Materials for a Monograph of Freycinetia Gaud. (Pandanaceae)

VI. Species of Borneo

By Benjamin C. Stone

School of Biological Sciences, University of Malaya
Kuala Lumpur, Malaysia

Abstract

Twenty-four species of Freycinetia Gaud. (Pandanaceae) are reported from Borneo, more than twice as many as previously known. Four species are new to science: F. parvicauleata, F. biloba, F. kalimantanica, and F. kinabaluana. The following new infraspecific taxa are also proposed: F. confusa var. minima, F. javanica var. expansa, F. robinsonii var. meijeri, and F. palawanensis var. andersoniana. A brief phytogeographic discussion is included.

No account of the Bornean species of Freycinetia has appeared since that of Merrill (1921), which listed 11 species. Since that time two further species have been described by Martelli (1929). The accumulation of specimens in various herbaria has not been accompanied by investigations into the taxonomy of the genus in Borneo, although other regions, in particular New Guinea and the Solomon Islands, have been the subject of study by Martelli and Perry (1939, 1940). Through the generosity of the Forest Department Herbaria in Sandakan (Sabah) and Kuching (Sarawak), as well as that of the Botanic Gardens (Singapore) and the Forest Research Institute (Kepong), most of the material collected in Borneo in recent years has been available to me for study. During academic leave from the University of Malaya in 1968 studies were undertaken of materials preserved in the herbaria of the University of Firenze (where both the Beccari collections and the Martelli Herbarium are kept), in the Rijksheerbarium, Leiden, in the Royal Botanic Gardens, Kew, and also Edinburgh, and in the British Museum (Natural History). From these studies it has been possible to gain a much better understanding of the genus and in particular of the species occurring in Borneo. In this paper, twenty-four species are reported, many for the first time, and four new species are proposed. The species are, wherever possible, referred to sections of the genus. These sections have been described in Part IV of this series.

Phytogeographic considerations. The relationships of the Bornean species rest chiefly with the rest of Malesia (i.e. Sumatra, Java, Malayan Peninsula, and the Philippines) and only to a slight extent with Eastern Indonesia (Celebes, Halmahera, Sunda Islands, etc.). As far as is presently known, there is no species shared by New Guinea and Borneo. Three species, at least (probably some other examples will be discovered) occur both in Borneo and in the Philippines but not elsewhere (F. discoidea, F. gitingiana, and F. palawanensis). Two species occur in the Philippines, Borneo,
and eastward, in Java, Sumatra, and Malaya. These are *F. sumatrana* and *F. angustifolia*. (These species are herein first reported for the Philippines). It, as seems possible, *F. imbricata* occurs in the Philippines under another name (possibly *F. montalbanica* Martelli) it could be added to the list. There are five species (*F. sumatrana*, *F. angustifolia*, *F. javanica*, *F. imbricata*, and *F. rigidifolia*) which occur in Borneo, in Malaya, and additionally in Sumatra, Java, or both, or (as to the first and last only) in the Andaman Islands, or (as to the first and third only) in southern Thailand.

This means that thirteen species appear to be endemic to Borneo. On the other hand it is entirely possible that further species will come to light as the exploration of the rich Bornean vegetation continues.

**Taxonomic characters, with some advice to collectors.** As is also true of *Pandanus* as represented in herbaria, there is a great preponderance of pistillate specimens of *Freycinetia*. There are perhaps two main reasons for this, one being the fact that the male inflorescences are ephemeral, while the developing fruits persist on the plants over a period of months; and the other reason being that since the classification of the genus has been based so heavily on pistillate materials there is little likelihood of staminate collections being properly identified unless accompanied by pistillate material of the same species. As will be noticed in the key and descriptions to follow, the value of certain vegetative characters has proved to be great, and attention by collectors to the securing of good vegetative material, especially the delicate leaf-base auricles, will greatly facilitate the identification of all specimens and in particular the males. Further distinctive characteristics, such as the color of the floral bracts and of the auricles, the presence of glaucousness, and the differences between leaf size and shape in adult and juvenile plants, should be borne in mind by the collectors and noted down. At present it is not possible to determine very young juvenile and seedling plants. The importance of ripe fruit with mature seeds is also great, and these are generally to be preferred to the immature fruits or flowers of pistillate plants if the floral bracts are lacking. The prophylls of developing young shoots are also of value, at least potentially, in the process of identification.

A cautionary word should be said of the external features of the pedicels. At present, no species known produces the staminate spadices on anything but smooth and glabrous pedicels. However, the presence of epidermal appendages (spine-like processes, aculeate or straight, or other scale-like structures which give to the pedicel a scabrid “feel” and appearance) is a useful and important diagnostic feature, although present only on pistillate inflorescence pedicels.

The following key to species is of necessity based on the features of pistillate specimens, since at least 14 of our species are known only from pistillate collections. It is hoped that careful attention will be paid to the desirability of obtaining material of the staminate inflorescences in future collections.
Key to Borneo Species of Freycinetia

