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The Genus Freycinetia (Pandanaceae) in New Guinea (part 3)

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RÉSUMÉ

HUYNH, K.-L. (2000). Le genre Freycinetia (Pandanaceae) en Nouvelle Guinée (3e partie). *Candollea* 55: 283-306. En anglais, résumés français et anglais.

Dix espèces nouvelles de *Freycinetia* de la Nouvelle Guinée sont décrites: *F. acuta*, *F. brevis*, *F. chartacea*, *F. concolor*, *F. craterensis*, *F. falcata*, *F. madangensis*, *F. morobeensis*, *F. obtusiacuminata*, et *F. takeuchii*. En outre, *F. flaviceps* Rendle, *F. forbesii* Ridl., *F. gibbseae* Rendle, *F. inermis* Ridl., *F. lateriflora* Ridl., *F. rhodospatha* Ridl., et *F. sogerensis* Rendle, tous de la Nouvelle Guinée et peu ou mal connus jusqu'à une date récente, sont redécrits à partir de leurs types en utilisant aussi des caractères anatomiques essentiels de la baie, de la graine, et des auricules de la feuille. Des observations chez un grand nombre d'espèces de la Nouvelle Guinée semblent indiquer que chez les espèces de ce genre qui ont des "infrutescences terminales", les rameaux porteurs d'infrutescence se développent de façon sympodiale et qu'ils sont pourvus de prophylles à la partie basale, lesquels peuvent manquer sur les collections faute d'être récoltés à temps. Les caractéristiques des "infrutescences terminales" et des "infrutescences latérales" sont décrites afin de reconnaître ces deux infrutescences avec certitude.

ABSTRACT

HUYNH, K.-L. (2000). The Genus Freycinetia (Pandanaceae) in New Guinea (part 3). *Candollea* 55: 283-306. In English, French and English abstracts.

Ten new species of *Freycinetia* from New Guinea are described: *F. acuta*, *F. brevis*, *F. chartacea*, *F. concolor*, *F. craterensis*, *F. falcata*, *F. madangensis*, *F. morobeensis*, *F. obtusiacuminata*, and *F. takeuchii*. In addition, a new description of *F. flaviceps* Rendle, *F. forbesii* Ridl., *F. gibbseae* Rendle, *F. inermis* Ridl., *F. lateriflora* Ridl., *F. rhodospatha* Ridl., and *F. sogerensis* Rendle, all from New Guinea and not correctly described or little known until recently, is given from their types, using also essential characters from the anatomy of berries, seeds and leaf auricles. Observations in a large number of species from New Guinea seem to indicate that in the species of the genus that have "terminal infructescences", the infructescence-bearing branchlets develop sympodially and have prophylls in the basal part but these may be lacking in specimens which were collected too late. Characteristics of "terminal infructescences" and "lateral infructescences" are described for these two infructescences to be recognized with certainty.

KEY-WORDS: PANDANACEAE – *Freycinetia* – New Guinea – Branching – Prophylls – Taxonomy.

Introduction

The present paper describes other unknown species of *Freycinetia* recently found from New Guinea, using characters from gross morphology and those recently found from the anatomy of berries, seeds, and leaf auricles. The anatomical characters were described in HUYNH (1999: 150), three of which are: presence/absence of a central sclerenchyma in pilei, of fusiform/elliptic fibre-bundles at successive levels along berries (to date, the berries that have these fibre

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bundles also have a central sclerenchyma), and of crystal cells in seeds. They give more substance to descriptions. In particular, they may be very useful in distinguishing between close species, as seen in HUYNH (1997: 381) between *F. bicolor* and *F. solomonensis*, and in HUYNH (1999: 178-185) between the species of the *F. angustissima* group and between those of the *F. klossii* group. Another type of fibre in berries was observed in sect. *Filiformicarpae* B. C. Stone, which is a small subgroup of sect. *Oligostigma* Warb. and is represented in New Guinea by *F. macrostachya*, *F. marginata*, and *F. undulata*. It consists in longitudinal fibre-strands extending in a single stretch along the berries, around a central sclerenchyma. In fact, it becomes evident that a suitable taxonomical study of *Freycinetia* is hardly possible without using anatomical features. Thus, in some species, the stigmas are indistinct when observed under the stereo-microscope with *x* 6-50 magnification currently used in the identification of plants, and the stigma numbers cannot be determined under these conditions (this was the case for example of *F. filifolia* and *F. stenophylla*: HUYNH, 1999: 158 and 181). By contrast, the stigma numbers can be determined by observing the numbers of fertilization canals in the transverse sections of the pilei, each fertilization canal corresponding to one stigma. Likewise, the presence or absence of a ring around the stigmatic areola is another essential specific character, but is questionable in some species by the fact that the ring is not very distinct. By contrast, anatomy makes it possible to know if the ring exists or not: it exists if the uppermost transverse sections of the berries are lignified; it does not if these sections are unlignified. Also, in some species, the final state of the leaf auricles (for example they will disintegrate into separate fibres, or they will not) may be determined by using anatomical features, and this knowledge may be useful in distinguishing between species (for example between *F. morobeensis* and *F. acuta*: see below, under Part 10). Anatomical features should be used in the taxonomy of *Freycinetia* also because anatomical preparations may be obtained within 1 hr by using hand-made sections.

Furthermore, as reported in a previous paper (HUYNH, 1999: 149), the ancient diagnoses of *Freycinetia* used only a small number of characters from gross morphology; later, other characters were successively found and also used for description. As a result, a large number of primary descriptions becomes insufficient for an accurate recognition of the species concerned, with the consequence that confusion sometimes occurred (see HUYNH, 1999: 178-182). Therefore, an effort has been made to tentatively investigate the types of "ancient" New-Guinean species and re-describe these in detail, using known characters from gross morphology and anatomy, with the aim of avoiding confusion of other species with them, in particular of those yet to be described. In fact, such type specimens are not easily accessible. It becomes evident that *Freycinetia* in New Guinea is very rich in species – considering the widely variable morphology of this genus and of the species already known from this island, the immensity of the island and its varied ecological conditions – but most of these species remain to be discovered since the greater part of the island has not been visited for collecting. Thus, the types of the species described by Ridley and Rendle are also investigated in the present study (they were among the first species described from New Guinea), except for those of *F. angustissima* and *F. klossii*, which were investigated in HUYNH (1999). The data obtained will be also described below. Some of the features observed will be illustrated, especially for leaves, which vary widely in shape from one species to another in the genus and in New Guinea.

Observations

1. *Freycinetia brevis* Huynh, **spec. nova** (sect. *Oligostigma*) (Fig. 1).

Internodia ramorum usque ad 1.5 cm longa 3.5 mm crassa, trigona, laevia. Folia 10-15 vel minus in ramulis, 2-6 cm longis in axe, 9-16 cm longa, 5-7 mm lata in medio 3 mm in basi (auriculis non inclusis), valde approximata (igitur longitudine et latitudine celeriter variantibus), lineari-lanceolata, in dimidio supero sensim attenuata, 5-6 mm acuminata, imbricata, in basi amplexicaulia; lamina in sicco viridula, membranaceo-chartacea, non plicata, non revoluta; venis longitudinalibus utrinque distinctis, sed transversalibus invisibilibus; marginibus armatis in 1/4-1/3 supera tantum, denticulis vix visibilibus; costa media armata in parte supera tantum

sed in spatio longiore quam in marginibus, denticulis longioribus quam marginalibus proximis, infimis ad 0.5 mm longis; auriculis 1.5 cm longis, 3 mm latis, triangularibus, ut videtur adnatis in apice, deciduis, cito in separatas fibras solutis. Infructescentia terminalis, 3 spicis praedita, axe brevi suffulta; pedunculo communi ca 5 mm longo; pedunculis ca 1 cm longis, 1.5 mm latis, laevibus; syncarpiis breviter cylindraceis, ca 1.5 cm longis 1 cm latis, immaturis, in sicco ± atro-brunneis. Baccae succulentae, ca 2.5 mm longae 1.5 mm latae, intra sclerenchymate centrali fibrisque destitutae; stigmatibus generaliter 2, minutis, aggregatis, areola stigmatica annulo destituta; raphe cellulis crystalliferis destituta.

Typus: *Jacobs 9298* (holo-, BISH!); Papua New Guinea, Mt Bosavi, northern side, ca 6°26'S 142°50'E, alt. 600-700 m, 18 October 1973; old well-drained volcanic soil, primary forest locally disturbed.

Creeper on trunks, a few meters long, leaves plain green, varying in width, fruits soft, dark red.

Freycinetia brevis is named in reference to its short fertile shoots. These are only 2-6 cm long in axis. Although the fertile shoots of *F. brevis* are reduced in axis, its infructescence is terminal, and not lateral, in particular because these shoots bear leaves. By contrast, in the species that have "lateral infructescences", the fertile shoots do not have leaves (see below, under Part 5).

Freycinetia brevis appears close to *F. stenophylla*. In this latter species also: the infructescence-bearing branchlets are short in axis; the berries generally have two stigmas, and they have no ring around the stigmatic areola, no central sclerenchyma, and no fibre bundles; the leaves are narrowly lanceolate and membranaceous (HUYNH, 1999: 180-181). *Freycinetia stenophylla* differs from *F. brevis* in that: its infructescence is monosyncarpic; its leaves are 8-12 cm long and 2-4 mm wide, with auricles which never disintegrate into separate fibres, and margins which are armed also in the lower part (HUYNH, 1999: 181).

2. *Freycinetia chartacea* Huynh, **spec. nova** (sect. *Oligostigma*) (Fig. 2).

Internodia ramulorum ca 1 cm longa 3 mm crassa, teretia, laevia. Folia (5-) 7-9 cm longa, 6-7 mm lata in tertia infera (ibi latissima) 2.5 mm in basi (auriculis non inclusis), lineari-lanceolata, e tertia infera ad apicem sensim attenuata, breviter acuminata, dissita, in basi semiamplexicaulia; lamina in sicco chartacea, facile flexibilia, non plicata, utrinque striata inter venas longitudinales; venis longitudinalibus distinctis in pagina abaxiali, minus in adaxiali; venis transversalibus utrinque invisibilibus; marginibus e circiter 1.5 cm supra basim ad apicem armatis, denticulis gracilibus, antrorsis, minutis (ut maximum 0.5 mm longis), interdum sparsis in brevi spatio in medio; costa media armata in dimidio supero, denticulis longioribus quam marginalibus proximis; auriculis omnibus non conservatis, ut videtur 10 mm longis 4 mm latis in separatas fibras solutis postremo. Infructescentia terminalis, 3 spicis praedita; pedunculo communi subnullo; pedunculis ca 1.5 cm longis, 1.5 mm latis, laevibus; syncarpiis ellipsoideis, ca 1.4 cm longis 7 mm latis, immaturis, in sicco modice brunneis. Baccae succulentae, intra sclerenchymate centrali fibrisque destitutae; stigmatibus 2, minutis, aggregatis, areola stigmatica annulo destituta.

Typus: *Darbyshire & Hoogland 8066* (holo-, G!; iso-, BM!); Papua New Guinea, Sepik district, Aitape subdistrict, between Sumo and Mafoka (on Rhainbrum River), alt. ca 50 ft, 4 July 1961.

Climber in undergrowth of tall forest on river flats, fruits pale orange when young to deep red when ripe; local names Toy (Pogatumo language, Sumo), Di (Orne language, Mafoka).

