THE GENUS PODOCARPUS IN THE NETHERLANDS INDIES

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When delimiting the area to be dealt with in this paper, it appeared, on the one hand, desirable to include some adjacent regions, such as the Malay Peninsula, North Borneo, Eastern New Guinea, the Bismarck Archipelago, and the Solomon Islands; on the other hand the war made it impossible to obtain herbarium materials from several Herbaria in Europe and the Tropics, and to elaborate the genus *Podocarpus* for the whole of Malaysia. Especially the Philippine Islands could not be taken into consideration, but the few materials I had the opportunity of examining have been included. I believe this treatment of the genus *Podocarpus* is rather complete for the Netherlands Indies proper.

The specimens which I could examine in Groningen were lent by the Directors of the following Herbaria:

(B) = the Herbarium of the Botanic Garden, Buitenzorg.
(BD) = the Herbarium of the Botanical Museum, Berlin-Dahlem.
(G) = the Herbarium of the University, Groningen.
(L) = the National Herbarium (Rijksherbarium), Leiden.
(Pa) = the Herbarium of the Sugar Experiment Station, Pasoeroean.
(S) = the Herbarium of the Botanic Garden, Singapore.
(U) = the Herbarium of the University, Utrecht.
(W) = the Herbarium of the University College of Agriculture, Wageningen.

To the Directors and Keepers of these Institutions I render my best thanks for their kindness in forwarding me the specimens.

Besides the above mentioned letters for indicating the Herbaria in which the specimens are preserved, the following abbreviations have often been used in the distribution lists:

B. = Boekit, Bukit = mountain, hill.
G. = Goenoeng, Gunong = mountain.
P. = Poeloe, Poelau, Puku, Pulau = island.
S. = Soengi, Soengei, Soengai, Sungei = river.
f = female specimen.
m = male specimen.
s = sterile specimen.

PODOCARPUS L'Héritier.

Nageia Gaertner, De fruct. et sem. pl. (1788) 191 p.p.; Kuntze, Rev. Gen. Plant., 2 (1891) 798; Baillon, Hist. pl., 12 (1892) 40. — *Podocarpus* [1]) (non Labillardière 1806) l'Héritier, ex Persoon, Synops., 2 (1807) 580, nomen conservandum; Blume, Enum. pl. Javae, 1 (1827) 88; Bennett, in Horsfield, Pl. Jav. rar. (1838) 35; Endlicher, Syn. Conif. (1847) 206; Blume, Rumphia, 3 (1847) 212; Miquel, Fl. Ind. Bat., II, 6 (1859) 1071; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 377; De Boer, Conif. Arch. Ind. (1866) 12; De Kirwan, Conif., 2 (1868) 223; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 368, 507; Miquel, in Siebold & Zuccarini, Fl. Jap., 2 (1870) 68; Bentham, Fl. austr., 6 (1873) 246; Bentham & Hooker f., Gen. pl., III, 1 (1880) 423, 434; Vidal y Soler, Fl. For. Fil. (1883) 277; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Hooker f., Fl. Br. Ind., V, 3 (1888) 649; Beissner, Nadelholzk. (1891) 16, 193; Kent, in Veitch's Man. Conif. (1900) 147; Bailey, Queensl. Fl., 5 (1902) 1497; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 54; Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 259; Brandis, Indian Trees (1906) 695; Pilger, in Engl. & Pr., Nat. Pflanzenfam., Nachtr. III (1908) 4; Baker & Smith, Res. Pin. Austr. (1910) 433; Koorders, Exkursionsfl. Java, 1 (1911) 63; Ridley, in Journ. Straits Br. Roy. As. Soc., 60 (1911) 56; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 155; Hallier, in Elbert, Sunda-Exped., 2 (1912) 295, 302; Koorders, Fl. Tjibodas, I, 2 (1922) 2; Ridley, Fl. Mal. Pen., 5 (1925) 280; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 240; Fitschen, Nadelholzk. (1930) 7, 61; Florin, in Kungl. Sv. Vet. Akad. Handl., 10, 1 (1931) 262, 285; Hickel, in Lecomte, Fl. gén. Indo-Chine, V, 10 (1931) 1066. — *Podocarpus* & *Nageia* Carrière, Traité gén. Conif., II, ed. 2 (1867) 643; Gordon, Pinetum, ed. 2 (1875) 326.

Dioecious, or very rarely monoecious. Male flowers cylindrical, rarely (*Dacrycarpus*) terminal on short lateral twigs, usually solitary or in bundles in the leaf axils sessile or on short common peduncles and each flower with sterile bud scales around its base, or sometimes bundled at the apex of small twigs, or in compound inflorescences, or rarely spicate; stamens usually imbricate, always with 2 thecae dehiscent.

[1]) I accept *Podocarpus* as a female noun, as it was considered so by l'Héritier and many subsequent authors. Later authors often take it as a male noun, but there is no real grammatical argument for this. Cfr. Danser, in Blumea, 1 (1935) 300—303.

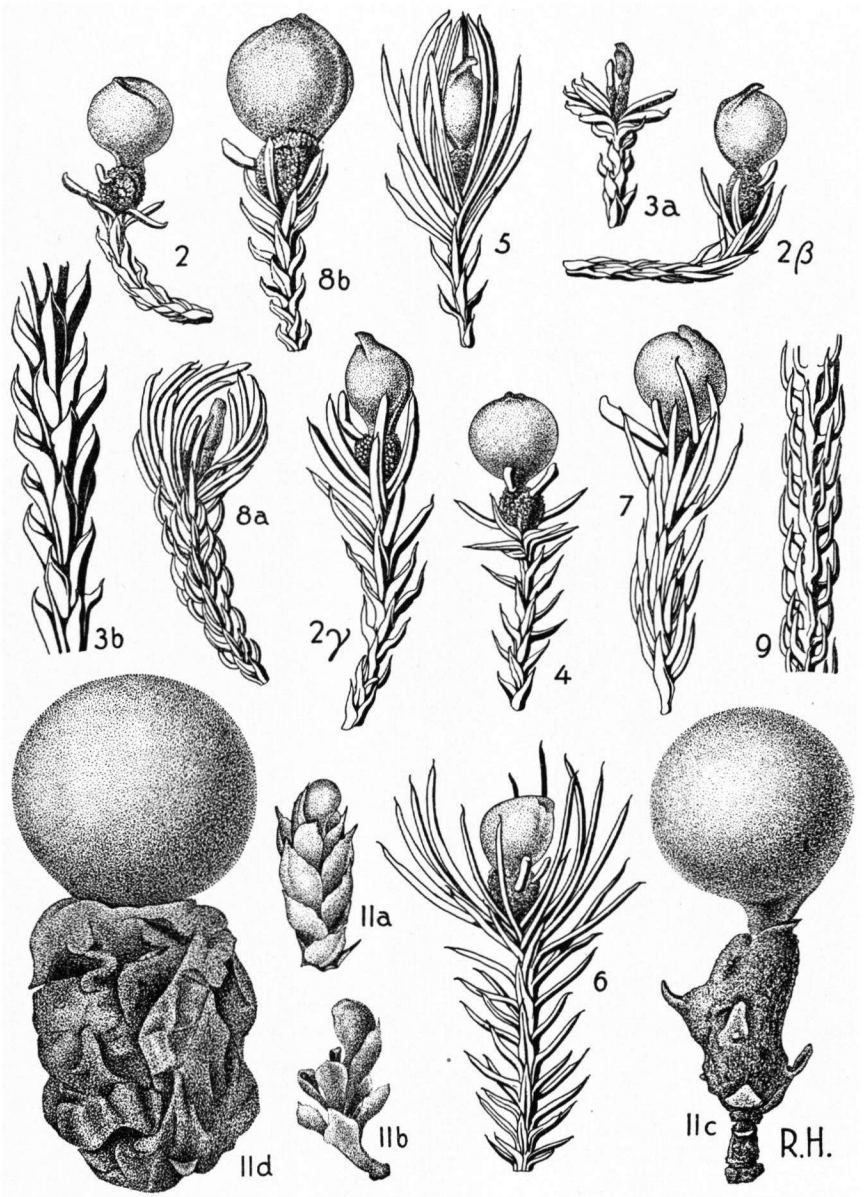

Plate IV. Fig. 2: *Podocarpus imbricata*, fruit (*Boerlage* s. n.); 2β: *P. imbricata* var. *curvula*, fruit (*Junghuhn* s. n.); 2γ: *P. imbricata* var. *kinabaluensis*, fruit (*Clemens* 29914); 3a: *P. papuana*, female flower (*Gibbs* 5540); 3b: *P. papuana*, twig fragment (*Gibbs* 5540); 4: *P. Steupii*, fruit (*Boschpr.* b.b. 22857); 5. *P. Cumingii*, fruit (*Elmer* 11684); 6: *P. cincta*, fruit (*Clemens* 5562); 7: *P. dacrydiifolia*, fruit (*Boschpr.* b.b. 13633); 8a: *P. compacta*, female flower (*Pulle* 964); 8b: *P. compacta*, fruit (*Brass* 4284); 9: *P. leptophylla*, twig fragment (*De Kock* 39); 11a—d: *P. Motleyi*; 11a and b: female flowers (*Corner* 21341), 11c: unripe fruit (*Boschpr.* 12T. 1P. 185), 11d: ripe fruit, shrivelled (*cf. Dep.* Fed. Mal. St. 16568). All figs. 2 ×.

with a slit, the filament nearly none, the apiculus small; pollen grains with 2 or 3 air-bladders. Female flowers usually single in the leaf axils, sometimes (*Dacrycarpus*) terminal on short lateral twigs, usually with a receptacle composed of 2 or more fleshy scales or leaf-bases, of which 1 or rarely 2 are fertile or sometimes (*Stachycarpus*) spike-shaped with 2—8 remote carpids, or with 1—2 ovules on the apices of short, non-thickened twigs; carpids always with a single ovule; ovules usually much overtopping the carpid, sometimes (*Dacrycarpus*) longitudinally connate with the carpid, always with a single integument, which is entirely connate with a cup-shaped, incurved excrescence of the carpid, the "ephimatium" [1]); micropyle directed towards the base of the carpid; seed rather large, globose or elliptical, sometimes shortly apiculate; testa with a fleshy or coriaceous outer layer, and a hard inner layer; cotyledons 2. — Trees or shrubs. Leaves sometimes (*Dacrycarpus*) scale-like or subulate, usually linear or lanceolate to ovate, scattered or more rarely (*Nageia, Polypodiopsis*) opposite, usually with a single rib, rarely (*Nageia*) with numerous longitudinal nerves.

GENERAL REMARKS.

The remarks on the genus *Podocarpus* following here have for the greater part already been given by Pilger in his monographic treatment of the *Taxaceae* and *Podocarpaceae* in Das Pflanzenreich, IV, 5 (1903), and Die natürlichen Pflanzenfamilien, ed. 2, XIII (1926). Here, however, they have been worked out somewhat more in detail for the species indigenous in the area, and several completions have been added. In the morphological terminology and nomenclature I followed Pilger almost entirely. Also the subdivision of *Podocarpus* in subgenera and sections has mainly been taken from this author, though I doubt whether the subdivision into two subgenera is right. Perhaps we had better not distinguish any subgenera, but only 6 equivalent groups, which we might call either subgenera or sections.

All *Podocarpi* are woody plants, but the dimensions may vary widely. *P. imbricata* and *P. amara* belong to the tallest trees of the tropics, sometimes reaching a height of 60 m and elevating their crowns to above the canopy of the forest. Most species are tall or moderate-sized trees, some of them up to 40 m tall, such as *P. dacrydiifolia, P. neriifolia, P. Blumei, P. Motleyi,* in other species less tall, such as *P. polystachya, P. Pilgeri, P. glauca,* and *P. thevetiaefolia.* One

[1]) See p. 367, footnote.

species, *P. brevifolia*, is only known as a shrub. Several *Podocarpi*, however, take this form when growing at high elevations, such as *P. imbricata* var. *curvula* and var. *kinabaluensis*, *P. compacta*, *P. neriifolia*, *P. Pilgeri*, *P. Brassii*, and in extreme cases these shrubs are less than 2 m high or even procumbent. The tall trees usually have a straight, columnal bole with branches usually in the upper portion only, whereas the smaller trees and the shrubs may be branched almost from the base.

The structure of the stem of all *Podocarpi* is monopodial, the main stems always continuing their growth from the terminal buds. The following modes of ramification may be distinguished:

1. In the section *Eupodocarpus* and in *P. amara* (*Stachycarpus*) the ramifications originate from the axils of the youngest leaves just below the terminal bud, thus causing the lateral twigs to be crowded nearly to whorls (up to 8 together) at the ends of the vegetation periods. Beside these, we now and then (e. g. in *P. thevetiaefolia*) meet with very short, few-leaved short side-twigs scattered over the vegetation periods.

2. In the section *Dacrycarpus* the lateral twigs are alternatingly bifarious, whereas the leaves are scattered (spirally arranged). Moreover there is a twig dimorphism, especially in seedlings and young sterile plants: the leaves of the lateral twigs are not scale-like or subulate as in the main twigs, but linear and turned into one plane and seemingly bifarious, this giving the twigs a pinnate appearance. These pinnate twigs are usually unbranched, rarely branched, and have a limited growth. Also the flower-bearing lateral twigs have a limited growth.

3. In the sections *Nageia* and *Polypodiopsis* the twigs are opposite and probably always decussate. In *Polypodiopsis* there is, moreover, a peculiar twig dimorphism, the main twigs only bearing scale-like leaves, the youngest lateral twigs well-developed leaves, turned into one plane in a particular manner (see below).

The number of vegetation periods bearing leaves at a certain moment usually varies from 1 to 3, but may amount to 5 in exposed localities at high elevations. In the latter case, the vegetation periods are very short and crowded, e. g. in *P. brevifolia* and *P. Brassii*, and the bud scales are persistent for several vegetation periods, whereas they usually fall off as soon as the twigs grow out.

The shape of the terminal bud which, except in the section *Dacrycarpus*, is always enclosed by adpressed scales, is often constant,

and furnishes valuable specific characters, varying from globose to narrowly conical. In some species, however, the length of the bud scales may vary widely, as in *P. neriifolia*, where the scales are sometimes ovate, acute, 2.5 mm long, sometimes subulate-acuminate, gradually attenuate, up to 30 mm long. In the section *Dacrycarpus* bud scales are entirely absent.

The leaves are very different as regards their shape and position, in different sections. In *Dacrycarpus* they are spirally arranged and subulate, or scale-like and densely imbricate, often entirely appressed. Especially in seedlings and young sterile plants there are, moreover, lateral twigs which in their basal part bear scale-like to subulate leaves, but for the rest linear, laterally flattened ones, which are directed into one plane and apparently bifarious. Between the leaves of the pinnately-leaved twigs and the scale-like or subulate leaves we find all kind of intermediary forms, especially such as are laterally flattened and quinquefarious. The linear leaves bear on both surfaces and at both sides of the midrib a narrow stripe with 1—3 rows of stomata.

In *Eupodocarpus* and *Stachycarpus* the leaves are scattered, and by their strongly flattened lamina similar to dicotyledonous leaves. Usually they are more or less spreading, sometimes deflexed, as in *P. deflexa*, in forms of high elevations adpressed to the twigs, as in *P. brevifolia, P. glauca, P. Brassii,* and mountain forms of *P. neriifolia* and *P. Pilgeri*. The shape of the leaves varies from linear or lanceolate to oblong; in *P. Rumphii* and *P. deflexa* they may be over 30 cm long, in *P. glauca* and *P. Brassii* only 10—22 mm. Towards the base they are always contracted into a very short petiole. The mode in which they are attenuate towards the apex often furnishes valuable distinctive characters; attention must, however, be paid to the fact, that the leaves of young plants are often different from those of adult plants of the same species, *viz.*, acuminate or even caudate-acuminate towards the tip. Another valuable distinctive character is in the midrib, which is usually prominent, but sometimes flat or even slightly impressed on the upper side, and sometimes characteristically shallowly grooved on the lower side. In *Eupodocarpus* and *Stachycarpus* stomata are only found on the underside of the leaves, in rather parallel rows.

The leaves of *Polypodiopsis* are decussate, but they are spread in one plane in a peculiar way. In the first place the internodes between the pairs of leaves are alternatingly twisted to the left and the right, so that the pairs of leaves become apparently superposed. Moreover,

all leaf bases show a torsion in the same direction[1]), so that the flattenings of all leaves come in one plane with the twig and with each other. As a result of the two torsions the leafy twigs have a pinnate appearance, and in the herbarium all leaves of the left side of the twig turn their morphological under side, all leaves on the right side the morphological upper side to the observer. Pilger was the first to point to these peculiarities in his description of *Podocarpus Rospigliosii* (Notizbl. Berlin-Dahlem, VIII, 1923, 273), and he drew attention to the resemblance of this species with *P. vitiensis*, but his description of the phenomenon is incomplete. Florin later (Kungl. Svensk. Vet. Akad. Handl., X, 1, 1931, 191, and XIX, 2, 1940, 8) gave a description and explication in full with photographs and diagrams of the phenomenon in *P. Rospigliosii*, *P. vitiensis* and *P. minor*, and in his last named paper he described the same for the fossil *P. araucoensis* from South Chile.

In the section *Nageia* the leaves are large, and ovate to oblong-lanceolate, and likewise decussate and turned into one plane, but not in the same way in all species. According to Florin (1931, p. 274) the species of this section may be devided into two groups. The first group, including *P. Blumei*, *P. Motleyi* and *P. Wallichiana*, has the leaves amphistomatic and all turned to the right (as in *P. vitiensis*), whereas a fleshy receptacle is present; in the other group, including *P. nagi*, *P. nankoënsis* and *P. formosensis*, the leaves are hypostomatic or nearly so, and are turned in different directions, all turning their morphological upper side towards the light. These groups also have a different geographical distribution. In this respect the Indo-Chinese *P. Fleuryi*, which Florin did not examine, is doubtful, as it agrees with the one group by the absence of a fleshy receptacle, with the other group by the leaves all being turned to the right, if at least Hickel's figure in Flore Indo-Chine, V, p. 1076, is correct.

The young roots of *Podocarpus* always bear nodules, probably caused by *Pseudomonas radicicola* (see Pilger 1926, l. c., p. 217). I found them in *P. imbricata*, *P. neriifolia*, incl. var. *polyantha*, and *P. Pilgeri*.

The flowers are nearly always dioecious, though sometimes

[1]) Florin speaks of a torsion towards the right, whereas I should prefer to call it a torsion to the left. If we place the twig upright before us, with the apex of the leaf in question towards the observer (as is usual in morphology) the leaf turns its upper side to the left, its underside to the right.

monoecy is mentioned. It seems probable that the latter may now and then occur in species which, as a rule, are dioecious, as the same is the case in several other genera of Conifers.

The male flowers are nearly cylindrical, and are composed of an axis covered with a large number of spirally arranged imbricate stamens; with a short filament and 2 oviformous elliptical thecae opening with a slit; the connective is prolongated above the thecae into a triangular or ovate tip, the "apiculus".

In *Dacrycarpus* the male flowers are simply terminal on short lateral twigs; the leaves of these twigs gradually merge into the little different stamens.

In *Eupodocarpus* the male flowers are always axillary. They are either single in the axils, or fascicled to 2—3, or to 3—5 as in *P. polystachya*, or even to 8 as in *P. Koordersii*. Usually they are sessile, more rarely are they placed on a short common peduncle. They are surrounded at their base by a large number of sterile scales entirely enclosing the flower in the bud stage. The shape of these buds furnishes an important character for the distinction of the species.

In *Stachycarpus* (*P. amara*), the male flowers are usually placed in threes on the extremities of axillary peduncles. More rarely we meet with more compound inflorescences with a more prolongated peduncle bearing either more numerous remote flowers or several fascicles of flowers. The flowers are always placed in the axils of triangular bracts and bear a few sterile scales in their basal parts, which hardly can be distinguished from the stamens.

In *Nageia* the male flowers are single in the axils of the leaves (*P. Motleyi*), or 3—6 in the axils of triangular bracts on common peduncles, which are inserted in the leaf axils.

In *Polypodiopsis* (*P. vitiensis*) the male flowers are usually placed in the axils of decussate bracts on leaf-less twigs; rarely do we find them in the axils of normal leaves besides, apparently also on the apices of the leafy twigs (cfr. the discussion of the species).

