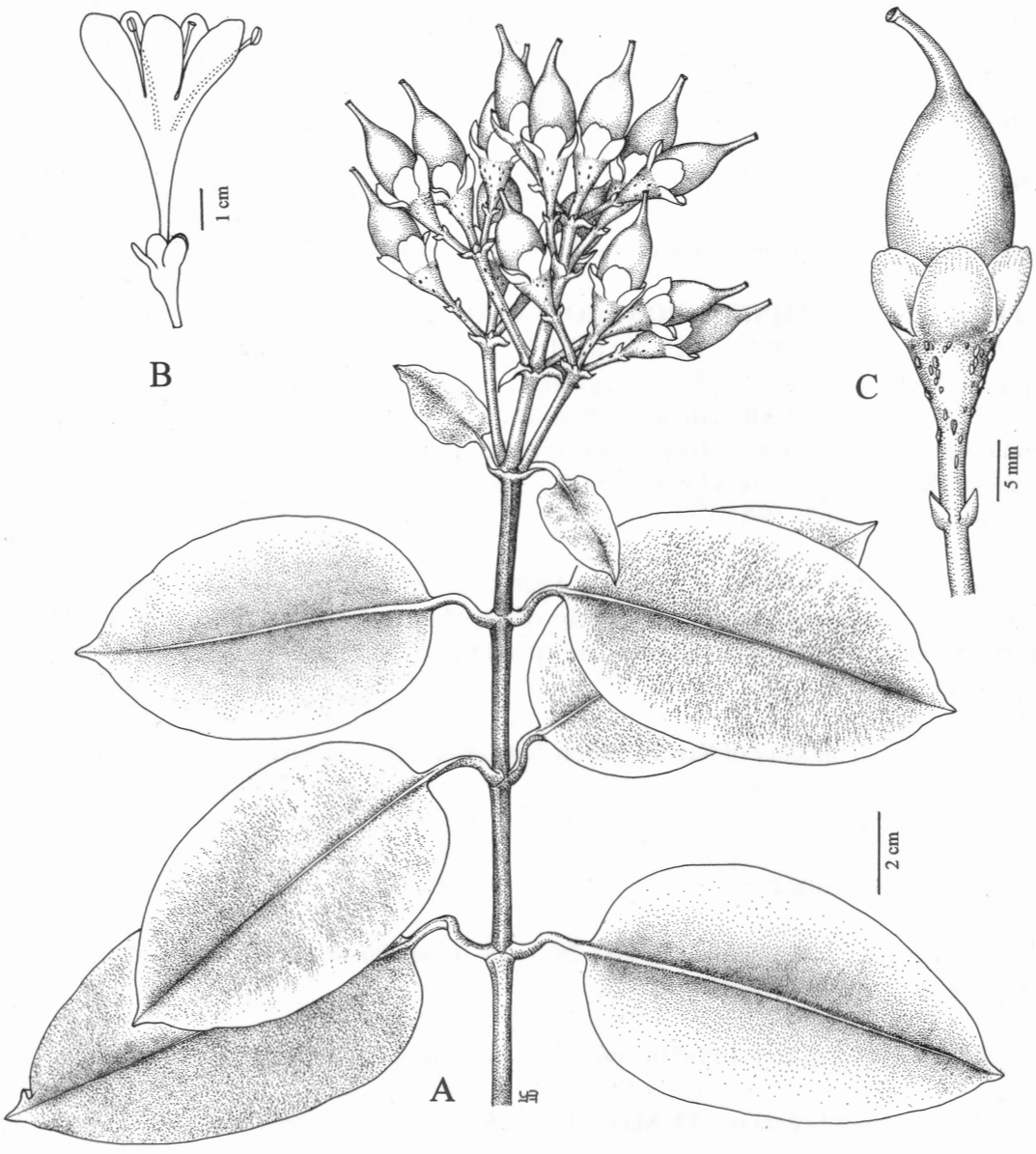

Fig. 25. *Fagraea littoralis* var. *borneensis*. **A.** Leafy fruiting branch. **B.** Flower. **C.** Fruit. From SAN 77795 except **C**, from *Main* 2144.

Climbing shrub. Bark fissured. Leaves elliptic-ovate, 5–12 × 2.5–3 cm, thick-coriaceous, upper surface wrinkled, shiny, lower surface coarse when dry, base rounded, margin plane, apex acute to acuminate, midrib prominent, sharp-ridged; lateral veins invisible; reticulations invisible to obscure; leaf stalks 1.8–2.5 cm long, axillary scale inconspicuous, slightly adnate to the stem. Inflorescence a few-flowered cyme, peduncle 2–6 cm long; pedicels 0.6–2.3 cm long; bracteoles 1 pair, small, 2–3 mm long, attached to upper part of pedicel or calyx cup base. Calyx cup-shaped, 1.1–1.9 cm long, divided halfway down to the base, calyx lobes 0.7–1 cm long. Corolla white, with sweet and pungent odour, infundibulate, to 6.5 cm long, the base very narrowed, the lobes to 2.5 cm long and 1.2 cm wide. Fruit a berry, elipsoid, 3.1 cm long, 2.2 cm wide, fruit calyx lobes patent.

DISTRIBUTION. Borneo, in all territories.

HABITAT. Usually found near rivers and lakes.

SPECIMENS EXAMINED—BORNEO. SABAH: Beaufort, Klias Forest Reserve, *Dewol & Karim* SAN 77795 (holotype SAN, isotype L). **SARAWAK:** 4th. Div. Marudi, Tinjar, Ulu Sg. Dapoi, *Ilias* S. 22914 (L, SAN, SAR). **BRUNEI:** Belait, River, above Nypa belt, *Val Niel* 4645 (L). **KALIMANTAN:** Banks of Lake Menjaban, *Main* 2144 (L); Silimbau Kapuas, banks of Lake Nibung, *Main* 2109 (L); Danau Sentarum Wildlife Reserve, Sg. Tengkidap, *Giesen* 124 (L).

F. littoralis var. *borneensis* is quite different from *F. littoralis* Bl. var *littoralis* (Javanese material) by its shorter leaf stalks (1.8–2.5 cm long), thick coriaceous leaves, rounded leaf base and longer inflorescence peduncle (2–6 cm long). Leenhouts annotated specimens of this new variety as "*F. ceilanica* (*minor*)".

37. Fagraea longipetiolata *Wong & Sugau* **sp. nov**. *F. splendenti Bl. similis, sed inflorescentis pedunculatis (pedunculis 0.3–3 cm longis) differt. Typus: Asah S 12941. Sarawak, Kuching, Arboretum (holotypus SAN, isotypi A, K, L, SAR)* (Fig. 26)

F. ceilanica sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Thunb. (1782).

Climbing shrub. Leaves elliptic to narrowly obovate, 3–10 × 2.5–4.5 cm, coriaceous, upper and lower surfaces shagreen; base cuneate, margin slightly recurved when dry, apex acute, mucronate; midrib prominent; lateral vein obscure; reticulations obscure; leaf stalks 2–3 cm long, sharply ridged when dry, axillary scale inconspicuous, adnate to the stem. Inflorescencea 2–3-flowered cyme, terminal; peduncle 0.3–0.4 cm long; pedicel 0.6–0.8 cm long; bracteole 1 pair, small, 2–3 mm long, attached to just below the calyx cup. Calyx campanulate, 1.5–2 cm long, 5–6 mm diameter, divided to halfway to the base, calyx lobes 0.6–0.7 cm long. Corolla 5 cm long, broadly infundibular with a widely tubular base just over 0.5 cm across, the lobes to 2 cm long and 1 cm wide. Fruit unknown.