Freycinetia chartacea is named in reference to its chartaceous leaves. It has branchlets 14-30 cm long in axis. It appears closest to *F. flaviceps*. In this latter species also: the leaves are linear-lanceolate and small (about 7-9 cm long and 5 mm wide); the berries do not have a ring around the stigmatic areola, and have neither central sclerenchyma nor fibre bundles. *Freycinetia flaviceps* differs from *F. chartacea* essentially in that: its syncarps are subglobose; in

particuler, its syncarp peduncles are hispidulous, and its leaves are subcoriaceous and have margins armed only at the apex (see below, under Part 14).

3. *Freycinetia madangensis* Huynh, **spec. nova** (sect. *Oligostigma*) (Fig. 3).

Internodia ramulorum 1-2 cm longa 5 mm crassa, teretia, laevia. Folia (12-) 16-18 cm longa, (2-) 3-4 cm lata in parte media 6 mm in basi (auriculis non inclusis), spathulato-subcuspidata, obtusa cum acumine, interdum lanceolata, dissita, in basi amplexicaulia; lamina in sicco submembranacea, non revoluta, viridula sed leviter pallidiore in pagina abaxiali, utrinque dense striata inter venas longitudinales; venis longitudinalibus utrinque distinctis sed transversalibus invisibilibus; marginibus armatis in 1/6 supera cum denticulis usque ad 0.5 mm longis, interdum 1 vel 2 denticulis minutis prope basim; costa media armata in dimidio supero; auriculis 2 cm longis, 5 mm latis, plerumque non conservatis, atrobrunneis et perspicue fuscioribus quam contigua vagina, utrinque dense fibrosis, ut videtur cito in fibras solutis, cellulis epidermicis hypodermicisque omnibus non lignosis, mesophyllo inter fasciculos vasorum separatis filis fibrarum 4-6 stratis compositis praedito. Infructescentia lateralis, 3 spicis praedita, axe 1.5 cm longo 2 mm lato suffulta, 5-6 internodiis composito, prophyllis in basi praedito sed foliis destituto; syncarpiis breviter cylindraceis vel subglobosis, 2 cm longis, 1-1.8 cm latis, maturis, in sicco pallide brunneis; pedunculis 1-1.5 cm longis, 1.5 mm latis, laevibus. Baccae succulentae, intra sclerenchymate centrali fibrisque destitutae; stigmatibus 2, areola stigmatica annulo destituta; pileo pyramidali, 3 mm longo, 3 mm lato. Semina 1 mm longa, 0.6 mm lata in medio, sublunata; raphe 0.2 mm lata, cellulis crystalliferis destituta; "strophiolo" distincto, 0.2 mm lato.

Typus: *Takeuchi & Gorrez 13407* (holo-, LAE!); Papua New Guinea, Madang Province, Josephstaal FMA, near Kumamdeber, along creek, ca 4°30'S 145°02'E, alt. 160 m, 28 July 1999; mature growth foothill forest with frequent landslips on slopes above streambed.

Climber, leaves herbaceous, adaxial side opaque dark green, lighter beneath, syncarps red.

With its infructescence which is lateral, and its leaves which are 16-18 × 3-4 cm, *F. madangensis* has no very closely related species. It may be compared with *F. oblanceolata*, which both belongs to sect. *Oligostigma* and has leaves which are spathulate and similar in size (15-21 × 3-4 cm). It differs from *F. oblanceolata* in that this latter species has terminal infructescences and leaves which in dry state are plicate-falcate and very frequently crispulous longitudinally (MARTELLI, 1910).

4. *Freycinetia falcata* Huynh, **spec. nova** (sect. *Oligostigma*) (Fig. 4).

Internodia teretia, laevia, 1-1.5 cm longa 2.5 mm crassa in ramis, 1-4 mm longa 1 mm crassa in ramulis. Folia (5-) 6-8 (-9) cm longa, (1.5-) 2-3 (-4) mm lata in medio 1.5 mm in basi (auriculis non inclusis), falcata sed saepe recta, e tertia supera ad apicem sensim attenuata, 2 mm acuminata, dissita, in basi subamplexicaulia; lamina in sicco chartacea, atroviridi, paginis concoloris; venis longitudinalibus utrinque visibilibus sed transversalibus invisibilibus; marginibus et costa media armatis in 1/6-1/3 supera, denticulis remotis, vix visibilibus; auriculis plerumque non conservatis, 5 mm longis, 1.5 mm latis, scariosis, translucentibus, adnatis, albidis et perspicue pallidioribus quam contigua vagina, inermibus, in apice truncatis et interdum 2 setis praeditis, cellulis epidermicis hypodermicisque omnibus tenuissimis et non lignosis, mesophyllo valde separatis filis fibrarum praedito sed fasciculis vasorum destituto, lamina inter fila fibrarum valde compressa. Prophylla (in basi surculorum lateralium rami fertilis) 3-20 mm longa, 2.5 mm lata, scariosa, albida. Infructescentia terminalis, 3 spicis praedita, axe 2.5 cm longo suffulta, inferne prophyllis superne foliis praedito; pedunculo communi 5 mm longo; pedunculis 1 cm longis, 1.5 mm latis, laevibus; syncarpiis cylindraceis, 2 cm longis, 1 cm crassis, immaturis, in sicco atrofuscis. Baccae succulentae (?), intra sclerenchymate centrali fibrisque destitutae; pileo pyramidali, 1 mm longo, 1.5 mm lato; stigmatibus 2 (-3), areola stigmatica annulo destituta.

Typus: *Takeuchi & Wiakabu 9450* (holo-, LAE!); New Ireland, Hans Meyer Range, Angil Mountain, 4°25.2'S 152°56.8'E, alt. ca 1800 m, 6 February 1994; pristine subcloud forest dominated by bryophytic and ferny growth.

Climber, apparently unarmed (?), branchlets slender, terete, pale brown, regularly annulate from circumferential abscission scars; leaves spiral, approximated at stem apices, herbaceous, unarmed, concolorously green at both surfaces, typical blade 80 × 3 mm, margins entire, often with scarious auricles; flowers not seen; infructescence a 3 spadix-like cluster, subtended by fibrillose remnants of the bracts, syncarps oblong, ca 20 mm long with stalk 7 mm long, carpels densely packed, green, each crowned by a punctiform stigma scar.

The leaves of *F. falcata* are armed in the upper 1/6-1/3 only, and the prickles are very small, which explains the field-data "leaves ... unarmed" mentioned above. *Freycinetia falcata* appears to have two sorts of branches, one being fertile the other sterile, which renders this species unusual. The fertile branches have no lateral branchlets but, instead, lateral shoots, which are only 0.5-2.5 cm long in axis. The shoots are separated from one another by leaves on the branch axis, and comprise prophylls below and foliage leaves above; prophylls and foliage leaves were both all or almost all preserved. At 5-6 mm above the uppermost shoot, the branch axis terminates abruptly, showing no traces of having been cut or broken. The shoot developed sympodially and bears an infructescence at its apex. This is a "terminal infructescence", not a "lateral infructescence", in particular because the shoot has foliage leaves (see below, under Part 5). By contrast, the sterile branches have no lateral shoots but lateral branchlets, which are 4-15 cm long in axis. On the branch axis, no leaves are observed between the branchlets (at least between some of them). The branchlets are numerous, each showing a tuft of leaves above and scars below on its axis; these latter may be remnants of leaves, but the lowermost of them may have been left by prophylls. The branch axis terminates abruptly like that of the fertile branches (see above), and the uppermost branchlet also developed sympodially. This latter in its turn has lateral branchlets.

No species appears very closely related to *F. falcata*, at least among those which were described from the Bismarck Archipelago (New Britain and New Ireland), Admiralty Islands, Louisiade Archipelago, New Guinea, and Solomon Islands. In its short, narrow and generally falcate leaves (Fig. 4), it may be compared with *F. brachyclada* (HUYNH, 1999: Fig. 9 and 14), from New Britain. This latter species differs from *F. falcata* essentially in having a monosyncarpic infructescence with a subglobose syncarp, and berries with generally one stigma.

Freycinetia falcata is named in reference to its generally falcate leaves.

5. *Freycinetia concolor* Huynh, **spec. nova** (sect. *Pleiostigma*) (Fig. 7).

Internodia ramulorum 1-2.5 cm longa, 6 mm crassa, prespicue trigona, laevia. Folia 15-20 cm longa, 2-2.5 (-3) cm lata in medio 8-10 mm in basi (auriculis non inclusis), latissima in medio vel 1/3 supera, lanceolata, interdum spathulata et obtusa, 5 mm acuminata, dissita, in basi semiamplexicaulia; lamina in sicco membranacea, viridula, non revoluta, non plicata, utrinque dense striata inter venas longitudinales, paginis concoloris; venis longitudinalibus subdistinctis in pagina adaxiali, obscuris vel invisibilibus in abaxiali; venis transversalibus utrinque invisibilibus; marginibus armatis in tertia infera et infra apicem, denticulis usque ad 0.5 mm longis, inferne perpendicularibus, superne antrorsis; costa media armata in 1/4-1/3 supera, denticulis antrorsis, inferne sparsis; auriculis 2.5 cm longis, 4-5 mm latis, triangularibus, adnatis, inermibus, atrobrunneis et perspicue fuscioribus quam contigua vagina, 3-nervatis, ut videtur cito in separatas fibras solutis, cellulis epidermicis hypodermicisque omnibus non lignosis, mesophyllo inter fasciculos vasorum separatis filis fibrarum 4-6 stratis compositis praedito. Prophylla (in basi ramuli fertilis) 0.5-7.5 cm longa, 1 cm lata, superis rigido-coriaceis, luteolis, acutis. Infructescentia terminalis, 3-4 spicis praedita; pedunculo communi ca 1 cm longo; pedunculis ca 2 cm longis, 2 mm latis, laevibus; syncarpiis cylindraceis, ca 4 cm longis 1.5 cm latis, maturis, in sicco atrofuscis. Baccae succulentae (?), 4 mm longae, intra sclerenchymate centrali fibrisque destitutae; pileo pyramidali, 1.5 mm longo, 2 mm lato; stigmatibus (2-) 3 (-4), areola stigmatica

annulo destituta. Semina 1.2 mm longa, 0.6 mm lata in medio, sublunata; raphe 0.2 mm lata, cellulis crystalliferis destituta; "strophiolo" distincto, 0.2 mm lato.

Typus: *Takeuchi 13778* (holo-, LAE!); Papua New Guinea, Madang Province, Josephstaal FMA, Guam River, ca 4°32'S 144°59'E, alt. ca 50 m, 9 August 1999; alluvial forest on riverine terraces.

Lianous, leaves coriaceous, concolourous medium green at both surfaces, syncarps ternate, green; local name "tam badi gab"; described by natives as having no traditional use.

Freycinetia concolor is remarkable in that the two surfaces of its leaves are concolourous in both living and dry state. Also, its berries do not have a ring around the stigmatic areola, and a central sclerenchyma is lacking.

Freycinetia concolor appears close to *F. craterensis*, described below. They have leaves ± similar in shape and little different in size. *Freycinetia craterensis* differs from *F. concolor* essentially in that: the two surfaces of its leaves are not concolourous either in living or dry state; the margins and midrib of its leaves are armed in the uppermost 1 cm only, and the auricles are up to 5 cm long; its syncarps are falcate; its berries have a ring around the stigmatic areola and a central sclerenchyma in the pilei.

