MATERIALS FOR A MONOGRAPH OF FREYCINETIA GAUD. IV. SUBDIVISION OF THE GENUS, WITH FIFTEEN NEW SECTIONS *

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ABSTRACT

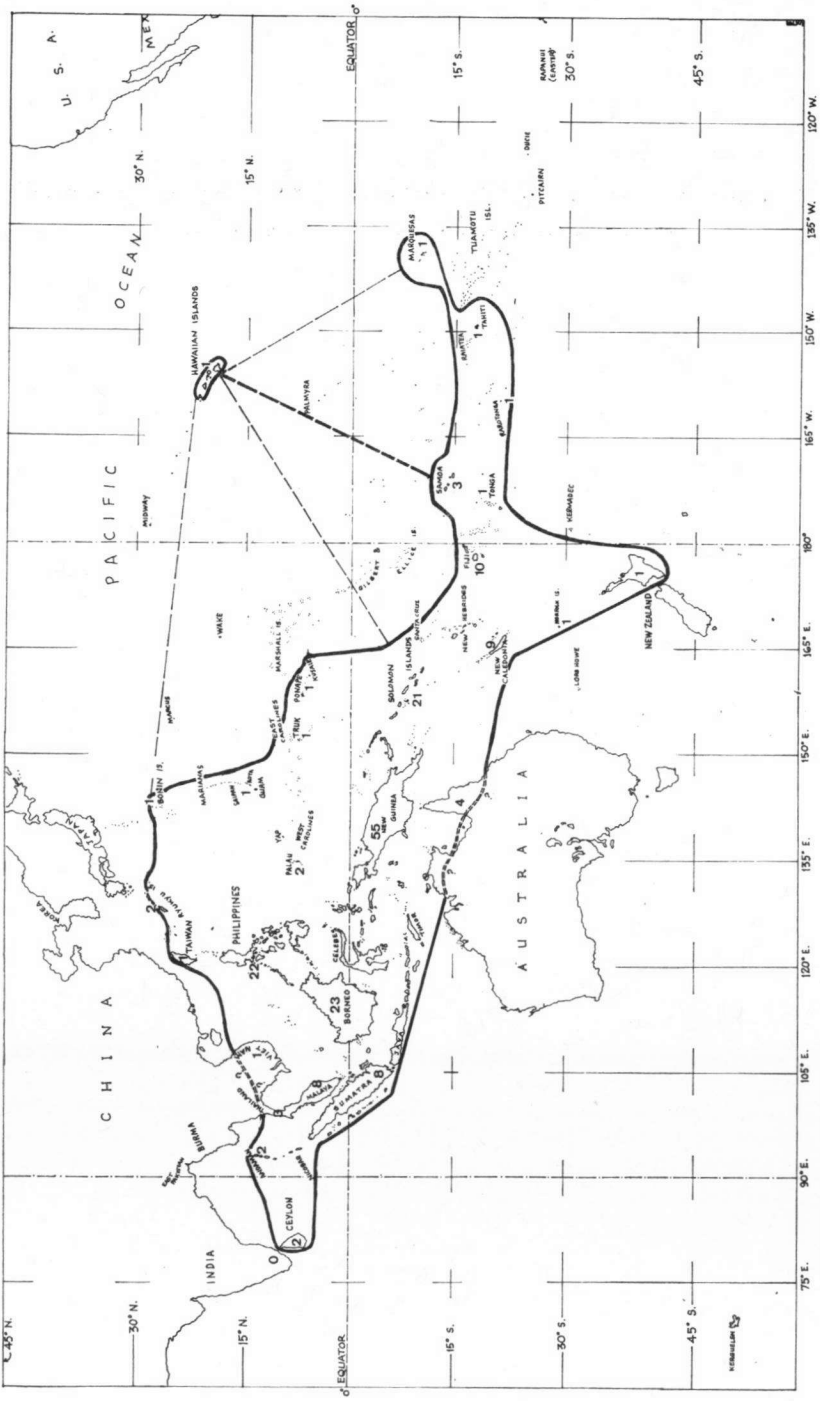
The previous subdivision of *Freycinetia* Gaud. (*Pandanaceae*) into two parts, Sect. *Oligostigma* Warb. and Sect. *Pleiostigma* Warb. (now called Sect. *Freycinetia*) has because of numerous additions to our knowledge of the genus become obsolete. Fifteen new sections are proposed, based on natural species-groups, and the original two sections are restricted and redefined. Species not yet adequately known may be termed *Freycinetiae imperfectae*, when only staminate specimens are known, or *incertae sedis*. A map showing the distribution of the genus is included.

INTRODUCTION

Hitherto the only attempt at subgeneric classification of *Freycinetia* Gaud. has been that of Warburg in the Pflanzenreich (1900). He divided the genus into two groups, which he named Sect. *Oligostigma* Warb. and Sect. *Pleiostigma* Warb. The latter, since it includes the type-species of the genus, *F. arborea* Gaud., must now be called Sect. *Freycinetia*, in accordance with the International Code of Botanical Nomenclature (Stone 1967a).