1. Leaf apex rather abruptly acuminate-caudate or cuspidate (but see also F. gitingiana). Leaves mostly relatively short, rarely much over 40 cm long.
2. Berry with one stigma (rarely 2). Leaves small, mostly 7–9 cm long, 2–3 cm wide, and elliptic 1 F. tenuis
2. Berry with 2 or more stigmas. Leaves mostly larger.
3. Berry with 2 or 3 stigmas.
4. Blades elliptic, proportionally very wide, 7.5 × 2.5 cm up to 22.5 × 7.5 cm, apex caudate, cauda slightly acuminate 17 F. hemsleyi
4. Blades oblanceolate, proportionally narrower, about 16 × 1–3 cm, apex abruptly caudate 12 F. borneensis
3. Berry with usually 3–7 stigmas (very rarely only 2).
5. Fem. pedicels glabrous. Leaves about 40 × 2.4 cm. Stigmas mostly 4–6 per berry 10 F. palawanensis var. andersoniana
5. Fem. pedicels spinulose-hispidulous or glabrous. Auricles denticulate to long-ciliate.
6. Auricles pectinate long-ciliate. Leaves 12–20 cm long, 2–3 cm wide, the margins at base and apex ciliate 13 F. ciliaris
6. Auricles minutely denticulate on margins. Leaves about 30 cm long, 2.5–3.5 cm wide, nearly entire except at extreme apex and base where margins bear few very minute denticulations 11 F. biloba

1. Leaf apex gradually and narrowly attenuate, subulate, or acute; leaves sometimes well over 1 m long.
7. Auricles lobed (i.e. upper end of auricle extended upward-outward like a lobe).
7a. Robust plants; leaves to 120 cm long, 4–6 cm wide. Cephalia long-cylindric. Stigmas usually 2 (rarely 3) per berry; pedicels stout, minutely scabrous 5 F. sumatrana
7a. Smaller plants; leaves c. 50 × 1 cm. Cephalia cylindric; stigmas 2; pedicels slender, distally spinulose 6 F. lucida
7. Auricles entire, at apex rounded, truncate, or tapered.
8. Cephalia usually 4–7 together, spirally crowded. Robust plants with leaves 80–100 cm long, 2.5 cm wide 7 F. kinabaluana
8. Cephalia usually ternate (3 together in an umbel), rarely 4, sometimes only 2 or solitary.
9. Auricles deeply pectinate-spinulose; leaves rigidly ensiform, narrow, abruptly narrowed at the auricle and with revolute margins 9 F. rigidifolia

9. Auricles, etc., not as above.

10. Inflorescences lateral (i.e. below the main cluster of leaves, produced at the apex of a short lateral branch bearing prophylls and floral bracts but no ordinary foliage); or sometimes both lateral and terminal.

11. Leaves mostly 15–35 cm long, 0.6–1.5 cm wide; fem. pedicels glabrous or (in one variety) slightly hispidulous. Cephalia subglobose or nearly short-oblong, ternate, binate or solitary 4 F. imbricata

11. Leaves mostly 40–60 cm long, 0.6 cm wide, cephalia subglobose, solitary or two 3 F. sarawakensis

10. Inflorescences invariably terminal (except in F. imbricata)

12. Inflorescence a raceme of small oblong well-spaced short-pedicellate cephalia. Leaves linear, less than 1 cm wide 2 F. angustifolia

12. Inflorescence umbellate (or solitary).

13. Robust plants with leaves 60–100 cm long, up to 3.3 cm wide, thickly coriaceous.

14. Stigmas invariably 2 per berry; berries extremely long and slender, filiform. Cephalia oblong-cylindric, borne on minutely but densely aculeolate pedicels 8 F. parviaculeata

14. Stigmas usually 4–8 per berry; berries broader than filiform. Cephalia subglobose, borne on glabrous pedicels 15 F. corneri

13. Leaves shorter, or narrower, or both.

15. Pedicels of pistillate inflorescences quite glabrous.

16. Stigmas 3–7 per berry. Leaves commonly 2 cm wide or wider.

17. Leaves mostly (20–) 40–50 cm long, about 2 cm wide.

18. Leaves acute, unarmed or nearly so; stigmas mostly 3–5 (–7) 14 F. concinna
18. Leaves acuminate, conspicuously prickly on basal margins; auricles purplish; stigmas usually 2, rarely 3–4
   \[16\] *F. discoidea*

17. Leaves mostly 12–25 cm long, 1–3 cm wide; in juvenile plants these dimensions somewhat exceeded. Auricles not purplish.
   \[18\] *F. javanica*

16. Stigmas 3–4 per berry; leaves 40–60 cm long, 0.6 cm wide
   \[3\] *F. sarawakensis*

15. Pistillate pedicels scabrid or hispidulous.

19. Stigmas usually 2 per berry. Leaves 45–70 cm long, about 1 cm wide, rather stiffly linear-ensiform and attenuate-subulate. Auricles purplish-brown, subtruncate, entire. Floral bracts purple
   \[21\] *F. winkleriana*

19. Stigmas 2–5 (–8) per berry. Auricles entire or somewhat denticulate on margin.

20. Leaves less than 15 mm wide,

21. Leaves 4–10 mm wide, lanceolate or linear.

22. Leaves linear, 4 mm wide
   \[24\] *F. confusa* var. *minima*

22. Leaves 7–10 mm wide
   \[4\] *F. imbricata* var. *kuchinensis*

21. Leaves 10–13 mm wide, long-lanceolate, gradually attenuate. Cephalia cylindric
   \[19\] *F. robinsonii* var. *meijeri*

20. Leaves 18–30+ mm wide.

23. Stigmas usually 2; cephalia slender cylindric, 4–6+ cm long, yellowish; leaves with short conspicuous prickles on margins near apex and base
   \[22\] *F. gitingiana*


24. Stigmas most commonly 4 (but 3–6); cephalia about 25 mm long; leaves virtually unarmed, apex acute
   \[20\] *F. creaghii*

24. Stigmas most commonly 6 (but 5–8); cephalia about 35 mm long; leaves almost unarmed, apex attenuate
   \[23\] *F. kalimantanica*
Enumeration of species

Sect. Oligostigma Warb. em. B. C. Stone

(1) *Freycinetia tenuis* Solms, Linnaea 42: 87, 1879.