It appears of interest to describe the stem branching of *F. concolor* in detail because it may elucidate the question of stem branching in other species. Consider the branch in Fig. 7. It shows leaves from its amputated base to its apex, and these increase in size upwards along the branch axis. It terminates abruptly at this apex, showing no traces of having been cut or broken. At about 3 cm below the apex, a lateral branchlet 26 cm long in axis developed sympodially and bears ten prophylls below, followed by foliage leaves and a typical "terminal infructescence". The prophylls are ± 1 cm wide, but their length increases upwards along the branchlet axis. The uppermost prophyll is 7.5 cm long; it is greenish like the leaves, thus making the transition between the lower prophylls and the leaves above. The two lowermost prophylls are scale-like; they are 5 mm and 1 cm long respectively. The subsequent prophylls below the uppermost prophyll are oblong, sharply acute, yellowish, coriaceous and rigid. As on the branch, the lower leaves are distinctly smaller than the upper leaves. This sympodial branching of fertile branchlets, with prophylls below, merging upwards with foliage leaves, followed by an infructescence, is also observed in *F. falcata* (see above, under Part 4), *F. takeuchii* (see below, under Part 6), and *F. craterensis* (see below, under Part 8), all of which also have "terminal infructescences". Most probably it is common among the *Freycinetia* species that have these infructescences, but the prophylls, like the lowermost leaves, were rarely preserved. Thus, in several species which have these infructescences, the lower part of the collected fertile branchlets showed only scars, but a former existence of prophylls was revealed by the presence of one or some uppermost prophylls still adherent on the branchlet axis (for example *F. takeuchii*: see below, under Part 6), or was suggested by the fact that the lower leaves preserved were smaller than the subsequent upper leaves (for example *F. obtusiacuminata*: see below, under Part 7). In *F. glomerosa* for example, the fertile branchlet had large leaves above and much smaller leaves below (HUYNH, 1999: Fig. 22), followed to the base by remnants of what HUYNH (1999: 166) called "non-foliaceous leaves". A comparison with the fertile branchlet of *F. concolor* (Fig. 7) now reveals that the "non-foliaceous leaves" of *F. glomerosa* are prophylls.

Prophylls were also observed in the *Freycinetia* species that have "lateral infructescences", also at the base of the axis bearing the infructescence. Therefore it is necessary to know how to distinguish these infructescences from the "terminal infructescences" mentioned above. Observations in some species with "lateral infructescences" and in several with "terminal infructescences" indicate that these two infructescences may be recognized as follows. In "lateral infructescences": as seen in *F. gibbseae* and *F. rhodospatha* (Fig. 24 and 25) and in some other species, the lateral shoots bearing infructescence were short in axis; they developed from a monopodial branching; they always showed prophylls at the base (probably because these prophylls are not easily detachable), followed by the outer bracts, longer and obtuse, then the inner bracts, shorter

and also obtuse, then by the infructescence spikes, but they did not have foliage leaves; the uppermost prophylls, sometimes preserved, were bract-like, making the transition between the lower prophylls and the bracts above. In "terminal infructescences", the case of most species of *Freycinetia*: the lateral branchlets/shoots bearing infructescence were long or short in axis; they developed from a sympodial branching (this should be verified further); they had prophylls at the base – as observed in some species (for example *F. concolor*: Fig. 7), but these prophylls were generally not preserved – , followed by the foliage leaves, longer, then the outer bracts, shorter and acute/caudate, then the inner bracts, shorter and obtuse, finally by the infructescence spikes; the uppermost prophyll was leaf-like, making the transition between the lower prophylls and the foliage leaves above. Both bracts withered as the infructescences developed, therefore they were generally lacking in pistillate collections but were frequently observed in staminate collections. To date, no outer bracts observed in these infructescences were obtuse, but this should be verified further. Thus, the most essential difference between "terminal infructescences" and "lateral infructescences" consists in the presence or absence of foliage leaves on the axis bearing the infructescence.

6. *Freycinetia takeuchii* Huynh, **spec. nova** (sect. *Pleiostigma*) (Fig. 5).

Internodia ramulorum 1-1.5 cm longa, 4 mm crassa, trigona, dense tenuiter granularia. Folia 13-15 cm longa, 1-1.3 cm lata in parte media 5 mm in basi (auriculis non inclusis), lanceolata, e circiter 1/3 supera ad apicem sensim attenuata, 5 mm acuminata, basim versus sensim attenuata, dissita, in basi semiamplexicaulia; lamina in sicco membranacea, viridula, non revoluta, utrinque dense striata inter venas longitudinales, paginis concoloris; venis longitudinalibus utrinque distinctis; venis transversalibus visibilibus in pagina abaxiali, obscuris vel invisibilibus in adaxiali; marginibus prope basim et infra apicem armatis cum denticulis usque ad 0.5 mm longis, ceterum sparsim vel inermibus; costa media e prope basim ad apicem armata, sparsim in parte infera; auriculis 2 cm longis, 3 mm latis, perspicue triangularibus (acutis in apice), adnatis, membranaceis, albidis, valde pallidioribus quam contigua vagina, fere e basi ad apicem armatis (denticulis superis usque ad 0.5 mm longis sed inferis vix visibilibus), in medio et prope marginem nervatis, preservatis in foliis superis, in fragmentis solutis, cellulis epidermicis adaxialibus lignosis sed abaxialibus non lignosis, mesophyllo inter fasciculos vasorum filis fibrarum destituto. Prophylla (in basi ramuli fertilis) usque ad 7 cm longa 5 mm lata, anguste linearia, acuta; auriculis adnatis, triangularibus, albidis, in apice armatis. Infructescentia terminalis, 3-4 spicis praedita; pedunculo communi ca 5 mm longo; pedunculis ca 1.5 cm longis, 2 mm latis, laevibus; syncarpiis subglobosis vel breviter ellipticis, ca 1.7 cm longis 1.4 cm latis, submaturis, in sicco brunneis. Baccae lignosae, intra sclerenchymate centrali praeditae sed fibris destitutae; pileo pyramidali, 2 mm longo, 2.5 mm lato; stigmatibus 3-5 (-7), areola stigmatica annulo distincto et nitido cincta. Semina 0.8 mm longa, 0.3 mm lata in medio, sublunata; raphe cellulis crystalliferis destituta; "strophiolo" nullo.

Typus: *Takeuchi & al. 13331* (holo-, LAE!); Papua New Guinea, Morobe Province, foothills NW of Waria River, buttress ridges flanking the Pao streambed by Yai village, near 7°57'14"S 147°35'55"E, alt. ca 200 m, 16 June 1999; natural growth low-statured forest on ultrabasics.

Lianous; leaves herbaceous with both surfaces medium green, syncarps orange.

The fertile branchlets are 9-15 cm long in axis and developed sympodially. They bear prophylls below, followed by foliage leaves, and a terminal infructescence. The uppermost prophylls only were preserved. They are 4-7 cm long and 4-5 mm wide, and increase in size upwards along the branchlet axis. They have white, triangular, and adnate auricles, as do foliage leaves, but narrower than the leaf auricles and armed at the apex only. *Freycinetia takeuchii* is unusual by the following features. Its leaf auricles are white, contrasting strongly with the nearby greenish sheath; the adaxial epidermis is lignified but the abaxial epidermis unlignified, and there are no fibre strands between the vascular bundles. In particular, its stem is densely granular, a feature to date also observed only in *F. ellipsoidalis*, *F. forbesii*, and *F. stenodonta* in New Guinea.

Freycinetia takeuchii appears closest to *F. forbesii*, considering their leaves which are ± the same size, and in particular their stem which is granular. *Freycinetia forbesii* differs from *F. takeuchii* essentially in that: its berries have 2 (-3) stigmas for which reason it belongs to sect. *Oligostigma*, and do not have a central sclerenchyma; its seeds are straight; its leaf auricles are 11 × 4 mm, chartaceous and translucent; its leaf margins are armed in the upper fifth only (see below, under Part 12). The other two New Guinea species that have a granular stem (*F. ellipsoidalis* and *F. stenodonta*) can be distinguished from *F. takeuchii* by their leaves, which are 4.5-5.5 × 1.5 cm in the former, and 4-6 × 2-3 cm in the latter.

Freycinetia takeuchii is named after Wayne Takeuchi, the principal collector of this specimen. By his numerous collections which are among the best in *Freycinetia*, Takeuchi has much contributed to the knowledge of this genus in New Guinea.

7. *Freycinetia obtusiacuminata* Huynh, **spec. nova** (sect. *Pleiostigma*) (Fig. 6).

Internodia ramulorum 9-15 mm longa, 3 mm crassa, teretia, laevia. Folia (5-) 7-9 cm longa, 2-2.5 (-3) cm lata in medio 5 mm in basi (auriculis non inclusis), elliptico-lanceolata, obtusa cum acumine ad 1 cm longo, longissima latissimaque in medio ramuli, dissita, in basi semiamplexicaulia; lamina in sicco chartacea, viridula, non revoluta, utrinque non vel obscure striata inter venas longitudinales, paginis concoloris; venis longitudinalibus transversalibusque distinctis in pagina abaxiali, minus sed visibilibus in adaxiali; marginibus armatis in 1-2 cm summis solum, costa media in 1-2 mm summis solum, interdum inermi; auriculis partim conservatis in aliquot foliis superis, 1-1.5 cm longis, 3-4 mm latis, scariosis, translucentibus, multifibrosis, pallidioribus quam contigua vagina, in separatas fibras solutis, fasciculis fibrarum fusiformibus/ellipticis tenuissimis praeditis, cellulis epidermicis hypodermicisque omnibus non lignosis. Infructescentia terminalis, (2-) 3 spicis praedita; pedunculo communi ca 5 mm longo; pedunculis 1-1.3 cm longis, 1.3 mm latis, laevibus; syncarpiis cylindraceis, 1-2 cm longis, 0.8-1.2 cm latis, submaturis, in sicco atrofuscis. Baccae succulentae (?), intra sclerenchymate centrali fibrisque destitutae; pileo pyramidali, 1.5 mm longo, 2 mm lato; stigmatibus generaliter 3-4, areola stigmatica ut videtur annulo destituta. Semina 0.8 mm longa, 0.4 mm lata in medio, sublunata; raphe cellulis crystalliferis destituta; "strophiolo" nullo.

Typus: *Takeuchi 12107* (holo-, LAE!); Papua New Guinea, Crater Mt. Wildlife Management area, ridge above Maimafu airstrip to base of cascade at Mt. Mopahve, ca 6°30'S 145°03'E, alt. 1495-1585 m, 16 July 1998; montane forest.

Understory climber, leaves pliant-herbaceous, medium green, syncarps green turning orange.

This specimen consists of terminal branchlets of 10-22 cm long in axis. These developed sympodially and show only scars in the lower part; for this reason, it is not known if they had borne basal prophylls or not. Auricles were partly preserved on some upper leaves; therefore it is not known if the leaf auricles of *F. obtusiacuminata* are adnate or free at the apex, and armed or not. *Freycinetia obtusiacuminata* is remarkable in that in dry state the two surfaces of its leaves are concolourous, and are not, or only faintly striate between the longitudinal veins. Also, its leaf auricles have fusiform-elliptic fibre-bundles. The presence of these fibre bundles in leaf auricles is a rare feature in *Freycinetia*. For the leaf shape (Fig. 6), *F. obtusiacuminata* may be compared with *F. ellipticifolia* and *F. elliptica*, from which it differs by its stigma numbers and leaves. In *F. ellipticifolia*, the berries have 1-2 stigmas for which reason it belongs to sect. *Oligostigma*; the leaves are 4.5-6 cm long and 2-2.5 cm wide; in addition, the seeds have a distinct "strophiole". In *F. elliptica*, the berries have 1-3 stigmas for which reason it also belongs to sect. *Oligostigma*; the leaves are 8-10 cm long and 4-4.5 cm wide.