The distinction between Warburg's original two sections lay in the number of stigmas per berry. In Sect. *Oligostigma*, there were supposed to be only 1, 2, or 3 stigmas per berry; while in Sect. *Pleiostigma*, there were 3 or more (as many as 10, or even more) per berry. However, even at the time of writing (1900) this distinction did not always hold, and since then, more than 100 species have been added to the genus, some of which cannot reasonably fit into either section. For example, *Freycinetia divaricata* Merr. & Perry produces fruits with from two to five stigmas per berry. The heads of fruit, which may consist of anywhere from less than a dozen to more than 1,000 berries, in various species, do not show a uniform number of stigmas per berry. In one head of fruit, therefore, evidence may be found suggesting that the species should belong in both of Warburg's sections. Such variation in stigmatic number makes complete dependence on this character irrational, just as it is in the closely allied genus *Pandanus* (Stone, 1967b).

* Supporting taxonomic papers in this series will continue to appear. The author's gratitude is here expressed to the many institutions which so generously offered facilities for study, and in particular to Dr. G. Moggi (University of Firenze), Prof. C. G. G. J. van Steenis (Rijksherbarium, Leiden), Mr. L. Forman and Mr. P. Green (Kew), Mr. B. L. Burtt (Edinburgh), Dr. W. T. Stearn and Mr. R. Ross (British Museum of Natural History), Dr. J. A. R. Anderson (Kuching, Sarawak), Dr. W. Meijer (Sandakan, Sabah), Mr. H. M. Burkill (Singapore), and the staff of the Indian Botanic Gardens (Howrah). To Prof. van Steenis and Mr. E. J. H. Corner (Cambridge University) continuing thanks for encouragement.


PACIFIC OCEAN
AUSTRALIA
CHINA
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EQUATOR
HAWAIIAN ISLANDS
MIDWAY
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MARSHALL IS.
GUAM
PALAU
WEST CAROLINES
PHILIPPINES
TAIWAN
BORNEO
CELEBES
SUMATRA
BURMA
CEYLON
BISMARCK ARCHIPELAGO
SOLOMON ISLANDS
NEW HEBRIDES
NEW CALEDONIA
FIJI IS.
SAMOA
TONGA
TUAMOTU ISL.
MARQUESAS
TAHITI
PITCAIRN
EASTER I.
KERMADEC
NEW ZEALAND
LORD HOWE
NORFOLK I.
U. S. A.
MEX.
120° W.
135° W.
150° W.
165° W.
180°
165° E.
150° E.
135° E.
120° E.
105° E.
90° E.
75° E.
45° N.
30° N.
15° N.
15° S.
30° S.
45° S.

Discrediting the basis for and the utility of the earlier sections has, however, been considerably easier than establishing a new infrageneric classification. That such a classification is desirable is unquestioned, as in any large genus, and recognition and delimitation of smaller groups is beneficial, provided that they are reasonably natural. Such classifications provide improved bases for further taxonomic work, for routine identifications, and for phytogeographic analysis, so that they clearly have both theoretical and practical value. On the other hand, infrageneric groups may be somewhat ephemeral unless a broad and intensive survey of the entire genus has been undertaken. For this reason, although my studies of *Freycinetia* have been in progress for several years, it did not appear advisable to attempt the piecemeal proposal of sections, and only after examination of the greater part of the numerous collections and detailed studies of living plants in several regions have I felt that a fairly complete infrageneric classification was possible. This is not to say that all species are known as yet, nor that all known species have been assigned to a section. But, as the following discussion shows, a large proportion of known species can be properly placed. The outcome is a scheme with fifteen newly proposed sections, plus the two original ones of Warburg (redefined), and a program for completing the classification. Among the species not yet assigned to a section there may well be some further natural groups which deserve formal recognition as sections. At present, no subgenera are acknowledged; all the sections are given equal rank. This might be subject later to alteration.

KEY TO THE SECTIONS

1. Inflorescence a terminal raceme of well-spaced cephalia . . . . . **1. Racemosiflorae**
1. Inflorescence an umbel, or a solitary cephalium, or if more than 3 cephalia together then the cephalia spirally crowded; inflorescence either terminal or lateral.
   2. Inflorescence lateral, i.e. terminating a short prophyllate bracteate side-shoot devoid of normal foliage leaves, usually axillary on older stems; *or*, inflorescences both lateral and terminal on the same plant.
      3. Inflorescence invariably lateral.
         4. Cephalia oblong-cylindric; stigmas usually 3—12 per berry . . . . . **2. Lateriflorae**
         4. Cephalia subglobose; stigmas usually 1—3, sometimes 4—6, per berry. . . **3. Solmsiella**
      3. Inflorescence either lateral or terminal or both . . . . . **4. Sarawakenses**
   2. Inflorescence invariably terminal.
      5. Leaves pseudopetiolate . . . . . **5. Pseudopetiolosae**
      5. Leaves never pseudopetiolate.
         6. Auricles with a free apical lobe . . . . . **6. Auriculifoliae**
         6. Auricles rounded, tapered, or truncate at apex.
            7. Cephalia quaternate or more numerous, the pedicels very closely spiralled **7. Polystachyae**
            7. Cephalia ternate (or fewer) or rarely quaternate.
               8. Berry linear-filiform, numerous; stigmas almost always 2 per berry; leaves rather broadly strap-shaped with broad, elongate, usually entire auricles. Cephalia cylindric. **8. Filiformicarpae**

Map 1. Distribution of the genus *Freycinetia* Gaud.