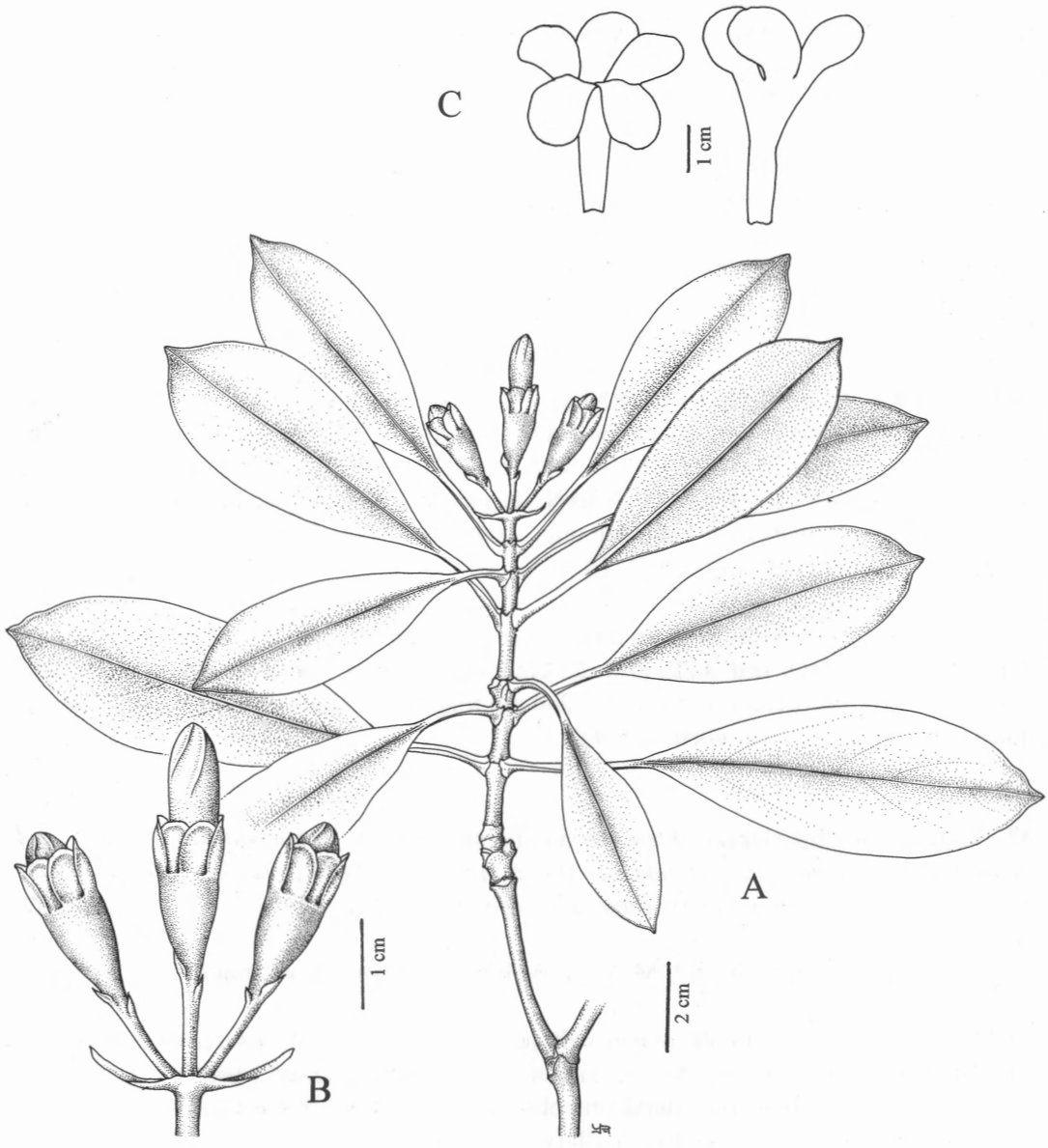

Fig. 26. *Fagraea longipetiolata*. **A.** Leafy flowering branch. **B.** Inflorescence. **C.** Corollas. From S. 12941 except **C**, from S. 26234.

DISTRIBUTION. Borneo (Sarawak and Brunei).

HABITAT. Primary lowland dipterocarp forests.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Kuching, Arboretum, *Asah* S. 12941 (holotype SAN, isotypes A, K, L, SAR); Kuching, Penrissen road, 12th mile, *Banyeng* S. 26234 (A, K, L, SAN, SING); Kuching, Semenggoh F.R., Arboretum, *Ghazali* S. 13655 (A, K, L).

F. longipetiolata most resembles *F. rarissima* Wong & Sugau in having typically elliptic leaves with lateral veins invisible or obscure and one pair of bracteoles (2–3 mm long) attached to just below the calyx cup. However, it differs from *F. rarissima* in having typically 3-flowered cymes and leaves with an acute-mucronate apex and which dry dark brown.

38. Fagraea macroscypha Baker (Fig. 18B)

Kew Bull. (1896) 25. Type: *Creagh*, British North Borneo, Kinabatangan (K).

F. involucrata var. *longipetiolata* Merr., Pl. Elm. Born. (1929) 251. Lectotype (here chosen): *Elmer* 21585, British North Borneo, Tawao (L).

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

HABITAT. In mixed dipterocarp forest.

SPECIMENS EXAMINED—BORNEO. SABAH: Kota Belud, Penataran River, *Beaman* 8867 (K, L), 9307 (K, L); Tawau, *Aban & Free* SAN 79673 (L, SAN); Beaufort, *Dewol & Karim* SAN 78175 (L, SAN); Tongod, Mananam, *Dewol & Patrick* SAN 89273 (K, L, SAN); Penampang, Babagon, *Dewol* SAN 77498 (K, L, SAN); Tambunan, Rampon, *Joseph et al.* SAN 123857 (SAN); Ranau, Pinawantai, *Shea & Aban* SAN 76845 (K, L, SAN); Tawao, *Elmer* 21585 (lectotype of *F. involucrata* var. *longipetiolata* Merr.) (L). **SARAWAK:** Kapit, *Chai* S. 36028 (SAR); Kapit, *Lee* S. 40241 (SAR); Native Coll. 2083 (SAR). **BRUNEI:** Temburong, Kuala Belalong, *Smythies, Wood & Ashton* SAN 17379 (L); K. Belalong, *Ashton* BRUN 5203 (K, L);Temburong, Temburong river, Wong Nguan rapids, *Coode* 6547 (K). **KALIMANTAN:** Central Kalimantan, Bukit Raya, *Mogea* 4152 (K, L).

39. Fagraea megalantha *Wong & Sugau* **sp. nov**. *F. ridleyi K. & G. similis, sed floribus maioribus (corolla c. 22.5–24 cm longa) et auriculis distinctis basi petiolis differt. Typus: Anderson S. 29378, Sarawak, 3rd. Div., Daro F.R., Tj. Belatok (holotypus SAR, isotypus L).* (Fig. 27)

F. auriculata sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Jack (1822).

Climber, up to 25 m high. Leaves oblanceolate, 29–30 × 12.5–13 cm, thick coriaceous, upper and lower surfaces smooth or shagreen, base attenuate to cuneate, margin plane, apex obtuse to rounded, midrib prominent; lateral veins 3–4 pairs, lower and upper side prominent, faint towards the margins; reticulations obscure; stalks 4–4.5 cm long, axillary scale inconspicuous, adnate to leaf stalk base, leaf-stalk auricle distinct 1 × 0.5 cm. Inflorescence most probably consisting of a solitary flower. Flower pale yellow; pedicel 1.5–2 cm long; bracteoles 2 pairs, 1–1.5 cm long, attached to pedicel and to calyx cup base. Calyx 5.5–6 cm long, 2.5–3 cm wide. Corolla broadly funnel-shaped, fleshy, corolla tube 13.5–14 cm long, contracted lower part 1.5 cm wide, expanded upper part 6 cm wide, corolla lobes oblong, 9–10 cm long, 4–4.5 cm wide; anthers 1.8 cm long. Mature fruit unknown.

DISTRIBUTION. Borneo (Sarawak); known only from the type.

HABITAT. Peat swamp forests.

See under *F. auriculata* here for the distinction from that and other closely related species.

40. Fagraea oblonga King & Gamble

J. As. Soc. Beng. 74, ii (1908) 612. Lectotype (here chosen): *King's coll.* 5430, Perak, Larut (K).

F. ceilanica sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte*, *non* Thunb. (1782).

DISTRIBUTION. Borneo, Malaya and Sumatra.