The pollen grains of all species examined have always airbladders, usually 2, in the section *Dacrycarpus*, however, 3 in number.

Female flowers. In *P. amara*, the only Malaysian species of the subgenus *Stachycarpus*, the female flower is an axillary twig up to 5 cm long bearing 2—3 remote, small, scale-like carpids each bearing an ovule and in the basal part a few sterile scales or scars of these. In other, non-Malaysian, species of *Stachycarpus* the number of carpids may amount to 8 or be reduced to one.

In all other sections the female flower is characterised by a so-called receptacle, which in different sections may be formed in different ways. In *Eupodocarpus* the flowers are always single in the leaf axils on slender naked peduncles 1—25 mm long. Each flower is composed of two fleshy scales (Cfr. *Plate V, 19, a and b.*), of which the one is fertile, the other sterile, connate over almost the whole length and together forming the nearly cylindrical receptacle. The sterile portion, which usually is somewhat shorter than the fertile one, goes out into a short free apical mucro, whereas the fertile part has, at its apex, a free narrow margin, and bears an ovule overtopping the carpid. More rarely the receptacle is composed of 3 or 4 fleshy scales (Cfr. *Plate V, 17 b, 14 a—c.*), and in the latter case these scales are arranged in 2 decussate pairs, the lower of which is fertile, the upper sterile. *P. salomoniensis* is only known with 4 scales; in *P. deflexa, P. neriifolia* var. *polyantha* and *P. Rumphii* a great part of the flowers have more than 2 scales, in *P. neriifolia, P. polystachya, P. Pilgeri, P. brevifolia, P. glauca,* and *P. Brassii* such flowers are rare; in the other species dealt with, female flowers are not or hardly known.

At the base of the receptacle we find in all Malaysian species two deciduous subulate, small leaves up to 6 mm long, the "foliola", decussately alternating with the scales forming the receptacle. Only once did I see in a Javan plant of *P. neriifolia* a flower, in which one of the foliola took part in the formation of the receptacle.

In the Malaysian species of *Nageia* there is also a receptacle; here, however, it does not become fleshy before the seed ripens. The flowers are placed on axillary peduncles up to 3 mm long, and are composed of 3—5 decussate pairs of small leaves nearly 3 mm long, and of which the uppermost, somewhat longer one bears an ovule (Cfr. *Plate V, 14 a—c*). Finally the axis and the basal portions of the scales form a fleshy receptacle bearing the non-fleshy apical parts of the scales on its surface. In some non-Malaysian species the receptacle does not become fleshy at all. In this section the peduncle moreover bears a few pairs of sterile, membranous, deciduous bracts.

In *Polypodiopsis* the female flowers behave, as far as known, as in the precedent section. Whether the receptacle becomes fleshy or not, is not known to me.

Whereas in all preceding sections the female flowers are always axillary, they are in the section *Dacrycarpus* terminal on short, normally leafy lateral twigs (Cfr. *Plate IV, 2—8*). The receptacle is, in this section, composed of usually 2 nearly equally long fleshy leaf-

bases with a very verruculose surface. The sterile portion bears on its top a short, cylindrical, leafy, free lamina, the fertile portion a long, erect, free carpid, which is connate with the ovule over its whole length and the extremity of which is sometimes visible on the top of the seed as a curved, free tip. The receptacle is sometimes composed of several leaf bases, which are very different in length and spirally arranged on the axis. When there are more than 2 scales, two of them are sometimes fertile, as we occasionally meet with in *P. imbricata, P. papuana, P. Steupii,* and *P. dacrydiifolia.* For the distinction of the species, the shape, length and direction of the leaves involucrating the receptacle are of great importance.

Each carpid always bears only one ovule with one integument. The ovule is, however, also involved by an excrescence of the carpid, the so-called *ephimatium* [1]), which in *Podocarpus* is entirely connate with the integument. It is always nearly ellipsoidal or globose-ellipsoidal, except in *P. amara,* where it is attenuate into a furrowed apiculus; it has the micropyle turned downward and close to the insertion on the receptacle. In most of the sections the ovule is much longer than the free margin of the receptacle, but in the section *Dacrycarpus* the ephimatium is entirely connate with the long carpid. In the young stage the limit between the ovule and the carpid is still distinct, but finally this limit disappears entirely, and only the extremity of the carpid is still visible as a slight elevation on the top of the seed. (Cfr. *Plate IV, 2—8*).

Fruit and seed. The receptacle is always fleshy, at least finally, and when the seed ripens it is juicy. In the section *Eupodocarpus* it even becomes broad-cylindrical or globose, and thicker than the seed, and then the composing parts can no longer be distinguished (Cfr. *Plate V, 19c*). In *Nageia* the same is the case, but here only the upper scales are almost entirely taken up in the receptacle, and of the further scales the decussate apical parts remain hard and dry and are diciduous (Cfr. *Plate IV, 11d*).

In *Dacrycarpus* the receptacle remains rather small and warty, and the free apical portions of the composing scales are persistent on it in maturity (Cfr. *Plate IV, 2—8*).

What is usually called the ripe seed and the seed testa are in

[1]) Pilger writes *epimatium.* I prefer to write *ephimatium,* in accordance with the derivation from *ἐπι* and *ἱματιον.*

reality the same parts covered with the ephimatium, or in the section *Dacrycarpus* partly with the carpid besides.

In *Eupodocarpus* the limit between the real seed and the ephimatium can hardly be distinguished anymore. In this section the seed is usually ellipsoidal or globose-ellipsoidal and nearly 10 mm, rarely up to 15 mm long. Its apparent wall is rather thin, but coriaceous or even harder.

In *Nageia* the outer layer of the seed wall is thin-coriaceous, the inner layer harder and rather bony. The seed is subglobose, and its diameter can reach 2 cm.

In *P. amara*, the only Malaysian species of *Stachycarpus*, the seed is subglobose with a small prominent apiculus; it is very large, reaching a diameter of 2.5—3 cm. Its testa is drupaceous; the inner layer, formed by the integument, is woody, very hard, and up to 2 mm thick; the outer layer, formed by the ephimatium, is very fleshy and finally juicy. It is curious, that it is exactly here that a fleshy receptacle is absent.

As has already been remarked, the so-called ripe seed of the section *Dacrycarpus* is not only formed by the ovule and the ephimatium, but by the carpid as well. The (apparent) testa is rather thin, but firmly coriaceous or bony; it has a smooth and shining surface, but is sometimes slightly uneven by resin bladders in the outer part. The seed is small, subglobose, up to 7 mm in diameter.

The ripe seed of *Podocarpus* is always filled up with a copious albumen (prothallium); the nucellus is still to be found as a thin membrane around the albumen. In the axis of the albumen we find the narrow-cylindrical embryo, with its rootlet directed towards the micropylar end of the seed, and the two cotyledons towards the opposite side.

HORIZONTAL DISTRIBUTION.

Of the 25 species occurring in the area dealt with in this paper, only one is cultivated there, and 24 are growing wild. Of these 13 have not been found outside the area, 7 have been found there and in the Philippines, one moreover in Queensland, 2 moreover in Southeastern Asia and the Fiji Islands, and one in the area and the Fiji Islands. Several species have very limited areas of distribution.

The subgenus *Stachycarpus* (see *Fig. 1*) is, in Malaysia, only represented by *P. amara*. The area of this species is extended over the whole of the Malay Archipelago, with the exception of Borneo, and reaches moreover the monsoon region of Queensland. Other species of

this subgenus have been found in Africa, South America, and Australia, including New Caledonia and New Zealand.

In the section *Dacrycarpus* (see *Fig. 2*), *P. imbricata* has a wide and continuous area of distribution. It is found in the whole Malay Archipelago, in a south-eastern direction reaching as far as the Fiji Islands, in a north-western direction as far as South China and Upper Burma. Only two species of *Dacrycarpus* are known from outside this area, viz., *P. Vieillardii* from New Caledonia and *P. dacrydioides* from New Zealand. Of the other species of this section *P. Cumingii* has a peculiar distribution, as it has been found in the Philippines and North Sumatra. Merrill, when discussing the floristic relationships of the Philippines (Enum. Phil. Fl. Pl., 4, 1926, 93), did not know any species with a distribution of that kind, and supposed that such species might always be found also in Borneo. This may be right for our species too. All other species of this section are limited to a single island.

Species of the section *Nageia* (see *Fig. 3*) are, outside the area dealt with, known in Formosa, Japan, French Indo-China, Burma and the Deccan Peninsula. Of the species occurring inside the area, *P. Blumei* is widely spread and has a distribution resembling that of *Nepenthes* and several other plants (see Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, XIII, 3, 1934, 350, and Tijdschr. Kon. Aardr. Genootsch., sér. 2, 52, 1935, 43). The area of these plants is partly determined by the influence of the East Monsoon, and is restricted to regions with at least 30 rainy days in the driest four months of the year. The distribution of *P. Wallichiana*, which is spread in a north-western direction from Cochin-China to Assam, and South Deccan, is exactly a continuation of that of *P. Blumei*, and, since the differences between these two species are slight and inconstant (see the discussion of *P. Blumei*), it seems probable that they are geographic variations of a single species. The same may be said of *P. Fleuryi*, another closely allied species, according to the description only different from *P. Wallichiana* by a dry instead of a juicy receptacle, and occurring in Cambodia, Annam, and Tonkin.

Besides these large-leaved species there belong to the section *Nageia* a number of small-leaved ones. *P. nagi* is common in South Japan and perhaps occurs in Formosa; of this island also the closely allied *P. nankoënsis* and *P. formosensis* are known. *P. Motleyi* is spread in the lower parts of Borneo, the Malay Peninsula, and Sumatra. This accentuates once more that the lowland floras of Borneo, the Malay Peninsula and Sumatra show greater affinities to each other than to

that of Java (cfr. Van Steenis, in Bull. Jard. Bot. Buitenzorg, sér. 3, XIII, 1, 1933, 23).

Of the section *Polypodiopsis* (see *Fig. 3*), *P. vitiensis* is the only species indigenous to the area. According to Florin (1931, l. c.) *P. minor*, from New Caledonia, and *P. Rospigliosii*, from Peru, belong to the same section.

The section *Eupodocarpus* (see *Fig. 4*) is spread in south-eastern Asia incl. Japan, and the Malay Archipelago, Australia incl. New Caledonia, the Fiji Islands, New Zealand and Tasmania, moreover in South and Central America, the West Indies, South and East Africa with Madagascar. Of the Malaysian species of *Eupodocarpus*, *P. neriifolia* has the widest area of distribution, extending in a northern and north-western direction to Nepal and South and East China, in an eastern direction to the Fiji Islands. This area recalls that of *P. imbricata*, but is spread more to the North and the West. All other Malaysian species have their area within that of *P. neriifolia*. *P. polystachya* is known from the eastern and southern coast of the Malay Peninsula, the islands between the Malay Peninsula and Sumatra on the one side and Borneo on the other side, the western and southern coast of Borneo, the Talaud Islands, and the coasts of the Philippines, northwards to the Batanes Islands. This peculiar distribution recalls that of *P. Motleyi*. *P. Pilgeri* has its distribution east of Wallace's line as it has been modified by Merrill, and *P. Rumphii* nearly so. The former is spread from Celebes and the Moluccas to the Solomon Islands, the latter is found from the Philippines, southwards to the Lesser Sunda Islands, and eastwards to New Guinea, and has, moreover, been collected in one locality on Borneo's East-coast. Two mountain forms, *P. brevifolia* and *P. glauca*, are known from the Philippines and Mt. Kinabalu in North Borneo; all other species are known from a single island only.

Attention must be drawn to the richness in species of New Guinea, where as many as 14 species have been collected, 7 of which are endemic: *P. papuana*, *P. cincta*, *P. compacta*, *P. leptophylla* (all of the section *Dacrycarpus*), *P. Ledermannii*, *P. thevetiaefolia* and *P. Brassii* (of the section *Eupodocarpus*). Most of these species belong to the subalpine zone, the others to the montane zone.

Many species are known from a single locality: *P. Steupii* from Rante Mario in Celebes, *P. dacrydiifolia* from Oeloe Saloe in Celebes, *P. cincta* from Mt. Sarawaket in eastern New Guinea, *P. deflexa* from G. Tahan in the Malay Peninsula, *P. salomoniensis* from the Solomon

Islands, *P. Koordersii* from Noesa Kambangan south of Java, *P. Ledermannii* from the Lordberg in Eastern New Guinea.

VERTICAL DISTRIBUTION.

After the elevation, at which they grow, the Malaysian species of *Podocarpus* may be distinguished in the following groups:

1. Species growing near the sea shore or in low, often swampy regions at low elevations, such as *P. polystachya* and *P. Motleyi.*

2. Species growing at rather low elevations, such as *P. Koordersii, P. neriifolia* var. *Teysmannii* and var. *polyantha.*

3. Species growing both in the tropical and in the lower parts of the montane zone, between 1000 and 2400 m elevation, such as *P. Rumphii* and *P. Blumei.*

4. Species with their main distribution in the montane zone; to this group belong the most common species: *P. imbricata,* incl. the var. *curvula, P. papuana, P. dacrydiifola, P. amara, P. neriifolia, P. deflexa, P. Ledermannii, P. glauca, P. Pilgeri,* and *P. vitiensis,* perhaps also *P. thevetiaefolia* and *P. salomoniensis. P. neriifolia,* however, also descends to sea level, *P. amara* to 300 m elevation. On the other hand, *P. Pilgeri, P. imbricata* and its var. *curvula* may extend far into the subalpine zone.

5. Species mainly or exclusively growing in the subalpine zone, between 2400 and 4200 m elevation: *P. compacta, P. cincta, P. Steupii, P. imbricata* var. *kinabaluensis, P. brevifolia, P. Brassii,* and probably also *P. Cumingii, P. leptophylla,* and *P. neriifolia* var. *atjehensis.* Several species of this group reach the tree limit, e. g. *P. imbricata* var. *kinabaluensis* and *P. brevifolia* on Mt. Kinabalu in Borneo, *P. compacta* and *P. Brassii* in the mountains of New Guinea. Especially the species of the latter group take the shrub form at high altitudes.

About the vegetation types, in which the different *Podocarpus* species occur, few remarks may be made.

In general, the Malaysian *Podocarpi* grow scattered in forests of dicotyledonous trees. The only reference to continuous *Podocarpus* forests is made by Junghuhn (Java, 1, 1851, 509), who says, that *P. imbricata* grows gregariously on some Javan mountain summits and covers the slopes. Also Conifer forests, in which *Podocarpus* species take an important part, are rather rare. Gibbs (Journ. Linn. Soc., 42, 1914, 36, 41) describes shrub formations, composed by *Podocarpus brevifolia, P. imbricata* (var. *kinabaluensis*), *Phyllocladus hypophylla* and *Dacrydium Gibbsiae,* found by her near the tree limit, and on

exposed slopes of Mt. Kinabalu. At lower elevations these species become more and more intermingled with dicotyledonous trees. Conifer forests in which *Podocarpus* species take a more or less important part, are more often mentioned from New Guinea. Lane-Poole (For. Res. Papua, 1925, 41) mentions such forests from Mt. Obree; here *P. thevetiaefolia* and *Xanthomyrthus longicuspis* together occupy over 80 % of the surface, and at the summit *P. thevetiaefolia* alone more than 50 %. A forest between the Upper Mimai and the Main Divide was (idem, p. 40), for the greater part composed of *Araucaria Cunninghamii* (36.96 %) and *Phyllocladus hypophylla* (28.9 %), whereas *Podocarpus amara* (with 7.52 %), *P. imbricata* (with 4.21 %) and *P. neriifolia* (with 0.51 %) together with *Quercus* and *Eugenia* species are of less importance. In a forest on Mt. Obree (p. 37) the major part of the vegetation was occupied by Conifers, among which also *Libocedrus papuana,* but *Quercus lamponga* and *Q. spicata, Eugenia, Cryptocarya,* and *Sideroxylon novoguineensis* (recte *Planchonella obovata*) were more abundant than in the former case. Forests of the Ubua Mts., near Laruni, consisted for 62.5 % of *Araucaria Cunninghamii,* for 18.6 % of *Quercus* sp., and for 4.8 % of *Podocarpus imbricata.* Lam (Fragm. Pap., 1928) described forests of Mt. Doorman mainly consisting of Conifers. As appears from the Conifers collected by him in this mountain, especially *Podocarpi* of the section *Dacrycarpus* are abundant. They were growing between 2430 and 2750 m elevation. Above 2750 m *Casuarina* and Conifers were the only trees. Also in the Arfak Mts. *Podocarpaceae* play an important part, as appears from the trees listed by Gibbs (Contrib. Arfak Mts., 1917, 27—32), such as *Podocarpus papuana, P. Rumphii, Dacrydium novoguineensis, Libocedrus arfakensis, Phyllocladus hypophylla,* and several Dicotyledonous species.

Steup mentions (Trop. Natuur, 27, 1934, 143), that in Central Celebes *Podocarpus neriifolia, P. imbricata, Phyllocladus hypophylla, Dacrydium elatum, Castanea acuminatissima, Eugenia* spp., and *Casuarina sumatrana,* constantly accompany *Agathis* in the *Agathis*-forests, but among them only *Phyllocladus* is abundant.

Podocarpus species sometimes occur in woods, which for the rest consist of few species of Dicotyledons only. According to herbarium labels, *Podocarpus imbricata* often occurs in the lower parts of the East-Javan *Casuarina* woods. According to De Voogd (Trop. Natuur, 27, 1938, 63), the summit of Mt. Moetis in Timor bears a pure *Eucalyptus* forest, but between 1500 and 2000 m elevation *Eucalyptus*

is intermingled with *Podocarpus imbricata* and *P. neriifolia* (var. *timorensis*) and as an undergrowth *Pygium latifolium*. Lane-Poole (l. c., p. 23) mentions *P. neriifolia* from forests around Embi Lake, which consist nearly entirely of *Anisophora polyandra* (65.14 %) and *Afzelia bijuga* (29.85 %).

A peculiar vegetation, in which *Podocarpaceae* occur, is that of the padangs, open sandy grounds with a heath-like vegetation. Such padangs with *Podocarpus* are described from the Malay Peninsula (cfr. Van Steenis, in Tijdschr. Kon. Aardr. Genootsch., 55, 1938, 756), Natoena Islands (Van Steenis, in Bull. Jard. Bot. Buitenzorg, sér. 3, XII, 1932, 151), and Borneo (Winkler, in Bot. Jahrb., 50, Suppl. vol. 1914, 204, and Witkamp & Posthumus, in Verslag Ned. Ind. Vereen. Natuurbesch., 1932, 81).

Most numerous are the indications in literature of forests, at different elevations, in which *Podocarpus* species are scattered between numerous other kinds of trees.

USE.

Different authors, e. g. Van Eeden (Houts. Ned. Ind., 1886; ed. 3, 1906), Filet (Plantk. Woordenboek, 1876), Gamble (Man. Ind. Timb., 1902), Ridley (Bull. Kol. Mus. Haarlem, 27, 1903), Koorders & Valeton (Bijdr. Booms. Java, 10, 1904), De Clercq (Nw. Plantk. Woordenb., 1909), Heyne (Nutt. pl. Ned. Ind., ed. 2, I, 1927), and Burkill (Dict. Econ. Prod. Mal. Pen., 2, 1935), mention that the wood of different *Podocarpi*, such as *P. imbricata, P. amara, P. Rumphii, P. neriifolia, P. Koordersii*, and *P. polystachya*, is used for building purposes and for making furniture. According to herbarium labels, *P. dacrydiifolia* is used for the same purposes. Especially *P. amara* and *P. imbricata*, which may be obtained in great quantities, are very useful in this respect. The wood of the latter species may also be used for making eating utensils, masts, tea boxes, and for carving figures. In general *Podocarpus* wood is not over-hard and easy to work. Especially when originating from high elevations it seems to be durable. Species growing near the sea shore are also used for making proas according to herbarium labels, e. g. *P. polystachya* and *P. neriifolia*. Species of the section *Nageia* furnish little durable wood and seem to be rarely used. The wood of *P. vitiensis* (sect. *Polypodiopsis*) on the contrary, is according to Gibbs (Ann. Bot., 26, 1912, 533) "the most valuable of the Fijian timbers, being not over-hard and very durable".

Other uses are rare. Ridley (ex Burkill l. c.) mentions, "that a decoction of the leaves of *P. neglecta*" (= *P. polystachya*) "may

be used as an alternative in rheumatism and for painful joints".