Thick solid black line shows the total area limit of the genus. Double-dash line (as in Indo-China and Queensland) indicates probable or possible boundary which, however, is locally in doubt. Broken thick black line between Hawaii and S.W. Polynesia (Samoa) indicates relationship of Hawaiian and Norfolk Island — New Zealand species. Thinner dash lines extending to Hawaii show weaker affinities.

The number (such as 2 at Ceylon, 8 at Malaya, etc.) indicates the approximate number of species existing in the region (including both endemic and wide-spread species). Exact figures for endemism are not yet available for the whole area of the genus, but it appears probable that Borneo, the Philippines, and especially the New Guinea — Solomon Islands area (Melanesia) will have the highest percentages, while Malaya, Sumatra, and Java have few or none.

8. Berry usually broader than linear; not with above character combination.
  9. Stigmas usually 1—3, or rarely to 6, per berry; cephalia globose to ellipsoid or short-oblong; berry succulent throughout when ripe (no rigid apex).
    10. Leaves elliptic or broadly oblanceolate.
      11. Cephalia globose; stigmas 1—3 (rarely 5) per berry. . . **9. Oligostigma**
      11. Cephalia short-oblong; stigmas mostly 3—6 (or more) per berry. **10. Warburgiella**
    10. Leaves linear-ensiform, less than 1 cm wide. . . . . **11. Ridleyella**
  9. Stigmas 1—3 or up to 12 or more per berry; berry when ripe not succulent throughout but with a rigid pileus (apex); cephalia various.
    12. Leaves stiffly ensiform, abruptly narrowed at base at top of auricle; auricles deeply pectinate-spinulose; leaf margin sometimes revolute; cephalia small, cylindric. . . . . **13. Hemsleyella**
    12. Not as above.
      13. Stigmas 2, sometimes 3, per berry; cephalia long-cylindric; robust plants. **12. Blumeella**
      13. Stigmas 4 to many (only in § 16, 2—5, but there cephalia are globose).
        14. Berry flat-topped, flat-sided, not rostrate; stigmas numerous, 4—12 or more, per berry; cephalia long cylindric; berries laterally compressed; robust plants with gradually attenuate or acuminate leaves.
          15. Auricles entire. . . . . **14. Freycinetia**
          15. Auricles denticulate; pedicels minutely roughened all around. **15. Taiwaniella**
        14. Berry rostrate.
          16. Cephalia globose; leaves short, elliptic-ensiform. **16. Devrieseella**
          16. Cephalia oblong-cylindric; leaves elongate, attenuate. **17. Gaudichaudiella**

DESCRIPTION OF THE SECTIONS

1. § Racemosiflorae B. C. Stone, *sect. nov.*

Inflorescentia terminalis racemosa, cephaliis pluribus 3—6 bene separatis brevepedicellatis.

Type-species: *Freycinetia angustifolia* Bl.

Included species: *F. jagorii* Warb.

Distribution: Indonesia, Malaysia, Philippines.

The conspicuous racemose inflorescence characterizes this section and abruptly distinguishes it, and the two species it includes, from all other *Freycinetiae*. While the majority of species in the genus produce cephalia in groups of three (i.e. ternate) at the apex of what has been termed the 'main peduncle' (actually a continuation of the stem proper) in an umbel, or produce only one or two heads similarly disposed, there are cases of supernumerary cephalia (in species normally ternate), and some species clusters (see Sect. *Polystachyae*, below) with the cephalia regularly borne in groups of 4, 5, 6, 7, or (very rarely) even more. In these, however, the pedicels are very close together and appear to be spiralled, very different from the well-separated pedicels of *Freycinetia angustifolia* and *F. jagorii*.

2. § Lateriflorae B. C. Stone, *sect. nov.*

Inflorescentia lateralis,cephaliis oblongato-cylindraceis; stigmata 3—6. Plantae robustae.

Type-species: *Freycinetia funicularis* (Sav. *ex* Lamk.) Merr. (Formerly known as *F. strobilacea* Bl.).

Included species: *F. kostermansii* B. C. Stone, *F. lauterbachii* Warb., *F. pleurantha* Merr. & Perry, *F. rhodospathe* Ridl., *F. sterrophylla* Merr. & Perry.

Distribution: Eastern Indonesia (including Java and Celebes), New Guinea, Solomon Islands.