*Liana* pumila montana silvatica in saxibus occurrents, caulis ad 4–5 mm diametro, internodiis 12–15 mm longis, *foliis* ellipticis acuminatis brevcaudatis basi angustatis 7–9 cm longis, 2–2.8 cm latis, auriculis brevibus ad 8 mm longis (delapsis); marginibus foliorum et costa, apicem versus excepta, inermibus caudis brevdecinctulis. *Inflorescentia* foeminea terminalis ternata pedicellis gracillis semiteretibus laevibus 16–18 mm longis, 1.5–1.8 mm crassis. Cephalia subglobosa vel breviter oblongata 1–1.8 cm longa, 8–10 mm lata. Baccae maturitate ad apicem succulentae, stigma unicum. Apex baccae rotundatus. *Inflorescentia* mascula subterminalis, bracteis ovatis acutis ad 23 × 16 mm. Spadix ad 1 cm longus, parte floriferis 4 × 2 mm.

Type: **SUMATRA**: *Korthals 23* (L!), staminate.

BORNEO: E. Sabah; Tambunan District, Koinaran, creeper in mountain forest in rocky soil, fruit green, Oct. 1962, G. Mikil SAN 31851 (SAN!). Mt. Kinabalu, Dallas, alt. 3,000 ft., Aug.–Sep. 1932, J. & M. S. Clemens 26210 (= 26734) (L!); Penibukan, 4,000–5,000 ft., Jan. 1933, Clemens 31038 (L!), 50137, 32135 (BM!).

This species is easily recognized among the Bornean *Freycinetia* by its small size and unistigmatic gynoecia. The small globose cephalia and the berries with rounded, succulent apices, place the species in the Sect. Oligostigma as recently delimited. It is very similar to *F. beccarii* Solms, the lectotype species of this section. The type specimen was staminate; these collections permit, for the first time, the description of the pistilate characters.

Sect. Racemosiflorae B. C. Stone

(2) *Freycinetia angustifolia* Blume, Rumphia 1: 149, t. 43. 1835.

Merrill, 1.c. 1921.

Type from Java. Previously reported from Borneo by Merrill (*Foxworthy 91, from Sarawak; Motley 1128, Kalimantan*).

SARAWAK: Lundu, unknown collector (but probably a duplicate of *Foxworthy 91*), staminate (SAR!). Simanggang District, Trisa P.F., small climber reaching 5 ft. high, in peat-swamp forest, Jan 1958, J. A. R. Anderson 14545 (SAR!).

INDONESIAN BORNEO (KALIMANTAN): Bandjermasim, Motley 1128 (K!).

This highly characteristic species can now be confirmed from the Philippines for the first time:

PHILIPPINES: Sibuyan; Mt. Giting-giting, Prov. Capiz, May 1910, *Elmer 12426* (labelled with MS name “F. baganot Martelli” — ined.) (L! EDINB!). — Same location, March 1910, *Elmer 12071* (det. as F. elmeri Martelli) (K! EDINB!).
Sect. Sarawakenses B. C. Stone

(3) *Freycinetia sarawakensis* Martelli, Webbia 3; 179, 1910. Merrill (1921) p. 34.

Type from Sarawak (*Beccari* 1829). Also recorded from Kalimantan (*Jaheri* 1017). *Hallier 3188* was also listed; there are two species under this number in Hallier’s collections. *Hallier 3188-bis* represents this species, while *3188* proper represents (and is the type of) *F. lucida* Martelli.


This unusual species is the type of Sect. Sarawakenses. No staminate collections are known so far, but in its curious lateral and solitary cephalia, and its elongated (50–60 cm long) leaves, only 6–8 mm wide, it is a striking species. The leaf auricles are about 25 × 3 mm. The pistillate cephalia are subglobose, about 30 × 25 mm, and are borne on a stout short pedicel 10 × 4 mm. So far this plant has not been found outside Borneo.

(4) *Freycinetia imbricata* Blume, Rumphia 1: 157, t. 40. 1835.

Figure 1.


Type from Java (Blume). Type of Ridley’s *F. kingiana* is *Kunstler 4654* from Perak, Malaya.


In pedicellis hispidulis et foliis latioribus differt.

*F. schefferi* Solms, Linnaea 42: 98, 1879.

Holotypus: MALAYA: Selangor; Gisting Sempah, 22nd mile, alt. 1,500 ft., climber on rock, July 1966, *Stone 5847a* (KLU!).


Type from Sarawak (*Beccari* P. B. 782-bis). Reported also from Indonesian Borneo (*Jaheri* 528).

BORNEO: Sarawak: Gat, upper Rejang River, fruit bright yellow, 1929, *J. & M. S. Clemens 21902* (Fl!).
Fig. 1. *Freycinetia imbricata* Bl. Java, Korthals (L. 908164).
Sect. Auriculifoliae B. C. Stone

   Type from Sumatra (Beccari). Type of F. valida from Malaya (Ridley).


PHILIPPINES: Basilan Island; Zamboanga Prov., Isobela de Basilan, Land grant of Univ. Philipp., Liborio Eto Ebaldo 988 (PNHI! distrib. as F. banahaensis Elm.). Vernacular name, "kayakan" in Yakan (Jan. 1941).

The cited specimen from Basilan extends this species for the first time into the Philippines. It is certain that the plants referred to F. auriculata Merr. are of the same species as this.

(6) Freycinetia lucida Martelli, Webbia 3: 168, 1910. Merrill (1921) 34. Figure 2.