The most useful species, *P. imbricata* and *P. amara*, are nowadays abundantly planted for reafforestation purposes. As ornamental trees *P. imbricata, P. neriifolia, P. polystachya* and *P. macrophylla* ssp. *maki* are sometimes planted; the latter species is exclusively known as such in Malaysia.

Remarks to the keys. As flowers, fruits and seeds of many species are very inadequately (if at all) known, and are often little different in allied species, it was necessary to base the key for all species mainly on sterile materials. Where possible, the characters of the seeds and fruits were taken into account. The key thus obtained must necessarily be inadequate to determine all species with certainty. After each determination by means of it, the descriptions of the species must always be carefully matched.

In the section *Dacrycarpus*, however, fruits and seeds are rather completely known, with the exception of those of one species, and therefore a special key for this section based on the differences in these parts has been added.

In order to give an insight in the natural relationships of the sections it was desirable to furnish also a key to the sections based on the most essential characters. After having made use of this key, one may compare the descriptions of the species to which the plant in question appears to belong, or, for *Dacrycarpus*, the special key for this section.

Key to the subgenera and sections, based on the most essential characters.

1a. Female flowers spike-like, with 2—8 ovules, or with 1—2 ovules on the extremity of a small twig. Seed usually large, its testa with woody inner layer. Receptacle absent . . . . . Subgen. I. **Stachycarpus**, spec. 1.

b. Female flowers single in the leaf axils, or terminal on short lateral twigs. Ovule one, rarely 2. Receptacle present . . . . . Subgen. II. **Protopodocarpus**, spec. 2—25

2a. Carpids connate with the ovules and overtopping them. Flowers terminal on short lateral twigs. Leaves small, scale-like or subulate or linear, often dimorphic . . . . . Sect. 1. **Dacrycarpus**, sp. 2—9
Cfr. also the special key for this section, p. 379.

b. Carpids not connate with the ovules. Ovules usually much overtopping the very small carpid 3

3a. Leaves opposite 4

b. Leaves scattered, linear to oblong . . Sect. 4. **Eupodocarpus**, sp. 13—25

4a. Leaves large, broad, ovate to broadly lanceolate, with many longitudinal nerves . . . . . Sect. 2. **Nageia**, sp. 10—11

b. Leaves small, with a single rib . . . . Sect. 3. **Polypodiopsis**, sp. 12

Key to all the species, as far as possible adapted to sterile materials.

1a. Leaves scale-like or subulate, or in young plants linear and bifariously arranged. Flowers terminal on short lateral twigs. (*Dacrycarpus*) . . . 2
b. Leaves broader, with flat lamina, linear to ovate-elliptical 11
2a. Leaves scale-like or somewhat subulate, usually dorsiventrally flattened, usually entirely adpressed, 1.5—4 mm long 3
b. Leaves subulate, nearly adpressed, spreading or divaricate, 1.25—6 mm long 4
3a. Leaves nearly 1.5 mm long. Involucral leaves below the receptacle straight, usually quadrangular on transverse section or laterally flattened, abruptly narrowed into a fine apiculus, horizontally spreading, 2.5—5 mm long. Male flowers 2 mm in diam. Whole area, at 700—3000 m el. . **2. P. imbricata**
b. Leaves 1.5—4 mm long. Involucral leaves dorsiventrally flattened, abruptly narrowed into a fine apiculus, usually adpressed, 2.5—5 mm long. Male flowers 2.5—3.5 mm in diam. Sumatra, Java, on high mountains . . . . . **2. P. imbricata** var. β **curvula**
4a. Leaves subulate, dorsiventrally flattened, very thin, horizontally spreading, but abruptly incurved below the middle, 1.25—2 mm long. New Guinea, at 3000 m el. . . . . **9. P. leptophylla**
b. Leaves otherwise, thicker, usually longer 5
5a. Leaves short- and thick-subulate, strongly spreading, with the lower surface S-shaped, vaulted above, strongly keeled beneath, triangular to quadrangular on transverse section, 1.5—2.5 mm long. Involucral leaves below the receptacle straight, slightly laterally flattened, abruptly narrowed into an apiculus, horizontally spreading, up to 4 mm long. New Guinea, at 1450—3000 m el. . . . . **3. P. papuana**
b. Leaves otherwise. Involucral leaves not horizontally spreading . . . 6
6a. Leaves strongly spreading, subulate, very falcate, very rigid, nearly quadrangular on transverse section, 2.5—3 mm long. Involucral leaves usually spreading, curved upwards, rather gradually narrowed into a fine point, 3—4 mm long. Celebes, at 3000 m el. . . . . **4. P. Steupii**
b. Leaves spreading or nearly adpressed, 2.5—6 mm long. Involucral leaves erect and nearly adpressed, or erect-spreading, usually longer than the receptacle 7
7a. Leaves in the uppermost part of the twigs usually quinquefariously arranged, spreading, laterally flattened, 4—8 mm long; other leaves slightly spreading, nearly quadrangular on transverse section, 3—6 mm long. Involucral leaves laterally flattened, erect or erect-spreading, thick, 5—8 mm long. Apex of the carpid free. Borneo, Mt. Kinabalu, high elevations up to the tree limit . . . . . **2. P. imbricata** var. γ **kinabaluensis**
b. Quinquefarious, laterally flattened leaves few or absent. Involucral leaves usually adpressed, longer than the receptacle and often involucrating the seed, dorsiventrally flattened on transverse section or quadrangular . . . 8
8a. Leaves rhomboidal on transverse section or rarely dorsiventrally flattened. Plants often with pinnately leaved twigs. Involucral leaves nearly rhomboidal on transverse section, 7—13 mm long. Apex of the carpid free or not so . 9

b. Leaves slightly dorsiventrally flattened, 2.5—6 mm long. Plants rarely with pinnately leaved twigs. Involucral leaves usually slightly dorsiventrally flattened, sometimes more quadrangular, 5—10 mm long. Apex of the carpid connate with the seed 10

9a. Subulate leaves very fine, rhomboidal on transverse section, spreading, 4—6 mm long; bifarious linear leaves very narrow. Involucral leaves 7—11 mm long. Apex of the carpid not free. New Guinea, at 2300—3000 m el . . . . . **6. P. cincta**

b. Subulate leaves usually much coarser, slightly dorsiventrally flattened or rhomboidal on transverse section, nearly adpressed, 3.5—6 mm long; bifarious linear leaves broader. Involucral leaves 7—13 mm long. Apex of the carpid free. Sumatra, Philippines, Borneo?, high mountains up to 3300 m el . . . . . **5. P. Cumingii**

10a. Leaves spreading, somewhat curved, 2.5—5 mm long. Involucral leaves 4—10 mm long. Plants densely branched. New Guinea, at 2600—4200 m el . . . . . **8. P. compacta**

b. Leaves somewhat more adpressed, 4—6.5 mm long Involucral leaves up to 10 mm long. Plants widely branched. Celebes, at 1800—2000 m el. . . . . **7. P. dacrydiifolia**

11a. Leaves opposite 12

b. Leaves scattered 14

12a. Leaves small, 1.5—3 cm long by 3—5 mm broad, with a single rib, pinnately arranged (Sect. *Polypodiopsis*). New Guinea, Bismarck Archip., at 900—2000 m el. . . . . **12. P. vitiensis**

b. Leaves much larger, with many longitudinal nerves. (Sect. *Nageia*) . . 13

13a. Leaves elliptical to broadly lanceolate, rather shortly, sometimes longer-acuminate, or more gradually narrowed into the apex, 7—23 cm long by 2—7 cm broad. Male flowers 3—6 in axillary peduncles. Throughout the whole area, with the exception of Central- and East-Java and the Lesser Sunda Islands, at 0—2100 m el . . . . . **10. P. Blumei**

b. Leaves elliptical or oblong, narrowed into the often slightly rounded apex, 3—6 cm long by 13—28 mm broad. Male flowers solitary in the leaf axils. Malay Peninsula, Sumatra, Borneo, at 0—500 m el. . . . **11. P. Motleyi**

14a. Leaves linear-lanceolate, usually somewhat caudate-acuminate, 5—12 cm long by 6—14 mm broad; midrib impressed above. Terminal buds globose, obtuse. Male flowers usually 3 fasciculate on short axillary peduncles. Female flowers spike-like, with 2—3 ovules, without fleshy receptacle. Seed testa with fleshy outer layer and woody inner layer. Malay Archipelago, with the exception of Borneo, at 300—1800 m el. (Subgenus *Stachycarpus*) . . . . . **1. P. amara**

b. Leaves linear to oblong; midrib on the upper surface prominent, flat, or sometimes slightly impressed towards the apex. Terminal buds acute or obtuse. Male flowers single or in bundles of 2—8 in the leaf axils, usually sessile, rarely shortly peduncled. Female flowers axillary, with fleshy receptacle, usually composed of 2, rarely 3 or 4 fleshy scales. Ovules 1, rarely 2. Seed testa rather thin, bony (Sect. *Eupodocarpus*) 15

15a. Leaves all or for the majority deflexed 16

b. Leaves erect, spreading or divaricate 17

16a. Leaves all entirely deflexed, 10—27 cm long by 7—12 mm broad, 12—25 times as long as broad; midrib on the lower surface broadly channelled. Male flower buds nearly globose. Malay Peninsula (G. Tahan), at 1800—2000 m el. . . . . **13. P. deflexa**

b. Leaves for the majority deflexed, those of the youngest vegetation period often not so, 7—18 cm long by 5—8.5 mm broad, 10—20 times as long as broad; midrib not channelled beneath. Male flower buds ovate-acute. Sumatra (Atjeh), at 2250—3300 m el. . . . **17. P. neriifolia var. δ atjehensis**

17a. Terminal buds globose or ovate, obtuse. Margins of leaves parallel . . 18

b. Terminal buds ovate or conical, acute 21

18a. Leaves broad-lanceolate, often rather abruptly short-acuminate, 8.5—17 cm long by 16—26 mm broad, 5—9 times as long as broad. Sumatra, Riau, Bangka, Borneo, at 0—450 m el . . . **17. P. neriifolia var. ε Teysmannii**

b. Leaves narrow, linear-lanceolate, at least 10 times as long as broad . . 19

19a. Terminal buds large, ovate. Leaves usually thin-coriaceous, flexible, 10—18 cm long by 7—16 mm broad, 10—20 times as long as broad, rather gradually narrowed towards the apex; midrib narrowly prominent, or prominent as a narrow line. Male flower buds large, ovate, obtuse. Java . . . . . **17. P. neriifolia** var. ζ **linearis**

b. Terminal buds globose. Leaves thick-coriaceous, rigid; midrib on the upper surface prominent but not sharply delimited, or prominent as a narrow line, flat or slightly impressed towards the apex 20

20a. Male flowers in bundles of 2—8. Flower buds globose. Leaves 13—21 cm long by 9—18 mm broad, 12—24 times as long as broad, rather gradually narrowed towards the apex. Java (Noesa Kambangan), at 50 m el. . . . . **15. P. Koordersii**

b. Male flowers solitary. Flower buds subglobose. Leaves 6—23 cm long by 8—23 mm broad, 8—17 times as long as broad, rather shortly or gradually narrowed towards the apex. Borneo, Philippines, Celebes, Moluccas, Lesser Sunda Islands, New Guinea, at 0—1650 m el. . . . . **16. P. Rumphii**

21a. Midrib on the upper surface little rounded-prominent, prominent as a narrow line, flat, or slightly impressed 22

b. Midrib on the upper surface strongly prominent, sharply delimited . . 25

22a. Leaves usually obtuse, 2.5—8 cm long by 5—9 mm broad, 4—11 times as long as broad; midrib flat or slightly impressed. New Guinea . . . . . **21. P. thevetiaefolia**

b. Leaves acute; midrib usually impressed towards the apex 23

23a. Leaves linear-lanceolate, with the margins parallel, shortly or rather gradually narrowed towards the apex, 6—23 cm long by 8—23 mm broad, 8—17 times as long as broad. Borneo, Philippines, Celebes, Lesser Sunda Islands, Moluccas, New Guinea, at 0—1650 m el . . . . . **16. P. Rumphii**

b. Leaves usually lanceolate, with the margins not parallel 24

24a. Leaves very gradually narrowed towards the apex, with the largest width below the middle, 5—13 cm long by 6—12 mm broad, 7—13 times as long as broad. Malay Peninsula, at 650—1000 m el . . . . . **17. P. neriifolia** var. η **Ridleyi**

b. Leaves rather shortly narrowed towards the apex, 3.5—6.5 cm long by

8—11 mm broad, 4—6 times as long as broad. Timor, at 1500—2000 m el. . . . . 17. **P. neriifolia** var. ε **timorensis**

25a. Leaves usually narrowed at the apex, obtuse 26
b. Leaves abruptly or gradually rounded towards the apex, acute . . . 28

26a. Leaves more or less spreading, with the margins not or only slightly incurved, 1.5—8 cm long by 4—13 mm broad, 2.5—7 times as long as broad. Male flowers solitary. Peduncles of the fruits rather long and slender. Philippines, Celebes, Obi, New Guinea, Solomon Islands, at 700—3000 m el. . . . . 22. **P. Pilgeri**
b. Leaves usually erect-spreading or adpressed, usually with incurved margins 27

27a. Leaves lanceolate-spathulate, 3—7.5 cm long by 4—7 mm broad, 7—12 times as long as broad, very gradually narrowed towards the nearly sessile base. Male flowers in bundles of 3—5. Female peduncles rather long. Cultivated . . . . . 20. **P. macrophylla** ssp. **maki**
b. Leaves oblong-lanceolate, 1—2.25 cm long by 3.5—6 mm broad, 3—5 times as long as broad, not very gradually narrowed into a short petiole. Male flowers single. Female peduncles very short. Mindoro, Borneo (Mt. Kinabalu), at 1300—1700 m el. . . . . 24. **P. glauca**

28a. Leaves often abruptly and shortly acuminate towards the apex . . . 29
b. Leaves abruptly or gradually narrowed towards the apex, sometimes slightly long-acuminate 30

29a. Leaves oblong or oblong-lanceolate, nearly caudate-acuminate, 3.5—5 times as long as broad, 6—12 cm long by 17—28 mm broad; midrib prominent on both surfaces. New Guinea, at 1000 m el . . . 18. **P. Ledermannii**
b. Leaves lanceolate, less strongly acuminate, 4.5—8 times as long as broad, 6—16 cm long by 13—20 mm broad, often with a furrow on the lower surface instead of the midrib. Female flowers numerous, scattered all over the youngest vegetation periods. Ovules 1—2. Sumatra (Palembang), at 75—600 m el . . . . . 17. **P. neriifolia** var. ι **polyantha**

30a. Scales of the terminal leaf buds and the male flower buds membranous. Leaves lanceolate, 6—10 cm long by 7—10 mm broad, 7—10 times as long as broad. Celebes, at 1300 m el . . 17. **P. neriifolia** var. γ **membranacea**
b. Scales of the buds herbaceous or coriaceous 31

31a. Leaves more than 10 times as long as broad 32
b. Leaves less than 10 times as long as broad 34

32a. Leaves thick-coriaceous, very narrowly lanceolate, 12—18 cm long by 6.5—8 mm broad, 18—23 times as long as broad. Receptacle composed of 4 fleshy scales, of which 2 fertile. Solomon Islands, at 1000 m el . . . . . 14. **P. salomoniensis**
b. Leaves thin- or rather thick-coriaceous, sometimes with the margins parallel, lanceolate or linear-lanceolate. Receptacle composed of 2 fleshy scales . 33

33a. Male flower buds small, globose or globose-ovate, obtuse. Leaves 3—24 cm long by 6—28 mm broad, 3—20 times as long as broad. Whole area, at 0—2850 m el . . . . . 17. **P. neriifolia**
b. Male flower buds large, ovate, acute. Leaves 10—17 cm long by 9—14 mm broad, 8—15 times as long as broad. Java . . . . . 17. **P. neriifolia** var. β **bracteata**

34a. Leaves 3—10 cm long by 4—12 mm broad, 5—10 times as long as broad,

with the margins usually parallel, abruptly narrowed towards the apex; midrib broadly channelled beneath. Male flowers in bundles of 3—5. Female peduncles very short and thick. Malay Peninsula, islands East of Sumatra, Borneo, Philippines, Talaud Islands (Karakelang), at very low el. . . . . **19. P. polystachya**

b. Leaves rather shortly or gradually narrowed towards the apex, with the margins not parallel 35

35a. Leaves thin-coriaceous 36

b. Leaves thick-coriaceous, rigid 37

36a. Leaves lanceolate, apex without fine point. Male flowers 1—3 together. Female peduncles slender. Whole area, at 0—2850 m el . **17. P. neriifolia**

b. Leaves lanceolate, or slightly spathulate, often with a fine point or an obtuse apiculus at the apex, 1.5—8 cm long by 4—13 mm broad, 2.5—7 times as long as broad. Male flowers solitary. Female peduncles slender. Philippines, Celebes, Obi, New Guinea, Solomon Islands, at 700—3000 m el . . . . . **22. P. Pilgeri**

37a. Leaves erect-spreading, on 1—3 vegetation periods, oblong-lanceolate, 3—7.5 mm long by 8—14 mm broad, 4—6 times as long as broad; midrib broadly channelled beneath. Riau, Karimata Arch., Borneo, at low el. . . . . **19. P. polystachya** var. *β* **rigida**

b. Leaves usually adpressed to the twigs, usually on 2—5 vegetation periods. Bud scales often partly persistent 38

38a. Leaves usually lanceolate, acute, 1.5—5.5 cm long by 4—7 mm broad, 3—8 times as long as broad. Male flowers thick, 4—5.5 mm in diam.. Female peduncles very short, 2—4 mm long, strongly flattened. Luzon, Mindanao, Borneo (Mt. Kinabalu), above 3000 m el. . . . . **23. P. brevifolia**

b. Leaves elliptical-oblong to oblong-lanceolate, acute, but often with a small obtuse apiculus 39

39a. Leaves sometimes more spreading, 1.5—8 cm long by 4—13 mm broad, 2.5—7 times as long as broad. Male flowers slender, 2—3.5 mm in diam.. Female flowers on usually slender, 3—12 mm long peduncles. Philippines, Celebes, Obi, New Guinea, Solomon Islands, at 700—3000 m el. . . . . **22. P. Pilgeri**

b. Leaves nearly always adpressed, 1—1.8 cm long by 3—7 mm broad, 2—5 times as long as broad. Male flowers thick, 3—7 mm in diam.. Female peduncles short, thick, 3—9 mm long. New Guinea, at 3000—3700 m el. . . . . **25. P. Brassii**

Key to the species of the section Dacrycarpus, for fruit-bearing materials.