There are three groups of species of *Freycinetia* which produce inflorescences that may be called lateral, that is, which terminate short distinctive side branches that bear prophylls and floral bracts but lack normal foliage leaves. Of these three groups, two seem quite closely related, i.e. Sections *Lateriflorae* and *Solmsiella*, while the third, Sect. *Sarawakenses*, seems quite distinct. The ability to produce both terminal and lateral inflorescences on the same plant appears to be lacking in the first two sections mentioned, while in Sect. *Sarawakenses* a main branch, itself terminating in an inflorescence, may also bear a lateral inflorescence. Evidence seems to favor the interpretation of lateral inflorescences as evolutionarily derivative. Again, comparison with *Pandanus* is illuminating. The great majority of species of *Pandanus* produce terminal inflorescences, while a few species (*P. joskei* Wright, *P. lateralis* Martelli, and *P. lamprocephalus* M. & P. may be mentioned; there are very few others) produce lateral inflorescences (defined in the same way as those of *Freycinetia*). Both genera clearly show that the possession of lateral inflorescences is not sufficient, by itself, to establish close relationship. In *Pandanus*, the first and last of the three species mentioned above are very closely related, i.e. they belong to the same section; but *P. lateralis* belongs to a different section by virtue of its stigmatic structure. Similarly in *Freycinetia*, although *Lateriflorae* and *Solmsiella* are probably closely related sections, *Sarawakenses* seems quite distant. Lateral inflorescences, whether or not looked upon as evidence of evolutionary specialization, are obviously not restricted to any one line of evolution in the family.

3. § Solmsiella B. C. Stone, *sect. nov.*

Inflorescentia lateralis, cephaliis globosis vel subglobosis; stigmata 2—6. Plantae modestae.

Type-species: *Freycinetia graminifolia* Solms.

Included species: *F. elegantula* B. C. Stone, *F. gibbsiae* Rendle, *F. lateriflora* Ridl., *F. monticola* Rendle. It is probable that *F. erythrospatha* Merr. & Perry pertains here also.

Distribution: New Caledonia, New Guinea.

As mentioned above, Sect. *Solmsiella* appears very similar to Sect. *Lateriflorae*, but seems to be well characterized by cephalium shape, stigmatic number, and the rather small size of the plants. The species are about evenly divided between New Caledonia and New Guinea, and are confined to one or the other of the two islands.

4. § Sarawakenses B. C. Stone, *sect. nov.*

Inflorescentia terminalis vel lateralis, cephaliis solitariis, globosis; stigmata 3—4.

Type-species: *Freycinetia sarawakensis* Martelli.

Tentatively included species: *F. imbricata* Bl.

Distribution: Borneo, Malaya, Java, Sumatra. The type-species is endemic in Borneo.

It is doubtful whether *F. imbricata* really belongs here; it occasionally produces cephalia in groups of 2 or 3. The type-species is a very distinctive but rare (or at any rate rarely collected) species. Of the few specimens which I have examined, most had lateral inflorescences, but one had a terminal inflorescence. In *F. imbricata*, both kinds of inflorescence are common.

5. § Pseudopetiolosae B. C. Stone, *sect. nov.*

Folia basi abrupte constricta petioliformata. Cephalia cylindracea ternata. Inflorescentia terminalis; stigmata 2—10.

Type-species: *Freycinetia caudata* Hemsley.

Included species: *F. petiolacea* Merr. & Perry.

Distribution: Fiji (the type-species); Solomon Islands.

These two species, obviously of close relationship, would have to be placed far apart in the original sectional scheme of Warburg. In other words I here place greater emphasis and reliance on other features, including the vegetative character of the 'pseudopetioles', than on stigmatic number alone. I have seen one inadequate specimen (without flowers or fruits) from the extreme west end of New Guinea (West Irian) which has the striking pseudopetioliform leaves of the Fiji and Solomons plants, but cannot further identify it. It might prove to be *F. petiolacea* itself, or a closely related but undescribed species.

6. § Auriculifoliae B. C. Stone, *sect. nov.*

Foliae auriculis apice unilobatis. Inflorescentia terminalis fere ternata, cephaliis cylindraceis. Bacca angusta; stigmata 1—3 plerumque 2.

Type-species: *Freycinetia sumatrana* Hemsley.

Included species: *F. walkeri* Solms, *F. auriculata* Merr., *F. amboinensis* Martelli, *F. ceramensis* Martelli, *F. loheri* Martelli, *F. vidalii* Hemsley.

Distribution: Ceylon, Malaysia, Indonesia, Java, Borneo, Philippines; to date not found east of Amboina.

Except for *F. vidalii*, these species are all very much alike, and further synonymy may be expected. The characteristic lobed auricles are fragile, and may be lacking on older leaves and in older specimens. It is also not precisely clear to what extent the shape and size of the auricular lobe may vary. The associated characters serve to identify this group.

7. § Polystachyae B. C. Stone, *sect. nov.*

Cephalia spiraliter aggregata congesta, cylindracea, plerumque 4—7.

Type-species: *Freycinetia multiflora* Merr.

Included species: *F. acutifolia* Merr., *F. angulata* C. B. Robinson, *F. robinsonii* Merr., *F. philippinensis* Hemsl. Possibly to be added is *F. cumingiana* Gaud.

Distribution: Philippines.

This entire group appears to be limited to the Philippines, but some quite similar species, as yet undescribed, from New Guinea and the Solomon Islands, may also belong to this section. Some others, such as *F. arfakiana* Martelli of New Guinea, may also qualify for placement here, although details of the berry form could prevent this.