Type from Indonesian Borneo (Hallier 3188) in BO!

Liana scandens; caulibus vetustioribus ramuligeris ad 12–15 mm diametro, internodiis 15–20 mm longis, radicibus aereis emittenti-bus, junioribus c. 8 mm diametror, internodiis 10–15 mm longis, foliosis. Folia longe linear-attenuata, 45–50 cm longa, 9–13 mm lata, sensim attenuata, marginibus denticulatis, in sicco revolutis; parte vaginantia c. 4.5 cm longo; auriculis castaneis 4–5 cm longis 4–5 mm lati apice unilobulatis integris vel ciliatis. Inflorescentia terminalis binatis. Cephalia foeminea cylindracea, immatura 48–50 mm longa, 12 mm crassa; pedunculis angustis 25–27 mm longis 2.5 mm lati distaliter minute et subsparse scabridulosis. Bacca (immatura) 4 mm longa, 1 mm lata; pileus vix 1 mm altus, late pyramidatus vertice plano. Stigmata 2 (rare 3, rarissime 4). Staminodia, minutissima, cetera ignota.

BORNEO: East Indonesian Borneo, Kutei, G. Beratus [Summit, Piek van Balikpapan] alt. 1,200 m, 19 July 1952, W. Meijer 904 (BO! L!).

This very interesting species is known so far only from the type collection and the recent one cited made by Willy Meijer.
Fig. 2. *Freycinetia lucida* Martelli. Borneo. Meijer 904.
In its lobed auricles, tapered leaves, terminal inflorescence, cylindric pistillate heads, and berries with usually 2 stigmas, *F. lucida* corresponds well with the characters of Sect. Auriculifoliae. From *F. sumatrana* Hemsl., it differs in its smaller overall dimensions and entire auricles, and in the different form of spinules which occur at the distal end of the peduncles. From *F. ceramensis* Martelli, which is undoubtedly its closest relative, the present species differs in its slightly smaller yet more strongly denticulate leaves, more slender pedicels with their distal ends, just below the cephalium, spinulose rather than smooth or minutely scabrous, and somewhat fewer and less crowded berries.

**Sect. Polystachya** B. C. Stone

(7) *Freycinetia kinabaluana* B. C. Stone, *sp. nov.*

*Liana* robusta caulis ad 2 cm diametro, *foliis* anguste attenuato-subulatis coriaceis 80–100 cm longis 2.5 cm latis, basi vaginantibus, auriculis 7–9 (–10) cm longis et 7–10 mm latis, marginibus foliorum basin versus minime et distantem paucidenticulatis (dentibus vix 0.7 mm longis), apicem versus dorso similime denticulatis, cetera laevibus. *Inflorescentia* foeminea terminalis cephalis pluribus plerumque 4–7 spiraliiter congestis pedicellis 5 cm longis 4–7 mm crassis subtrigonatis vel semiteretibus ad angulis et in lineis dorsalis scabridulis (papillis 0.2 mm longis) in sicco fuscoatris. Cephalia breve oblongata vel obscure ellipsoidea juventute breviter cylindracea, ad 5 vel 6 cm longa et 3.5–5 cm lata. Baccae numeroae maturitate flavidae, ad 20–24 mm longae et 3–3.5 mm latae, clavatae, pileis 5 mm longis anguste pyramidatis, areola stigmaticae c. 1 × 1 vel 1 × 2 mm, stigmatibus (4–) 5–7 (–9); semenibus ad 1.2 mm longis angustis linear-ellipticis raphe inconspicuis et strophio nullo.

Holotypus: BORNEO: W. Sabah; Mt. Kinabalu, 5,000 ft., Mesilau River, Apr 1964, W. L. Chew & E. J. H. Corner (1964 Royal Society Expedition) RSNB 7013 (K!). Isotypes (SING! SAR! SAN!).

Exciccate: BORNEO: W. Sabah; Mt. Kinabalu, 5,200 ft., below Lumu-Lumu, Apr 1933, C. E. Carr SFN 27104 (SING!). Bembangan River, 5,000 ft., Feb 1964, Chew & Corner RSNB 4405 (K! SING! SAN! SAR!). Mt. Kinabalu, Tenompok, 5,000 ft., Mar 1932, J. & M. S. Clemens 28711 (=29550) (L!). Mesilau River, 5,000 ft., Jan 1964, Chew & Corner RSNB 4177 (K!): Feb 1964, Chew & Corner RSNB 4306 (K!).

A distinctive large species apparently related to *F. corneri* B. C. Stone, *F. philippinensis* Hemsl. and *F. multiflora* Merr., and perhaps also to *F. whitmorei* B. C. Stone of the Solomon Islands.

In its numerous spirally crowded cylindric cephalia this species appears to belong in Sect. Polystachyae. In a very superficial way it also resembles *F. sumatrana* Hemsl. but differs in many characters.
Sect. Filiformicarpae B. C. Stone

(8) Freycinetia parviaculeata B. C. Stone, sp. nov. Figure 3.

F. valde proxeime F. tessellata et F. ponapensis sed pedicellis omnino dense scabridulis et foliorum marginibus conspicue late denticulatis.