1a. Leaves very thinly subulate, divaricate, but abruptly incurved below the middle, very strongly dorsiventrally flattened, 1.25—2 mm long. New Guinea, at 3000 m el . . . . . **9. P. leptophylla**

b. Leaves thicker, scale-like or subulate, 1.5—6 mm long, sometimes with linear, bifariously arranged leaves 2

2a. Sterile involucral leaves below the receptacle horizontally or strongly spreading 3

b. Sterile involucral leaves erect-spreading, or erect and adpressed . . . 5
3a. Involucral leaves straight, usually horizontally spreading, abruptly narrowed into a fine point, usually somewhat laterally flattened 4
b. Involucral leaves usually somewhat incurved, usually spreading, more gradually narrowed into a fine point, triangular or quadrangular on transverse section. Celebes, at 3000 m el . . . . . 4. **P. Steupii**
4a. Typical leaves scale-like or somewhat subulate, usually adpressed, usually strongly dorsiventrally flattened. Whole area, at 700—3000 m el. . . . . 2. **P. imbricata**
b. Typical leaves shortly-subulate, strongly spreading, vaulted above, keeled beneath, the lower surface with an S-shaped curvation. New Guinea, at 1450—3000 m el . . . . . 3. **P. papuana**
5a. Involucral leaves not or hardly longer than the receptacle, dorsiventrally flattened. Sumatra, Java, at 1400—3300 m el. . . . . 2. **P. imbricata** var. **β curvula**
b. Involucral leaves usually much longer than the receptacle 6
6a. Involucral leaves very laterally flattened. Borneo (Mt. Kinabalu), above 3000 m el . . . . . 2. **P. imbricata** var. **γ kinabaluensis**
b. Involucral leaves dorsiventrally flattened or quadrangular on transverse section 7
7a. Typical leaves nearly quadrangular on transverse section; involucral leaves quadrangular on transverse section, 7—13 mm long, often involucrating the seed 8
b. Typical leaves somewhat dorsiventrally flattened; involucral leaves dorsiventrally flattened or quadrangular on transverse section, 5—10 mm long, usually only involucrating the basal part of the seed 9
8a. Apex of the carpid free, usually strongly prominent. Typical leaves usually more adpressed and coarser than in the following species. Leaves of the pinnate lateral twigs linear, rather broad. Sumatra, Philippines, Borneo ?, at high el., up to 3300 m . . . . . 5. **P. Cumingii**
b. Apex of the carpid connate with the seed, hardly prominent. Typical leaves very fine. Leaves of the pinnate lateral twigs very narrowly linear. New Guinea, at 2300—3000 m el. . . . . 6. **P. cincta**
9a. Involucral leaves dorsiventrally flattened. Typical leaves slightly spreading, 4—6.5 mm long. Plants widely branched. Celebes, at 1800—2000 m el. . . . . 7. **P. dacrydiifolia**
b. Involucral leaves quadrangular on transverse section or dorsiventrally flattened. Typical leaves spreading, somewhat incurved, 2.5—5 mm long. Plants densely branched. New Guinea, at 2600—4200 m el. . . 8. **P. compacta**

I. Subgen. **STACHYCARPUS** Engler

§ *Taxoideae* Bennett, in Horsfield, Pl. jav. rar., 1 (1838) 40. — Sect. *Stachycarpus* Endlicher, Syn. Conif. (1847) 218; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 399; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 518; de Kirwan, Conif., 2 (1868) 224; Gordon, Pinetum, ed. 2 (1875) 351; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1889) 105;

Pilger, in Engl., Pflanzenreich, IV, 5 (1903) 63; in Engl. & Pr., Nat. Pflanzenfam., Nachtr. 3 (1908) 3; Foxworthy, in Philipp. Journ. Sc., 6 (1911) Bot., 158; Stiles, in Ann. Bot., 26 (1912) 448; Gibbs, in Ann. Bot., 26 (1912) 537. — Subgen. *Stachycarpus* Engler, in Engl. & Pr., Nat. Pflanzenfam., Nachtr. (1897) 21; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 242, 245; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 262, 266.

Male flowers in terminal spikes, single or several together in the axils of bracts or leaves, or rarely several together fasciculate at the

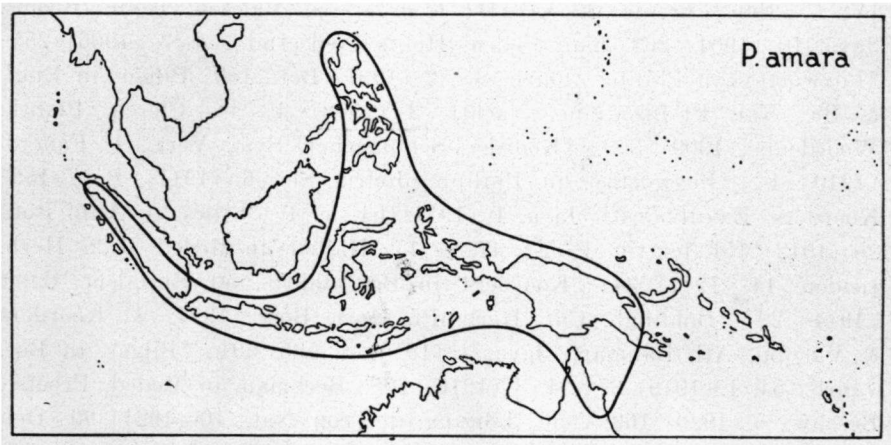

Fig. 1. Area of the only Malaysian species of the subgenus *Stachycarpus*.

apex of a naked peduncle*. Female flowers spike-shaped, composed of a woody twig with 2—8 remote, fertile carpids*, or the ovules 1—2 on the apex of a small leafy or scaly twig; carpids small, receptacle wanting; seed usually large or very large, the inner layer of its testa often thick and woody, the outer layer often fleshy. — Trees, often very tall; leaves scattered* or bifariously arranged, lanceolate or linear-lanceolate*, or small and linear; stomata on the lower surface only.

* Only the characters marked with an asterisk bear upon the species indigenous to the area dealt with.

1. Podocarpus amara Blume — *Podocarpus Sprengelii* Blume, in Flora, VII, 1 (1824) 292, nomen. — *Podocarpus amara* Blume, Enum. pl. Javae, 1 (1827) 88; Bennett, in Horsfield, Pl. jav. rar. (1838) 40; *Hasskarl, Cat. pl. Hort. Bot. Bog. (1844) 70; Endlicher, Syn. Conif. (1847) 217; Blume, Rumphia, 3 (1847) 213, t. 170; Junghuhn, Java, 1

(1851) 507; Walpers, Annal., 3 (1852) 448; Dietrich, Syn. pl., 5 (1852) 446; Miquel, Fl. Ind. Bat., II, 6 (1859) 1073; Kurz, in Nat. Tijdschr. Ned. Ind., 27 (1864) 216; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 395; Teysmann & Binnendijk, Cat. plant. Hort. Bot. Bog. (1866) 14; De Boer, Conif. Arch. Ind. (1866) 20, 28, 35, 36, 37; Carrière, Conif., II, ed. 2 (1867) 667; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 516; de Kirwan, Conif., 2 (1868) 228; Gordon, Pinetum, ed. 2 (1875) 327; Filet, Plantk. Woordenb. (1867) 138, 180, 182; Van Eeden, Houts. Ned. Ind. (1886) 135; Warburg, Monsunia, 1 (1900) 192; Koorders, in Nat. Tijdschr. Ned. Ind., 62 (1902) 216; *Pilger, in Engl., Pflanzenr., IV, 5 (1903) 68, ic. 13, A—D; Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 263; Van Eeden, Houts. Ned. Ind., ed. 3 (1906) 255; *Foxworthy, in Philipp. Journ. Sc., 2 (1907) Bot., 159; Pilger, in Engl. & Pr., Nat. Pflanzenfam., Nachtr. 3 (1908) 4; De Clercq, Plantk. Woordenb. (1909) 309; *Koorders-Schumacher, Syst. Verz., 1, Fam. 5 (1910) 1; *Foxworthy, in Philipp. Journ. Sc., 6 (1911) Bot., 159; Koorders, Exkursionsfl. Java, 1 (1911) 64, ic. 1; *Stiles, in Ann. Bot., 26 (1912) 451, textfig. 1, c, t. 47, ic. 17; Hallier, in Meded. Rijks Herb. Leiden, 14 (1912) 34; *Koorders, in Bot. Jahrb., 50, Supplem. Band (1914) 297; Boldingh, Cat. Herb. Pl. Hort. Bog. (1914) 4; Koorders & Valeton, Atl. Baumart. Java, 3 (1915) t. 590, 591; *Pilger, in Bot. Jahrb., 54, 1 (1916) 37; 54, 3 (1916) 208; Beekman, in Meded. Proefst. Boschw., 5 (1920) 169, t. 56; Lörzing, in Trop. Nat., 10 (1921) 99; Den Berger, in Meded. Proefst. Boschw., 7 (1922) 40, ic. 15; Koorders, Fl. Tjibodas, I, 2 (1922) 2; *Merrill, Enum. Phil. Fl. Pl., I, 1 (1923) 2; Seifritz, in Bull. Torr. Bot. Club, 50 (1923) 292; Lane-Poole, For. res. Papua (1925) 73, 37, 40, 64, 65; *Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 245, ic. 131, A—D; Heyne, Nutt. Pl. Ned. Ind., ed. 2 (1927) I, 108; *Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. 1 (1930) 236; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 262, 263, 266, ic. 73, b—c; von Malm, in Fedde, Repert., 34 (1934) 266; Janssonius, Mikrographie, 13 (1936) 478; Steup, in Trop. Nat., 27 (1938) 143; *Francis, in Queensl. Agric. Journ. (1939) 5; Wasscher, in Backer, Bekn. Fl. Java, 2 (1940) Fam. 18, 2. — *Podocarpus eurhyncha* Miquel, Fl. Ind. Bat., II, 6 (1859) 1074; supplem. Sumatra (1860) 252, 589; De Boer, Conif. Arch. Ind. (1866) 24, 28, 36, 37, t. III, 2; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 518; Gordon, Pinetum, ed. 2 (1875) 336; Filet, Plantk. Woordenb. (1876) 270; Fern.-Vill., Noviss. App. (1880) 211; Warburg, Monsunia, 1 (1900) 193; — *Podocarpus dulcamara* Seemann, in Bonplandia, 9 (1861) 253;

10 (1862) 365. — *Nageia amara* et *N. eurhyncha* Kuntze, Rev. gen. pl., 2 (1891) 800. — *Podocarpus pedunculata* Bailey, in Queensl. Agric. Journ., V, 4 (1899) 390, 404, t. 149; Queensl. Fl., 5 (1902) 1498; Compreh. Catal. Queensl. Pl. (1913) 510; Baker, Hardwoods Austr. (1919) 429.

* *P. amarus.*

Twigs scattered or subverticillate, spreading, rather slender, terete, with thickened base, more angular between the leaves. Terminal buds, small, globose; bud scales orbicular, ovate or obovate, obtuse, up to 2 mm long. Leaves scattered, spreading, somewhat coriaceous, usually straight, linear-lanceolate, with the margins parallel over a great part of the length, cuneately narrowed into the short petiole, usually slightly caudate-acuminate towards the rather obtuse apex, 5—15 (usually 8—11) cm long by 6—14 (usually 8—11) mm broad, 7—11 × as long as broad; midrib usually impressed in a narrow furrow above, broader and slightly prominent beneath; lamina with slightly recurved margins, shining above, dull beneath. Leaves of young plants more oblong-lanceolate, with abruptly and strongly caudate-acuminate apex, 4—11 cm long by 9—20 mm broad, 3.4—7 × as long as broad. Male flowers 1—4 (usually 3) on the top of very short, 1—5 mm long, usually somewhat flattened peduncles in the leaf axils, sometimes in more compound inflorescences; flowers cylindrical, up to 3.5 cm long and 3.5 mm in diameter, in the axils of triangular, adpressed, decurrent bracts, with few sterile scales at the base, which hardly differ from the stamens; connective with short, triangular, acute apiculus; pollen grains with 2 air bladders. Female flowers single in the leaf axils, composed of a spicate twig 3—5 cm long, with some crowded scars at the base and some remote scars in the lower half, the upper portion with 2—3 divaricate, ovate-triangular, obtuse, usually spreading, nearly 2 mm long carpids, which are decurrent on the thickened axis and 0.5—1 cm remote from each other; ovule nearly ovate, longer than the carpid, acuminate towards the furrowed apex; seeds 1—2, globose, with small, obtuse apiculus, up to 2.5 cm in diameter; testa composed of 2 layers, the outer one fleshy, 2—3.5 mm thick, the inner one hard and woody 1.5—2 mm thick. (Description from all the specimens examined.) Cfr. *Fig. 1.*

According to herbarium labels, *P. amara* is a tree up to 60 m tall and with a straight, columnal bole to 2 m in diameter, without buttresses, with greyish bark and horizontally spreading branches. The crown is usually irregular and usually occupies one-fourth to one-half

of the total height. The fruit is dark blue (Wind 6506), bluish black (Koorders 1216), red (Toxopeus s.n.) or black (Koorders 1219). The taste of the young fruit is bitter (b.b. 7192, b.b. 2924).

P. amara occurs in old, primary forests from 800 to 2000 m elevation, only rarely descending to 300 m, and once collected at 3600 m elevation (both New Guinea). It is, apart from the characters of the section, easily recognised in the sterile state by the small, globose terminal buds, the linear-lanceolate leaves somewhat caudate-acuminate towards the apex, and the midrib impressed on the upper surface.

On the very abruptly caudate-acuminate leaves of young plants Miquel based his *P. eurhyncha*. The leaves of adult trees are, according to Lane-Poole, up to 21 cm long. According to Seemann, the leaves have a sweet-bitter taste, whence the name *P. dulcamara* of this author. The seed is, according to Koorders and Pilger, up to 3 cm in diameter. According to Koorders' Exkursionsflora, the seed is black-purple, with bluish bloom; according to Francis it is bright red.

The male flowers are usually arranged in peduncled fascicles of three in the leaf axils, but sometimes they form more compound inflorescences; in the extreme case these inflorescences are composed of leafless twigs up to 3 cm long, bearing 3—5 fascicles of flowers as described above; in other cases we meet with inflorescences with 4—10 sessile, somewhat remote flowers on a common axis.

SUMATRA. Atjeh: subdiv. Gajo Loeëus, G. Agosan, 1800 m el., *Boschproefstation* b.b. 22449, v.n.: beboeloeh (B, s); Gajoe & Alas distr., Batok Toba (Koeta Bea), *Pringgo Atmodjo* 526 (B, L, f); Oostkust (E. coast): subdiv. Karolanden, *Houtvester* Sum. Oostkust 17 (B, L, m); Sigoeroenggoeroeng, on Laoet Kawar, 1500 m el., *Boschpr.* b.b. 5444 (B, L, s); Bandar Baroe, 1250 m el., *Boschpr.* b.b. 8351, v.n.: sitoboe (B, L, m); Oedjoeng Gorep, 1525 m el., *Boschpr.* b.b. 7192, v.n.: sangka sempilit (B, f); East Siboeatan, 1350 m el., *Galoengi-Schnepper* 10, v.n.: sitoboe (B, m); East of the Siboeatan, near Pantjarbaroe, 1400 m el., *Lörzing* 7119 (B, L, m); *Boschpr.* b.b. 2778, v.n.: sitoboe (B, L, f); subdiv. Simeloengoen, near Pematang Siantar, 700 m el., *Boschpr.* b.b. 20391, v.n.: medang merah (B, s); Marihat-hoeta, Batoeloteng Reserve, 800 m el., *Boschpr.* b.b. 2924, v.n.: sitoboe (B, L, f); Westkust (W. coast): Batangbaroes, *Teysmann* 517 H. B., v.n.: sapie (B, U, s), originals of *Podocarpus eurhyncha Miquel*; G. Singgalang, *Beccari* P. S. 295 (L, s); subdiv. Kerintji Painan, Padang Melintang, 1100 m el., *Boschpr.* 18734 (B, s); Palembang: subdiv. Pasemahlanden, Pg. Oebar, marga Lb. Boentaboenta, 1000 m el., *Boschpr.* T. B. 214, v.n.: kajoe boeloeh (B, L, s); Djangkar, 900 m el., *Boschpr.* b.b. 8130, v.n.: kajoe tadji (B, m).

BANGKA (very doubtful). Foot of G. Maras, near Pangkal-Lajang (ex *Kurz*, l. c.); cultivated in *Hort. Bot. Bogor.*, V. F. 91—91a, from Bangka (ex *Dakkus*, l. c.).

JAVA. Without exact locality, *Blume* s. n., v.n.: kiputri (L, m), perhaps ori-

ginals of the species; *Kuhl & Van Hasselt* s.n., v.n.: kimerak (L, m); West-Java: G. Gedé, *native coll.* s.n. (B, f); *"Houtsoorten van den Gedeh* 107", v.n.: ki-bima (L, m); *"Houtsoorten van den Gedeh* 637", v.n.: ki-putri lalakina (L, s); G. Gedé, Pasir Keroed, 1000 m el., *Boschpr.* Ja. 1908, v.n.: kimerak (B, L, s); *Boschpr.* Ja. 1909 (B, L, s); Tjibodas, coll.? (B, m); Tjibodas, 1425 m el., *Hallier* 183, v.n.: kibimah (B, s); *Koorders* for. no. 3074a, herb. no. 1245 (B, m), 1246 (B, L, s), 12607 (B, L, m), 41806 (B, s), v.n.: kajoe lilin or kililin; for. no. 3408a, herb. no. 42038, v.n.: kibima (B, s); 1500 m el., *Danser* 6100 (G, s); Tjibeureum, 1600 m el., *Koorders* 39352 (B, m), 39392, v.n.: kibima (B, L, f); Gegerbintang, *Koorders* for. no. 3235a, herb. no. 14326, v.n.: kibima (B, s); for. no. 3305a, herb. no. 15544, v.n.: kibima (B, f); 1500 m el., *Den Berger* 550 (B, L, s); Tjidjamboe, Soemedang (probably G. Boekittoenggoel), *Wind* 6506 (B, L, f); Takokak, *Koorders* for. no. 2124a, herb. no. 1238, v.n.: kimerak (B, s), 1239, v.n.: kibima (B, L, s), 11908 (B, L, s); 25577, v.n.: kimerak (B, L, s), 39623 (B, L, s); 1247 (B, s); G. Geulis (G. Kendeng, S.E. of Tjidadap & Tjibeber), 1000 m el., *Bakhuizen van den Brink* 5981 (B, s); *Bakhuizen van den Brink fil.* 3012 (U, s); Tjigenteng, *Koorders* for. no. 2197a, herb. no. 1241 (B, s), 1242 (B, m), 15748 (B, m), v.n.: kimerak; for. no. 2215a, herb. no. 15751, v.n.: kipait (B, L, m); for. no. 2216a, herb. no. 15752, v.n.: kipait (B, L, m); *Koorders* 1248 (B, L, m); Pengalengan, 1400 m el., *Opziener* Pengalengan X, v.n.: kimerak (W, f, m); Tjilaki near Pengalengan, *Warburg* 11117 (ex *Warburg* l.c.); G. Malabar, *Reinwardt* s.n. (L, s); *Kuhl & Van Hasselt* s.n. (L, s); Pangentjongan, *Koorders* for. no. 2416a, herb. no. 10944, v.n.: kimerak (B, f); for. no. 2416aa, herb. no. 14026, v.n.: kimerak (B, s), 14195 (B, L, s); 1400 m el., *Koorders* 13143, v.n.: kimerak (B, s); 1500 m el., *Koorders* 14185 (B, L, f, m); Pasir Ipis, *Koorders* for. no. 2442a, herb. no. 13855, v.n.: kimerak (B, s); 1500 m el., *Koorders* 14201 (B, m); Pangentjongan, G. Gloenggoeng, 1400 m el., *Koorders* 1257, v.n.: kimerak (B, s); near Koeboeran Tjimalaka, *Koorders* for. no. 2454aa, herb. no. 26576 (B, L, s); Pasir Kaboejoetan, *Koorders* for. no. 580*, herb. no. 26785 (B, L, f, m); Noesa Gedé in the Pendjaloe Lake, 720 m el., *Koorders* for. no. 99*, herb. no. 44322, v.n.: kibima (B, s); Central Java: G. Slamet, forest Bentjana, 1300—1400 m el., *Koorders* 1226, v.n.: kajoe toean (B, s); 1227 (B, s); 1228, v.n.: kajoe toean (B, s); N.W. G. Prahoe, forest Soerdja, 1400 m el., *Koorders* 11247, v.n.: kibima (B, L, s); G. Oengaran, Telemojo, *Koorders* for. no. 2268i, herb. no. 1220 (B, s); for. no. 2291i, herb. no. 1221 (B, s); for. no. 2432i, herb. no. 1224, v.n.: winong (B, s), 1225 (B, L, s); East-Java: G. Wilis, 2000 m el., *Warburg* 3531 (ex *Warburg*, l.c.); Ngebel, 1450 m el., *Koorders* for. no. 2099f, herb. no. 1216 (B, L, W, m), 1217 (B, s), 23340 (B, L, m), 38783, v.n.: tjemoro tikoeng (B, L, m); for. no. 2118f, herb. no. 1218 (B, L, f), 1219 (B, L, f), 38650, v.n.: tjemoro (B, L, f, m); for. no. 365*, herb. no. 29187, v.n.: tedji (B, f); G. Ardjoeno, 1800 m el., *Koorders* for. no. 2094*, herb. no. 38189 (B, s); G. Tengger, Tosari, forest Sekorkoening, 1650 m el., *Koorders* for. no. 1928*, herb. no. 37924, v.n.: tadji (B, L, s); G. Argobajoe, 1700 m el., *Bremekamp* s.n., v.n.: tadji (B, s); G. Ijang, Bermi-Taman Hidoep, 1500—2000 m el., Van Steenis 10844 (B, m); G. Kendeng, near Kajoemas, 1100 m el., *Backer* 30723 (B, L, f); Pantjoer Idjen, *Koorders* for. no. 4016t, herb. no. 1231 (B, L, m), 14377, v.n.: radin (B, s); for. no. 4117t, herb. no. 1232, v.n.: rodin (B, f), 1233, v.n.: rhadin (B, L, f), 14367, v.n.: radin (B, f), 28508, v.n.: radin (B, L, f); for. no. 4178t, herb. no. 14378, v.n.: radin (B, L, m), 21093

(B, L, m); for. no. 4185t, herb. no. 14379, v.n.: radin (B, f), 28506 (B, f), 32478 (B, f); for. no. 4202t, herb. no. 14380, v.n.: radin (B, L, f); for. no. 9426t, herb. no. 1234, v.n.: rodin (B, L, s), 1235, v.n.: radin (B, f); for. no. 889*, herb. no. 28503 (B, m); for. no. 2212*, herb. no. 21092 (B, m); for. no. 3446*, herb. no. 32439, v.n.: raden (B, s); *Koorders* 14381, v.n.: radin (B, f); 14382, v.n.: radin (B, m).