HABITAT. Lowland and highlands, including limestone.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Kuching, G. Penrissen, *Ilias* S. 16330 (SAN, SAR); G. Mulu, *Lee* S. 38077 (SAN, SAR); 4th. Div., Bintulu, Ulu Sg. Kokus, *Hirano & Hotta* 483 (SAN, SAR); Baram, G. Mulu, *Ilias* S 15090 (A, K, L, M, S). **MALAYA.** Perak, Cottage, *Ridley* 5558 (L); Perak, Larut, *King's Coll.* 5430 (K); Perak, *Scortechini s.n.* (K). **SUMATRA.** W. Sumatra, east of Pajakumbuh, Taram, River Tjampo, *Meijer* 7088 (L).

41. Fagraea oreophila *Wong & Sugau* **sp. nov**. *F. oblongae K. & G. similis, sed foliis ellipticis vel angustate obovatis differt. Typus: Chew, Corner & Stainton No. 1090, Sabah, Mt. Kinabalu, Eastern shoulder (holotypus SAN).* (Fig. 28)

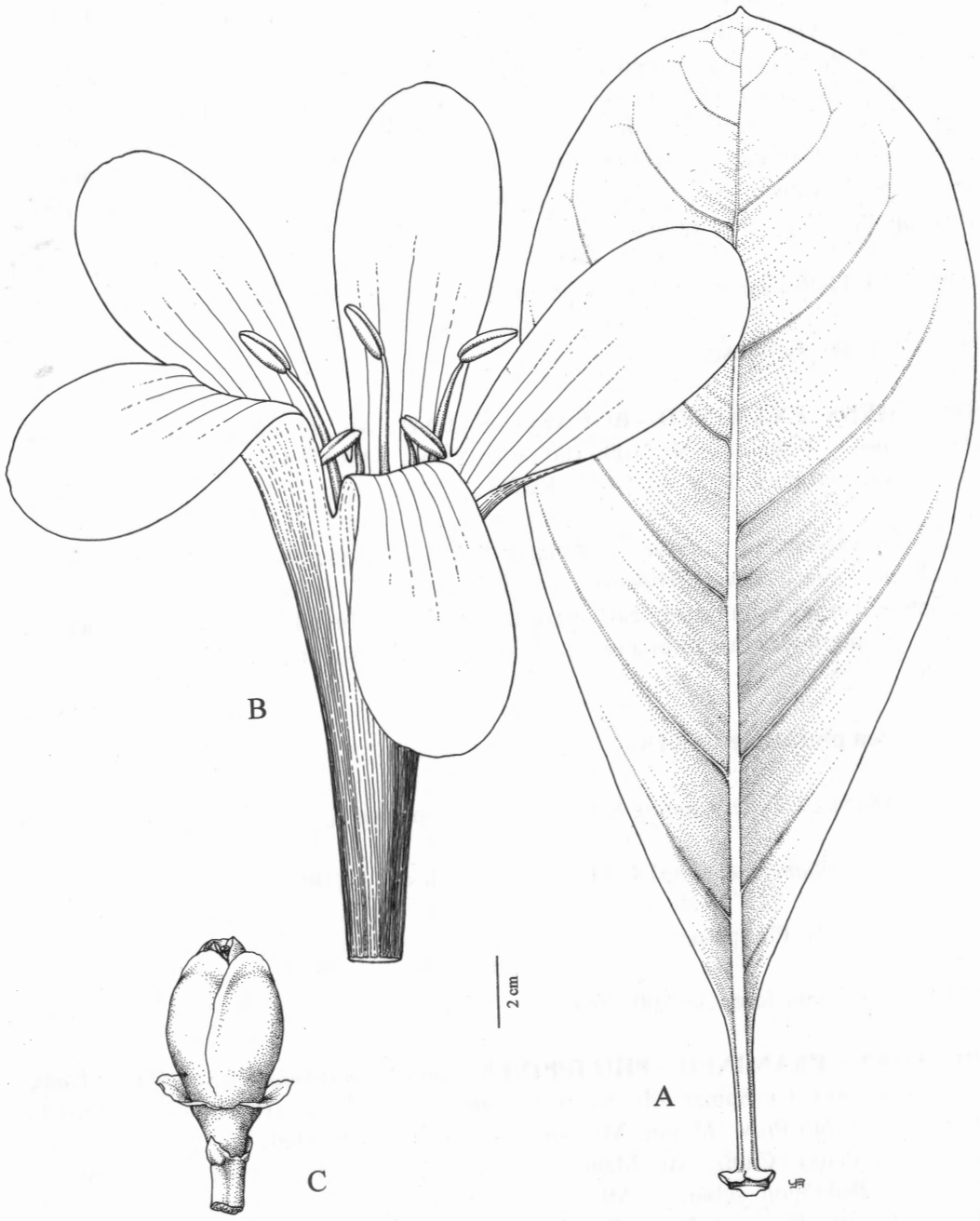

Fig. 27. *Fagraea megalantha*. **A.** Leaf. **B.** Corolla. **C.** Young fruit. All from S. 29378.

F. ceilanica sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Thunb. (1782).

Habit unknown (probably small tree). Branch internodes with longitudinal ridges originating just below the leaf stalk. Leaves obovate, 7–9 × 2.5–4 cm, coriaceous, upper and lower side shagreen, base attenuate, decurrent, margin plane to slightly finely recurved, apex obtuse, acute, midrib prominent; lateral veins obscure; reticulations obscure; leaf stalks 1–1.5 cm, broadly winged, axillary scale inconspicuous, adnate to leaf stalk base. Inflorescence 3-flowered; pedicels 0.8–2.0 cm long; bracteoles 1–2 pairs, 4–6 mm long; corolla pale yellow or white, tube *c.* 2.5 cm long and 5–6 mm wide, corolla lobes *c.* 1.5–1.8 cm long, 0.8–1 cm wide. Fruit green, fruit calyx 1–1.5 cm long, 1–1.5 cm wide.

DISTRIBUTION. Sabah (on Mt. Kinabalu) and Sarawak (Mt. Murud).

HABITAT. Mossy forests.

SPECIMENS EXAMINED—BORNEO. SABAH: Mt. Kinabalu, Eastern shoulder, *Chew, Corner & Stainton* No. 1090 (holotype SAN). **SARAWAK:** 4th. Div. proposed G. Murud National Park, *Yii* S. 44474 (K, KEP, L, SAN, SAR).

F. oreophila resembles *F. dulitensis* Wong & Sugau in having obovate and thin coriaceous leaves and solitary flowers. However, it is distinct from *F. dulitensis* in its slightly visible leaf lateral veins, and ultimate leafy branches developing broadened, somewhat corky and very short internodes that form a series of coarse cicatrices along the branches.

42. Fagraea plumeriaeflora DC.

Prod. 9 (1845) 29. Type: *Cuming* 838 from the Philippines (L).

F. blumei ssp. *plumeriaeflora* (DC.) Leenh., Fl. Males. 1, 6 (1962) 323.

DISTRIBUTION. Philippines.

HABITAT. Primary forest, at 500–2000 m.

SPECIMENS EXAMINED—PHILIPPINES. Lanuza, Surigao, del Sur, Puyat Timber Corp., *Rojo* 300 (L); Samar, Mt. Bodoton, *Gutierra et al.* 711 (Herb. no. 117698) (L); Mindanao, Davao Prov., Mainit, Mt. Apo, *Edano* Phil. Nat. Herb. no. 1345 (L), *Elmer* 11915 (L); Panay, Capiz, Mt. Mandioas, *Ramos & Edano* Bur. Sci. no. 30688 (L); Mindanao, Bukidnon subprov., Mt. Katanglad, *Sulit* Phil. Nat. Herb. no. 9886 (L), Mahilucot River, *Ramos & Edano* Bur. Sci. no. 38645 (L), Agusan prov., Cabadbaran, Mt. Hilong-Hilong, *Mendoza & Convocar* Phil. Nat. Herb. no. 10750 (L).