8. *Freycinetia craterensis* Huynh, **spec. nova** (sect. *Pleiostigma*) (Fig. 8).

Internodia ramulorum 0.7-2 cm longa, 6 mm crassa, teretia, laevia. Folia 20-28 cm longa, (2-) 2.3-2.5 (-3) cm lata in medio 7-8 mm in basi (auriculis non inclusis), plerumque latissima inter 1/5 superam et 1/4 inferam, apice abrupte attenuata, subcuspidata, ca 5 mm acuminata, basim versus sensim attenuata, dissita, in basi semiamplexicaulia; lamina in sicco submembranacea, atroviridula vel brunneola vel brunnea sed pallidiore in pagina abaxiali, non revoluta, utrinque dense striata inter venas longitudinales; venis longitudinalibus leviter visibilibus in pagina abaxiali, indistinctis in adaxiali; venis transversalibus utrinque invisibilibus; marginibus et costa media armatis in 5-10 mm summis solum, denticulis sparsis minutissimis; auriculis 5 cm longis, 6 mm latis in basi, perspicue triangularibus (acutis in apice), adnatis, inermibus, dense fibrosis, fuscioribus quam contigua vagina, conservatis in foliis superis, ut videtur cito in separatas fibras solutis, cellulis epidermicis hypodermicisque omnibus tenuissimis et non lignosis, mesophyllo inter fasciculos vasorum separatis filis fibrarum praedito, lamina inter fila fibrarum valde compressa. Prophylla (in basi ramuli fertilis) 1-12 cm longa, 2 cm lata, rigido-coriacea; marginibus et costa media sparsim armatis in 5-10 mm summis solum; auriculis adnatis, perspicue triangularibus, omnibus conservatis, 1/2-2/3 tam longis quam prophyllis. Infructescentia terminalis, 2 spicis praedita; pedunculo communi ca 1.5 cm longo; pedunculis ca 2 cm longis, 3 mm latis, laevibus; syncarpiis falcatis, ca 4.5 cm longis 2 cm latis 1.5 cm crassis, submaturis, in sicco atrofuscis. Baccae lignosae, intra sclerenchymate centrali praeditae sed fibris destitutae; pileo pyramidali, 1.5 mm longo, 2 mm lato; stigmatibus (2-) 3-5 (-7), areola stigmatica annulo tenui subnitido cincta. Semina 0.9 mm longa, 0.4 mm lata in medio, sublunata; raphe cellulis crystalliferis destituta; "strophiolo" nullo.

Typus: *Takeuchi 11955* (holo-, LAE!); Papua New Guinea, Crater Mt. Wildlife Management area, near junction of Wara O and the Pio River, ca. 6°47'S 145°02'E, alt. 510-610 m, 30 March 1997; foothill forest.

Understory climber, stem cylindrical, prickly, dark green, leaves coriaceous, adaxially dark opaque green, abaxially medium green, syncarps red.

The terminal branchlet bearing the infructescence is about 19 cm long in axis. It shows prophylls below, merging upwards with the foliage leaves. All the prophylls were preserved. *Freycinetia craterensis* is remarkable in that its leaves are almost unarmed and that its syncarps are falcate, which indicates that these have an irregular development like those of *F. louisiadensis* (HUYNH, 1999: 176). *Freycinetia craterensis* appears close to *F. concolor*, described above. The two species may be distinguished by their leaves and the shape of their syncarps (see above, under Part 5).

9. *Freycinetia acuta* Huynh, **spec. nova** (sect. *Pleiostigma*) (Fig. 9).

Internodia ramulorum usque ad 1.5 cm longa 5 mm crassa, subtrigona, laevia. Folia 18-25 cm longa, 0.7-1 cm lata in parte media 7-8 mm in basi (auriculis non inclusis), sublanceolata, e circiter 1/3 supera ad apicem sensim attenuata, ca 5 mm acuminata, e circiter medio basim versus leviter attenuata, imbricata, in basi amplexicaulia; lamina in sicco submembranacea, non revoluta, viridula sed leviter pallidiore in pagina adaxiali, distincte striata inter venas longitudinales in pagina adaxiali, minus in abaxiali; venis longitudinalibus distinctis in pagina abaxiali, minus sed visibilibus in adaxiali; venis transversalibus utrinque invisibilibus; marginibus armatis in 1/5 infera cum denticulis perpendicularibus usque ad 1 mm longis, minute infra apicem, ceterum sparsim vel inermibus; costa media minute armata in dimidio supero, interdum sparsim; auriculis 2.5 cm longis, 5-6 mm latis, in apice rotundato 2 mm longo liberis, brunneis et perspicue fuscioribus quam contigua vagina, omnibus conservatis, fere e basi ad apicem minute armatis (denticulis usque ad 0.6 mm longis in apice), dense fibrosis, diverse in fibras solutis, cellulis epidermicis hypodermicisque omnibus non lignosis, mesophyllo inter fasciculos vasorum valde separatis filis fibrarum 3-5 stratis compositis praedito (igitur auriculae verosimiliter in separatas fibras omnino solutae postremo). Infructescentia terminalis, 3 spicis

praedita; pedunculo communi nullo; pedunculis ca 1.8 cm longis, 1.8 mm latis, sparsim scabridis in angulis; syncarpiis cylindraceis, ca 1.2 cm longis 0.7 cm latis, immaturis, in sicco atrobrunneis. Baccae lignosae, 2 mm longae, 1 mm latae, intra sclerenchymate centrali crasso in pileo et fasciculis fibrarum fusiformibus/ellipticis praeditae; stigmatibus (2-) 3, areola stigmatica annulo nitenti cincta; pileo pyramidali, 1 mm longo, 2/3 mm lato, rectangulari.

Typus: *Takeuchi 12875* (holo-, LAE!); Papua New Guinea, Crater Mt. Wildlife Management area, ridge by Abegarama village, above the airstrip at Bayavaytai, ca 6°30'S 145°03'E, alt. 1675 m, 2 August 1998; montane forest mosaic of natural growth and regrowth communities.

Climber in mossy understory, occasional.

Freycinetia acuta is named in reference to its acute leaves. It appears closest to *F. morobeensis* (see below, under Part 10). Considering the shape and size of its leaves, *F. acuta* may also be compared with *F. lunata* and *F. linearifolia* which also belong to sect. *Pleiostigma*. These two species differ from *F. acuta* in that: in *F. lunata*, the leaves are remote on the stem axis, the syncarp peduncles are smooth, and in particular the berries do not have fusiform/elliptic fibre-bundles; in *F. linearifolia*, the syncarp peduncles are smooth, and in particular the leaf auricles are ± 1 cm long and fimbriate.

10. *Freycinetia morobeensis* Huynh, **spec. nova** (sect. *Pleiostigma*) (Fig. 10).

Internodia ramulorum usque ad 1.2 cm longa 5 mm crassa, teretia, laevia. Folia (20-) 23-25 cm longa, e circiter 1/4 supera ad prope basim 6-7 mm lata, in basi 8 mm lata (auriculis non inclusis), ensiformia, e circiter 1/4 supera ad apicem sensim attenuata, breviter acuminata, imbricata, in basi semiamplexicaulia; lamina in sicco atrobrunnea in pagina adaxiali sed pallidiore in abaxiali, submembranacea/subcoriacea, non plicata, leviter revoluta (i.e. in marginibus solum), striata inter venas longitudinales in pagina adaxiali; venis longitudinalibus visibilibus in pagina abaxiali, minus vel invisibilibus in adaxiali; venis transversalibus utrinque invisibilibus; marginibus e circiter 3 cm supra basim ad apicem armatis, denticulis prope basim usque ad 0.5 mm longis perpendicularibus interdum retrorsis, sursum versus antrorsis multo brevioribus plerumque vix visibilibus; costa media diverse armata in parte supera; auriculis 3.5-4 cm longis, 5-6 mm latis, triangularibus, in apice 7 mm liberis, fere e basi ad apicem (ibi utrinque) minute armatis, membranaceis, brunneolis et perspicue pallidioribus quam contigua vagina, omnibus conservatis, in margine et partim solum in separatas fibras solutis, cellulis epidermicis hypodermicisque omnibus non lignosis, filis fibrarum in mesophyllo 2-3 stratis compositis, contiguis, cum fasciculis vasorum unicam taeniam fibrarum formantibus (igitur auriculae verosimiliter nunquam in separatas fibras omnino solutae postremo). Infructescentia terminalis, 3 spicis praedita; pedunculo communi ca 1.8 cm longo; pedunculis ca 1.2 cm longis, 4 mm latis, ex apice ad basim scabridis; syncarpiis cylindraceis, ca 2.2 cm longis 1.3 cm latis, immaturis, in sicco atrofuscis. Baccae lignosae, 5 mm longae, 1.5 mm latae, intra sclerenchymate centrali crasso in pileo et fasciculis fibrarum fusiformibus/ellipticis praeditae; stigmatibus 3 (-4), areola stigmatica annulo nitenti cincta; pileo pyramidali, 2.5 mm longo.

Typus: *Clemens 4170* (holo-, G!); Papua New Guinea, Morobe district, Yunzaing, alt. 4500 ft, September 1936.

It was also in Yunzaing that *F. elliptica*, *F. latibracteata* and *F. oreophila* were observed or first found (MERRILL & PERRY, 1939).

Freycinetia morobeensis appears very close to *F. acuta*, and may be considered as a form of it. They have the same stigma numbers and almost the same leaves. In both species, the leaves are imbricating, the syncarp peduncles scabrid, and the berries have a central sclerenchyma and fusiform/elliptic fibre-bundles. Their difference consists essentially in the leaf shape and auricles, and the infructescence peduncle. In *F. morobeensis*: the infructescence peduncle is up to 1.8 cm long; the leaves are ensiform, not widening in the middle (Fig. 10); the auricles are 4 cm long and 5-6 mm wide, and disintegrating into separate fibres only along the marginal 1.5 mm of the auricle width; the auricles are lighter than the nearby sheath in dry state; in particular, the 2-3 layered fibre-strands in the auricle mesophyll are contiguous and form with the vascular bundles

a single fibre-strand, with the consequence that the non-marginal part of the auricles will not finally disintegrate into separate fibres. In *F. acuta*: the infructescence peduncle is nil; the leaves are widening in the middle and may be termed sublanceolate (Fig. 9); the auricles are 2.5 cm long (thus distinctly shorter for leaves of the same length) and 5-6 mm wide, and disintegrating into separate fibres throughout the auricle width; the auricles are darker than the nearby sheath in dry state; in particular, the 3-5 layered fibre-strands between the vascular bundles in the auricle mesophyll are clearly separate from one another, with the consequence that the auricles will finally disintegrate into separate fibres. Another difference, which however may be disregarded: the longest marginal prickles of the leaves of *F. morobeensis* are only half as long as those of *F. acuta*.