LESSER SUNDA ISLANDS. Bali: subdiv. Kloengkloeng, Pengadjaran, 1100 m el., *Boschpr.* b.b. 11784, v.n.: tjempadak (B, f); Tjatoer, 1200 m el., *Boschpr.* b.b. 16997, v.n.: tjempandak (B, s). Lombok: N. side of G. Rindjani, below Tengengeah, 950—1500 m el., *Elbert* 982 (L, s); Tengengeah, 1450—1600 m el., *Elbert* 996 (L, s). Soembawa: Batoelanteh, 1400 m el., *De Voogd* 1649 (B, s). Sóémba: Djagasnange, 975 m el., *Boschpr.* b.b. 5401, v.n.: bokhaoe (B, s). Timor: subdiv. Koepang, Leok, 800 m el., *Boschpr.* b.b. 17582, v.n.: haoe loeganel (B, f).

PHILIPPINE ISLANDS. Luzon: Benguet prov., *For. Bur.* 10895 coll. *Curran* (B, f); Lepanto subprov., *For. Bur.* 10951 coll. *Curran* (ex *Foxworthy*, in Phil. J. Sc., 6, 159). Mindoro: Mt. Halcon, 1800 m el., *Merrill* 5703 (ex *Foxworthy*, in Phil. J. Sc., 2, 258). Mindanao: Davao distr., Todaya, Mt. Apo, *Elmer* 11539 (B, L, m); *Elmer* 11682 (B, L, U, f).

CELEBES. Rante Mario, above 1500 m el. (ex *Steup* l. c.); subdiv. Enrekang, Sawito, 1600 m el., *Boschpr.* b.b. 20785, v.n.: doke doke, doke laki (B, s); G. Bantaèng, Loka, *Teysmann* 14069 (B, L, s).

MOLUCCAS. Batjan: G. Sibéla, S. slope, 1000 m el., *Boschpr.* b.b. 23242 (B, s); Boeroe: Fat' Koton, 1450 m el., *Toxopeus* s.n. (B, L, f); Wa' Lata, 1000 m el., *Boschpr.* b.b. 21497, v.n.: biali (B, s).

NEW GUINEA. N.W. Part: Pikpik, 500 m el., *Boschpr.* b.b. 22247, v.n.: towar (B, s); Mt. Genofa, 300 m el., *Boschpr.* b.b. 22582, v.n.: efroewetana (B, s); N.E. Part: Etappenberg, 850 m el., *Ledermann* 9421 (BD, m); Felsspitze, 1400—1500 m el., *Ledermann* 13000 (BD, m); Morobe distr., Sattelberg, 1100 m el., *Clemens* 3113 (BD, s); Yunzaing, 1500 m el., *Clemens* 3854-bis (BD, m); Ogeramnang, 1900—2000 m el., *Clemens* 5325 (BD, f); Ogeramnang, *Lane-Poole* 552 (ex *Lane-Poole* l. c.); S.E. Part: Boridi, 3600 m el., *Carr* 13486 (BD, L, m); 1700 m, *Carr* 14765 (L, f); Owen Stanley Range, Mt. Obree—Laruni spur, above 2000 m el., *Lane-Poole* 377 (ex *Lane-Poole* l. c.).

Cultivated: in the Buitenzorg Botanic Garden, V. F. 27, from Java (B, s); in Botanic Garden Sibolangit no. 24 (B, s).

II. Subgen. **PROTOPODOCARPUS** Engler

in Engl. & Pr., Nat. Pflanzenfam., Nachtr. (1897) 21; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 242, 245; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 267.

Female flowers single, on axillary peduncles or terminal on short lateral twigs; receptacle usually present; ovules single, rarely two.

1. Sect. **Dacrycarpus** Endlicher

§ *Dacrydioideae* Bennett, in Horsfield, Pl. jav. rar., 1 (1838) 41. — Sect. *Dacrycarpus* Endlicher, Syn. Conif. (1847) 221; Miquel, Fl. Ind.

Bat., II, 6 (1859) 1074; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 403; De Boer, Conif. Arch. Ind. (1866) 25; Carrière, Traité Conif., ed. 2, II (1867) 676; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 520; de Kirwan, Conif., 2 (1868) 224; Gordon, Pinetum, ed. 2 (1875) 356; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1889) 105; Beissner, Nadelholzkunde (1891) 17; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 55; in Engl. & Pr., Nat. Pflanzenfam., Nachtr. 3 (1908) 3; Foxworthy, in Philipp. Journ. Sc., 6 (1911) Bot., 156; Stiles, in Ann. Bot., 26 (1912) 448; Gibbs, in Ann. Bot., 26 (1912) 525; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 242, 245; Hickel, in Lecomte,

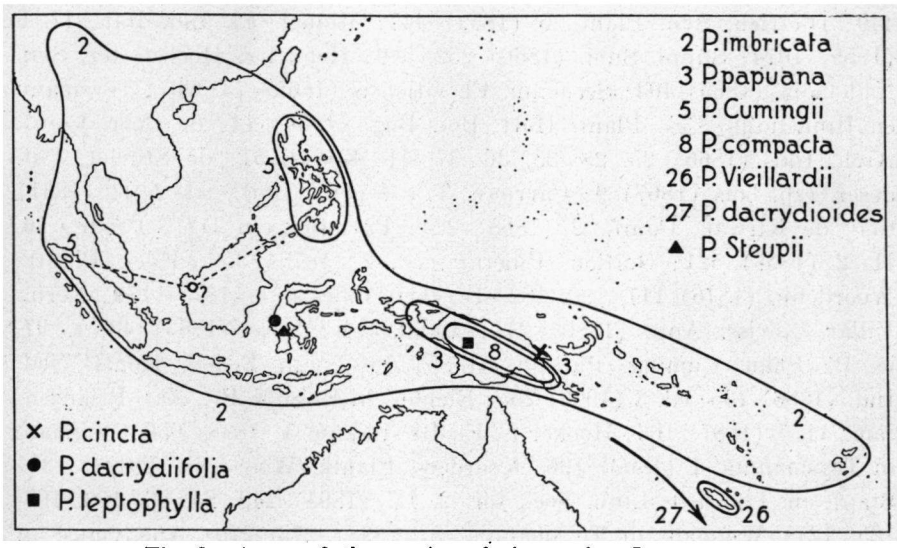

Fig. 2. Areas of the species of the section *Dacrycarpus*.

Fl. Indo-Chine, V, 10 (1931) 1066; Van Steenis, in Bull. Jard. Bot. Buitenzorg, sér. 3, XIII, 2 (1934) 194; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 267, 269; 19, 2 (1940) 23, 69, ic. 2.

Male flowers terminal on short lateral twigs, cylindrical; stamens only slightly different from the leaves; apiculus large. Female flowers terminal on short lateral twigs, of which the leaves surrounding the flowers are different from the typical ones; receptacle small, warty, composed of usually 2, sometimes more numerous fleshy leaf-bases, the sterile scales with short free lamina, the fertile ones with long free carpid, which overtops it at the apex; seed (incl. carpid and ephimatium) small, subglobose, with a coriaceous testa, which is distinguishable

from the carpid only at the apex. — Trees or shrubs, with very small, scale-like or subulate leaves, and especially in the young state moreover with short, sterile twigs with bifarious, linear leaves; stomata on both surfaces of the leaves.

2. Podocarpus imbricata Blume. — *Podocarpus cupressina* R. Brown, ex Mirbach, Geogr. Conif., in Mém. Mus. Hist. Nat., 13 (1825) 47, 75, nomen; Bennett, in Horsfield, Pl. Jav. rar., 1 (1838) 35, t. X; *Hasskarl, Cat. Plant. Hort. Bot. Bog. (1844) 70; Lindley, Veg. kingd. (1846) 231; Endlicher, Syn. Conif. (1847) 222; Blume, Rumphia, 3 (1847) 218, t. 172, ic. 2, 172-B, ic. 2; Junghuhn, Java, 1 (1851) 507, 546, 663; Miquel, Pl. Junghuhn, 1 (1851) 3; Walpers, Ann. Bot. Syst., 3 (1852) 449; Dietrich, Syn. Plant., 5 (1852) 447; Miquel, Fl. Ind. Bat., II, 6 (1859) 1074; Suppl. Sum. (1860) 252, 589; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 403; Seemann, Fl. vitiensis (1865—73) 267; Teysmann en Binnendijk, Cat. Plant. Hort. Bot. Bog. (1866) 14; de Boer, Conif. Arch. Ind. (1866) 25, 28, 35, 36, 37, 41, 42, 43, 51; de Sturler, Cat. descr. esp. bois (1867) 9; Carrière, Traité gén. Conif., ed. 2, II (1867) 677; de Kirwan, Conif., 2 (1868) 224; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 521; Gordon, Pinetum, ed. 2 (1875) 356; Filet, Plantk. Woordenb. (1876) 117, 180, 182; Beccari, Malesia, 1 (1878) 179; Fern.-Villar, Noviss. App. (1880) 211; Vidal, Sin. Atlas (1883) 43, t. 97, ic. B; Phan. Cuming. Philipp. (1885) 160; Van Eeden, Houts. Ned. Ind. (1886) 135; ed. 3 (1906) 255; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 106; Hooker f., Fl. Br. Ind., 5, 3 (1888) 650; Wigman, in Teysmannia, 1 (1890) 196; Koorders, Plantk. Woordenb. (1894) 130; Stapf, in Transact. Linn. Soc., ser. 2, IV (1894) 249, 84, 86, 103, 107, 125, 127; Wigman, in Teysmannia, 8 (1898) 273, 279; Anonymus, in Kew Bull. (1899) 110; Warburg, Monsunia, 1 (1900) 191; Gamble, Man. Ind. Timb. (1902) 702; Koorders, in Nat. Tijdschr. N. I., 62 (1902) 216; Ridley, Bull. Kol. Mus. Haarlem, 27 (1903) 105 = Agric. Bull. Str. and Fed. Mal. States, 1, 289; *Wigman, in Teysmannia, 15 (1904) 5, 463; Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 262; Brandis, Ind. Trees (1906) 696; De Clercq, Plantk. Woordenb. (1909) 309; *Ridley, in Journ. Str. Br. Roy. As. Soc., 60 (1911) 58; Hallier, in Elbert, Sunda-Exped., 2 (1912) 293, ic. 159; *Stiles, in Ann. Bot., 26 (1912) 458; Elbert, in Meded. Rijksherb. Leiden, 12 (1912) 5; Hallier, in Meded. Rijksherb. Leiden, 12 (1912) 10; Boldingh, Cat. Herb. Plant. Hort. Bot. Bog. (1914) 4; Koorders, in Bot. Jahrb., 50, Suppl. Band (1914) 280; *Leefmans, in Trop. Nat., 3 (1914) 87; *Lörzing, in Trop. Nat., 3 (1914) 123; *Ridley, in Journ. Fed. Mal. St. Mus., VI, 3 (1915)

198; VIII, 4 (1917) 87; von Wiesner, Rohstoffe Pflanzenr., ed. 3, II (1918) 362; Beekman, in Meded. Proefst. Boschw., 5 (1920) 171, t. 56; Beccari, For. Borneo, ed. 2 (1921) 148; Lane-Poole, For. res. Papua (1925) 73, 35, 37, 38, 39, 40, 50, 60, 65; Ridley, ex Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, XIII, 3 (1935) 338; Janssonius, Mikrographie, 13 (1936) 485. — *Podocarpus imbricata* Blume, Enum. pl. Javae, 1 (1827) 89; *Pilger, in Engl., Pflanzenr., IV, 5 (1903) 56; *Koorders-Schumacher, Syst. Verz., I, Fam. 5 (1910) 3; Koorders, Exkursionsfl. Java, 1 (1911) 64, ic. 2; *Foxworthy, in Philipp. Journ. Sci., 6 (1911) 157; Hallier, in Meded. Rijksherb. Leiden, 14 (1912) 34; Gibbs, in Ann. Bot., 26 (1912) 525, t. 49, ic. 1—9; Koorders, in Nova Guinea, VIII, 2 (1914) 616; *Koorders, in Bot. Jahrb., 50, Suppl. Band (1914) 297; Gibbs, in Journ. Linn. Soc., Bot., 42 (1914) 32, 35, 36, 41; Stapf, in Journ. Linn. Soc., 42 (1914) 193; Koorders & Valeton, Atlas Baumarten Java, 3 (1915) ic. 585, 586; *Pilger, in Bot. Jahrb., 54, 1 (1916) 36; *54, 3 (1916) 208; *Gibbs, Contr. Arfak Mts. (1917) 82; Merrill, Bibl. enum. Born. pl. (1921) 31; Lörzing, in Trop. Nat., 10 (1921) 98, fig. 1, 2; Koorders, Fl. Tjibodas, I, 2 (1922) 3; Seifritz, in Bull. Torrey Bot. Club, 50 (1923) 292, fig. 5; Lam, in Trop. Nat., 13 (1924) 20; *Ridley, Fl. Mal. Pen., 5 (1925) 283; *Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 245, ic. 124, E; Dammerman, in Trop. Nat., 15 (1926) 81; Delsman, in Trop. Nat., 15 (1926) 194, ic. 1; Heyne, Nutt. Pl. Ned. Ind., ed. 2, I (1927) 109; Schmucker, in Beih. Bot. Centralbl., 43, 2 (1927) 52, 63, 65; Lam, Fragmenta Pap., 5 (1928) 177 = Nat. Tijdschr. Ned. Ind., 88 (1928) 314; Van Steenis, in Trop. Nat., 17 (1928) 206; Jochems, in Trop. Nat., 18 (1929) 29; Docters van Leeuwen, in Bull. Jard. Bot. Buitenz., sér. 3, XI (1930) 29; Van Steenis, in Trop. Nat., 19 (1930) 76, 89; *Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. I (1930) 236; Hickel, in Lecomte, Fl. Indo-Chine, V, 10 (1930) 1068; Guillaumin, in Journ. Arn. Arb., 13 (1932) 117; Van Steenis, in Trop. Nat., 21 (1932) 106; in Bull. Jard. Bot. Buitenz., sér. 3, XIII, 1 (1933) 18; *XIII, 2 (1934) 194; XIII, 3 (1934) 313, 338; Polak, in Verh. Kon. Akad. Wet. Amsterdam, XXX, 3 (1933) 66, 74, t. I, ic. 23, t. IV, ic. 134; Docters van Leeuwen, Verh. Kon. Akad. Wet. Amsterdam, 31 (1933) 16, 18, 19, 47, 49, 53, 66, 95; Steup, in Trop. Nat., 23 (1934) 62; *Merrill, in Contr. Arn. Arb., 8 (1934) 14; *in Proc. Fifth Pac. Sci. Congr. Can., 4 (1934) 3269; von Malm, in Fedde Rep., 34 (1934) 266; Van Steenis, in Tijdschr. Kon. Ned. Aardr. Gen., 52 (1935) 45, 52, 390; *Burkill, Dict. Econ. Prod. Mal. Pen., 2 (1935) 1779; *Pilger, in Bot. Jahrb., 68 (1936) 244; Van Steenis, in Bull. Jard. Bot.

Buitenz., sér. 3, XIV, 1 (1936) 59, 65; Venema, in Blumea, suppl. 1 (1937) 89; De Voogd, in Trop. Nat., 27 (1938) 63; Steup, in Trop. Nat., 27 (1938) 143; Van Steenis, in Tijdschr. Kon. Ned. Aardr. Gen., 55 (1938) 762, 790; Hoogerwerf, in Elfde Versl. Ned. Ind. Ver. Nat. besch. (1939) 263; Grevenstuk, in Trop. Nat., 28 (1939) 65; Wasscher, in Backer, Bekn. Fl. Java, 2 (1940), Fam. 18, 2; Florin, in Kungl. Svensk. Vet. Akad. Handl., 19, 2 (1940) 23, 69. — *Nageia cupressina* Kuntze, Rev. Gen. Plant., 2 (1891) 800. — **Podocarpus javanica* Merrill, in Philipp. Journ. Sc., 19 (1921) 338; *Enum. Philipp. Fl. Pl., I, 1 (1923) 3; Van Steenis, in Trop. Nat., 20 (1931) 169; *H. H. Hu, in Proc. Fifth Pac. Sc. Congr., 4 (1934) 3274, 3283, 3286; *Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 267, 268, 285, t. 29, ic. 10.

**imbricatus*, *javanicus*.

Seedlings and young, sterile main twigs covered with densely imbricate, adpressed, thin, dorsiventrally flattened leaves, which are narrowly triangular-subulate, 3—4 mm long and 0.75 (rarely up to 1.25) mm broad, sessile with broad base and decurrent on the twig, with prominent midrib on the lower surface, acuminate into a thin mucro towards the apex; sometimes the twigs partly with thicker, adpressed leaves, which are strongly keeled on the back, and sometimes slightly spirally twisted around the twig; rarely the leaves entirely laterally flattened and somewhat spreading. Sterile lateral twigs bifariously alternating on the main twigs, at distances of 0.5—3 cm from each other; leaves in a basal portion 3—10 mm long of the lateral twigs small, adpressed, imbricate, subulate, up to 2 mm long, for the rest pinnately arranged, thin-coriaceous, laterally flattened, linear, slightly falcate towards the base and the apex, attached to the twig with broad base, attenuate into a thin apical mucro, the longest middle ones 5—7 mm long by 0.75—2 mm broad, the pinnate leafy twigs nearly lanceolate-ovate or sometimes sub-elliptical in outline, 2—10 cm long by 7—30 (usually 10—22) mm broad; midrib slightly prominent; lamina shining and with a narrow line bearing 1—3 longitudinal rows of stomata along each side of the midrib on both surfaces. Youngest terminal shoots slender, sometimes very long (up to 20 cm) overtopping the youngest lateral twigs, bearing narrowly triangular-subulate leaves, penicillate terminal buds, and bifariously alternating lateral buds. Twigs in more adult trees very strongly branched and crowded; old twigs covered with the remnants of the triangular-subulate leaves decurrent with dilated base; lateral twigs often with thickened base, usually separated from the main twig by a groove, straight or slightly curved, slender, cord-shaped, 0.75—1.25 mm

in diam. incl. the leaves; the leaves densely imbricate, entirely adpressed, thick-coriaceous, dorsiventrally flattened, scale-like or slightly subulate, somewhat narrowed towards the base, rather shortly narrowed into a thin mucro towards the apex, about 1.5 mm long, keeled beneath, rarely somewhat subulate and spreading; the twigs sometimes dilated at the apex into a pinnate portion with the leaves thicker-coriaceous than in young plants. Male flowers terminal on short lateral twigs, 2—3.5 cm long, bearing acute scale-like leaves, cylindrical, 7—12 mm long by 2 mm in diam.; stamens with large, triangular, acute, keeled apiculus; pollen grains with 3 air bladders. Female flowers terminal on short, often nutant lateral twigs bearing short, scale-like leaves, which often are slightly larger towards the extremity and there forming an involucre of subulate usually nearly quadrangular or slightly laterally flattened sterile leaves which are abruptly acuminate into a fine mucro; receptacle composed of 2 or more fleshy leaf-bases, the sterile ones of which bear a short, cylindrical, slightly flattened, obtuse, free lamina; the fertile one, or sometimes two, with an oblong carpid. Fruit-bearing twigs 3—15 mm long; involucral leaves below the ripe fruit horizontally spreading 2.5—4 mm, rarely up to 5 mm long; receptacle short-cylindrical or slightly obconical, 3—4 mm long and in diam., warty; sterile laminae up to 3 mm long. Seed subglobose, rarely slightly narrowed towards the apex, obtuse, 4—6 mm in diam., erect or somewhat oblique, often with slightly prominent rib on the back and with slightly prominent margin of the carpid at the apex. (Description from all the collections mentioned below.) Cfr. *Fig. 2; Plate IV, 2.*

P. imbricata is a tree up to 60 m tall (according to Junghuhn, 1851, p. 509, foot-note, this is exaggerated). The bole is usually columnal, terete, to 2 m in diam., and without buttresses or with small ones; the crown is usually highly attached and is thin. The bark is reddish (Bangham 1074), dark-brown (Koorders 1270, Boschpr. b.b. 8532, b.b. 15504 and b.b. 5460), dark brownish-black (Koorders 1271), dark grey (Koorders 1274) or grey (Koorders 1269). The wood is light red (Boschpr. b.b. 8532, b.d. 5460), yellow (b.b. 15504), or brown, not citrine (Endert 3682). The bark is said to yield some resin (Boschpr. b.b. 5543), colourless sap (b.b. 8532, Ja. 1925, b.b. 19559), a little white sap (b.b. 7708 and b.b. 11629), a little red sap (b.b. 6934), or a little light red sap (b.b. 12602). The male flower is green (Bünnemeijer 4340) or reddish green (b.b. 23538). The fruit is green (Clemens 33618 and 51635, Koorders 27705), yellow-green (Boschpr. 15504), or red (b.b. 5443, Sapiin s.n., Koorders 1279 and 1281, Clemens 3323).