Scandens, robusta, caulis ad 15 mm diametro. Folia erectopatentia basi ampletentia coriacea ad 60 cm longa et 3.3 cm lata, apice acuto, margine e basi ad apicem denticulata, dentibus antrorsibus fere 1 mm longis et 3–7 mm separatis; costa media dorso apicem versus simillime denticulata, cetera laevia; auriculis ad 10–12 cm longis et 1–1.5 cm latis, membranaceis, margine ut videtur integris (sed fragmentatis). Inflorescentia foeminea terminalis breve pedunculata, cephalis oblongo-cylindraceis ad 7 cm longis et 3 cm latis, pedicellis 20–24 mm longis et 5 mm crassis, obscure trigonatis, in toto dense aculeatissimis. Baccae 13–15 mm longae, 2–3 mm latae (in sicco) apice coriaceo pileo angusto elongato 5–6 × 1–2 mm truncato, parte basilari succulenti seminiferosi rubri, areola stigmatica elliptico c. 1 mm lati annulo bruneo nitente cincta, stigmatibus 2 rarissime 3 discretis, seminibus falcato-lunatis c. 1 mm longis rubro-miniatis, raphe alba angusta, strophiolo nullo.

Holotypus: BORNEO: Sarawak; Miri District, Sungei Dalam, low altitude, on tree by stream in swamp forest, fruit bright red, June 1961, Dan bin Haji Bakar SAR 4502 (SAR!). Isotypes in K! L!

This species is the first of Sect. Filiformicarpae to be reported from Borneo, and indeed is the first known west of Wallace’s Line. It is distinguished from its congeners by the broad and conspicuous marginal leaf-prickles and the densely aculeate pedicels (see illustration), to which the specific epithet refers.

BORNEO: Sarawak: Rejang Mangrove Reserve, Nov. 1968, Anderson S. 26572 (SAR!).

Sect. Hemsleyella B. C. Stone

(9) Freycinetia rigidifolia Hemsley, Kew Bull. 1896: 166. Merrill (1921) 34. Figure 4.


Type of Hemsley’s species was from Sarawak (Haviland 436); that of Ridley’s from Malaya (Ridley 7636).

The species has been reported from Indonesian Borneo (Jaheri 1017).

Recent collections disclose that this is evidently quite a common species in Borneo, and that it also occurs in the Anambas Islands and in the Andaman Islands.
Fig. 3. *Freycinetia parviaculeata* B. C. Stone. Holotype. Right: leaf apex. Center: part of fruit pedicel, showing spinules; below, enlarged view of spinules. Left, above: berry in profile and top view, with seed in profile to same scale; below, seed enlarged.
BORNEO: Sabah: Mt. Kinabalu; Tenompok, 5,000 ft., March 1932, Clemens 26075 (K!); 26378 (K!); 28750 (L!); 29331 (K!); 30175 (K! L!). Penibukan, 4,000 ft., Sep 1932, Clemens 40510 (L!). Marai Parai, 9,000 ft., Mai 1933, Clemens 32385 (L!). Mesilau River, 5,000 ft., Feb 1964, Chew & Corner RSNB 4269 (SAN! SING!). Ranau Distr. along Kambarango Rd., Aug 1963, Mikil SAN 38635 (K! SAN!). Sandakan Distr. 25 mi SW of Sandakan, Lungmanis, Mar 1955, G. H. S. Wood SAN A-2922 (SAN!). Kabili-Sepilok Forest Reserve, Mai 1961, Patrick Ping San SAN 24845 (SAN!). Ranau, Mesilau trail, on tree NT-980, 4,500 ft., Feb 1965, Sadau SAN 42888 (K! SAN!). Sarawak; Bau, limestone hills, 1893, Ridley 11712 (K!). Same location, Jul 1963, Quisumbing PNH 87630 (PNH!). Bidi cliff, C. J. Brooks (K!). Gunong Subis, Niah, 400 ft., on ‘mor’ layer at summit of limestone hill, bracts bright orange, June 1962, Anderson S. 16426 (K! SAR!). Bau District, 700 ft., Aug 1963, Chew 561 (K!). Near Kuching, Dec, 1892, Haviland 3132 (K! SAR!). Near Long Kapa Mt. Dulit, Ulu Tinjar, 700–900 m, bracts scarlet, P. W. Richards 1964 (L!) KALIMANTAN: W. Koetai, n. 39, nr. Mt. Kemoel, 1,600 m., Oct. 1925, Ender 4374 (L!); 4136 (L!).

ANAMBAS ISLANDS: Boenegeran, east side of Gunong Ranai, Apr 1928, van Steenis 1200 (L!).

ANDAMAN ISLANDS: S. Andaman, Kurz (Fl!).

This very well characterized species seems to be one of the most common species in Borneo. It is also in Malaya, where it has been known by the name F. acuminata Ridl. Its closest relative, and the only other member of Sect. Hemsleyella, is F. pectinata Merr. & Perry of the Solomon Islands.

Of the specimens cited, a few deserve particular mention. Several of the Clemens collections, particularly 40510, 40452 and 40453, all from Mt. Kinabalu, are somewhat unusual in their narrower leaves (about 17 cm long and 5.5 mm wide) and the short auricular spinules, differences which however noticeable appear to grade continuously into those of larger plants. The extreme of size increase is afforded by the Richards 1964 specimen, which has leaves 44 cm long and 18 mm wide.

Frey cinetiae Imperfectae vel Incertae Sedis


Liana scandens, caulis ad 1 cm diametro, internodiis ad 2 cm longis, foliis anguste lanceolatis ad 42 (vel ultra?) cm longis et 2–2.5 cm latis apice acuminato-caudato, basem versus leviter angustatis, marginibus inermibus apicem versus excepta; cauda minute denticulata; auriculis delapsis ad 3 cm longis. Inflorescentia terminalis breve-pedunculatis binis vel ternis pedicellis brevis c. 9 × 5 mm laevibus. Cephalia foeminea cylindracea ad 9 cm longa
Fig. 4. *Freycinetia rigidifolia* Hemsley. Habit (SAN. 59284).
et 1.8 cm crassa. Baccae immaturaee 6 mm longae lageniformatae in pileo abrupte angustato 2 mm longo terminatae, areola stigmatica 1 mm lato subtruncato, stigmatibus 4–6, parte basilari seminiferi semenibus 1.5 mm longis angustis sublinearis raphe perangusto strophiolo nullo.