11. Further notes on *Freycinetia inermis* Ridl. (sect. *Oligostigma*).

Until recently, *F. inermis* was an obscure species because of some doubts given by RIDLEY's description (1916). For example, the syncarp peduncles were described as being 3.1 mm long, and the leaves linear-lanceolate and obtuse. It was difficult to imagine such short syncarp-peduncles in *Freycinetia*, at least in mature infructescences, and leaves which are linear-lanceolate but obtuse. In addition, the number of syncarps in the infructescence was not indicated. RIDLEY (1916) described *F. inermis* using three specimens collected by Boden Kloss at "Canoe Camp, 150 ft; Camp I, 300 ft; Camp III, 2500 ft" respectively. These collecting sites were in Mt. Carstensz (see next), whose central position is at about 4°14'S 137°15'E, in Irian Jaya (formerly Netherlands New Guinea). Given this difference in altitude and location between the collecting sites, and considering the state of the morphological knowledge of *Freycinetia* at that time, one may wonder if all three specimens actually belong to one and the same species and how RIDLEY (1916) used them to describe *F. inermis*.

The first syntype of *F. inermis* (*Boden Kloss s.n.*, Canoe Camp, BM!), here designated as lectotype, is investigated in the present study. It was collected in October or November 1912, during the "Utakwa Expedition to Mt. Carstensz" as indicated in the specimen. ("Utakwa" is Utakwa River: see RENDLE, 1917.) It comprises the very short upper part of a branch that is divided above into three branchlets, one of which developed sympodially and was preserved in length. This branchlet is about 31 cm long in axis, with internodes 7-12 mm long, up to 4 mm thick, terete, and smooth. It bears a terminal infructescence. The foliage of that branchlet abruptly changes size at least three times (Fig. 22). Thus, when going from the base to the apex of the branchlet, the leaves along the lowermost 6 cm were not preserved (they might be about 10 cm long and 1.3 cm wide, as are the leaves in the basal part of a partly preserved branchlet, but probably there had been prophylls instead); above that level, leaves of 5.5-6.5 × 0.7-1 cm are observed; then, those of about 10 × 1.3 cm; then, those of 3.5-6.5 × 0.4-0.7 cm; then, those of 9-9.5 × 0.9-1 cm; then, smaller leaves of varied sizes. Such a repeated change in the size of leaves along the axis of one and the same terminal branchlet is unusual in *Freycinetia*. On the whole, the leaves are (3.5-) 8-10 cm long and (4-) 8-10 (-13) mm wide, widest in the middle part sometimes at the lower third, about 4 mm wide at the base (the auricles not included). They are typically lanceolate and acute at the apex (Fig. 11-14), 0-1.5 mm acuminate, remote and semiamplexicaul on the stem axis, unpleated, submembranaceous but ± rigid in texture (this corroborates "Folia ... tenuiter coriacea" in the original description), dark brown but a little lighter at the abaxial face. The longitudinal veins are visible at the adaxial face, distinct and ± prominent at the abaxial face. The transverse veins are invisible. The margins are unarmed, or armed only in the uppermost 5 mm with minute prickles. The midrib is unarmed, or armed only below the apex, or sparsely armed almost to the base, with minute prickles; the lowermost prickles are sometimes retrorse. No auricles were preserved. The infructescence shows two spikes (Fig. 22), but apparently there is room for a third spike; the peduncle is nil. Both syncarps are dark brown and mature. One is subcylindric, 2.3 cm long, 1.3 cm wide near the apex and 1.1 cm near the base. The other syncarp is clavato-cylindric, 2.4 cm long, 1.3 cm wide near the apex and 0.7 cm near the base. The syncarp peduncles are 1.3 cm long, 2.2 mm thick, smooth. The berries are succulent. They have no ring around the stigmatic areola, no central sclerenchyma, and no fibre bundles. At present, only a low percentage of berries shows distinct stigmas, and these are twin, hippocrepiform, and

closely aggregated. However, since the apices of these berries are as broad as those of most of the other berries, it may be assumed that the berries of this species generally have two stigmas. The seeds are biconvex, 0.9 mm long and 0.5 mm wide; the endosperm is curved, its concave side facing the raphe; the "strophiole", the endosperm, and the raphe are each about 1/3 the seed width; in the raphe, crystal cells are absent, and raphide cells sparse.

Freycinetia inermis has sometimes been misidentified. Thus, some New Guinea collections (in herb.) have been identified as belonging to this species, but their leaves are all linear-lanceolate and their berries have a central sclerenchyma and a ring around the stigmatic areola. Likewise, some Solomon collections were attributed to *F. inermis* by STONE (1970). However, by contrast with what was described above from the type of this species, they have berries with 1-3 stigmas, and their leaves have auricles preserved (since these were observed being "often disintegrating into more or less persistent fibres") and margins armed in the lower part and the upper third (STONE, 1970: 357, Fig. 4).

12. Further notes on *Freycinetia forbesii* Ridl. (sect. *Oligostigma*).

RIDLEY (1886) described *F. forbesii* using two collections: one from Mt. Korkoko, the other from Mt. Meroka. However he indicated the collector number "352" for the second collection only, which should be read as *Forbes 352*. Later, RENDLE (1923) specified that the collector number of the Korkoko collection was "628a", which should be read as *Forbes 628a*. Again, one may wonder if these two collections actually belong to one and the same species and how RIDLEY (1886) used them to describe *F. forbesii*. The Korkoko syntype of *F. forbesii* (*Forbes 628a*, BM!), here designated as lectotype, is investigated in the present study. It was collected on 27 January 1886 in the Sogeri region whose central position is at about 9°28'45"S 147°31'37"E, as seen in the specimen. It comprises the upper part about 16.5 cm long of a terminal branchlet, bearing leaves all along and a terminal infructescence; the internodes are 5-20 mm long, up to 3.5 mm thick, trigonous, and densely granular. Granular stem is unusual (see above, under Part 6). The leaves are very clearly remote and semiamplexicaul on the stem axis. Two quite different sorts of leaves are observed on that branchlet (Fig. 23). The three uppermost leaves are 4.5-8 cm long, 4 mm wide, and very narrowly lanceolate. They are arranged along 1 cm below the infructescence peduncle. The subsequent lower leaves are much larger. They are lanceolate (Fig. 15), 15-16 cm long, (1.2-) 1.5-1.8 cm wide in the middle, 3 mm wide at the base (the auricles not included), 5 mm acuminate, ± chartaceous, dark green but a little lighter at the abaxial face, unpleated, striate between the longitudinal veins at the adaxial face; most of them are tessellate at the abaxial face, not or obscurely or sparsely so at the adaxial face; the longitudinal veins are ± prominent at the abaxial face, just visible at the adaxial face; the transverse veins are visible where the blade is tessellate; the margins are armed along the upper fifth, with minute prickles (hardly 1/4 mm long); the midrib is armed along the upper half, with remote or sparse prickles, up to 2/3 mm long; the auricles preserved on some upper leaves are adnate, triangular, 11 mm long and 4 mm wide, slightly brownish, translucent, chartaceous, very sparsely armed in the upper half, breaking transversely into pieces, and with one longitudinal vein. It is unusual in *Freycinetia* to observe two so widely different sorts of leaves on one and the same terminal branchlet. The infructescence is 4-syncarpic, with a peduncle 7 mm long; the bracts along the peduncle were not preserved. The syncarps are shortly elliptico-pyramidal, up to 2 cm long and 1.5 cm wide (mature), light brown, with peduncles 1.5 cm long, 2 mm wide, smooth. The berries are 5 mm long; they have a nitid ring around the stigmatic areola, but no central sclerenchyma and no fibre bundles. They have 2, sometimes 3 stigmas. They were however originally described as having one stigma, rarely more ("Pistilla monocarpica rarius syncarpica"): this seemed to be due to the fact that the stigmas of this species are in general very closely aggregated, therefore rarely distinct. That the berries have two or three stigmas is indicated by the fact that firstly, the ring around the stigmatic areola is slightly bilobate, sometimes slightly trilobate, and secondly, transverse sections of berries show two or three fertilization canals and 2- or 3-celled ovary. *Freycinetia forbesii* is thus a typical example of the utility/necessity of the berry anatomy in the taxonomy of *Freycinetia* (see under Introduction). The seeds are straight, 0.8 mm long and

0.3 mm wide. The "strophiole" is nil. The raphe is nil or almost so, with some raphide cells very thin and closely applied to the endosperm, but without crystal cells. Nil or almost nil raphe was not frequently observed in *Freycinetia*.

13. Further notes on *Freycinetia lateriflora* Ridl. (sect. *Oligostigma*).

RIDLEY (1916) described *F. lateriflora* using three specimens collected by Boden Kloss at "Camp III, 2500 ft; VI b and VI e, 3900 to 5500 ft" respectively. These collecting sites were in Mt. Carstensz (see next), whose location is indicated above, under Part 11. Again, given this difference in altitude and location between the collecting sites, one may wonder if these specimens actually belong to one and the same species and how RIDLEY (1916) used them to describe *F. lateriflora*. The first syntype of *F. lateriflora* (*Boden Kloss s.n.*, Camp III, BM!) is investigated in the present study. It was collected in February 1913, during the "Utakwa Expedition to Mt. Carstensz" as indicated in the specimen. It comprises a terminal branchlet and two separate lateral shoots, but no infructescences for which reason the lateral inflorescences described by RIDLEY (1916) are not observed in the present study. The lateral shoots are 1-2 cm long in axis. The branchlet is about 35 cm long in axis, with internodes up to 14 mm long and 2.5 mm thick, terete, smooth but densely striate longitudinally. The leaves are (7.5-) 14-20 cm long, 3.5-4 (-5) mm wide from about the upper third to near the base, in the upper third gradually attenuate to the apex, in general slightly curved (Fig. 16), 1-2 mm acuminate, subcoriaceous or submembranaceous, dark greenish or brown but a little lighter at the abaxial face, unpleated, semiamplexicaul on the stem axis, remote for most of them, the uppermost imbricating. The longitudinal veins are distinct at both faces, with striations between them, but the transverse veins are invisible. The margins are unarmed, or armed in the uppermost 3-5 mm only. The midrib is unarmed, sometimes armed with one or two prickles below the apex. The auricles preserved on some upper leaves are adnate, up to 1 cm long and 4 mm wide, truncate at the apex, scarious, whitish, and unarmed; they have one vascular bundle, which partitions the auricle into two halves; observed from above, the proximal half shows longitudinal "nerves", which however are not vascular bundles but single, large and thick-walled fibres, as revealed by the auricle transverse sections; the distal half is devoid of such "nerves"; both the adaxial and abaxial epidermis and both the adaxial and abaxial hypodermis are not distinct, therefore all four are most probably unlignified. Single, large and thick-walled fibres in leaf auricles are unusual in *Freycinetia*. However, RIDLEY (1916) described *F. lateriflora* as having leaves 12 cm long and 3 mm wide, and he also included infructescence and bracts in the description. He therefore seemed to use another syntype. This syntype should further be designated as lectotype, and investigated in order to observe in particular the lateral infructescences of this species.