According to statements by different authors the receptacle is red (Brandis, l. c., Delsman, l. c.), or yellow-green, purple later (Pilger, 1903, l. c.), and the seed is red (Brandis, l. c., Koorders and Valeton, 1904, l. c., Van Eeden, 1906, l. c., Ridley, 1911, l. c.). The bark is reddish (Koorders and Valeton, l. c., Van Eeden, l. c.), or reddish-brown (Koorders, 1911 l. c., Ridley, 1903, l. c.), greyish brown or light yellow (Burkill, l. c.), greyish-yellow or light greyish-brown or yellow (Heyne, l. c.).

P. imbricata occurs in primary and secondary forests from 700 m up to about 3000 m el., but especially between 1000 and 2000 m el. (according to Koorders and Valeton, l. c., in Java especially between 1400 and 1750 m el.). At this altitude the specimens usually grow scattered, whereas the columnal boles raise their crowns to above the canopy of the forest. Yet, also above 2500 m el. there occur 15—20 m tall trees (Mt. Kinabalu, Clemens 33618, Celebes, Boschpr. b.b. 15155, and Kjellberg 3792). From the New Hebrides I saw a collection from only 165 m el. Moreover, *P. imbricata* is cultivated as an ornamental tree, and is, at present, much planted for reafforestation.

The pinnate twigs are usually not branched and have a limited growth; it seems likely, that they will be shed as a whole.

Some plants from the Malay Peninsula and Sumatra have the leaves on the fertile twigs much coarser, less scale-like, longer and narrower, slightly spreading and often slightly falcate, *e. g.* the collections For. Dep. F. M. S. 22563 and 28284, Kelsall 1984, Boschpr. b.b. 4130, and b.b. 2436. Also the specimen Endert 3682, from Borneo, has the leaves coarser and somewhat spreading, but the female flowers are entirely typical. The leaves of Bur. Sci. 10829, from Luzon, are somewhat more subulate. On the other hand, there occur plants with the scale-like leaves finer, slightly spreading, strongly keeled on the back, and often more or less convex above, *e. g.*, Lörzing 8936, b.b. 7708, Bünnemeijer 4340, and De Voogd 119, all from Sumatra, Bur. Sci. 8328 from Luzon, and Boschpr. b.b. 23538 from Celebes. Also the leaves of Carr 13264, from New Guinea, are somewhat spreading, whereas the 2—6 cm long and 4—6 mm broad, terminal, pinnate twigs are linear in outline. I have also included the specimen Gjellerup 1148, from New Guinea, in this species, though it strongly deviates as regards the foliage; the short, subulate leaves are rather strongly spreading and this points somewhat towards *P. papuana*; the fruits, however, are entirely typical.

The specimens Sing. Field no. 27010, Clemens 28631 and 29779, all from Mt. Kinabalu at ca. 5000 ft el., are 30—100 ft tall trees of normal

shape and foliage. The specimens Sing. Field no. 27735 and 27553, from 6500 ft. el., and Clemens 33618 and 51635, from 8000 ft el., however, are in some respects intermediary between the former specimens and the var. *kinabaluensis*, especially as regards the foliage. The sterile leaves below the fruit are strongly laterally flattened, but straight or very slightly falcate, nearly horizontally spreading, and nearly 5 mm long. The seed, however, shows the typical shape.

In *P. imbricata* the sterile leaves below the very young female flowers are perhaps always erect and envelop the flower entirely or for a great part. Below the ripe fruit, however, they are nearly always horizontally spreading and usually subquadrangular or slightly laterally flattened. By these characters the species may be distinguished from all other species and varieties, with the exception of *P. papuana*.

The receptacle, which is usually composed of 2 fleshy bracts, sometimes is composed of more numerous, scattered bracts, of which sometimes 2 are fertile. The sterile parts, which usually are of a different length, mostly bear a free, short lamina each. In such cases the two fertile scales are not exactly opposite, but sometimes more obliquely so, which reveals the spiral structure of the receptacle.

MALAY PENINSULA. Kedah: Kedah Peak, 1000 m el., *For. Departm.* F. M. S. Field no. 13654 coll. *Watson* (S, s); *Low* (ex *Ridley* 1925, l. c.); *Griffith* (ex *Ridley* 1911, l. c.); Penang: *Wallich, Maingay* (ex *Hooker* 1888, l. c.); Penang Hill, *Curtis* (ex *Ridley* 1911, l. c.); Perak: Cameron's Highlands, Tapah, *For. Departm.* F. M. S. Field no. 10937 coll. *Henderson* (S, m); G. Batu Putih, *Wray* (ex *Ridley* 1925, l. c.); Pahang: Fraser Hill, *For. Departm.* F. M. S. Field no. 22563 coll. *Deris*, v.n.: ru (S, f); Kluang Terbang, *Barnes* 10907 (S, f); G. Tahan, by the Teku (ex *Ridley* 1915, l. c.); S. Telom, 900 m el., *Sing.* Field no. 23931 coll. *Strugnell* (B, s); S. Gesoh, *For. Dep.* F. M. S. Field no. 28284 coll. *Dolman*, v.n.: ru bukit (S, f); P. Tioman, G. Kajang, 1100 m el., *Sing.* Field no. 18608 coll. *Md. Nur* (S, s); Selangor: Bukit Hitam, *Kelsall* 1984 (S, s); Semangkok Pass, *Ridley* 8635 (ex *Ridley* 1911, l. c.); Batang Padang, Pahang Track, Semangkok Pass, *Burn Murdoch* 11964 (S, s); Johore: G. Pulai, *Ridley* 3716 (S, f).

SUMATRA. Atjeh: Boer-ni-Lintang, 1800 m el., *Van Steenis* 6290 (B, s); Gajolanden, from bivouac K. Kapi and K. Aoenan to bivouac Paja, 1100—1250 m el., *Van Steenis* 9957 (B, s); G. Kemiri, 3300—2850 m el., *Van Steenis* 9712 (B, s); Gajo- en Alaslanden, Gajo Loeëus, G. Paragan, *Pringgo Atmodjo* 82 & 90 partly (B, L, s); Oostkust (E. coast): near Pantjarbatoe, E. foot of the Siboeatan, 1400 m el., *Lörzing* 7117, v.n.: sampinoer boenga (B, L, f); above Bandarbaroe, 1200—1300 m el., *Lörzing* 6676 (B, s); Dolok Singgalang, 1800 m el., *Lörzing* 8936 (B, f); near Piso-piso, 1350—1500 m el., *Bangham* 1074 (S, s); *Bangham* 1127 (ex *Merrill* 1934, l. c.); Siosar, 1575 m el., *Lörzing* 8627 (B, L, s); Sibajak, 1900 m el., *Lörzing* 8299 (B, s); subdiv. Karolanden, Sigoeroenggoeroeng, on the Laoet Kawar, 1500 m el., *Boschproefstation* b.b. 5443, v.n.: beroe, sampinoer boenga (B, L, f); Pantjoerbatoe, res. Siboeatan, 1400 m el., *Boschpr.* b.b. 2768, v.n.: sam-

pinoer boenga (B, L, f); b.b. 7708 (B, L, f); Tongkoh, 1800 m el., *Boschpr.* b.b. 6235, v.n.: kajoe roe (B, s); subdiv. Simeloengoen, Marehat Hoeta, 700 m el., *Boschpr.* b.b. 4866, v.n.: sapinoer damanik (B, L, s); Girsang, 1200 m el., *Bosohpr.* b.b. 8532, v.n.: sapinoer boenga (B, s); Simeloengoen, *Yates* 2148 (B, L, s); Berastagi, *Yates* 1987 (L, S, s); Tinggiradja, *Jochems* 24 (B, s); Tapiannoeli: Loeboekraja, 1000—1300 m el., *Junghuhn* s.n. (L, s); 1600—1900 m el., *Junghuhn* s.n. (L, s); Westkust (W. coast): Alahanpandjang, *Teysmann* 518 H.B., v.n.: kayoe ambo (B, U, s); Padangsche Bovenlanden, G. Singgalang, *Becoari* P.S. 49 (L, s); 2500 m el., *Schiffner* 1474 (L, f); 1700 m el., *Schiffner* 1473 (L, s); G. Pago, 1400 m el., *Bünnemeijer* 4340 (B, f); id., 2000 m el., thicket, *Bünnemeijer* 4022 (B, s); subdiv. Solok, Loeboeksoelasih, res. Airtaroesan, 1000 m el., *Boschpr.* 4130, v.n.: kajoe amboen (B, L, U, W, s); subdiv. Kerintji Indrapoera, Air Lebo, 1200 m el., *Boschpr.* b.b. 18752, v.n.: kajoe emboen (B, S, s); G. Kerintji, Siolok Daras, 1000 m el., *Ridley* (ex *Ridley* 1917, l.c.); Bengkoeloe: subdiv. Redjang, near ds. Airdingin, Paja Magelang, *Boschpr.* b.b. 2436 (B, L, s); subdiv. Kroeï, Waimengakoe, 950 m el., *Boschpr.* b.b. 8737, v.n.: talas (B, L, U, s); G. Pesagi, 1700 m el., Rappard P. 19 (B, s); G. Pesagi, Liwa, 1800 m el., *De Voogd* 119 (B, s); 1700 m el., *De Voogd* 134 (B, s); Palembang: subdiv. Pasemahlanden, Pg. Meroenggang, marga Boemiagoeng, slope of the G. Dempo, *Boschpr.* T. B. 449, v.n.: roe (B, f); G. Seminoeng, 1800 m el., *Rappard* S. 28 (B, s); near summit of G. Pesagi, 2000 m el., *Van Steenis* 3695 (B, s).

Borneo. British North Borneo: Mt. Kinabalu, E. of Lodge, 1650 m el., *Clemens* 29779 (B, L, s); *Clemens* 28631 (B, L, S, s); path to Ranau, 1600 m el., *Sing.* Field No. 27010 coll. *Carr* (S, f); Kadamaian River, 2150 m el., *Sing.* Field No. 27735 coll. *Carr* (S, f); main spur below Kamborangah, 2150 m el., *Sing.* Field No. 27553 coll. *Carr* (S, f); above Panataran Basin, 2600 m el., *Clemens* 33618 (B, L, f); Masilau River, 2600 m el., *Clemens 51635* (L, f); Sarawak: *Moulton*; *Foxworthy* (ex *Merrill* 1921, l.c.); G. Wah, 700 m el., and G. Poë, 1150 m el., *Becoari* (ex *Parlatore* 1868, l.c.); Kapit, Upper Rejang River, *Clemens* 21066, cultivated (B, s); Western part: G. Damoes, *Hallier* B. 458 (B, s); Southern Part: without exact locality, prob. G. Sakoembang, *Korthals* s.n. (G, L, f); G. Sakoembang, *Korthals* s.n. (L, s); Eastern Part: West Koetai, near Kong Kemoel, 1100 m el., *Endert* 3682 (B, f).

Java. Without exact locality: *Blume* s.n. (L, f); *Wichura* 2237 (ex *Pilger* 1903, l.c.); *Junghuhn* s.n., v.n.: kimerak (B, L, U, s); *Korthals* s.n. (L, s); *Waitz* s.n. (L, s); *Waitz* s.n., seedling (L, s); W. Java: Nirmala, 1200—1500 m el., *Backer* 11050 (B, s); G. Salak, *Koorders* 24182, v.n.: kitjamara (B, L, s); *Zollinger* 2229 or 2262 (U, f); G. Gadjah, 1500 m el., *Bakhuizen van den Brink fil.* 726 (U, s); G. Tjisalak above Tjitjoeroeg, *Bakhuizen van den Brink fil.* 2553 (U, s); G. Gedé, *De Vriese* s.n. (L, f); between Tjipanas and Tjibodas, 1500 m el., *Hallier* 427 (B, f); Tjibodas, 1400—1500 m el., *Sapiin* s.n., v.n.: kipoetri (B, f); *Raap* 713 (L, f); *Sapei* 147 (B, f); *Hallier* 653 (B, s); *De Monchy* s.n. (B, L, s); *Danser* 5886 (G, s); *Backer* 31326 (B, m); *Van Steenis* 1882 (B, s); *Koorders* for. no. 3053a, herb. no. 1270, v.n.: *kitjamara* (B, L, f), 12618 (B, f); 15582 (B, f), 41790 (B, s); for. no. 3073a, herb. no. 1271, v.n.: kipoetri (B, f), 1272 (B, s), 12608 (B, f); for. no. 3090a, herb. no. 1273, v.n.: kipoetri (B, L, s), 12599 (B, f), 41820 (B, s); for. no. 3127a, herb. no. 1274, v.n.: kitjamara (B, W, s), 12581 (B, s), 41843 (B, s); for. no. 3276a, herb. no. 25922 (B, L, f), 41951 (B, f); for. no. 3312a, herb.

no. 25819, v.n.: kibima (B, s); for. no. 3342a, herb. no. 41972 (B, s); for. no. 2578*, herb. no. 37111 (B, s); 1600 m el., *Koorders* 39364, v.n.: kipoetri (B, s); forest G. Poetri, *Koorders* for. no. 3243*, herb. no. 14321 (B, s); forest Rawahpandjang, *Koorders* for. no. 3295a, herb. no. 15534, v.n.: kitjamara, kipoetri (B, L, s); G. Gedé, S. slope, 1800 m el., *Backer* 14742 (B, s); 2400 m el., *Backer* 3358, v.n.: kipoetri (B, s); Tjibeureum, *Arsin* 19690 (B, s); *Schiffner* 1475 (L, f); way to the hot springs, *Boerlage*, s. n., v.n.: kipoetri (B, L, f); way to Kandang Badak, 2390 m el., *Bruggeman* 3716 (B, s); Kandang Badak, *Burck* s. n., v.n.: kibima (B, s); above Kandang Badak, 2500—2550 m el., *Backer* 31376 (B, s); G. Pangranggo, *Kuhl & Van Hasselt* s. n. (L, s); 2900 m el., *Palmer & Bryant* 988 (S, s); Gegerbintang, *Koorders* for. no. 3233a, herb. no. 14323, v.n.: kipoetri (B, s), 41921 (B, f); 1500 m el., *Den Berger* 549, v.n.: kipoetri (B, L, s); 2000 m el., *Den Berger* 637 (B, m); G. Boerangrang, N. Slope, 1500—1600 m el., *Backer* 14329 (B, s); 1800 m el., *Bakhuizen van den Brink* 4606 (B, s); Pasir Kohok, 1220 m el., *Bakhuizen van den Brink* 4422 (B, s); G. Tangkoebanprahoe, *Scheffer* s. n., v.n.: djamoedjoe (B, f); above Lembang, *Junghuhn* s. n. (L, f); Bandoeng, *Junghuhn* s. n., v.n.: kitjamara (L, f); "Kina-Bandoeng", *Scheffer* s. n., v.n.: jamoedjoe (B, s); reg. Bandoeng, forest garden G-F, 2000 m el., *Boschproefstation* Ja. 4001, v.n.: djamoedjoe (B, s); 2100 m el., *Boschpr.* Ja. 3986 (B, s); Takokak, Djampangwètan, 1150 m el., *Koorders* 1277 (B, s); for. no. 2019*, herb. no. 27704, v.n.: tjemara (B, L, s); for. no. 2396*, herb. no. 15535, v.n.: tjamara (B, L, f); Goenoeng Rosa, S. of Lampegan, 1200 m el., *Leefmans* s. n. (B, s); Tjigoea, S. of Tjireunghas, 1150—1200 m el., *Backer* 15121 (B, s); G. Bèsèr, 1100 m el., *Winckel* s. n., v.n.: kihadji (L, s); *Bakhuizen van den Brink* 740, v.n.: kihadji (B, s); 1300 m el., *Bakhuizen van den Brink* 1936, v.n.: kihadji (B, L, s); *Backer* 22582 (B, s); Tjempaka, S. of Tjibeber, 1100 m el., planted along the road, *Backer* 23017 (B, s); *Bakhuizen van den Brink* 1811 (B, L, s); reg. Bandoeng, Datarpoespa, 1700 m el., *Boschpr.* Ja. 1925, v.n.: djamoedjoe (B, s); Tjigenteng, *Koorders* for. no. 2170a, herb. no. 1269, v.n.: djamoedjoe (B, m); *Koorders* 1276 (B, f); Pengalengan, 1500 m el., *Opziener* Pengalengan XIII, v.n.: djamoedjoe (W, f); G. Tiloe, *Warburg* 11119 (ex *Warburg* 1900, l. c.); G. Malabar, 1800 m el., *Pulle* s. n. (B, U, s); G. Patoeha, Telaga Patengan, *Junghuhn* s. n. (L, s); G. Kendang, 1000—2000 m el., *Junghuhn* s. n. (L, s); G. Kendang. Kawah Manoek, *Van Rijckevorsel* 66 (B, s); G. Tjikoerai, above Waspada, 1800 m el., *Backer* 5406 (B, s); G. Oeroeg, *Smith & Rant* 350 (B, f); G. Telagabodas, *Boerlage* s. n. (L, s); Pangentjongan, *Koorders* 1275 (B, L, s); 14159 (B, f); Forest Pasirbingking, *Koorders* for. no. 2433aa, herb. no. 14122, v.n.: kihades (B, s); forest Pasirkaboejoetan, 1500 m el., *Koorders* 14141, v.n.: kihades (B, L, f); Pangentjongan, N.W. G. Gloengoeng, 1400 m el., *Koorders* 1299, v.n.: kihades (B, s); Noesagedé, in the Pendjaloe Lake, 720 m el., *Koorders* for. no. 705*, herb. no. 44321, v.n.: kitjemara (B, s); G. Tjerimai, *Van der Meer Mohr* 9 (B, s); *Vermeulen* 50 (B, s); 1650—2000 m el., *Junghuhn* s. n. (L, s); above Linggandjati, 1500 m el., *Backer* 4922 (B, s); Koeningan, *Houter* 14, v.n.: kidjamoedjoe (B, s); Central Java: G. Slamet, *De Boer* 6603 (B, f); 2240 and more m el., *Backer* 461 (B, s); 1800 m el., *Brascamp* 18, v.n.: tjemara (B, L, s); forest Bentjana, 1400—1500 m el.; *Koorders* 1286, v.n.: tjemara (B, s); G. Ragadjambangan, 2100 m el., *Backer* 16157 (B, s); G. Prahoe, 2550 m el., *Koorders* 11246 (B, s); *Backer* 21819 (B, s); above Soerdja, 1400 m el., *Koorders* 1287, v.n.: tjemara (B, s); G. Diëng, *Junghuhn* s. n., v.n.: tjamara (L, s); G. Kembang, near Badakas, 2200 m el., *Koorders* 10906 (B, s);