Exsiccatae: PHILIPPINES: Mindanao; Bukidnon Province, Mt. Katanglad, Mar 1949, M. D. Sulit PNH 10082 (PNH!).

This is a very distinct species. The new variety is named in honor of the Conservator of Forests for Sarawak, who collected the type specimen. It differs from the commoner Philippine variety in its broader, longer leaves and larger fruiting heads.

(11) *Freycinetia biloba* B. C. Stone, *sp. nov.*

*Liana* scandens caulis ad 8 mm diametro trigonatis, internodiis 1–2 cm longis, *follis* erecto-patentibus 23–34 cm longis, 2.5–3.6 cm latissi oblanceolatis acuminatis cuspidato-caudatis, fere inermibus caudo (3–4 cm longo) et marginibus basalis per brevem spatiam (1–2 cm) excepta, dentibus minutis 0.1–0.2 mm longis obtusatis 1–5 mm separatis, costa media cariniformata laxe sed apicem versus minutissime denticulato. Auriculae ad 25 mm longae et 6–7 mm latae, membranaceae mox caducae leniter rotundata marginibus creberrima minutissimeque ciliato-denticulatis. *Inflorescentia* ternata terminalis, pedunculis communis 20–25 mm longis ad angulas dense hispidulis, pedicellis 15–20 mm longis 2.5 mm crassis suberetibus omnino (basem extremam excepta) stramineo-hispidulis (setis ad 0.5 mm longis antorris congruus aciculari-ventricosis). Cephalia cylindracea immatura ad 30 × 8 mm. Baccae numerosae, pileis ad 1 mm latis, stigmatibus (3–) 4–8 (–10) vulgo 4–6.

Holotypus: BORNEO: W. Sabah, Beaufort District, Beaufort Hill, in primary forest, Mar 1961, Meijer SAN 24834 (SAN!).

Exsiccatae: BORNEO: Sarawak; Sungei Belaga, hillside with mixed dipterocarp forest, inflorescence chrome yellow, Apr 1963, P. S. Ashton S. 18229 (K!). — Mt. Mattang, primary forest, fruit red-orange, 5 April 1968, J. Dransfield 763 (KLU!).

This species appears similar to *F. ciliaris* Martelli, despite the major difference in facies caused by the much longer and more numerous spine-like cilia on the leaf of the latter. *F. biloba* also somewhat resembles *F. jaheriana* Martelli (of New Guinea) but has berries with more numerous stigmas and considerably narrower leaf. However the nearest relative is *F. kamiana* Stone of Malaya. The specific epithet is in reference to the two short conspicuous auricles.

Type from Indonesian Borneo (*Jaheri 925*) at Leleboelan Tepoetz (1896–97). A fragment in the Martelli Herbarium in Firenze has a leaf 16 × 2.8 cm, abruptly cuspidate-caudate, with the cauda 2 cm long; basal auricles 24 × 4–5 mm, apparently rounded; immature berries 5 × 2.5 mm, pileus narrowed abruptly below the short stigmatic area; and stigmas 2 or 3 per berry.


Type from Tawao, Sabah (*Elmer 21632*).

*Stems* to 5–8 mm thick; *leaves* oblanceolate, 12–20 cm long, (1.3–) 2–3 cm wide, caudate-acuminate, acumen 2–3 cm long, spinulose; margins (except medially) spinulose; auricles 11–14 mm long, 4–5 mm wide, inarched at apex, pectinate-spinulose with setae 1–1.5 (or more) mm long, caducous. Inflorescence ternate, terminal, the pedicels hispidulous, berry with 3–7 stigmas on a dome-like pileus.

**BORNEO**: Sabah; Sandakan District, Paitan Forest Reserve, 50 ft., primary forest nr. swamp, Feb. 1963, *Ampuria SAN 32085* (K! L! SAN!). Sepilok Forest Reserve, lowland swamp, uncommon low climber, bracts greenish-white, male spadices 3, oblong, 1 cm long, March 1967, *Stone & Meijer 6713* (KLU!).

One of the most characteristic of the Borneo species, and indeed very distinct in the genus.


Type from Tawao, Sabah (*Elmer 21596*).

**BORNEO**: Sarawak; Tatau District, Kakus-Pandan Forest Reserve, on exposed rocky ridge in “kerangas” forest, inflorescence yellowish-green, 1,300 ft., Oct. 1959, *E. F. Brunig S. 11954* (SAR!).


Type from Singapore (*Corner*).

**BORNEO**: Central E. pt., W. Koetai, n. 39, Mt. Kemoel, alt. 1,800 m, mountains in forest, big climber, Oct. 1925, *Endert 4453* (L!).
This species hitherto known only from Singapore and Johore now appears in Borneo. Among the large robust species it is quickly distinguished by its smooth pedicels, subglobose cephalia, 4–8–stigmatic berries, and broad acute leaves with the subtruncate auricles slightly dENTICulate at the apex.

(16) Freycinetia discoidea Martelli, Leafl. Philipp. Bot. 111 (Art. 60): 1113, 1911. Figure 5.

Type from Sibuyan Island, P.I. (Elmer 12197).