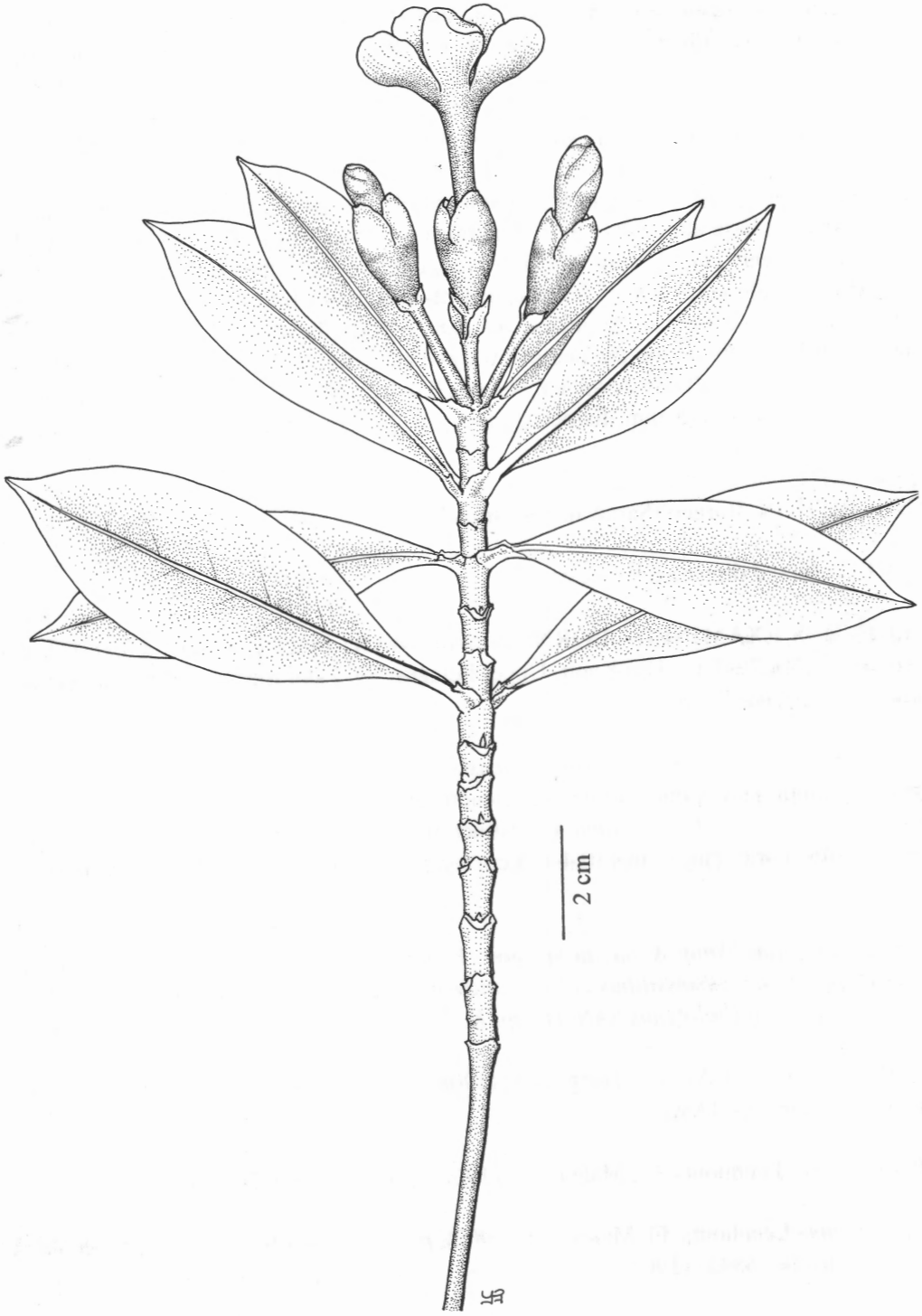

Fig. 28. *Fagraea oreophila*, leafy flowering branch. From S. 44474.

43. Fagraea rarissima *Wong & Sugau* **sp. nov**. *F. blumei Ridl. similis, sed foliis venis laterlibus obscuris differt. Typus: Burley & Lee B.L. 324, Sarawak, Matang (holotypus SAN).* (Fig. 29)

F. ceilanica sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Thunb. (1782).

Shrub; stem bark grey. Leaves narrowly elliptic, 4–8.5 × 1.5–2.5 cm, coriaceous, drying greenish brown; base attenuate-cuneate, margins recurved when dry, apex caudate; midrib slightly prominent; lateral veins invisible; reticulations invisible; leaf stalks 0.5–1.5 cm long axillary scale conspicuous, adnate to leaf-stalk base. Inflorescence a 2–3-flowered cyme; peduncle *c.* 0.3 cm long; pedicel 0.5–0.8 cm long; bracteole 1 pair, small, 2–3 mm long, attached to halfway on the pedicel. Calyx campanulate, 0.8–1 cm long, 0.6–0.7 cm diameter, divided to halfway down, calyx lobes 0.4–0.5 cm long. Corolla salverform, white, tube 2–2.5 cm long, 4–5 mm diameter, lobes 1.5–1.7 cm long. Fruit ellipsoid, 1–1.5 cm long, fruit calyx patent.

DISTRIBUTION. Borneo (Sarawak and Brunei).

HABITAT. Mixed dipterocarp forests.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Matang, *Burley & Lee* B.L 324 (holotype SAN); 7th Div., Ulu Kapit, Upper Pelagus, Sg. Paku tributary of Sg. Lebau, near rumah Rapek, *Chai* S. 33231 (L, SAR).

F. rarissima most resembles *F. kinabaluensis* Wong & Sugau not only in its smallish, narrowly elliptic leaves but also its conspicuous axillary scale which is adnate to the leaf stalk base. However, *F. rarissima* is distinct from *F. kinabaluensis* in having solitary flowers, with shorter calyx cups (0.4–0.5 cm long) and calyx lobes (0.4–0.5 cm long).

44. Fagraea renae *Wong & Sugau* **sp. nov**. *F. blumei G. Don similis, sed inflorescentiis typice sessilibus vet subsessilibus et foliis angustioribus differt. Typus: Anderson S. 19121, Sarawak, Bau, Bidi (holotypus SAN, isotypi K, L, SAR, SING).* (Fig. 30)

F. vaginata K. & G., J. As. Soc. Beng. 74, 2 (1908) 610, *pro parte* (excl. syntypes from Java, which = *F. blumei* G. Don).

F. blumei sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* G. Don (1837).

F. ridleyi sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* K. & G. *emend.* Leenhouts (lectotype: Ridley 5845) (1962).