G. Soendara, 1700 m el., *Koorders* 11280, planted, v.n.: tjemara (B, s); G. Oengaran, 1000—1350 m el., *Junghuhn* s.n. (L, s); *Koorders* for. no. 2380i, herb. no. 1283, v.n.: tjemara rante (B, L, s); for. no. 2423i, herb. no. 1284 (B, L, s); for. no. 3041i, herb. no. 1285, v.n.: tjemara (B, L, s); for. no. 728*, herb. no. 27705, v.n.: tjemara godong (B, L, W, f); Telamojo, 1400 m el., *Koorders* for. no. 2328*, herb. no. 35782, v.n.: tjemara (B, s); East Java: G. Lawoe, *Diepenhorst* s.n. (L, s); near Sarangan, 1600 m el., *Dorgelo* S. 248, v.n.: pohon aroeh (Pa, s); 1433 m el., *De Raat* s.n. (B, s); G. Koekoesan, 1500—1700 m el., *Elbert* 52 (L, s); G. Wilis, 1500 m el., *Lörzing* 868, v.n.: tjemara waris (B, s); Ngebel, 1450 m el., *Koorders* for. no. 2050f, herb. no. 1278, v.n.: tjemara toekoeng (B, L, s), 38699, v.n.: tjemara (B, s); for. no. 2120f, herb. no. 1279β, v.n.: tjemara tikoeng (B, L, s); 29188, v.n.: tjemara (B, L, s), 38652 (B, L, s); for. no. 2126f, herb. no. 1280 (B, L, f), 1281 & 1282, v.n.: tjemoro toekoeng, tjemara tikoeng (B, L, f); 38626, v.n.: tjemara (B, L, s); for. no. 362*, herb. no. 29189, v.n.: tjemara tikoeng (B, f); G. Wilis above Poedok, 1700 m el., *Koorders* 1288, v.n.: tadji (B, s); G. Wilis-Boetak, *Warburg* 3512 (ex *Warburg* 1900, l.c.); Toeloengagoeng, Gondanggoenoeng, 1900 m el., *Boschpr.* Ja. 3614 (B, s); G. Andjasmoro, above Segoenoeng, 1500—1900 m el., *Winckel* s.n. (B, s); G. Kawi, above Poedjon, *Burger* 6336, v.n.: tjemara (B, f); G. Dorowati, 1400—1500 m el., *Backer* s.n. (B, s); G. Koekoesan, 1600 m el., *Bijhouwer* 105 (B, s); G. Ardjoeno, *Zollinger* 2229 or 2262 (U, s, f); 2100—2400 m el., *Koorders* for. no. 1863*, herb. no. 38188 (B, s); for. no. 1985*, herb. no. 38187 (B, L, f); G. Tengger, *Horsfield* (ex *Bennett* 1838, l.c.); *Mousset* 334 (B, s); near Ngadasari, 2000 m el., *Koorders* 37922, v.n.: hroeh, aroeh (B, L, s); forest Sekarkoening, 1700 m el., *Koorders* for. no. 2056*, herb. no. 37923, v.n.: aroeh (B, L, s); Ngadiwono, 1600 m el., *Siegel* s.n. in Herb. *Kobus* s.n. (B, s); above Tosari, 2000 m el., *Leefmans* 31 (B, s); G. Smeroe, S. slope, Ranoe Daroengan, 1000 m el., *Bijhouwer* 222 (B, s); G. Ijang, *Van Dillewijn* 175 (Pa, s); 900—2200 m el., *Snep-vangers* s.n. (B, f); 2300 m el., *Koorders* 43663 (B, s); N.E. slope 1300 and more m el., rain forest and tjemara forest, *Backer* 9604 (B, s); *Jeswiet* 257 (B, s); Tjemoro Lantjang, 2200 m el., *Jeswiet & Hagedoorn* 450 (B, s); W. slope, Bermi to Taman Hidoep, 1600—2000 m el., *Van Steenis* 10812, v.n.: kadjoe pokis, tjemara bineh (B, f); G. Raëng, Soemberwringin, 1650 m el., *Clason-Laarman* 184 (G, s); Idjen Plateau, 1700 m el., *Koorders* 1292 (B, s); 1294 (B, f); for. no. 9401t, herb. no. 1289 (B, f); for. no. 9408t, herb. no. 1290 (B, L, s); for. no. 9412t, herb. no. 1291 (B, s), 28505 (B, s); for. no. 9431t, herb. no. 1293 (B, f); for. no. 9432t, herb. no. 1295 (B, f); Pantjoer Idjen, forest G. Kendeng, 1700 m el., *Koorders* 1298, v.n.: tjemoro bini (B, s); for. no. 885*, herb. no. 28507, v.n.: tjoemara (B, f); path from Litjin to Oengoepoengoep, Rogodjampi, *Koorders* 1296 (B, L, f).

Lesser Sunda Islands. Bali: B. Batoekaoe, 1930 m el., *Sarip* (Exp. *Maier*) 371, v.n.: taroepanda (B, L, s); subdiv. Boeleleng, Tambokan, 1400 m el., *Boschpr.* b.b. 11629, v.n.: tjemara pendek (B, s); 1300 m el., *Boschpr.* b.b. 17269, v.n.: tjemara pandak (B, s); Lombok: G. Rindjani, Sangkareang, S.S.E. slope, 700—1700 m el., *Gründler* (Exp. *Elbert*) 2266 (L, s); Plambi, 200—400 m el., *Gründler* 2428 (ex *Hallier* 1912, l.c.); subdiv. Central Lombok, Lenek, 700 m el., *Boschpr.* b.b. 15504, v.n.: majangmekar (B, L, f); Soembawa: G. Batoelanteh, N. slope, 1500—1700 m el., *Gründler* (Exp. *Elbert*) 4191 (L, s); 1600 m el., Batoedoelang, *Boschpr.* b.b. 6934, v.n.: bage (B, s); 1000—1200 m el., *Rensch* 692 (L, s); Soemba: subdiv. Central & East Soemba, Laironda, 1000 m el., *Boschpr.* b.b. 9003, v.n.: kadjoe oeamang (B,

L, U, s); *Iboet* 547, v.n.: kadjoe oewana (B, L, s); Flores: G. Kasteru, N.W. slope, 1800 m el., *Posthumus* 3235 (B, L, s); Rana Mesé, 1300 m el., *Rensch* 1162, 1307 (B, s); subdiv. Maoesnere, G. Hangamanoe, 1600 m el., *Boschpr.* b.b. 6904, v.n.: mboe (B, s); subdiv. Ende, Walo Lele, 1000 m el., *Boschpr.* b.b. 12602, v.n.: peto (B, s); Timor: *Forbes* 3855 (B, L, s); G. Moetis (*De Voogd* 1938, l. c.); subdiv. South Central Timor, Nenas, 1600 m el., *Boschpr.* b.b. 11803, v.n. haoe toeni (B, L, f).

PHILIPPINES. Luzon: Benguet prov., *For. Bureau* 10829 coll. *Curran* (B, L, s); *Clemens* 16251d (S, s); Mt. Santo Tomas, *Elmer* 6551 (B, f); Pauai, 2100 m el., *Bur. Sci.* 8328 coll. *MacGregor* (B, f); 2300 m el., *Bur.* Sci. 4405 coll. *Mearns* (L, S, f); distr. Lepanto, Mt. Data, *Elmer* 4546 (L, s); *For. Bureau* 14498 coll. *Darling* (L, s); prov. Tayabas, Mt. Banajao, *Weiss* 3820 partly (B, f); Bontoc subprov.; Abra prov., Zambales prov.; Mindoro; Negros (all *Foxworthy* 1911, l. c., but probably partly *P. Cumingii*); Mindanao: prov. Misamis, Mt. Malindang, *For. Bureau* 4666 coll. *Mearns & Hutchinson* (B, L, S, s); Zamboanga distr. (ex *Foxworthy* 1911, l. c.); Davao distr., Mt. Apo, *Schadenberg* (ex *Warburg*, 1900, l. c.); Mt. Dagatpan, *Warburg* 14721 (ex *Warburg* 1900, l. c.).

CELEBES. Subdiv. Paloe, Woeka Tampai, 2500 m el., *Boschpr.* b.b. 15155, v.n.: siori (B, L, s); subdiv. Poso, Lake Poso, 2000 m el., *Boschpr.* b.b. 14898 (B, s); Central Celebes, Boeloe Palaka, *Abendanon* s.n. (B, f); subdiv. Upper Binoeang, Talamanti, *Boschpr.* b.b. 20202, v.n.: sarre (B, s); subdiv. Makale-Rantepao, Doa (Baloesoe), 1150 m el., *Boschpr.* b.b. 21274, v.n.: sapoeko pangala (B, s); subdiv. Palopo, To Lemo, 2300 m el., *Boschpr.* b.b. 23538, v.n. angin-angin (B, m); subdiv. Masamba, Taladoe, 1300 m el., *Boschpr.* b.b. 24173 (B, s); subdiv. Malili, 1500 m el., *Boschpr.* b.b. 24209, v.n.: angin (B, s); Porehoe, 1200 m el., *Boschpr.* b.b. 19559, v.n.: angin-angin (B, s); 1500 m el., *Boschpr.* b.b. 19563, v.n.: angin-angin (B, f); subdiv. Bantaèng, Paringtalasa, 2000 m el., *Boschpr.* b.b. 5460, v.n.: kajoe angin (B, L, f); G, Bantaèng, *Everett* 42 (B, s); 2060 m el., *Bünnemeijer* 12019, v.n.: kajoe parang (B, L, U, f); 2200 m el., *Bünnemeijer* 11855 (B, s); 11977, v.n.: kajoe parang (B, f); 2300 m el., *Bünnemeijer* 11903 (B, L, s); Bantaèng, Lanjienga, 1500 m el., *Teysmann* 13984, v.n.: tjamba-tjamba (B, f); *Teysmann* 13988, v.n.: kajoe angien (B, f); Wawo-Kraèng, *Warburg* 16892; near Manipi, *Warburg* 16432, 2000 m el., *Sarasin* 1263a, Lompobatang, 2000 m el., *Sarasin* 1263b (all ex *Warburg* 1900, l. c.); S.E. Celebes, Poka Pindjang, 2700—3000 m el., *Kjellberg* 3792 (B, f).

MOLUCCAS. Batjan: G. Sibéla (ex *Warburg* 1900, l. c.); Boeroe, Fakal, 1100 m el., *Toxopeus* 485 (B, L, s).

NEW GUINEA. N.W. Part: Arfak Mts., Angi Lake, 1900 m el., *Gjellerup* 1148 (B, f); ridge to Doorman Top, 2650 m el., *Lam* 2160 (B, s); S.W. Part: Hellwig Mts., *von Römer* 746 (B, L, s), 751 (B, s); 1350 m el., *von Römer* 1022 (ex *Koorders* 1914, l. c.); N.E. Part: Mt. Sarawaket (ex *Lane-Poole*, 1925, l. c.); Morobe Distr., Ogeramnang, 1960 m el., *Clemens* 5473 (BD, s); Yunzaing, 1530 m el., *Clemens* 3323 (BD, f); S.E. Part: Alola, 2000 m el., *Carr* 14194 (L, f); Boridi, 1550 m el., *Carr* 13264 (BD, L, s); Mt. Knutsford, *MacGregor*; Mt. Obree, 2300 m el., *Sayer* (both ex *Koorders* 1914, l. c.); Mt. Obree, *Lane-Poole* 259 & 554 (ex *Lane-Poole* 1925, l. c.); Mt. Scratchley, 3300—3400 m el., *MacGregor*; Wharton Range, 3300 m el., *MacGregor* (ex Kew Bull. 1899, l. c.); Central Division, Wharton

Range, Murray Pass, 2840 m el., *Brass* 4768 (BD, s); Mt. Tafa, 2400 m el., *Brass* 5115 (BD, s).

BISMARCK ARCHIPELAGO. New Ireland (Neu-Mecklenburg), Namatanai, near Butam, 1000 m el., *Peekel* 588 (BD, s).

NEW HEBRIDES. Aneityum Island: Anelgauhat Bay, 170 m el., *Kajewski* 849 (B, f).

Cultivated: in the Botanic Garden, Singapore (S, m, f, s); in the Botanic Garden Sibolangit, no. 23 (B, s); in the Bot. Garden Buitenzorg no. V. F. 24, from Sumatra (B, m); V. F. 28, from Java (B, f, G, Pa, s); X. B. 24, from unknown provenance (B, s); XI. B. XVI, 56, from Java (B, s).

Further distribution: Upper Burma (ex *Hooker* 1888), French Indo-China: Tonkin, Annam, Laos, Cambodia (ex *Hickel* 1931), China: Kwantung, Kwangsi (ex *Hu* 1934), Hainan, *How* 72870 (B, f); New Caledonia? (ex *Stapf* 1914), and Fiji Islands (ex *Gibbs* 1914).

P. imbricata var. **β curvula** (Miquel) Wasscher, n. comb. — *Podocarpus cupressina* R. Brown var. *curvula* Miquel, Pl. Junghuhn., 1 (1851) 4; Fl. Ind. Bat., II, 6 (1859) 1074. — *Dacrydium* sp. Van Steenis, in Tijdschr. Kon. Ned. Aardr. Gen., 55 (1938) 762, 764, 772, 781, phot. 6, see below.

All twigs usually curved towards one side, stouter and thicker than in the main form of the species, the leafy twigs 1—2 mm in diam. Leaves scale-like or slightly subulate, thick, nearly adpressed, 1.5—4 mm long, flat above, strongly keeled beneath; young terminal shoots sometimes with thinner, to 4 mm long, often somewhat spreading leaves; pinnate twigs as in the main form of the species. Male flowers on short, straight, 1.5—12 mm long lateral twigs with normal, scale-like or slightly subulate leaves, short-cylindrical, 6—15 mm long, 2.5—3.5 mm in diam.; stamens with ovate-triangular, finely acuminate, 1 mm long and 0.5 mm broad apiculus; pollen grains with 3 air bladders. Female flowers on short, usually nutant lateral twigs with normal scale-like or somewhat subulate leaves; sterile leaves below the flowers subulate, erect, adpressed, dorsiventrally flattened, slightly rounded above, strongly keeled beneath; receptacle composed of 2 or 3 fleshy bracts, of which 1—2 fertile and 1—2 sterile; the apex of the carpid curved over the top of the ovule. Fruit-bearing twigs 3—15 mm long; sterile leaves below the fruit not spreading or only slightly so, up to 4.5 mm long; receptacle short-cylindrical, warty, 3—4 mm long and 2.5—3 mm broad; seed globose, rarely slightly narrowed towards the apex, 5—6.5 mm in diam., smooth, shining, slightly nerved on the back; free part of the apex of the carpid usually short, little or not prominent. (Description from the specimens mentioned below). Cfr. *Plate IV, 2β.*

The var. *curvula* is based by Miquel upon the different leaves and the shorter-petioled lateral male flowers, which, according to him, moreover have a different shape. Though the differential character of the shorter-petioled lateral male flowers does not exist, this variety, which is always overlooked by later authors, is rightly distinguished. It differs from the main form in the invariably curved-down twigs (expressed in Miquel's name), the much coarser foliage, the larger male flowers, the always erect, adpressed, dorsiventrally flattened sterile leaves below the fruit, and the usually short free apex of the carpid on the top of the seed.

According to herbarium labels, the plants from Java mentioned below are erect trees up to 30 m tall. The plants from Sumatra, however, are always small, up to 8 m tall, often procumbent trees. The variety occurs from 1350—3300 m el., but, with the exception of some of Junghuhn's specimens, all the collections are from elevations of 2000 m and more. The main form of species is said to occur from 700—3000 m, but mainly occurs between 1000 and 2000 m el. Though these elevations and those of the variety do not exclude each other, it yet seems possible, that the variety usually occurs at higher elevations than the species and takes the shrub-form on the exposed mountain summits. From observations by Junghuhn and other authors on the mountain flora, however, it appears that the question is not so simple. Junghuhn (Java, ed. 2, I, p. 509) says about the trees of *P. imbricata*, which occur at lower elevations, that they have a columnal shape and usually are growing scattered; about those from higher elevations, he writes (translated from the Dutch): "On those summits, however, they are growing gregariously, covering the steepest slopes and raising themselves pyramidally as young firs and juniper-trees. These pyramidal small trees are not taller than 10 to 20 feet, and have verticillate branches directed upward, of which the ..... young twigs grow downward." It does not seem impossible to me, that these social trees belong to the var. *curvula*, especially so since Schmucker l. c. writes, that also the specimens from the highest elevations preserve the typical tree-shape, though of course more compact and smaller than at lower elevations. Docters van Leeuwen (1933, p. 18) writes in respect to the mountain flora of Mt. Pangranggo-Gedé "Blaauw says that the low temperatures in these areas cause several species to die out after a reduction to dwarf form. This is, in my opinion, not correct: at the highest limits, reached by a species, very big individuals are sometimes met with, e. g. of *Podocarpus imbricata*." Speaking about of the forests of Junghuhn's

fourth zone he writes, however, that trees higher than 5 to 6 m are rare, whereas, moreover, they usually are branched more strongly towards the base, spreading the branches laterally, the trees in this way becoming more shrub-like. Among the trees composing the so-called "moss covered forests" he mentions also *Podocarpus imbricata*.

Taking into consideration all this, it does not seem impossible, that the shape of the tree is not the same on all mountain summits; on the other hand, it might be true, however, that the pyramidal trees always belong to the var. *curvula*, and that this variety does not occur on all mountains.

In his report of the expedition in the Gajo regions (1938), Van Steenis mentions this variety as "the weeping *Dacrydium*", a characteristic tree with dwarfy habit, and always low, sometimes appressed to the soil on windy localities in the mountains.

SUMATRA. Atjeh: Gajolanden, Poetjoek Angasan, 2600 m el., *Van Steenis* 8357 partly, v.n.: sangoe (B, s); *Van Steenis* 8380 (B, f); G. Leuser, upper course of the Lau Alas, 2100—2250 m el., *Van Steenis* 8423 (B, m, f); *Van Steenis* 8459 (B, s); Goh Lemboeh, summit, 2900—3050 m el., *Van Steenis* 8986 (B, f, m); G. Kemiri, E. slope, 2900—3314 m el., *Van Steenis* 9642, v.n.: sangoe (B, f).

JAVA. Without exact locality, *Junghuhn* s.n. (L, f); *Blume* s.n. (L, f); West Java: G. Gedé, 1350—2350 m el., *Junghuhn* s.n. (L, s); Pengalengan, 1350 m el., *Junghuhn* s.n. (L, U, f); G. Papandajan, 2200 m el., *Van Steenis* 4135, v.n.: djamoedjoe (B, f); Tegal Aloen-aloen, 2400 m el., *Van Steenis* 4778 (B, f); G. Tjerimai, 1650—2350 m el., *Junghuhn* s.n. (L, m); 2000 m el., *Docters van Leeuwen-Reijnvaan* 2529 (B, f); Central Java: Diëng Mts., G. Prahoe, *Junghuhn* s.n. (L, U, f, m); Kedoe, Wonosobo, *Zwart* 6517 (B, L, f); East Java: G. Kawi, Tjemorokandang, 2700 m el., *Docters van Leeuwen-Reijnvaan* 12264 (B, f); 2680—2780 m el., *Arens & Wurth* s.n. (B, s).

P. imbricata var. γ **kinabaluensis** Wasscher, n. var. — *Podocarpus cupressina* Stapf, in Transact. Linn. Soc., ser. 2, IV (1894) 249. — *Podocarpus imbricata* Gibbs, in Ann. Bot., 26 (1912) 525, p.p., t. 49, ic. 1—9; in Journ. Linn. Soc., 42 (1914) 35, 36, 41, p.p.; Stapf, in Journ. Linn. Soc., 42 (1914) 193 p.p.; Merrill, Bibl. En. Born. Pl. (1921) 31, p.p.

Ramuli erecti vel incurvati, minus dense foliati quam in speciei forma typica; folia nonnihil divergentia apice incurvata, strictissima, pungentia, sectione transversa subrhomboidea, 3—6 mm longa, in ramulis vetustioribus nonnunquam paulum dorsiventraliter applanata; folia in ramulorum partibus superioribus magis quinquefaria, divergentia, magis lateraliter applanata, 4—8 mm longa, suprema nonnunquam paulum pinnatim disposita; ramuli terminales iuveniles brevissimi, circiter 3—4 mm diametro foliis inclusis. Flores masculi ignoti. Flores

feminei terminales in ramulis lateralibus brevibus rectis, foliis receptaculum involucrantibus usque ad maturitatem erectis vel vix divergentibus, leviter lateraliter applanatis, falcatis, 5—8 mm longis, receptaculum et plerumque seminis partem inferiorem includentibus; semen 5—6 mm diametro, apice carpidii libero, ad 1 mm longo, supra apicem seminis curvato.