8. § Filiformicarpae B. C. Stone, *sect. nov.*

Stigmata 2 (rarissime 1 vel 3). Bacca elongato-filiformis, apice minute truncata. Cephalia terminalia ternata cylindracea. Folia media vel magna, oblongo-elongata, acuminata vel acuta, auriculis elongatis latis integris.

Type-species: *Freycinetia reineckei* Warb.

Included species: *F. australiensis* Warb., *F. apoensis* Martelli, *F. curranii* Merr., *F. macrostachya* Martelli, *F. maxima* Merr., *F. mariannensis* Merr., *F. kanehirae* B. C. Stone,

F. parviaculeata B. C. Stone, *F. ponapensis* Martelli, *F. tessellata* Merr. & Perry, *F. undulata* Merr. & Perry.

Distribution: Borneo, Philippines, New Guinea, Solomon Islands, New Hebrides, Samoa, Micronesia, Northern Australia.

This is a very homogeneous and distinctive section. The robust size of the plants, the broad and rather acute leaves, broad entire auricles, terminal inflorescences, cylindric stout cephalia, and very numerous, slender, elongated, red berries with two small stigmas, form a highly characteristic combination of features. Although one species of this section has been located in Borneo, none penetrates westward, and the section appears completely absent from the Malay Peninsula, Sumatra, and Java.

9. § Oligostigma Warb., Pflanzenr. IV. 9 (1900) 27, *emend.* Stone.

Berries succulent throughout, clear to apex when ripe, with no rigid pileus. Stigmas few, usually 1—4. Cephalia globose to ellipsoid or oblong. Inflorescence terminal. Smallish plants, usually with relatively short and wide leaves.

Lectotype-species: *Freycinetia beccarii* Solms.

Included species: *F. globiceps* Warb., *F. crucigera* Kaneh., *F. elliptica* Merr. & Perry, *F. ellipsoidalis* Merr. & Perry, *F. nervosa* Merr. & Perry, *F. propinqua* Domin, *F. oblanceolata* Martelli, *F. scandens* Gaud., *F. tenuis* Solms, and *F. inermis* Ridl. Possibly to be added is *F. divaricata* Merr. & Perry.

Distribution: New Guinea, Queensland, westward to Borneo.

This section, as here redefined, includes a narrower range of forms than it did for Warburg. Since Warburg did not select a type-species, the lectotype-species chosen above has been drawn from the group of species which appear to best exemplify Warburg's intention, and of course was originally included by Warburg. The species originally included by Warburg were divided into two groups (by his key; not named), and it is from the first group (including species 1—7) that *F. beccarii* was taken. The second group included such diverse species as *F. reineckei* (see Sect. *Filiformicarpae*) and *F. lauterbachii* (Sect. *Lateriflorae*).

10. § Warburgiella B. C. Stone, *sect. nov.*

Inflorescentia terminalis ternata, cephaliis oblongis; stigmata 3—5(—8). Folia elliptica vel oblanceolata frequenter pro genere lata.

Type-species: *Freycinetia marantifolia* Hemsley.

Included species: *F. decipiens* Merr. & Perry, *F. verruculosa* Warb.

Distribution: Solomon Islands and New Guinea; New Caledonia.

It is probable that on further study certain species from the Philippines and Borneo may be added to this section (e.g. *F. hemsleyi* Warb.): *F. javanica* Bl. may also belong here.

11. § Ridleyella B. C. Stone, *sect. nov.*

Inflorescentia terminalis ternata, cephaliis globosis; stigmata 1—5. Folia linearia vel anguste lanceolata parva.

Type-species: *Freycinetia angustissima* Ridley.

Included species: *F. flaviceps* Rendle, *F. forbesii* Ridl., *F. linearis* Merr. & Perry, *F. linearifolia* Merr. & Perry (? slightly doubtful).

Distribution: New Guinea.

There is another group of species, superficially very similar to those mentioned here, which differ, however, in possessing a rostrate pileus, that occurs in the Philippines. This group comprises *Freycinetia monocephala* Elmer, *F. bulusanensis* Merr., and *F. leptophylla* Martelli, and perhaps also *F. ensifolia* Merr. They appear to form a link between Sect. *Ridleyella* and Sect. *Devrieseella*, differing from the latter in their narrower leaves.

12. § Blumeella B. C. Stone, *sect. nov.*

Inflorescentia terminalis ternata, cephaliis cylindraceis; stigmata 2 vel 3. Plantae robustae, foliis elongatis attenuatis auriculis latesubtruncatis apice denticulatis.

Type-species: *Freycinetia radicans* Gaud.

Included species: *F. insignis* Bl., *F. timorensis* Martelli, *F. archboldiana* Merr. & Perry, *F. pseudo-insignis* Warb. (*sensu* Merr. & Perry); perhaps also *F. lombokensis* Markgraf.

Distribution: Java and Eastern Indonesia, New Guinea.

This section approaches closely Sect. *Auriculifoliae*, and possibly the two should be combined, although as yet species with intermediate characters have not been discerned. At any rate they are quite generally similar and no doubt closely related.