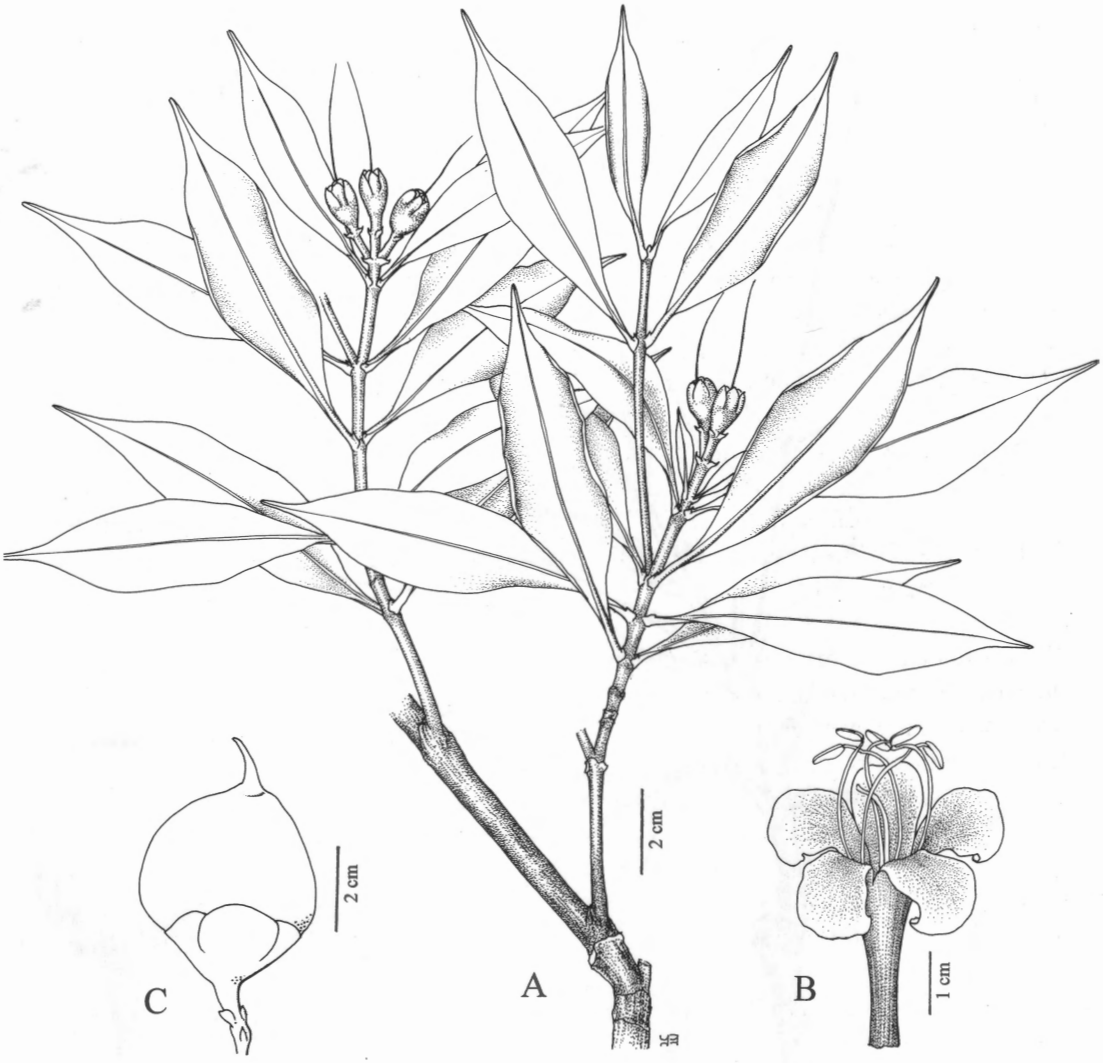

Fig. 29. *Fagraea rarissima*. **A.** Leafy branch with young fruits. **B.** Corolla. **C.** Fruit. **A, B** from *Burley & Lee* 324; **C** from S. 33231.

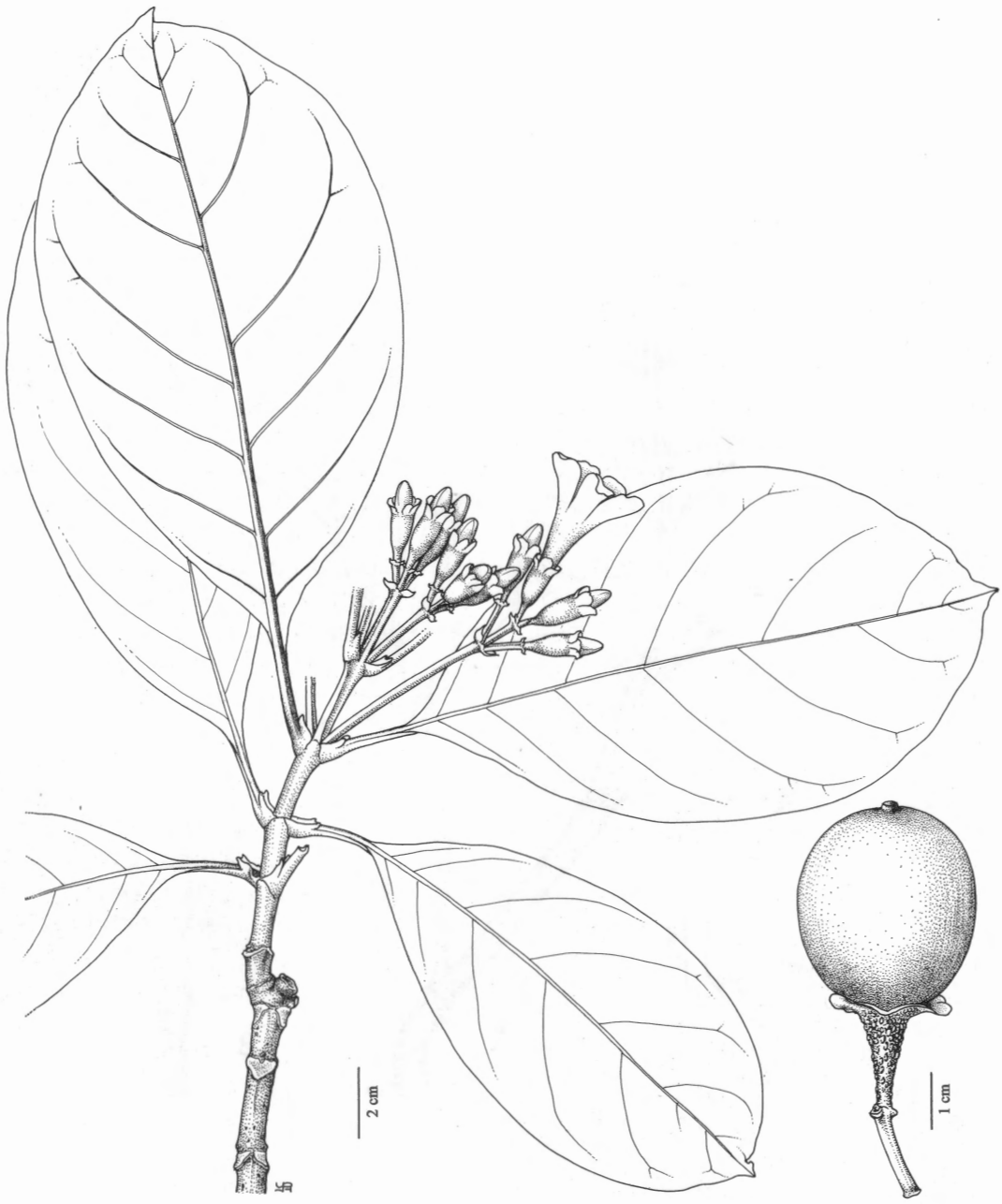

Fig. 30. *Fagraea renae*, leafy flowering branch and a fruit. From S. 19121 (fruit from S. 34381).

Strangling epiphytic shrub. Bark smooth, pale grey; inner bark yellow. Leaves broadly elliptic to broadly oblanceolate, 11–20 × 6–12.5 cm, coriaceous, upper surface smooth, lower surface smooth, base attenuate to broadly cuneate, margin plane, apex with a short abrupt acumen, midrib prominent, rounded; lateral veins 3–6 pairs, lower side prominent, distinctly forked towards the margins, terete, upper side flat to impressed or sunken; reticulations obscure; leaf stalks 2–5 cm long, axillary scale conspicuous, adnate to leaf stalk base. Inflorescence a few- to many-flowered cyme, with 2 main basal branches in the axils of apical leaves, subsessile; pedicel 0.8–1.5 cm long, smooth or lenticellate; bracteoles 1 pair, small, attached to halfway on the pedicel. Calyx campanulate, 1.4–1.6 cm long, calyx lobe 0.4–0.6 cm long. Corolla funnel-shaped, pale yellow, tube 1.5–2 cm long, 0.5–1 cm wide, lobes oblong, 1.5–2 cm long. Stamens creamy. Style club shaped, white, exserted for 0.8–1 cm; stigma greenish. Fruit a berry, ellipsoid to globose, 3–5 cm long, 2–4 cm wide, fruit calyx patent. Seeds ovoid, small, 2 × 1 mm, brownish black.

DISTRIBUTION. Borneo (Sabah and Sarawak) and Malay Peninsula.

HABITAT. Primary and secondary forests, sometimes in mossy forest, also recorded on limestone; river banks and hillsides, from lowlands up to 1200 m.