This is a striking species here first reported tentatively from Borneo. The leaves are markedly glaucous on their undersurface, about 38 cm long and 2.5 cm wide, broadly linear, with auricles 50 × 5 mm having entire margins though a very few spinules occur at the truncate apex. The floral bracts are pinkish-orange; pedicels are smooth, 15–20 mm long; cephalia about 50 × 14 mm; and the berries have 2–5, but commonly 2–3, stigmas. One discordant feature is the indication of scabrid pedicels in the original description, while our specimens have quite glabrous pedicels. Conceivably this is an important difference.

(17) Freycinetia hemsleyi Warburg, Pflanzenr. IV. 9: 36, 1900.

Merrill (1921) 34.


Type from Sarawak (Beccari P. B. 3598).

This plant has not appeared again in more recent collections. It is probably a close relative of F. javanica Bl. and perhaps with that species should form a section. It has however much broader leaves of more oblanceolate form, and fewer stigmas per berry. The following brief description, improving somewhat on Hemsley’s and Warburg’s, is added, with the hope that the species may be again collected:

Stems to 5–6 mm diameter; leaves elliptico-oblanceolate, broadest beyond the middle, about 3 times longer than wide, up to 22.5 × 7.5 cm, more often about 16 × 4.5–5 cm, slightly cuspidate; auricles short, about 11 × 4.5 mm, denticulate along their margins and abruptly rounded at apex; leaf-veins widely spaced, 20–25 per leaf-half, from 1–1.9 mm apart; inflorescence terminal and ternate, the pedicels about 20 × 3 mm, scabridulous on the angles, and all around distally; immature cephalia about 15 × 7 mm; berry with 2–4, or rarely 5, stigmas.
Fig. 5. *Freycinetia discoidea* Martelli. Habit (P. P. Sam 27822).
(18) *Freycinetia javanica* Blume, Rumphia 1: 156, t. 41. 1835. Merrill (1921) 34.
Type from Java (Blume).
var. *javanica*

BORNEO: Eastern pt., Nunukan, N. of Tarakan, inner forests at low altitude, with dipterocarps, a climber on Oncosperma, Nov. 1953, *Meijer 2100* (L!).
var. *expansa* B. C. Stone, *var. nov.*
Ab var. typica in foliis valde latioribus differt.


These plants cannot be specifically segregated from Blume’s *F. javanica*, yet they differ from most of the Javan, Malayan, and Sumatran collections I have seen in their broader leaves. However it is somewhat doubtful that this feature is maintained throughout Sarawak; certainly the Meijer specimen from East Borneo appears to be the typical variety.

Type from Luzon, P.I. (Forestry Bureau 3037, *Borden*).
Represented in Borneo only by the following variety.
var. *meijeri* B. C. Stone, *var. nov.*

*Liana* scandens, caulis ad 7 mm diametro. *Folia* anguste lanceolata attenuata 27–41 cm longa 9–13 mm lata, tenuiter coriacea, basi amplexentia, marginibus, basem apicemque, minute et sub-sparse denticulata, tenuiter coriacea, dentibus ad 0.4 mm longis, 1–2 mm separatis; auriculis 28–45 mm longis, basem versus 5–6 mm latis, chartaceis, brunneis, attenuatis, integerrimis, lateraliter fragmentatis. *Inflorescentia* foeminea terminalis, ternatis, pedicellis 23–28 mm longis, 2–2.3 mm crassis, distaliter ad angulas hispidulocrabridis; cephalis cylindraceutis 25–40 mm longis, 7–9 mm crassis (immaturis), baccis numerosis, pileo sulcato pyramidato areola stigmatic a 1 mm lato, stigmatibus 2–3, plerumque 2. *Inflorescentia* mascula simillima sed parviora ternata, pedicellis c. 24 mm longis, 1–1.5 mm crassis, laevibus, spicibus c. 15 × 3 mm staminibus numerosis filamentiis c. 1 mm longis, antheris subgloboso-oblongis, 0.2 mm longis; bracteis lanceolatis.
Holotype: BORNEO: Sabah; Penampang District, Sangai-sangai, Babagon Rd., c. 4,000 ft. alt., primary forest, near riverside, fruit green, 17 March 1965, J. K. Laiangah SAN 44362 (L!). Isotype SAN!

This species is very close to F. vidalii Hemsol. of the Philippines, differing in the shorter and slightly wider leaves; and also superficially resembles F. apayaoensis Merr., another Philippine species, which however has stiffer, more evidently denticulate, lineate, ensiform leaves. But F. robinsonii is closest to F. multiflora Merr.


This new variety is dedicated to Willy Meijer, formerly Forest Botanist at Sandakan, who provided much help in the field on the author’s excursions in 1967.


Liana scandens, caulis ad 12 mm diametro. Folia erecto-patentia tenue coriacea basi amplexicarpa vaginata, ad 45 cm longa et 3 cm lata, late linearia sed basim versus paullulo angustata apicem versus subabrupte acutata non acuminata, marginibus inermibus (in base apiceque per brevem spatiam excepta dein perminuto persparsa denticulatis); auriculis ad 4 cm longis et 4 mm (vel ultra?) latis, ut videtur fragmentatis. Inflorescentia foeminea terminalis breve-pedunculata cephalis tennis subellipsoideis 2.5 cm longis et 1.5 cm latis, pedicellis 16 mm longis et 2 mm crassis, minute spinuloso-scabridis. Baccae immaturae 6 mm longae, pileo anguste obconico 2.5 mm alto in sicco leviter costulato. Areola stigmatica 0.5–0.8 mm lata stigmatibus 3–5 vulgo 3 bene distincta.