13. § Hemsleyella B. C. Stone, *sect. nov.*

Inflorescentia terminalis ternata, cephaliis cylindraceis; stigmata 1—6. Folia rigide ensiformia basi abrupte contracta, auriculis profunde spinuloso-pectinatis, foliorum marginibus revolutis.

Type-species: *Freycinetia rigidifolia* Hemsley (synonym, *F. acuminata* Ridl.).

Included species: *F. pectinata* Merr. & Perry.

Distribution: Andaman Islands, Malaya, Borneo (type-sp.); Solomon Islands (*F. pectinata*).

A small but clear-cut section. The species differ chiefly in the number of stigmas per berry: 1—2 in *F. rigidifolia*, 4—6 in *F. pectinata*. In vegetative features they hardly differ.

14. § Freycinetia. Syn. Sect. *Pleiostigma* Warb. Pflanzenr. IV.9 (1900) 28, in part.

Robust plants with elongated, acuminate or attenuate leaves. Inflorescence invariably terminal, usually ternate. Cephalia cylindric. Berries relatively stout, flat-topped, commonly bilaterally compressed, with numerous (4—12 or more) stigmas.

Type-species: *Freycinetia arborea* Gaud. (generitype).

Included species: *F. baueriana* Endl., *F. banksii* A. Cunn., *F. laeta* Merr. & Perry, *F. rapensis* F. Br. Possibly to be included here is *F. percostata* Merr. & Perry.

Distribution: New Guinea eastward to Polynesia (Hawaii and New Zealand).

This section appears to include species which possess several rather specialized features in common, including the high degree of carpel connation resulting in polystigmatic gynoecia. It is of interest that none of these species appears west of the areas of main concentration of the genus (i.e. in Borneo, Java, Sumatra, Malaysia, etc.), but the section is represented in the extreme north-eastern and extreme south-eastern corners of the generic range, namely in Hawaii and New Zealand. (In this connection it may be mentioned that there seems scarcely any difference between *F. banksii* of New Zealand and *F. baueriana* of Norfolk Island.) Indeed in these islands the genus is represented only by one species (*F. arborea* in Hawaii, *F. banksii* in New Zealand's North Island only, and *F. baueriana* in Norfolk Island).

In the Philippines there are some species which may prove to be additions to this section. Most of the Philippine plants with the general facies of Sect. *Freycinetia* appear, however, to form a natural unit here named Sect. *Taiwaniella.*

15. § Taiwaniella B. C. Stone, *sect. nov.*

Plantae robustae. Inflorescentia terminalis ternata, cephaliis cylindraceis; stigmata numerosa (4—8 vel ultra). Auriculae foliorum rotundatae denticulatae. Pedicelli minute scabriduli.

Type-species: *Freycinetia formosana* Hemsley.

Included species: *F. scabripes* Warb., *F. ferox* Warb., *F. rigida* Elmer, *F. robusta* Elmer, *F. peripiezocarpa* Martelli, *F. botuliformis* Merr.

Distribution: Philippines, Formosa, Bonin Islands.

This section corresponds closely to the characters of Sect. *Freycinetia*, but differs in (a) the denticulate auricle margins, and (b) the minutely scabridulous pedicels. There is nevertheless a special closeness of these two sections. The names listed above are perhaps more numerous than the actual number of species involved, and some will probably fall as synonyms after further study. It may be mentioned here that the Bonin Islands plants, referred to as *F. boninensis* Nakai, are better considered as *F. formosana* var. *boninensis* Nakai. In addition, *F. batanensis* Martelli and *F. banahaensis* Elmer are mere varieties, if not in fact synonyms, of *F. formosana.*

16. § Devrieseella B. C. Stone, *sect. nov.*

Plantae mediocres; folia lanceolata subbrevia. Inflorescentia terminalis ternata, cephaliis globosis, baccis valde rostratis; stigmata plerumque 2—5.

Type-species: *Freycinetia devriesei* Solms.

Included species: *F. rostrata* Merr., *F. megacarpa* Merr. Probably also *F. ensifolia* Merr., *F. williamsii* Merr.

Distribution: Celebes and Philippines.

As mentioned above this section seems to be linked with Sect. *Ridleyella* by such species as *F. leptophylla* Martelli, but this may be a superficial judgement since the leaf length-to-width ratio is involved. The markedly rostrate berries are a rather strong evidence for separation.