SPECIMENS EXAMINED—BORNEO. SABAH: Sandakan, Segaliud Lokan, *Aban & Leopold* SAN 80987 (AA, K, KEP, KLU, L, SAN, SAR, SING); Sandakan, Segaliud Lokan, *Aban* SAN 81130 (K, KEP, L, SAR, SING); Sandakan, Segaliud Lokan, *Charington* SAN 75555 (K, L, SAN); Lahad Datu, Ulu Segama, Sungai Beatrice, *Cockburn* SAN 84984 (SAN); Lahad Datu, Ulu Sungai Danum, *Cockburn* SAN 85112 (L, SAN); Ranau, Mount Kinabalu, Mesilau, *Collenette* 628 (K), 21598 (A, CANB, G, K, L, SAR); Lamag, *Dadau* No. 44903 (K, L); Keningau, mile 16, Nabawan-Keningau road, *Dewol* SAN 83783 (SAN); Kinabatangan, Keruak Forest Reserve, *Francis & Jarius* SAN 107815 (SAN); Tawau,, Ulu Segama, *Free & Sumbing* SAN 79152 (K, L, SAR, SING); Sandakan, Kretam, *James* SAN 33961 (K, KEP, L, SAR, SING); Lahad Datu, Ulu Segama, *Joseph et al.* SAN 123697 (SAN); Lahad Datu, Bukit Bole, Segama, *M. Chai* SAN 25981 (K, L); Lahad Datu, Danum Valley, *Madani* SAN 112926 (SAN); Lamag, Sungai Bangan, *Madani* SAN 33225 (SAN); *Madani* SAN 72979 (SAN); Mostyn, Kalumpang Forest Reserve, *Sinaggul* No. 57039 (SAN); Sandakan, Sungai Binuang, *Singh* SAN 30702 (K, L); Kinabatangan, Latangon, *Singh* SAN 31092 (K); Lahad Datu, Ulu Sungai Danum, *Stone* 85415 (KLU); Lahad Datu, Masuli-Koyah, *Wood* SAN 15023 (BO, BRI, K, KEP, L, SING). **SARAWAK:** 1st Div., Bau, Bukit Krian, *Anderson, Ashton & Wolfendon* S. 22094 (A, BO, K, L, SING, SAN); 1st Div., Bau, Bidi, *Anderson* S. 19121 (holotype SAN, isotypes K, L, SING); 1st Div., Bau, Bukit Gebong, on limestone rock, *Anderson* S. 27651 (A, BO, K, L, SING); 1st Div., Kuching, *Ashton* S. 21015 (A, K, L, SAR); 5th Div., Hose mountains, base of Bukit Temedu, *c.* 1100 m alt., dacite, *Ashton* S. 19009 (SAR); Segan Forest Reserve, N. Sepulau, *Ashton* S. 22070 (A, BO, K, KEP, L, MEL, SAN, SING); 1st Div., Bidi area, 3-4 km SSW of Bau, alt. 150 m, *Burley & Lee* 329 (SAR); Bau, Kuching, Tai Ton, Bukit Tabai, *Chai & Lee* S. 22880 (A, BO, K, KEP, L, MEL, MOSC, SAN, SAR, SING); 7th Div., Ulu Sg.

Kapit, Bkt. Goram, *Chai* S. 36186 (SAR); Kuching, Padawan, Bkt. Megetang, *Erwin & Paul* S. 27468 (A, BO, K, KEP, L, SAN, SAR); 1st Div., Bau, Krongkong road, Bidi, *James* S. 42129; Miri, Ulu Luah, *Othman* S. 21333 (K, L, SAR, SING); Bau, *Purseglove* P 4480; 4th Div., Lambir N.P., *Rena* S. 40346 (E, L, K, KEP); Miri, mile 6.5, Bakam road, *Sibat* S. 25174 (A, BO, FHO, K, KEP, L, MEL, SAN, SAR, SING); *Sylvester* 34; 1st Div., Bau, Sebauran, *Sylvester* S. 34381 (K, KEP, L, MO, SAN, SAR); Bau, *Tan* 123 (SAR). **KALIMANTAN:** Kalimantan Timur, foot of Gunung Seribu, *Ueda & Darnaedy* B. 8974 (L); Berouw, Mapulu, *Kostermans* 13964 (K, L). **MALAYA.** Perak, Larut, *King's coll.* 3868 (L); Tapah Hills, 3000 ft., *Ng* FRI 1373 (KEP, L).

F. renae resembles *F. blumei* G. Don in having conspicuous axillary scales adnate to the leaf-stalk bases and a branched inflorescence, but differs by its sessile to subsessile inflorescence and higher number (3–6 pairs) of lateral veins that are prominent on the lower leaf surface and distinctly forked towards the margins. It is also close to *F. floribunda* Wong & Sugau but differs by its more compact inflorescence with much shorter branches.

This species commemorates the late Rena George of the Sarawak herbarium.

45. Fagraea resinosa Leenhouts

Bull. Jard. Bot. Brux. 32 (1962) 429. Type: *Hallier* 3162, Amai Ambit (holotype L, isotype BO).

F. auriculata ssp. *borneensis* Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non F. borneensis* Scheff. (1869).

DISTRIBUTION. Borneo (Sabah, Sarawak, Brunei and Kalimantan).

HABITAT. Montane forest, also recorded at *c.* 1000 m on limestone on Mt. Api in Sarawak..

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, Kundasang, Ulu Liwagu, *Chew, Corner & Stainton* 1381 (K, L, SAN); Mt. Kinabalu, Bambangan river, *Chew & Corner* RSNB 4447 (K, SAN); Ranau, Kinabalu, *Lajangah* SAN 44769 (SAN); Ranau, Kinabalu N.P., NE boundary, *Sadau* SAN 49792 (K, L, SAN); Ranau, Kinabalu, *Sinanggol* SAN 51364 (SAN). **SARAWAK:** 5th. Div., Limbang, G. Pagon, *Awa & Lee* S 47912 (K, KEP, L, MO, SAN); 4th. Div. Baram, Kelabit Highland, summit of Apo Dari, *Chai* S 35930 (A, K, L, MO, SAN); 1st., Div., Serian/Semenggoh road, 74th mile, Sabal Keruing F.R., *Dania* S 41030 (K, KEP, L, MU, SAN); Kapit, Melinau, Ulu Sampurau, Bkt. Salong, *Ilias* S 29300 (K, L, SING); 7th Div., Kapit, Melinau, Ulu Sampurau, Bukit Sampandai, *Ilias* S. 40911 (L); Baram, Tutoh, Ulu Melinau, Gunung Api, *Anderson* S. 30889 (L). **BRUNEI**: Temburong, Bukit Belalong, *Asah* BRUN 3083 (BRUN, K); ridge northeast of Gunung

Retak, 1350 m, *Sands* 5407 (BRUN, K). **KALIMANTAN:** W. Koetai, *c.* 1800 m, *Endert* 4369 (K, L).

Leenhouts (1962) noted that *F. resinosa* was then known only through specimens with fruit or flower buds; in fact, he had erroneously placed the flowering specimens of this under his "*F. auriculata* ssp. *borneensis*". *F. resinosa* has corollas (including lobes) up to about 8–9 cm long; *F. borneensis* (the basis of his *F. auriculata* ssp. *borneensis*) has corollas about 1.5 times as long.

46. Fagraea ridleyi King & Gamble

J. As. Soc. Beng. 74, ii (1908) 612. Lectotype (Leenhouts, Fl. Males. 1, 6 (1962) 320): *Ridley* 5845, Singapore (SING).

F. ridleyi sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte*.

DISTRIBUTION. Borneo, Malay Peninsula and Lingga.

HABITAT. Lowland mixed dipterocarp and *kerangas* forest in Borneo.

SPECIMENS EXAMINED—BORNEO. SARAWAK: 4th. Div., Lambir N.P., on the way to Lambir Hill, *Rena George* S. 40346 (E, K, KEP, L, UE); *Beccari* 1450 (K). **BRUNEI:** Andulau Forest Reserve, *Ashton* BRUN 66 (L); Temburong, Bukit Peradayan, *Ashton* BRUN 537 (BRUN, K); Belait, Labi, Bukit Teraja, *Kirkup* 270 (BRUN, K). **MALAYA.** Singapore, Bukit Timah, *Ridley* 5845 (K, SING).

The robust twigs, extremely thick-coriaceous leaves and short terminal cymes distinguish this species, which is an epiphytic climber or strangler. One Iban name recorded from Sarawak is *buah telan kenyalang* ("the fruit that the Hornbill swallows").

47. Fagraea splendens Blume

Mus. Bot. 1 (1850) 168. Type: *Korthals, s.n.*, Borneo (L: sheet no. 908.127-639).

F. heterophylla Bl., Mus. Bot. 1 (1850) 168. Type: *Korthals, s.n.*, Borneo, Banjermarsing (L: sheet no. 908.127-518).

F. acuminatissima Merr., J. Str. Br. R. As. Soc. 77 (1917) 232; Leenhouts, Fl. Males. 1, 6 (1962) 319. Type: Native coll. 686, Sarawak (isotype L).