14. Further notes on *Freycinetia flaviceps* Rendle (sect. *Oligostigma*).

Freycinetia flaviceps and *F. gibbseae* are the two species described by Rendle from the Arfak Mountains, whose central position is at about 1°14'S 134°01'E, in the extreme North of Irian Jaya. The type of *F. flaviceps* (*Gibbs 6125*, BM!), which is investigated in the present study, was collected in December 1913. This is the only specimen used by RENDLE (1917) to describe this species; it bears short notes on the material, and sketches of seed, and of berry in both apical view and axial section, the notes and the sketches either made with pencil apparently by Rendle; it seems to be the holotype. It comprises a terminal branchlet about 46 cm long in axis, with internodes 1-1.5 cm long, 2-3.5 mm thick, terete, smooth. The branchlet bears a terminal infructescence and leaves from the apex to 23 cm above the base, the lower leaves not preserved. The leaves are linear-lanceolate (Fig. 17 and 18), (6-) 7-9 (-11) cm long and 4.5 (-8) mm wide – only the lowermost preserved is 11 × 0.8 cm (Fig. 18) – , 2.5 mm wide at the base (the auricles not included), widest in the middle part, gradually attenuate from the middle to the apex, 4-5 mm acuminate, subcoriaceous, light-brownish or light-greenish but lighter at the adaxial face, unpleated, remote and semiamplexicaul on the stem axis. The longitudinal veins are partly visible at both faces, but the transverse veins are invisible. The margins and the midrib are both armed in

the uppermost 1 cm only (sometimes 1.5 cm), with minute prickles. The auricles were not preserved. The infructescence is 3-syncarpic, with a peduncle 9 mm long; the bracts along the peduncle were not preserved. The syncarps are subglobose, up to 1.8 cm long and 1.4 cm wide, mature, brown, with peduncles 1.1 cm long and 1.5 mm wide, hispidulous from the apex almost to the base. The berries are succulent and 5 mm long; they have two hippocrepiform and aggregated stigmas, but have no ring around the stigmatic areola, no central sclerenchyma, and no fibre bundles. The seeds are ± straight, 1.1 mm long and 0.4 mm wide; at the middle, the endosperm is half as wide as the seed, while the raphe and the "strophiole" each occupy a quarter; the "strophiole" is distinct but not strongly lignified at any side; the raphe has numerous raphide cells but no crystal cells.

15. Further notes on *Freycinetia gibbseae* Rendle (sect. *Pleiostigma*).

RENDLE's description (1917) of *F. gibbseae* may appear insufficient for this species to be recognized with certainty. For example, it did not indicate the number of syncarps in the infructescence. A new description of this species using its type (*Gibbs 5516*, holotype, BM!) is also of great interest because this specimen is an informative example of "lateral infructescences", given that all the infructescence components (prophylls, bracts, spikes) were preserved. By contrast, generally only prophylls and spikes were preserved in the pistillate collections of other species that have these infructescences. For example, none of the infructescences of *F. funicularis* investigated by the present author had bracts preserved; this was also the case of *F. sogerensis* (see below, under Part 17) and of *F. louisiadensis* (HUYNH, 1999: Fig. 34). The type of *F. gibbseae* was collected in December 1913 in the Arfak Mountains, like that of *F. flaviceps* (see above, under Part 14). It comprises a branch separated into two parts. The branch bears cauline leaves above, with six twisted rootlets up to 5-6 cm long among them, and two infructescences and a sterile lateral shoot in the middle (Fig. 24). The internodes are smooth. The cauline leaves are 16-22 cm long, 3.5-6 mm wide from the middle part to near the base, linear-ensiform (Fig. 19), from the upper 1/4-1/3 gradually attenuate to the apex, 4-5 mm acuminate, rigidly coriaceous, brown or dark green but it is difficult to determine which face is lighter, unpleated, imbricating and amplexicaul on the stem axis. The longitudinal veins are slightly visible at both faces, but the transverse veins invisible. The margins are armed from about 3 cm above the base to the apex, with prickles antrorse, in the lower part up to 1 mm long and 5 mm apart, higher up minute and closer. The midrib is generally armed from a little below the middle to the apex, with prickles generally more remote than the marginal prickles at the same levels. The auricles are up to 3 cm long and 3.5 mm wide, adnate, scarious, membranaceous, armed with 1-2 prickles about 2/3 mm long at the apex, disintegrating into separate fibres. The sterile lateral shoot is about 1.5 cm long in axis, and comprises prophylls at the base, these merging upwards with the foliage leaves, which are much shorter than the cauline leaves (Fig. 24). The prophylls and foliage leaves form three rows along the axis.

Both infructescences are "lateral infructescences", either at the apex of a lateral shoot also about 1.5 cm long in axis. The shoot developed from a monopodial branching (Fig. 24). The axis has several lower prophylls at the base, followed by some upper prophylls which are wider and bract-like in both shape and colour thus making the transition between the lower prophylls and the bracts above, then by the outer bracts, much larger (Fig. 24), then the inner bracts, a little shorter, finally by the infructescence spikes; but it has no foliage leaves (Fig. 24). Both prophylls and both bracts form three rows along the shoot axis. The bracts are triangular, up to 4.5 cm long and 3.5 cm wide, 2-3 mm acuminate, obtuse; the margins are armed along the uppermost 1 cm, the midrib along the uppermost 3-4 mm. Both infructescences are 3-syncarpic. The syncarps are brown, elliptico-pyramidal, up to 1.7 cm long and 1.1 cm wide, immature, with peduncles up to 2.5 cm long and 3.5 mm thick, hispidulous all along, especially at the angles, the prickles being up to 2/3-3/4 mm long, and mostly antrorse. The berries are lignous. They have a nitid ring around the stigmatic areola, (3-) 4-5 (-11) stigmas which form a convex prominence over the ring, and a central sclerenchyma and fusiform/elliptic fibre-bundles. Thin and whitish staminodes are observed around their base. The existence of staminodes around the berry base is

common in *Freycinetia* (HUYNH, 1991: 318), but in *F. gibbseae* the staminodes are distinct enough to be readily observed under the stereo-microscope with × 6-50 magnification. The existence of fusiform/elliptic fibre-bundles in the berries of *F. gibbseae* facilitates the recognition of this species since these fibre bundles do not exist in other species which have both "lateral infructescences" and belong to sect. *Pleiostigma* (for example *F. funicularis* and *F. louisiadensis*: HUYNH, 1997: 366; 1999: 175).

16. Further notes on *Freycinetia rhodospatha* Ridl. (sect. *Pleiostigma*).

The type of *F. rhodospatha* (*Boden Kloss s.n.*, BM!), which is investigated in the present study, was collected at Camp III, probably in February 1913 (as was the first syntype of *F. lateriflora*: see above, under Part 13), during the "Utakwa Expedition to Mt. Carstensz" as indicated in the specimen. This is the only specimen used by RIDLEY (1916) to describe *F. rhodospatha*; it seems to be the holotype. It comprises a fraction of branch with leaves, several rootlets, and a fertile lateral shoot below (Fig. 25). The internodes are up to 2.5 cm long and 1.5 cm thick, terete, smooth. The rootlets are up to 50 cm long and 3.5 mm thick, stiff, each beneath a leaf. The leaves are up to 37-39 cm long (they were originally described as being 30 cm long), 2.4 cm wide in the middle part and 2 cm near the base (the auricles not included), at about the upper 1/4-1/5 abruptly attenuate to the apex, acuminate, remote and semiamplexicaul on the stem axis, very dark brown at both faces, rigidly coriaceous, unpleated. The longitudinal veins are distinct at the adaxial face, less so at the abaxial face, but the transversal veins are indistinct. The margins are unarmed, sometimes armed with some prickles at the apex and/or near the base. The midrib is unarmed. The auricles were not preserved. The fertile lateral shoot is about 3 cm long in axis. The shoot developed from a monopodial branching (Fig. 25). It bears several lower prophylls at the base, followed by some upper prophylls which are wider and bract-like in both shape and colour thus making the transition between the lower prophylls and the bracts above, then by the outer bracts, much larger (Fig. 25), then the inner bracts, a little shorter, finally by the infructescence spikes. Both prophylls and both bracts form three rows along the shoot axis. The shoot has no foliage leaves (Fig. 25), which corroborates the description of the infructescence of *F. rhodospatha* by RIDLEY (1916) as being lateral (see above, under Part 5). The bracts are rigidly coriaceous, up to 10 cm long and 4 cm wide, acuminate, obtuse, unarmed, densely and distinctly nerved longitudinally at both faces. The infructescence is 3-syncarpic (it was originally described as having four spikes). The syncarps are brown, cylindric, up to 3 cm long and 8 mm wide, immature, with peduncles 3 cm long and 3-4 mm thick, hispidulous along the upper part, smooth along the lower part. The berries are lignous, cuneate, 2 mm long and 1.5 mm wide. They have an unnitid ring around the stigmatic areola, 4-5 (-8) stigmas which form a convex prominence over the ring, a very thick central sclerenchyma and dense fusiform/elliptic fibre-bundles. The existence of these fibre bundles in the berries of *F. rhodospatha* facilitates the recognition of this species, as it does for *F. gibbseae* (see above, under Part 15).

17. Further notes on *Freycinetia sogerensis* Rendle (sect. *Pleiostigma*).

RENDLE's description (1923) of *F. sogerensis* is fairly accurate when compared with the type of this species and the present knowledge of the taxonomic morphology of *Freycinetia*, but not sufficient for this species to be recognized with certainty. In particular it does not ascertain clearly that the infructescences are lateral, which is an important character in this species. The type of *F. sogerensis* (*Forbes 75*, BM!), which is investigated in the present study, is the only specimen used by RENDLE (1923) to describe this species; it seems to be the holotype. It was collected on 19 October 1885 in the Sogeri region as was the Korkoko syntype of *F. forbesii* (see above, under Part 12). It comprises a terminal branchlet whose upper part was not preserved. The preserved part is about 20 cm long. It bears leaves and three infructescences, each infructescence at the apex of a lateral shoot, the lowermost lateral shoot at about 15 cm above the base. Each lateral shoot is about 1 cm long in axis; it developed from a monopodial branching; it has prophylls at the base, followed by a 3-syncarpic infructescence, but no foliage leaves. No bracts

were preserved. The syncarps were preserved in the lowermost infructescence only. The fact that the infructescences are each borne on a short lateral shoot without foliage leaves indicates that they are "lateral infructescences" (see above, under Part 5). The leaves are 25-30 cm long, 9-13 mm wide in the middle and 8 mm near the base (the auricles not included), from about the upper third gradually attenuate to the apex (Fig. 20 and 21), remote and semiamplexicaul on the stem axis, submembranaceous, unpleated, brown at the adaxial face but ± greenish (in any case lighter) at the abaxial face. The apex is acute but not acuminate. The longitudinal veins are distinct at the abaxial face, less so at the adaxial face; the transverse veins are indistinct. The margins are armed with prickles perpendicular or antrorse and up to 2/3 mm long in the basal part, and with minute prickles below the apex, but unarmed between. The midrib is very sparsely armed in the upper half with minute prickles. The auricles are up to 2.5 cm long and 5 mm wide, and disintegrating into separate fibres. The syncarps are brown, elliptico-pyramidal, about 1.5 cm long and 1 cm wide, immature, with peduncles about 1.5 cm long and 2 mm thick, and sparsely hispidulous. The berries are lignous, about 3 mm long and 1 mm wide, with apices distinctly separate from one another which is an uncommon feature in *Freycinetia*. They have a nitid ring around the stigmatic areola, 2-4 (-5) stigmas whose apices are generally at the same level as the ring, and a very thick central sclerenchyma and fusiform/elliptic fibre-bundles. The existence of these fibre bundles in the berries of *F. sogerensis* facilitates the recognition of this species, as it does for *F. gibbseae* (see above, under Part 15). When MERRILL & PERRY (1939: 147) compared *F. klossii* with *F. sogerensis*, they found that the description of the former species by RIDLEY (1916) was "so vague that it might easily be the same as *F. sogerensis*". Such a confusion is no longer possible in particular because it is now known that *F. sogerensis* has "lateral infructescences" and berries with fusiform/elliptic fibre-bundles, while *F. klossii* has "terminal infructescences" and berries without these fibre bundles (HUYNH, 1999: 185). This is also an example of the utility/necessity of the berry anatomy in the taxonomy of *Freycinetia*.