17. § Gaudichaudiella B. C. Stone, *sect. nov.*

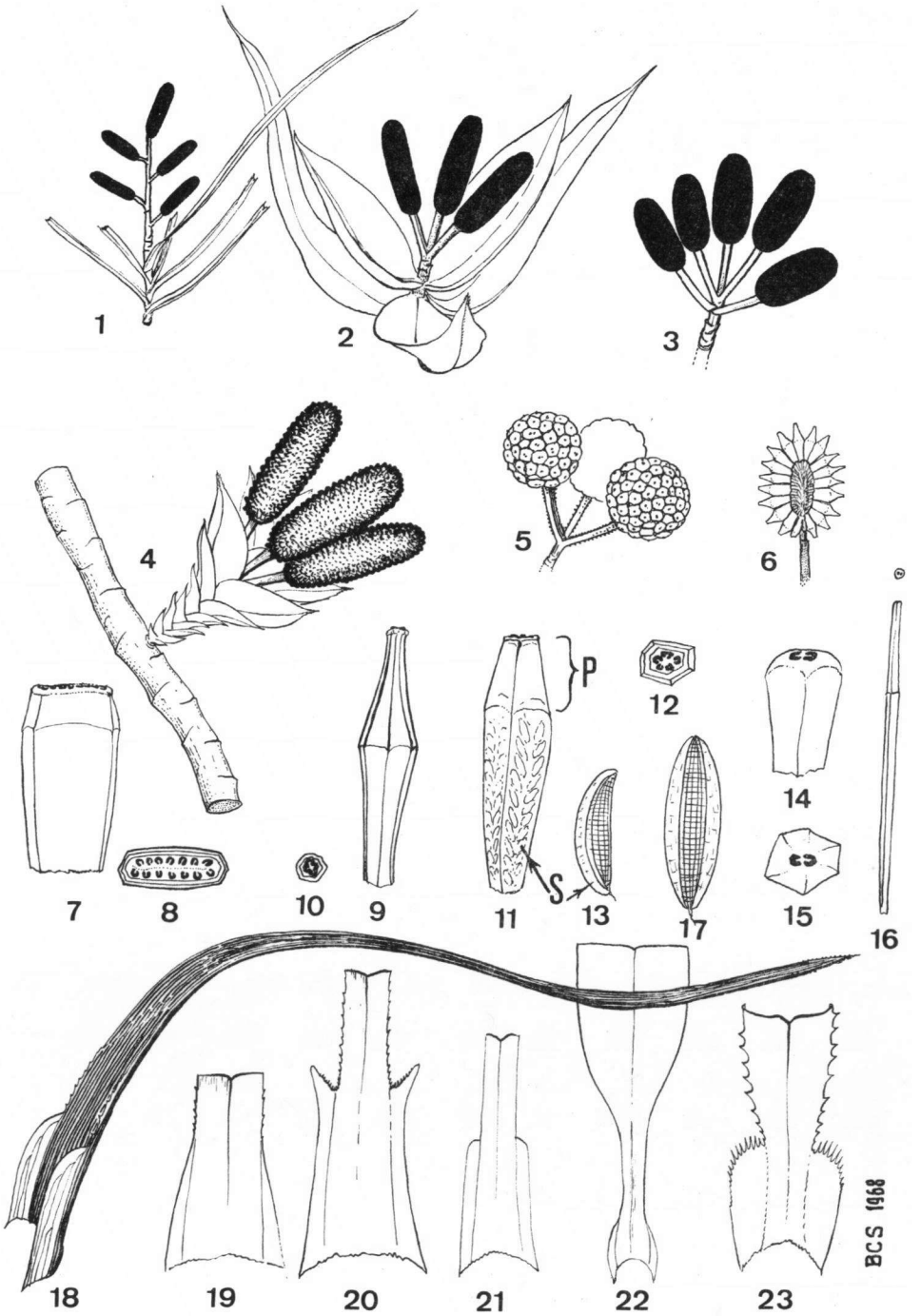
Plantae subrobustae vel robustae. Folia elongata acuminata. Inflorescentia terminalis ternata, cephaliis cylindraceis. Bacca apice rostrata. Stigmata plerumque 4—10.

Type-species: *Freycinetia impavida* (Gaud. *ex* Hombr. in D'Urville) B. C. Stone. (Previously called *F. victoriperrea* Solms and *F. demissa* Br. & Benn.).

Included species: *F. marquisensis* F. Br., *F. hivaoensis* Martelli, *F. storckii* Seem., *F. urvilleana* Gaud. *ex* Hombr. in D'Urville, *F. samoensis* Warb., *F. solomonensis* B. C. Stone, *F. parksii* Martelli.

Distribution: Melanesia and Polynesia.

This section is close to Sect. *Freycinetia* and also resembles Sect. *Taiwaniella.* Its distribution pattern too is similar to that of Sect. *Freycinetia.* The characteristic rostrate berries serve as a chief distinguishing feature.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BCS 1968

DISCUSSION

There are about 259 binomials in a complete list of species of *Freycinetia*. It is still too early to say just how many of these will prove to be worth maintaining as acceptably distinct species, but it is clear that there do exist a fair number of synonyms. On the other hand there are undetected species coming to light. I believe that there are well over 100 species in the genus, possibly 150; but it seems unlikely that there are more than 200. This may serve as a tentative estimate of the dimensions of the genus.