F. ceilanica sensu Leenhouts, Fl. Males. 1, 6 (1962), *pro parte, non* Thunb. (1782).

DISTRIBUTION. Borneo, Malaya and Sumatra.

HABITAT. Occurring on various types of soil, from sea level up to 1333 m.

SPECIMENS EXAMINED—BORNEO. SABAH: Sandakan, Samawana river, *Kless* SFN 18685 (K); Tawau, Ulu Sungai Kalumpang, *Aban* SAN 30473 (L); Kota Belud, Kandasan, *Wood & Kapis* SAN 16396 (L); Beaufort, Pangi, 5 miles wnw of Tenom, *Wood* SAN 15209 (L); Lahad Datu, Segama river, near Lakanan river, *Beaman* 10109 (K, L). **SARAWAK:** Binatang, Pulau Buit, *Anderson* 7943 (L); Kapit, Sut, Sg. Bena, *Ilias* S 41714 (K, KEP, KLU, SAR); Miri, Lambir N.P., *Lee* S. 46570 (K, KEP, L, MO, SAN, SAR); Balingian, Bawan, Begrih, Rumah Temenggong, *Chai* S 19454 (K, L, SAR, SING). **BRUNEI:** Badas F.R., *Ashton* BRUN 5549 (BRUN, K); Seria, Lumut Hill, *Fuchs* 21196 (K); Kuala Belalong, *Jacobs* 5633 (K, L); Belait, falls upstream from Batu Melintang swamp, *Wong* WKM 683 (BRUN, K); Kuala Belait, Andalau F.R., *Wood, Smythies & Ashton* SAN 17512 (L, SAN). **KALIMANTAN:** Peak of Balikpapan (G. Beratus), *Kostermans* 7466 (L); W. Kalimantan, S of Pontianak, G. Paluna nature reserve, *van Balgooy & Setten* 5434 (L); S. Kalimantan, 10 km NE of Muara Uya, Jaro Dam, *Kuswata* 778 (L); E. Kalimantan, Wanariset, *Ambri & Arifin* W 332 (K). **SUMATRA.** Asahan, *Yates* 2587 (K).

Leenhouts (1962) identified the types of Blume's *F. splendens* and *F. heterophylla* as *F. ceilanica* and hence used Merrill's name (*F. acuminatissima*) for this species.

48. Fagraea stonei *Wong & Sugau* **sp. nov**. *F. carnosae Jack similis, sed bracteolis paribus decussatis duobus parvis et tubis corollae maturis longioribus (11.5–15 cm) differt. Typus: Lideh SAN 109531, Sabah, Telupid, Tawai (holotypus SAN).* (Fig. 31)

Woody climber or epiphytic shrub. Leaves broadly elliptic to lanceolate, 5–13.5 × 3–6 cm, thick coriaceous, upper and lower surfaces smooth, base cuneate to rounded, margin recurved when dry, apex cuspidate or acute; midrib prominent, sharply ridged; lateral veins invisible; reticulations obscure; leaf stalks 1.5–2.5 cm long, axillary scale inconspicuous. Flower solitary; pedicel 0.2–0.5 cm long; bracteoles 2 pairs, small, 5–6 mm long, attached to calyx cup base and to halfway on the pedicel. Calyx cup-shaped, 2.5–3.8 cm long, 2.3–2.5 cm diameter, divided to more than halfway down, calyx lobes 1.8–2.3 cm long. Corolla infundibular, to 8 cm long, the tube to 4 cm long and 6–7 mm across at the base, the lobes to 4.8 cm long and 2.5 cm wide. Fruit a berry, ellipsoid, mucronate apically, 3–4 x 2–3 cm, fruit calyx clasping the fruit base. Seeds ovoid, small, 2 × 1 mm, brownish black. DISTRIBUTION. Borneo (Sabah and Sarawak).

HABITAT. Heath forests, white-sand podsols, also basalt ridges.

SPECIMENS EXAMINED—BORNEO. SABAH: Telupid, Tawai, *Lideh* SAN 109531

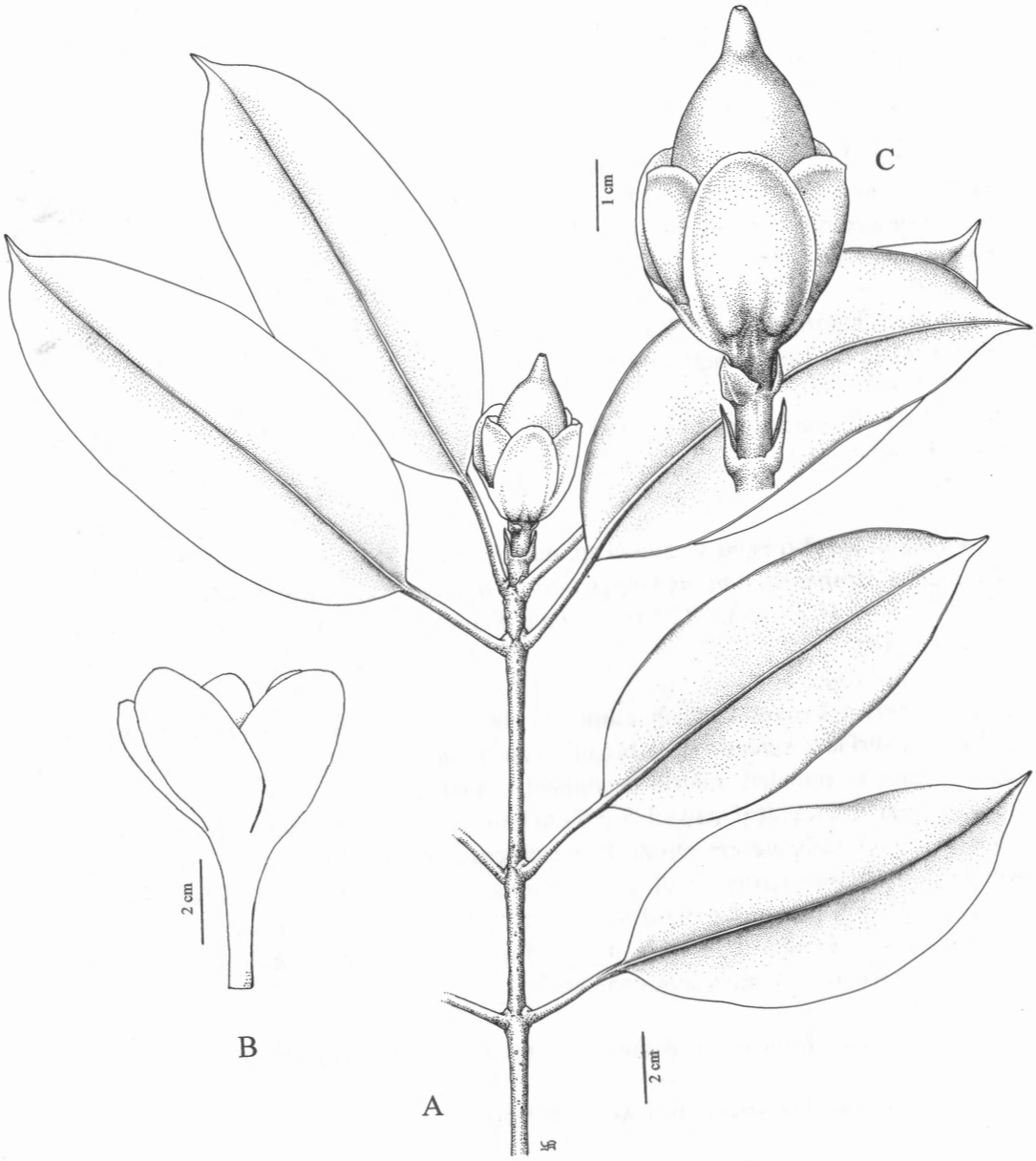

Fig. 31. *Fagraea stonei*. **A.** Leafy fruiting branch. **B.** Corolla. **C.** Young fruit. **A, C** from SAN 109531; **B** from *Nooteboom & Chai* 2177.