Type: BORNEO: Sabah: Madai, Governor Creagh (K!) staminate.

BORNEO: Sarawak; Kuching District, 300 ft., Semengoh Forest Reserve, lowland primary dipterocarp forest, May 1961, Ghazalli S. 13676 (SAR!).

The type is a staminate specimen, which may account for the fact that no other collections have ever been identified as this species. The above collection permits fuller description and shows the characters of the pistillate form.
(21) Freycinetia winkleriana Martelli, Webbia 2: 168, 1919. Winkler, Engl. Bot. Jahrb. 48: 87. 1912. Merrill (1912) 34. Engl. Bot. Jahrb. 48: 87. 1912. Merrill (1921) 34. Type from Indonesian Borneo (Winkler 3313). Stems to 5 mm diameter; leaves slender, linear, rather stiffly erect, up to 70 cm long, 10–11 mm wide, apex long attenuate-subulate and subflagellate, triquet, leaf-base marginal teeth (just above auricles) c. 0.5 mm long; median margins unarmed; apex denticulate, teeth 1–2 mm apart; midrib distally dorsally spinulose. Auricles slender, up to 45 × 3 mm, entire, slightly rounded to subtruncate at apex, often brownish-purplish. Inflorescence terminal, cephalia usually 3 but occasionally 4, on pedicels about 20 × 2 mm, closely and finely hispidulous at distal ends; immature pistillate cephalia cylindric, about 20 × 4.5 mm. Berries usually with 2, sometimes with 3, rarely with 4 stigmas.

BORNEO: Sarawak; Bintulu District, Bukit Urang, common climber, spathes purple, Apr 1960, Brunig S. 12033 (K! SAR!). Kuching, 1911, Salub (SING-026532l). Kuching, “native collector,” 475 (PNH!). KALIMANTAN; near Mempawa, peat forest behind Kampong Sungei Koenjit, Oct. 1940, Polak 704 (L!).

SUMATRA: Indragiri uplands, Berapit, primary forest, Apr 1939, Buwalds 6354 (L!).

The above specimen first extends the range to Sumatra.


BORNEO: Sabah; Mt. Kinabalu, Kokolitan, 2,500 ft., Mai 1933, C. E. Carr SFN. 27342 (SING!).

This plant seems probably to be of Philippine affinity, and in particular resembles F. gitingiana Martelli. Because of this, and in view of the imperfect state of our knowledge of the Philippine Freycinetiae, I equate it with that species tentatively. The field notes indicate that it is a species with “golden yellow fruits” which seems to be a rather rare color.

(23) Freycinetia kalimantanica B. C. Stone, sp. nov. Figure 6.

Liana scandens, caulis ad 1 cm crassiss; foliis c. 50–60 cm longis, c. 18 mm latiss, attenuatis, paene inermis, marginibus base perpaucu minuteque denticulatis (denticibus 2–3), apice extremam minute denticulato; nervis c. 40–44; auriculis subpersistentiis, usque ad 12 cm longis, attenuatis, inermibus, brunneis subnittentibus, sectilis vel fissis in segmentibus, ultime caducis, base 12–13 mm latis. Inflorescentia terminalis ternatis, cephalis oblongo-cylindraceis, pedicellis 12–15 mm longis, 5 mm crassis, dense minuteque aureo-brunneo-hispido-scabridis; cephalis 3.5–4 cm longis, 1.5–1.8 cm crassis; braccis plurimis immaturis 4.5 mm longis, pilo plano 0.5 mm alto, stigmatibus plerumque 5–8. Cetera ignota.
Holotype: BORNEO: W. Koetai no 38, 1,500 m alt., 15 Oct. 1925, F. H. Endert 4184 (BO!).

Very distinct among the Borneo species by the broad, rather shining brown auricles, which fragment into segments by lateral splits, and are evidently entire. The leaves are virtually unarmed.

The name is based on the Indonesian name for Borneo, Kalimantan.

This species is evidently closely allied to F. corneri Stone but differs in the densely scabrid ♀ pedicels and smaller leaves and fruits.


Not *F. confusa* Elmer 1907 (renamed by Elmer *F. villarii* 1908).

Type from Singapore (*Ridley 4757*, lectotype, SING!).

Represented in Borneo by the following variety.

var. *minima* B. C. Stone, var. nov.

Foliis brevioribus plerumque 12–16 cm longis.


The species proper is known from Malaya and Sumatra; this is its first report in Borneo, but the specimens cited all agree in the shorter leaves (only about half as long as in Malayan and Sumatran specimens seen) and a varietal status is thus proposed.

In its very narrow leaves it cannot be confused with other species except perhaps *F. sarawakensis*, which has much longer leaves and lateral inflorescences usually of only one cephalium; or *F. winkleriana*, which has longer, slightly wider, more rigid, and basally purple-tinged leaves with much narrower auricles (those in *F. confusa* are pale or stramineous, reach 2–3 mm width, and are sometimes truncate at apex and minutely ciliolate, while those of *F. winkleriana* are only 1 mm wide at apex, entire, and often purplish). Another similar plant is *F. imbricata* var. *kuchinensis*, but it has somewhat wider, more lanceolate leaves, with the margins sometimes recurved.

An additional specimen:

BORNEO: Sarawak; ridge between Sungei Balang and Sg. Balleh in extreme headwaters of Balleh, Kapit District, 1,200 ft. alt., sandstone-derived soils, small root-climber, 30 June 1969, Anderson & Ilias Paie S. 28334 (KLU, L, SAR).
References