It will be noted that in the above enumeration of sections, approximately 100 species have been referred to a section, mostly with confidence though some with more or less doubt. There are many binomials, and certainly some species, which therefore are not as yet definitely referable to one of the sections so far defined. These must remain temporarily *incertae sedis*. Sometimes this is because a species has been described from a staminate specimen, and no collections are yet known of pistillate materials. Such cases may be taken as the '*Freycinetiae imperfectae*'. In other cases although the pistillate specimens are at hand there are certain characters lacking (such as the fragile and often missing auricles). In still other cases the species, sometimes with similar ones, appears to form a group that can neither be accommodated in a section nor can be clearly discriminated as yet. Some such groups might later be clarified and described as additional sections; others may turn out to be linking in nature and result in the merging of two sections. On the whole, however, it has been the policy here to name and describe only those groups which are fairly clear-cut.

EXPLANATION OF THE FIGURES

Fig. 1. Racemose inflorescence of *F. angustifolia* Bl. illustrative of §*Racemosiflorae*.
Fig. 2. Terminal inflorescence, with ternate cephalia of cylindric form.
Fig. 3. Spirally congested cephalia as in §*Polystachyae*.
Fig. 4. Lateral inflorescence as in §*Lateriflorae*, with basal prophylls, upper floral bracts, and ternate cephalia.
Fig. 5. Globose cephalia, borne on hispidulous pedicels.
Fig. 6. Longitudinal section of an ellipsoid cephalium with rostrate berries, with rigid pilei.
Fig. 7. Polystigmatic berry of *F. banksii* A. Cunn., §*Freycinetia*.
Fig. 8. The same in top view showing strong bilateral compression.
Fig. 9. Rostrate sublageniform berry as in §*Gaudichaudiella* or §*Devrieseella*.
Fig. 10. The same in top view.
Fig. 11. Side view of berry with rigid pileus (P) showing location of seeds (S).
Fig. 12. The same in top view.
Fig. 13. Enlarged diagrammatic view of seed (raphe on left side).
Fig. 14. Berry of §*Oligostigma*, showing succulent apex.
Fig. 15. The same in top view.
Fig. 16. Berry of §*Filiformicarpae*, showing filiform bistigmatic form.
Fig. 17. Seed of type having strophiole (right side) as well as raphe.
Fig. 18. Leaf showing basal auricles (these entire with rounded apex).
Fig. 19. Auricles with tapered form.
Fig. 20. Lobed auricles as in §*Auriculifoliae*.
Fig. 21. Truncate auricles.
Fig. 22. Basal part of leaf, showing pseudopetiolar form, of §*Pseudopetiolosae*.
Fig. 23. Pectinate-spinulose auricles of §*Hemsleyella*.

At this stage a detailed study of the distributions of the sections would be premature, although eventually such a study should be profoundly informative and interesting. Only after the vast majority of known species have been satisfactorily assigned to sections can such studies be thorough. In the meantime, however, there are a few evident aspects which are worth mentioning. First, it is interesting to note that no section has an area, or total range, as great as the range of the genus itself. Secondly, the scarcity of highly endemic and localized sections should be pointed out. Only Sect. *Sarawakenses*, and that rather doubtfully, is restricted to one region (Borneo in this case). Another section, *Warburgiella*, is known so far only from New Caledonia and the Solomon Islands, but it may well turn up also in New Guinea when more data are available. Finally it appears that 'Wallace's Line' (or some approximation thereof) may turn out to be a major phytogeographic boundary in this genus.

A comprehensive discussion of the distribution of the genus would be incomplete without reference to dispersal. The fleshy berries of *Freycinetia*, with their rather numerous small seeds, are well adapted for dispersal by frugivorous birds and small mammals. Observations by van der Pijl in Indonesia have shown that bats are involved in the pollination of some species, and it is probable that the fruit-eating bats such as flying-foxes (*Pteropus* spp.) are attracted to ripe fruits of *Freycinetia* (personal observations in the Solomon Islands). It is also known that rats (perhaps introduced species as well as *Rattus exulans*, the Polynesian rat) seek out inflorescences, although they appear to prefer the fleshy colored bracts (of *Freycinetia arborea* Gaud. and *F. ponapensis* Martelli, at least) as edible materials. This again might be of importance in pollen dispersal though not in fruit dispersal. Observations of seedling location show that germination and growth may occur either on the ground or in crotches of trees, etc., so that plants may sometimes be epiphytic, though this is probably only temporary as the wide-spreading root system may contact the ground later. Nearly all of the large plants so far observed *in situ* showed a root-connection with soil; however, the clasping aerial-root system could well have been equally or more richly developed. At any rate there appears the possibility, if not likelihood, that seed germination could take place initially well above the forest floor. Such an ability would be a valuable one if bird, or bat, dispersal occurred. Unfortunately I do not know of any definite records of *Freycinetia* fruit serving as food for birds, nor of the recovery of their seeds from gullet contents, so the above is speculation, though very plausible.

TERMINOLOGY

As an aid to the understanding of the somewhat specialized terminology used in the key and descriptions the illustrated glossary (Figures 1—23) is provided.

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Plate 1. Occurrence of *Pelvetia canaliculata* and *Fucus spiralis* in an open area in the belt of *Ascophyllum nodosum* and *Fucus vesiculosus* on a dike slope, west of Kortgene, May 1958. End 1959 the vegetation of *Ascophyllum* and *Fucus vesiculosus* had become closed and *Pelvetia* and *Fucus spiralis* had disappeared.