(holotype SAN); *Mansus & Francis* SAN 108451 (SAN). **SARAWAK:** 1st Div., Kuala Sungai Sarawak, Muara Telas, *Chai et al.* S.38567 (K, KEP, L, MO, SAN); 5th Div., Balingian, Bawan, Begrih, Rumah Temenggong, *Chai* S. 19462 (K, L, SAR); *Haviland* 3067 (SAR); 7th Div., Bario, Kelabit highlands, *Nooteboom & Chai* 2177 (SAR); 3rd Div., Anap, Bt. Mersing, *Sibat* S. 22140 (K, L); 3rd Div., Anap, Bt. Mersing, *Sibat* S. 22189 (A, K, L, SAN, SING).

F. stonei resembles *F. carnosa* Jack in having typically solitary flowers and thick-coriaceous leaves with obscure lateral veins, but it differs in having smaller bracteoles at the base of the flower and a corolla tube that is much shorter (2.5–4 cm long). *F. stonei* also differs from *F. calcarea* Hend. because that has 2 large basal bracts, the leaves are without recurved margins, and the calyx lobes are 1.5 times as large.

Leenhouts identified, in 1963 and 1970 (after his revision of 1962), some of the above specimens in the Leiden herbarium as *F. ceilanica*, and others as "indet.".

This species commemorates the late Dr B.C. Stone, teacher and mentor to many Malaysian students of botany.

49. Fagraea tuyukii *Wong & Sugau* **sp. nov**. *F. littorali Bl. similis, sed squamis stipulaceis axillaribus conspicuis, adnatis basi petioli, et foliis crassis marginibus recurvatis in sicco differt. Typus: Meijer SAN 122605, Sabah, Keningau, Trusmadi, Sinua (holotypus SAN, isotypus SAR).* (Fig. 32)

Habit unknown. Leaves smallish, elliptic to obovate, 4–8 × 4–7 cm, stiff coriaceous, upper and lower surfaces smooth, base broadly cuneate to rounded, margin recurved when dry, apex obtuse to rounded, midrib prominent, rounded; lateral veins obscure or invisible; reticulations obscure; leaf stalks 1.5–1.7 cm long, axillary scale conspicuous, adnate to leaf-stalk base, leaf-stalk auricle absent. Infructescence of a few fruits in a cyme; pedicel 1–1.5 cm long; bracteoles 1 pair, small, 2–3 mm long, attached to halfway on the pedicel. Calyx cup-shaped (in fruit), warty, 0.9–1.4 cm long, 1–1.2 cm wide; lobes orbicular, 1.5–1.8 mm across. Flower unknown. Fruit a berry, ellipsoid, mucronate apically, 2.5–3 cm long, 2.5–2.7 cm wide, fruit calyx lobes patent.

DISTRIBUTION. Endemic to Borneo (Sabah); known only from the type.

HABITAT. Upper dipterocarp forests, at 700–800 m.

F. tuyukii most resembles *F. littoralis* Bl. not only in its elliptic to ovate-obovate leaves with cuneate to rounded base, but also in its warty calyx cup. However, it is distinct from *F.littoralis* in its conspicuous axillary scales, thicker leaves with recurved margins (when dry), and fewer flowers. Compared with *F. stonei* Wong & Sugau, it differs in having few flowers and conspicuous axillary scales.

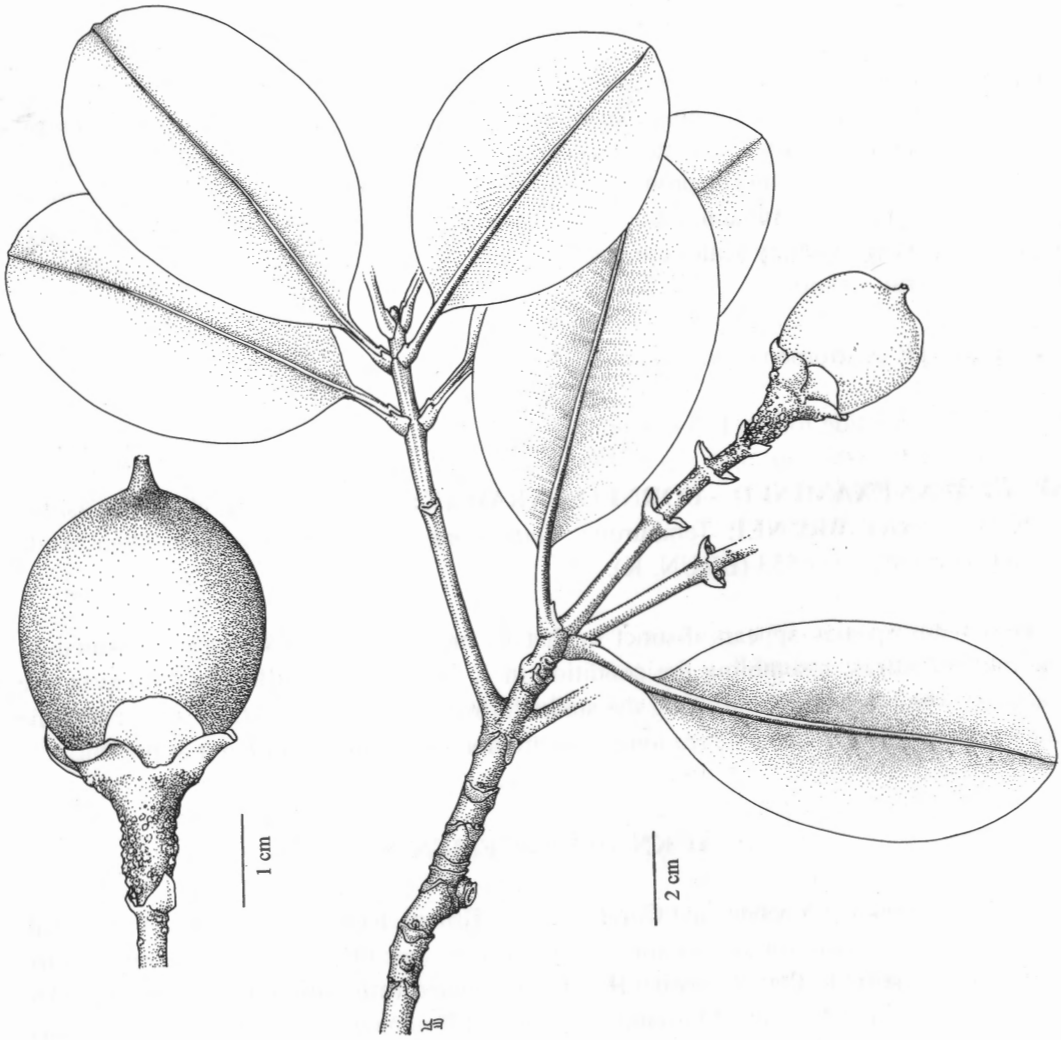

Fig. 32. *Fagraea tuyukii*, leafy fruiting branch and detail of fruit. From SAN 122605.

The habit of this distinct species is not known due to the lack of detailed field notes, but the material suggests a climbing habit.

The species is named after the late Tuyuk Gangou, who served the Sandakan herbarium as tree-climber for many years.

50. Fagraea sp. **A**

Epiphytic shrub. Branch internodes with 4 ridges, each originating just below a leaf-stalk auricle. Leaves large, broadly obovate, 40–45 × 17–18.5 cm, thick-coriaceous, upper and lower surfaces smooth; base attenuate, decurrent, margin plane to slightly finely recurved when dry, apex acute, midrib prominent; lateral veins 4–5 pairs, lower side prominent, upper side impressed or sunken; reticulations obscure; stalks 3–3.5 cm long, winged (wings several mm wide), axillary scales conspicuous, leaf-stalk auricles distinct, to 3–5 mm long. Flower and fruit unknown.

DISTRIBUTION. Borneo (Sarawak).

HABITAT. Riverside forest, 100–200 m.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Balleh, Mujong, N. Amau, *Ashton* S. 12121 (SAR). **BRUNEI:** Temburong, Temburong River, just upstream from Wong Nguan rapids, *Coode* 6553 (BRUN, K).

Although this species appears distinct in that its branch internodes have 4 conspicuous longitudinal ridges, resembling the condition in *F. imperialis*, it differs in its leaves, the blades of which are decurrent along the stalks forming distinct wings (in *F. imperialis* the leaf stalks are distinct and 1–2 cm long). We are not confident of naming it at present.

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