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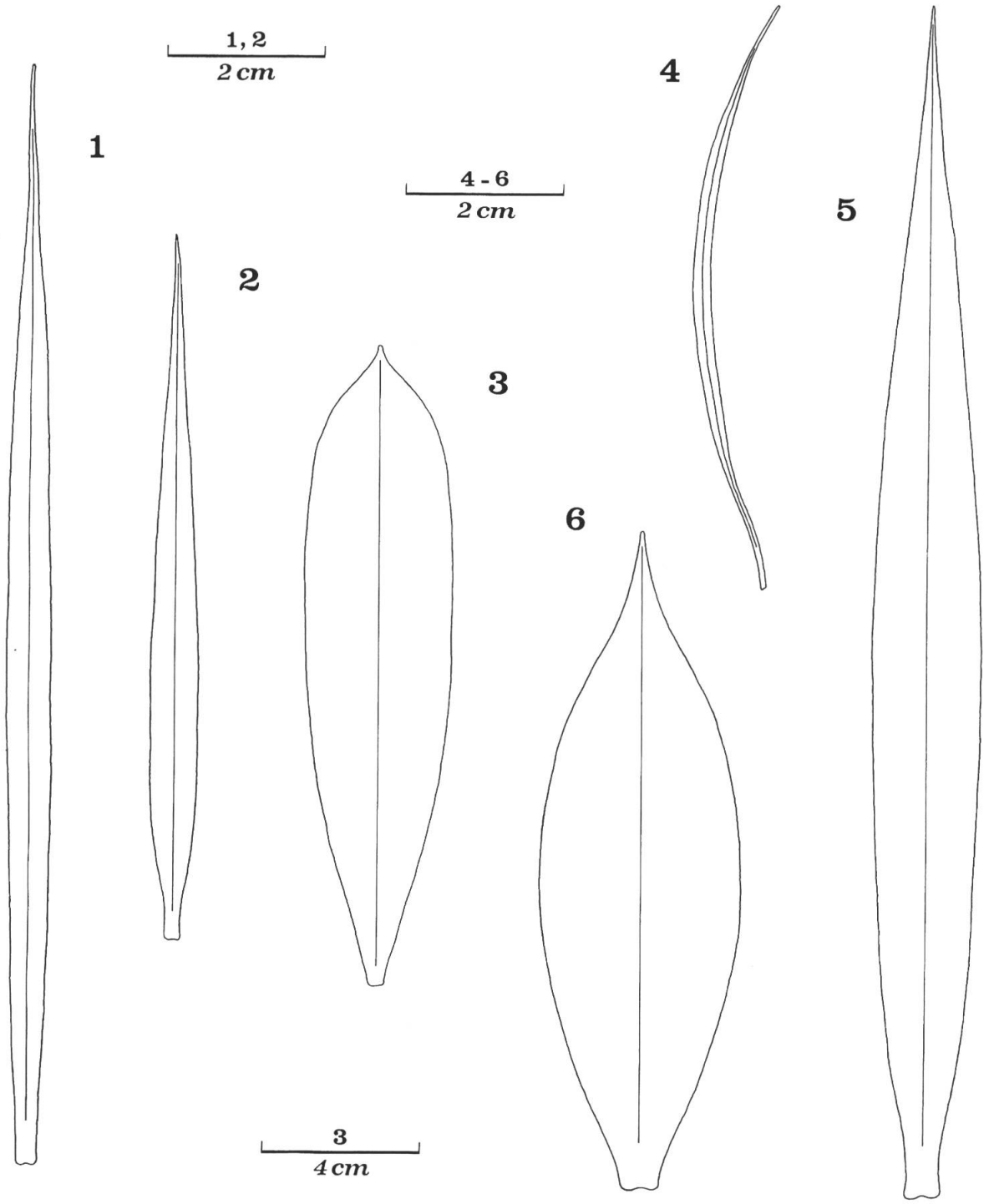

Fig. 1-6. – Leaves of New Guinea *Freycinetia*, flattened horizontally, viewed by the adaxial face (auricles not shown): – **1:** *F. brevis* Huynh [*Jacobs 9298*]. – **2:** *F. chartacea* Huynh [*Darbyshire & Hoogland 8066*, G!]. – **3:** *F. madangensis* Huynh [*Takeuchi & Gorrez 13407*]. – **4:** *F. falcata* Huynh [*Takeuchi & Wiakabu 9450*]. – **5:** *F. takeuchii* Huynh [*Takeuchi & al. 13331*]. – **6:** *F. obtusiacuminata* Huynh [*Takeuchi 12107*].

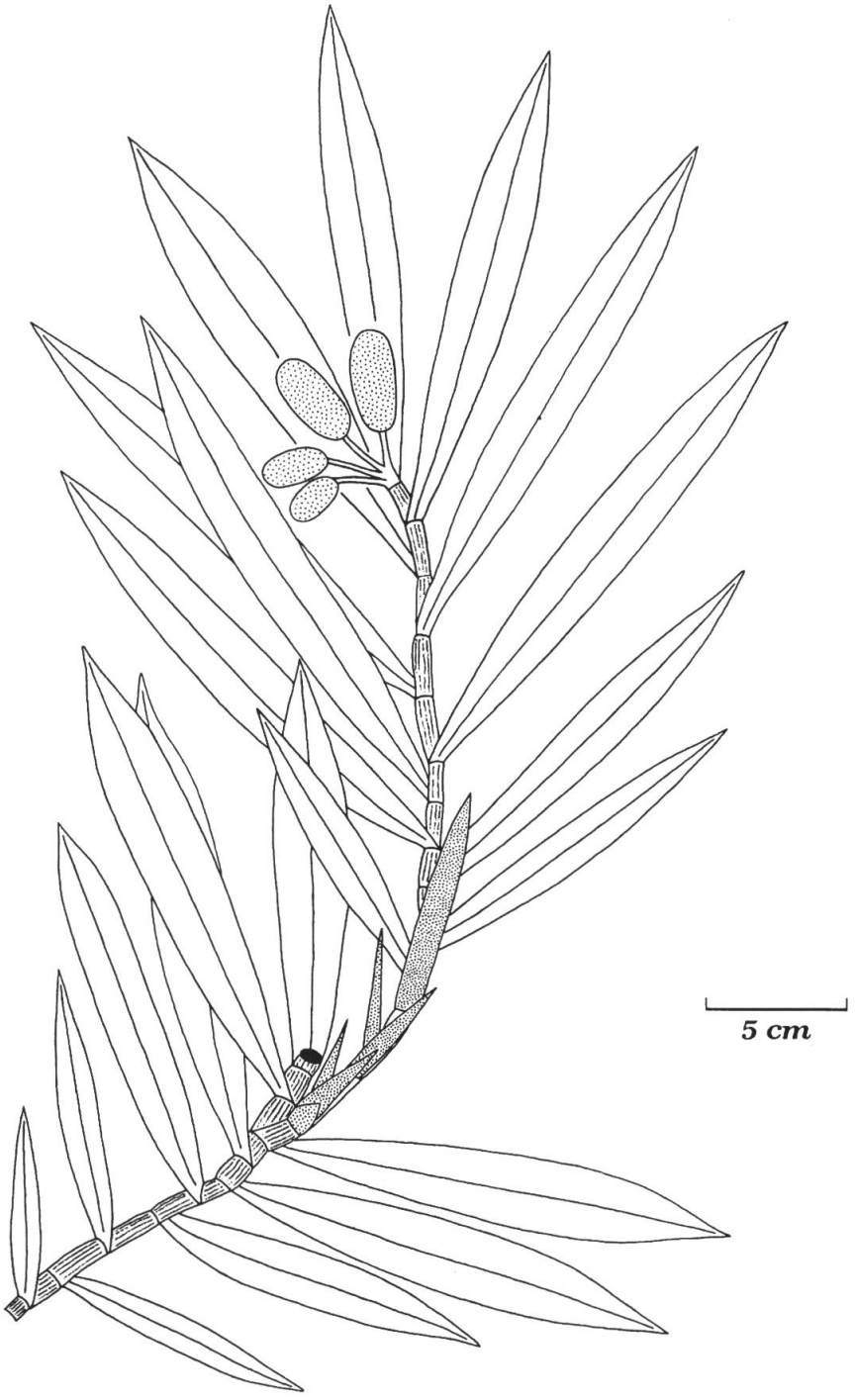

Fig. 7. – *Freycinetia concolor* Huynh [*Takeuchi 13778*]: Upper part of a branch with sympodial branchlet showing from the base: prophylls (densely dotted; four prophylls not shown), leaves, and syncarps (sparsely dotted).

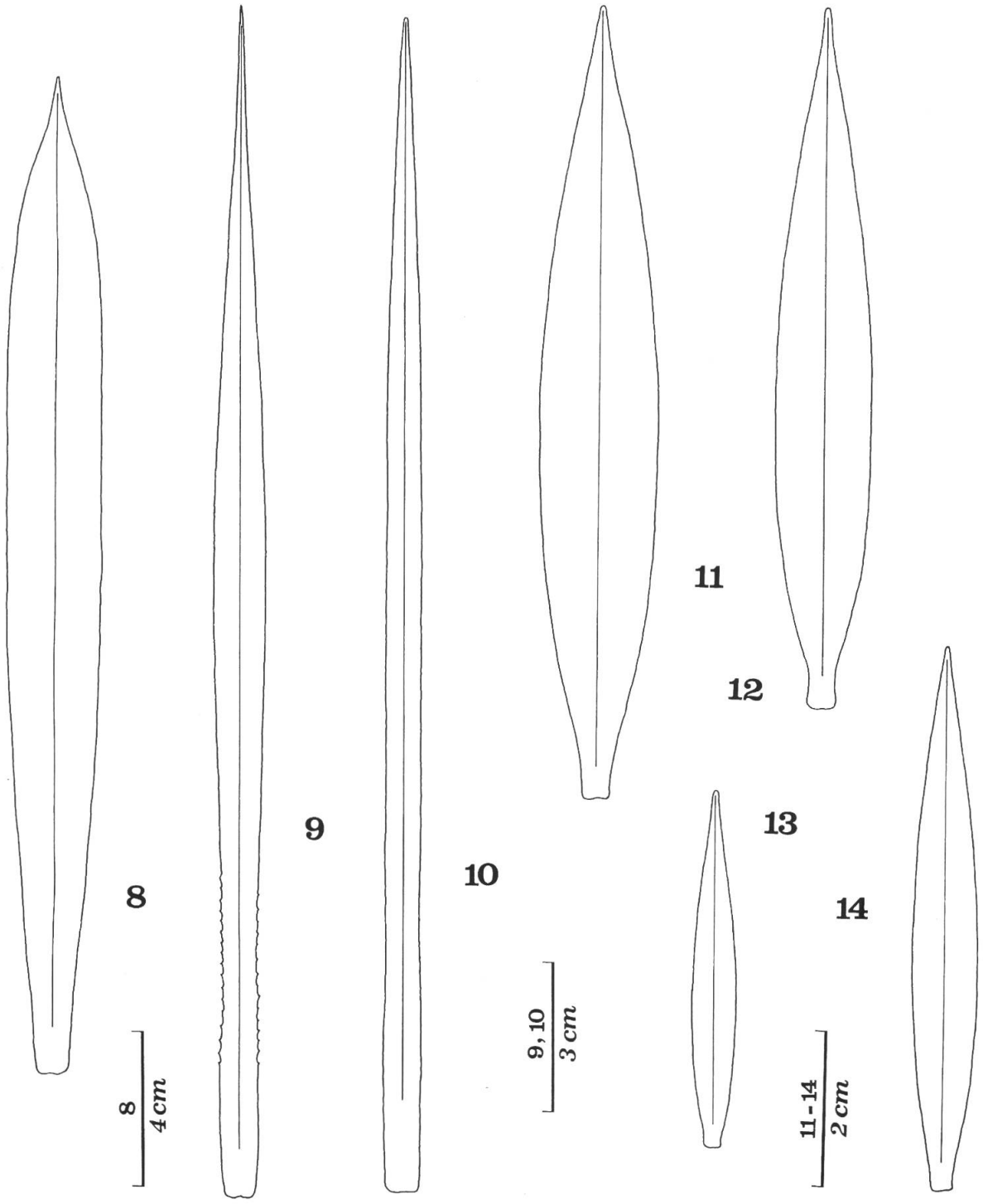

Fig. 8-14. – Leaves of New Guinea *Freycinetia*, flattened horizontally, viewed by the adaxial face (auricles not shown): – **8:** *F. craterensis* Huynh [*Takeuchi 11955*]. – **9:** *F. acuta* Huynh [*Takeuchi 12875*]. – **10:** *F. morobeensis* Huynh [*Clemens 4170*]. – **11-14:** *F. inermis* Ridl. [*Boden Kloss s.n.*]: leaves below the branchlet, and at 8 cm, 12 cm, and 16 cm above the branchlet base respectively (the branchlet, about 31 cm long and described in the text, is shown in Fig. 22).

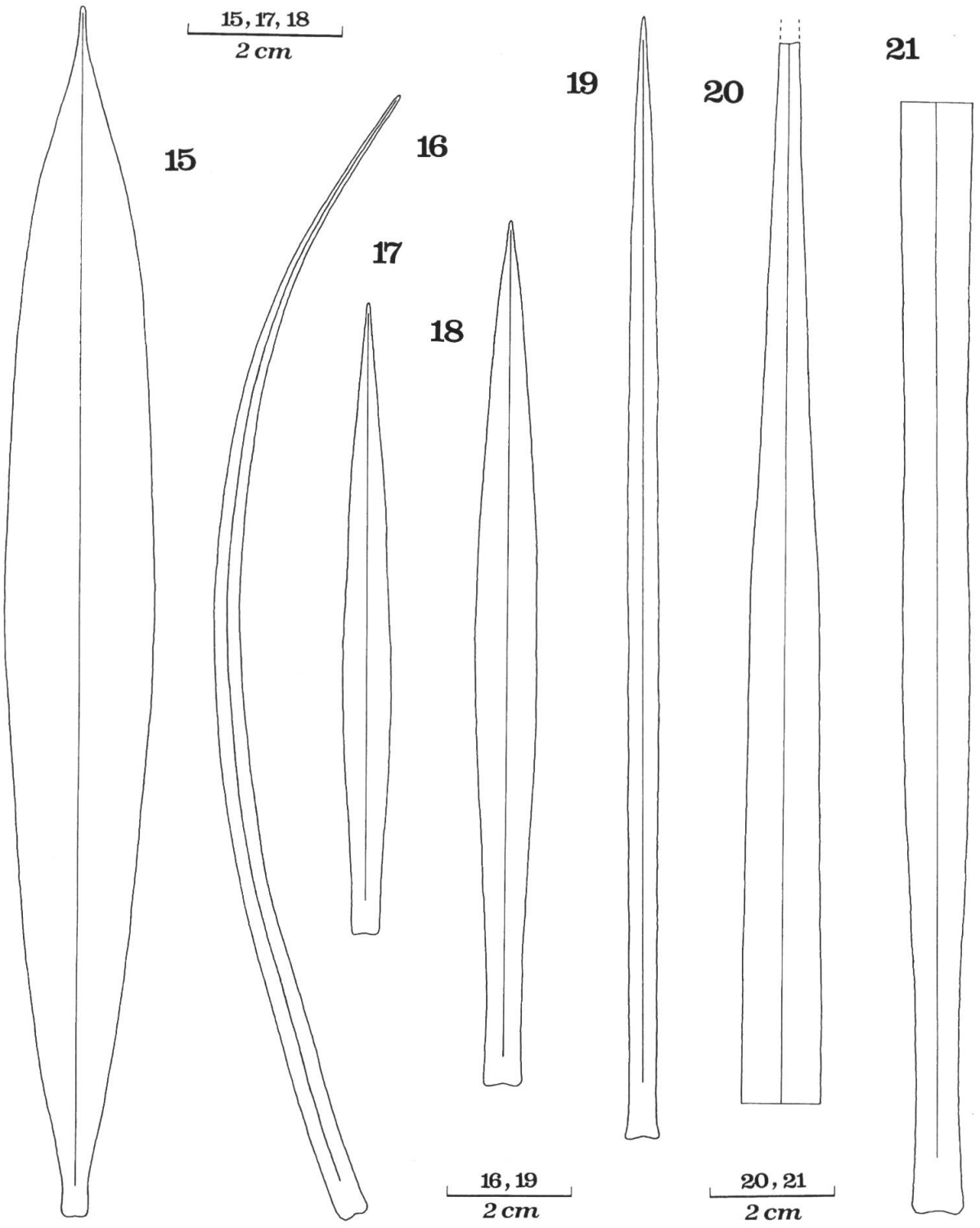

Fig. 15-21. – Leaves of New Guinea *Freycinetia*, flattened horizontally, viewed by the adaxial face (auricles not shown): – **15:** *F. forbesii* Ridl. [*Forbes 628a*]. – **16:** *F. lateriflora* Ridl. [*Boden Kloss s.n.*]. – **17, 18:** *F. flaviceps* Rendle [*Gibbs 6125*]: an upper leaf and the lowermost leaf preserved of the branchlet respectively (the branchlet is described in the text). – **19:** *F. gibbseae* Rendle [*Gibbs 5516*]. – **20, 21:** *F. sogerensis* Rendle [*Forbes 75*]: upper part and lower part of leaf.

Fig. 22. – *Freycinetia inermis* Ridl. [*Boden Kloss s.n.*]: Branchlet, sympodial on left of the apex of a branch (this latter at bottom), showing two syncarps at top and leaves repeatedly changing size along the branchlet axis. Scale bar = 10 cm.

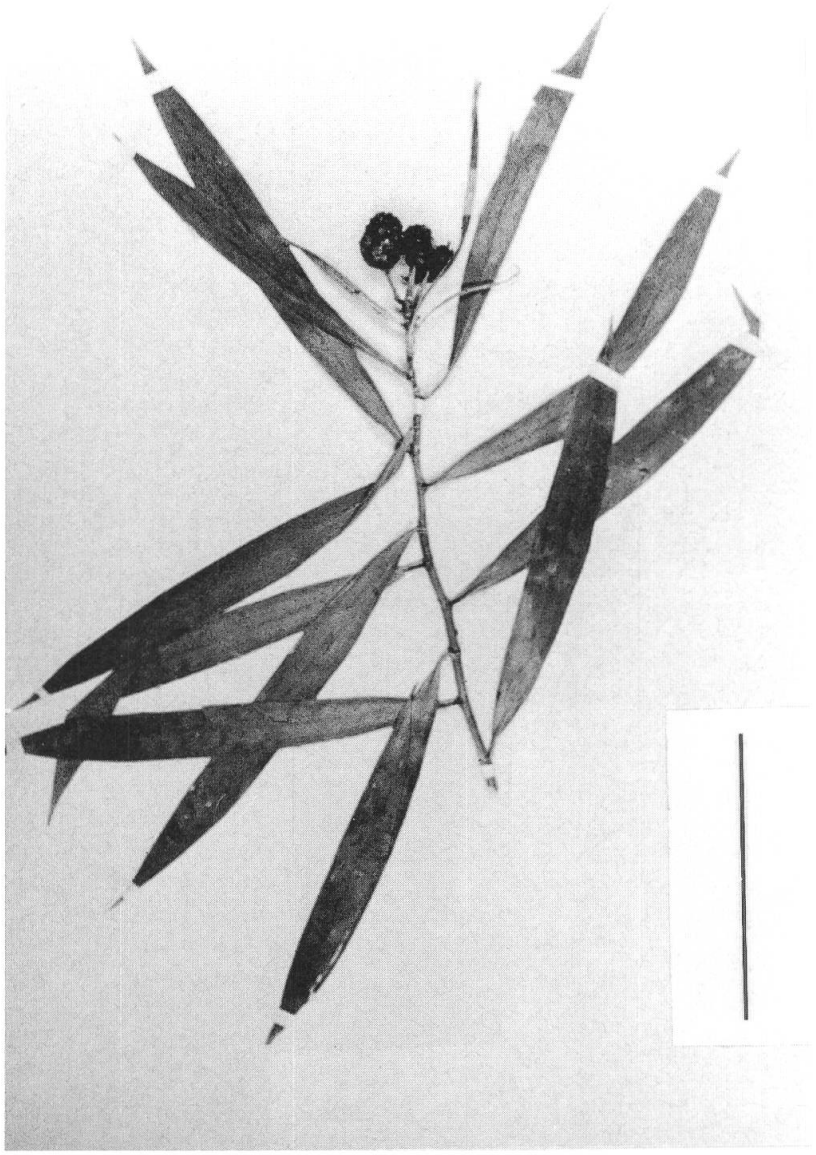

Fig. 23. – *Freycinetia forbesii* Ridl. [*Forbes 628a*]: Upper part of a branchlet, showing a 4-syncarpic infructescence at top (only three syncarps visible) and leaves below, the three uppermost leaves much narrower than the other leaves. Scale bar = 10 cm.

Fig. 24. – *Freycinetia gibbseae* Rendle [*Gibbs 5516*]: Fraction of branch, showing from bottom: on the left of the branch axis, a sterile lateral shoot, with prophylls at the base, merging upwards with the foliage leaves; almost at the same level on the right, a lateral infructescence, with several lower prophylls at the base, followed by two bract-like upper prophylls, and three syncarps (the bracts not preserved); at upper level on the left, another lateral infructescence, with prophylls and bracts preserved (the inner bracts and the syncarps not visible, being superimposed by outer bracts); at the top, cauline leaves. Scale bar = 10 cm.

Fig. 25. – *Freycinetia rhodospatha* Ridl. [*Boden Kloss s.n.*]: Fraction of a branch, showing from the top: rootlets, leaves, and a lateral infructescence on the left of the branch axis (the lower part of the infructescence, composed of lower prophylls, is still adherent on the branch axis; the upper part, removed and placed below, on the right of the branch axis, shows three bract-like upper prophylls, four outer bracts, and two syncarps at each side of the middle outer bract; the third syncarp and the inner bracts are not visible, being superimposed by outer bracts). Scale bar = 10 cm.