Twigs scattered, erect or upturned, much branched, very compact, with short, lateral twigs, less densely leaved than in the main form of the species, with the leaves slightly spreading with incurved apex, very rigid, pungent, subrhomboidal on transverse section, with slightly concave sides, 3—6 mm long, on older twigs sometimes slightly dorsiventrally flattened; the leaves in the upper parts of the twigs more exactly 5-farious, spreading, thick-coriaceous, slightly falcate, more laterally flattened, narrowly rhomboidal, with slightly concave sides, decurrent, 4—8 mm long; the uppermost ones sometimes somewhat pinnately arranged; young terminal shoots very short, densely leaved, about 3—4 mm in diam., with subulate, usually 3—4 mm long leaves. Male flowers unknown. Female flowers terminal on short, straight lateral twigs; leaves below the flowers gradually more erect or erect-spreading, slightly laterally flattened, narrowly rhomboidal; receptacle usually composed of 2 fleshy scales. Fruit-bearing twigs erect or slightly spreading, 7—16 mm long; sterile leaves below the fruit erect or erect-spreading also when ripe, falcate, 5—8 mm long, involving the receptacle and usually also the basal part of the seed; receptacle cylindrical or somewhat obconical, warty, 2—4 mm long and 2 mm in diam.; sterile lamina slightly flattened, 2½—3 mm long. Seed subglobose, 5—6 mm in diam., smooth, shining, with not or only slightly prominent rib; apex of the carpid free, curved over the seed, up to 1 mm long. (Description from all the specimens mentioned below.) Cfr. *Plate IV, 2 γ*.

According to herbarium labels, this variety is a small tree or shrub. The female flower is light-blue (Clemens 32316), the fruit purple (Clemens 27092—27854), dark-brown (Clemens 28910), blue (Clemens 29914), or brownish with pinkish red (Clemens 32316). The plant occurs on Mt. Kinabalu at high elevations up to the timberline in shrub-formations, of which it often represents the principal element, forming strongly compact, small, sometimes only 2 m high shrubs.

Though strongly deviating from the main form, these plants must be regarded as only a local form of *P. imbricata*. Also Gibbs (1912, l. c.) evidently regards them as a mountain form of this species, when

she writes: "A graceful forest tree, about 70 ft high, with straight trunk and compact crown..... It is a true mesophyllous mixed forest type, occurs always singly. As it runs up the exposed slopes of Kinabalu, however, it is finally, in the sclerophyllous dwarf forest subsummit zone, reduced to a compact shrub 5—6 ft high..... There the ultimate branches are erect, the terminal portion showing the cupressoid form of leaves, but arranged radially and five-seriate"; and further on: "The leaves subtending the strobilus pass gradually into the bracts of the latter and spread out round it in both the Fijian and Buitenzorg material, though not in that from the subsummit zone of Kinabalu". Indeed, this variety shows marked differences from the species in many respects, *e. g.*, in the much coarser, foliage, the numerous 5-farious, longer leaves towards the extremities of the twigs, the compact growth, the erect twigs, the shorter young terminal shoots, and especially in the erect or erect-spreading, longer, laterally flattened, sterile leaves below the fruit, and the free apex of the carpid on the top of the seed. There occur, however, on Mt. Kinabalu intermediates between the variety and the main form of the species (see the discussion of the main form above).

The specimen Haviland 1094 is a sterile branch with pinnate twigs, of nearly normal shape. The subulate leaves, however, are thick-coriaceous, 8—10 mm long by 1.25—1.5 mm broad. The pinnate twigs are 2.5—5 cm long by 13—19 mm broad.

BORNEO. British North Borneo: Mt. Kinabalu, 3600 m el., *Haviland* 1094 (S, s); *Haviland* 1095 (S, f); 3350 m el., *Holttum* s. n. (S, f); 2000—4000 m el., spur above Lobang to the granite cone, *Gibbs* 4166 (ex *Stapf* 1914, l. c.); 4260 m el., *Clemens* 27092—27854 (L, f); Paka Cave to Low's Peak, *Clemens* 10636 (B, f); above Paka, 3860 m el., *Clemens* 27854, type of the variety (B, f); Paka, 3600 m el., *Clemens* 28910 (B, L, f); at side of granite dome, 4030 m el., *Clemens* 29914 (B, L, f); Marai Parai, above Kamburangan, 3300—3600 m el., *Clemens* 32316 (B, L, f); 3600 m el., at highest timberline, *Clemens* 32317 (B, L, f); 3600 m el. *Clemens* 32318 (B, L, s); Paka Paka, 3350 m el., *Sing.* Field no. 28052 coll. *Carr* (S, f); Gurulau Spur, 3600 m el., *Clemens* 51201 (L, f).

3. Podocarpus papuana Ridley — *Podocarpus papuanus* Ridley, in Transact. Linn. Soc. London, IX, 1 (1916) 158; Gibbs, Contr. Arfak Mts. (1917) 80, ic. 4; Pilger, in Engler, Nat. Pfl. fam., ed. 2, 13 (1926) 245; Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, vol. XIII, 2 (1934) 194; Florin, in Kungl. Svensk. Vet. Akad. Handl., X, 1 (1931) 267, 268; XIX, 2 (1940) 23.

Seedlings and young main twigs bearing pinnately leaved lateral twigs. Leaves of the main twigs adpressed, imbricate, thick-subulate, with the largest width just below the middle, narrowed towards the

base and decurrent, tapering into the acute, incurved apex, flat above, keeled beneath, concave at both sides of the keel, 2—2.5 mm long by 0.6 mm broad; leaves of the young extremities overtopping the pinnate twigs, more densely imbricate, smaller and less strongly keeled. Pinnately leaved lateral twigs narrowly ovate-lanceolate in outline, 22—30 mm long (in seedlings up to 40 mm) by 8—12 mm broad, the leaves bifarious, linear or sometimes more ovate, sligthly falcate, inserted on the twig with broad base, and decurrent on the twig, acuminate into the short incurved mucro, in adult trees thick-coriaceous, the longest ones 5—7 mm long by 1.25—1.5 mm broad, with slightly prominent midrib on both surfaces; the basal leaves of the twig imbricate, subulate. Fertile twigs not very densely branched, the twigs erect or spreading, their leaves strongly, sometimes nearly horizontally spreading, short- and very thick-subulate, with incurved apex and decurrent base, with the largest width somewhat below the middle, slightly narrowed towards the base, sessile on the twig with thick base, strongly decurrent, acuminate into the incurved mucro, triangular to quadrangular in section, strongly vaulted above, strongly keeled beneath, concave on both sides of the keel; moreover, some twigs with somewhat longer and more laterally flattened, quinquefarious leaves. Male flowers (according to Ridley) cylindrical, obtuse, 6 mm long by 2 mm in diam., with ovate, acute scales. Female flowers terminal on short lateral twigs with scale-like subulate leaves; sterile leaves below the receptacle straight, thick-subulate, quadrangular or slightly laterally flattened, abruptly shortly acuminate into a short incurved apiculus; receptacle composed of 2—4 leaf-bases, of which 1—2 fertile and 1—3 sterile, the sterile ones with often somewhat oblique carpid overtopping the ovule, the fertile ones with short, obtuse lamina. Fruit-bearing twigs up to 12 mm long; sterile leaves below the fruit horizontally spreading, 2.5—3 mm long; receptacle warty, cylindrical, the composing scales often clearly distinguishable, 3—4 mm long and 2.5—3 mm broad, the sterile scale often somewhat shorter; free, sterile lamina 1.5—2 mm long; seed subglobose, 5 mm in diam. (Description from the specimen Gibbs 5540.) Cfr. *Fig. 2; Plate IV, 3a, 3b.*

From Ridley's description it is not clear, whether it represents the same species as that described here. According to Ridley, *P. papuana* is allied to *P. imbricata*, but differs "(1) in the much thinner longer leaves of the sterile branches, which are much longer in proportion to their breadth than in *P. papuana*; (2) in the thick lanceolate short leaves of the fertile branches; (3) in the absence, as far as good series

of specimens show, of the slender whip-like fertile branches, so characteristic of this species. The seed is quite globose, without any point, and the male-flower scales are more ovate and thicker." Ridley's description is based upon two male specimens from Mt. Carstensz, collected by Kloss at 2500 ft and 8300—11000 ft el. respectively, and one female plant from Wharton Range, collected by Giulianetti at 11000 ft el. Moreover, the author includes in this species a specimen, collected by Burke between the south coast and the Owen Stanley Range, and the collections Lorentz 1698 and 1699 from the Hellwig mountains. The 2 latter plants were included in the genus *Dacrydium* by Koorders (Nova Guinea, VIII, 1, 1909, p. 177). Of the plants mentioned above, I only had the opportunity of examining Lorentz' collections. In my opinion, Lorentz 1699 belongs to *Podocarpus*, Lorentz 1698 to *Dacrydium* (in spite of the fact, that Koorders writes about these plants: "Ferner geht aus den Mitteilungen von Lorentz die wichtige Tatsache hervor, dass 'soweit erinnerlich', das gesamte Material von ihm von einem einzigen Baum gesammelt wurde"). According to Gibbs, Giulianetti's plant is no *P. papuana*, and must undoubtedly be included in *P. imbricata*. In my opinion Burke's collection should be included in *Dacrydium*, in accordance with the remarks given by Koorders, who says, that this plant has leaves up to 19 mm long, and agrees with "the form *D. Junghuhnii* from Sumatra". Gibbs has given a new description of the female plant, based upon the specimen Gibbs 5540 from the Arfak mountains, and a plant, collected by Beccari, likewise from the Arfak mountains (Hatam). According to her, the leaves of the seedlings and youth forms of *P. imbricata* and *P. papuana* are not different from each other. As regards the adult trees, she writes: "..... but the foliage of the mature tree is more spreading and distinct, the scales of the male cones differ in shape, while the female cones are larger and very glaucous in appearance. The fusion of the lamina of the fertile bract with the ovuligerous scale" (= ephimatium) "is also less complete than is the case in *P. imbricatus* and the position of the seed is more oblique". I had no opportunity of examining Beccari's plant; of the specimen Gibbs 5540 I saw a fragment, but without ripe seeds. This plant is closely allied to *P. imbricata*, but the foliage is very different. The sterile leaves below the fruit are here horizontally spreading as well, and have nearly the same shape as in *P. imbricata*. That the situation of the seed is oblique is not very important, since this sometimes also occurs in *P. imbricata*. Though I did not see Kloss' type-specimens, I here follow Gibbs in including

her collection in *P. papuana.* This specimen is from a "fine tree with pendant branches".

The specimen Lam 2159 only is a small fragment, picked up from the ground; the foliage entirely agrees with that of Gibbs 5540. The other three collections mentioned below are doubtful. Brass 4962, "a thick-boled tree, 15—20 m tall, with spreading crown of thinly foliaged branches", has both the rather strongly spreading subulate leaves, and the S-shaped curvation of the lower surface and the strongly vaulted upper surface, but much less distinctly so than Gibbs' plant, and, as regards the foliage, it more closely resembles the sterile twigs of this collection. Brass' collection also bears some terminal, pinnately leaved twigs up to 2.5 cm long and 7 mm broad. Perhaps also Lorentz 1699, a 15 m tall tree with a bole 60 cm in diam., must be included in this species, in spite of the deviating foliage. The leaves are much longer, up to 3.5 mm long, narrower, straighter, much less spreading and less rounded above. On the uppermost lateral twigs the leaves are nearly exactly quinquefarious and spreading, laterally flattened, and up to 4 mm long. The foliage of Lam 2153, a tree 15 m tall, is much like that of the preceding specimen, but here the greater deal of the twigs has quinquefarious leaves.

NEW GUINEA. N.W. Part: Arfak Mountains, Angi Lakes, 2300—3000 m el., *Gibbs* 5540 (B, f); ridge to Doormantop, 1460 m el., *Lam* 2159 (B, s).

Perhaps also:

NEW GUINEA. N.W. Part: ridge to Doormantop, 2550 m el., *Lam* 2153 (B, s); S.W. Part: Hellwig mountains, 2100 m el., *Lorentz* 1699 (B, L, U, s); S.E. Part: Central Division, Mt. Tafa, 2400 m el., *Brass* 4962 (BD, s).

4. Podocarpus Steupii Wasscher, n. sp. — *Podocarpus papuanus* (non Ridley) Steup, in Trop. Nat., 27 (1938) 145.

Rami plusminus incurvati, ramossimi, dense fasciculati. Folia oblique divergentia, rigidissima, valde falcata, subulata, acuta, pungentia, 2.5—3 mm longa, subquadriangula, facie inferiore acute, superiore minus acute carinata, decurrentia; folia ramulorum partium superiorum magis quinquefaria, lateraliter applanata, crassa, oblique divergentia, ad 5 mm longa, raro subpinnatim disposita; ramuli terminales novissimi breves, crassiores. Flores masculi ignoti. Flores feminei terminales in ramulis lateralibus brevibus folia brevia subulata, apicem versus in folia longiora plerumque adiacentia transientia ferentibus; receptaculum e 2 vel pluribus squamis carnosis compositum, squama sterili lamina libera obtusa, fertili carpidio erecto; ovulum unicum, raro 2. Ramuli fructiferi ad 16 mm longi, foliis sterilibus fructum involucrantibus divergentibus vel divaricatis, rectis vel nonnihil in-

curvatis, subquadriangulis, facie inferiore valde carinatis, plerumque sensim attenuatis in apicem acutum pungentem, 3—4 mm longis; receptaculum breve cylindraceum vel paulum obconicum, 2—3 mm longum 3 mm crassum, verrucosum; semen subglobosum, 5—6 mm diametro, apice anguste sed distincte elevato carpidii coronatum.

Twigs incurvate, strongly branched, compact. Leaves on the older twigs slightly spreading, triangular-subulate, dorsiventrally flattened, 2—3 mm long, decurrent with 1 mm broad base, strongly keeled; leaves of younger twigs strongly spreading, very rigid, strongly falcate, subulate, pungent, 2.5—3 mm long, nearly quadrangular on transverse section, slightly but sharply keeled above, strongly and sharply keeled beneath, concave on each side of the decurrent keel; leaves on the upper lateral twigs usually quinquefarious, laterally flattened, straight or slightly falcate, rigid, strongly spreading, rather abruptly attenuate into the mucronate apex, very strongly nerved, or sometimes indistinctly bifarious, in both cases up to 5 mm long. Young terminal shoots short, hardly overtopping the lateral twigs, rather stout. Male flowers unknown. Female flowers terminal on short lateral twigs with short, 2 mm long, slightly spreading, subulate leaves, which are usually adpressed, longer-subulate towards the apex; receptacle composed of 2 or more fleshy leaf-bases, the sterile one with short, obtuse, slightly laterally flattened, slightly falcate, free lamina, the fertile one with erect carpid, which overtops the ovule; ovules 1, rarely 2. Fruit-bearing twigs up to 16 mm long; sterile leaves below the fruit spreading or divaricate, straight or subfalcate, nearly quadrangular on transverse section, strongly keeled beneath, usually rather gradually narrowed into the mucronate, acute apex, 3—4 mm long; receptacle very short-cylindrical or somewhat obconical, 2—3 mm long and 3 mm in diam., warty; free lamina up to 3 mm long; seed subglobose, 5—6 mm in diam., somewhat keeled at the side of the carpid, with distinct, narrow, slightly prominent apex of the carpid. (Description from the type specimen.) Cfr. *Fig. 2; Plate IV, 4.*

According to the herbarium label, the specimen mentioned below is a tree 12 m tall, with a bole 22 cm in diam. The lowermost branches are attached at 4.5 m above the base, whereas the incurved branchlets with leaf-bearing twigs are more or less bundled.

This species is probably most closely allied to *P. imbricata*, of which, however, it may be distinguished by the coarser, more subulate and spreading leaves and the different shape of the sterile leaves surrounding the receptacle. In general appearance it resembles *P. com-*

pacta most of all, but differs from it in the shorter, spreading, not dorsiventrally flattened leaves surrounding the receptacle, and the different shape of the other leaves.

CELEBES. Subdiv. Enrékang, Rantelemo, 3000 m el., *Boschproefstation* b.b. 22857, v.n.: tjimba-tjimba (B, f), type of the species.

5. **Podocarpus Cumingii** Parlatore, in D.C., Prodr., 16, II, 2 (1868) 521; Gordon, Pinetum, ed. 2 (1875) 356. — *Podocarpus cupressina* (non R. Brown) Vidal y Soler, Phan. Cuming. Phil. (1885) 160. — *Nageia Cumingii* Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Podocarpus imbricatus* var. *Cumingii* Pilger, in Engl., Pflanzenr., IV, 5 (1903) 56; Foxworthy, in Philipp. Journ. Sci., 2 (1907) Bot. 258; Perkins, Fragm. Fl. Philipp., 1 (1904) 44; Merrill, in Philipp. Journ. Sci., 5 (1910) Bot. 324; Pilger, in Bot. Jahrb., 54, 1 (1916) 36. — *Podocarpus imbricatus* Foxworthy, in Philipp. Journ. Sci., 6 (1911) Bot. 157 p.p. — *Podocarpus javanicus* Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 3 p.p.

Twigs very compactly branched, erect or spreading. Leaves of the older twigs usually nearly adpressed, subulate, slightly dorsiventrally flattened, 3.5—6 mm long, keeled above, strongly keeled beneath, concave on each side of the keel, sometimes longer-subulate, straight and slightly spreading, 5—8 mm long and somewhat rhomboidal on transverse section; on the younger twigs similar, but somewhat shorter leaves, towards the apices sometimes quinquefarious, spreading, often more laterally flattened, subfalcate, 4—5 (rarely up to 8) mm long; on the uppermost lateral twigs the leaves often not entirely bifarious, slightly falcate, linear, usually up to 6 mm long by 1 mm broad, rarely up to 12 mm long by 1.25 mm broad. Young terminal shoots short, little overtopping the lateral twigs, with nearly adpressed or slightly spreading, subulate leaves. Male flowers terminal on short, 2—5 mm long lateral twigs with adpressed or slightly spreading, subulate, 2—2.5 mm long leaves; flowers cylindrical, 8—10 mm long by 2.5—3.5 mm in diam.; stamens with triangular, acute apiculus. Female flowers on short, lateral twigs with short, 2—2.5 mm long, somewhat spreading, falcate, subulate leaves, of which those involucrating the flowers are erect, narrow, subulate, abruptly narrowed into a thin mucro and nearly rhomboidal in transverse section with concave sides; receptacle composed of 2 (rarely more) fleshy leaf-bases, the sterile ones with slightly laterally flattened, obtuse lamina, the fertile ones with a carpid, which overtops the ovule; ovule 1, rarely 2. Fruit-bearing twigs straight, 6—18 mm long; sterile involucral leaves erect, enclosing the fruit, 7—13 mm long; receptacle subcylindrical or sub-

obconical, 2—3 mm long and 2 mm broad, warty; sterile lamina 3 mm long; seed globose, sometimes slightly narrowed towards the base, sometimes with distinct apiculus towards the apex, usually with slightly prominent rib on the back, 3.5—5.5 mm in diam., smooth, shining; apex of the carpid free, curved over the apex of the seed, up to 1.5 mm long. (Description from all the Philippine and Sumatra materials.) Cfr. *Fig. 2; Plate IV, 5.*

This species, based upon the specimen Cuming 803 by Parlatore, was degraded to a variety of *P. imbricata* by Pilger. It was simply included in this species by Warburg (Monsunia, 1, p. 191), as well as by Foxworthy. Also according to Perkins it differs so little from this species, that it might be better to unite the two. In my opinion, however, the difference is sufficiently large to distinguish it as a species. It differs from *P. imbricata, e. g.,* in its much less distinct leaf-dimorphism, the much longer, more subulate leaves, the absence of twigs with entirely adpressed, scale-like leaves, and the short young terminal shoots, but especially in the much longer, erect, falcate, sterile leaves involucrating the fruit and the always free apex of the carpid. According to Foxworthy, there occur many transitions between *P. Cumingii* and *P. imbricata.* It is probable, however, that he failed to note the differences in the involucral leaves and the apex of the carpid, since he only gives Pilger's description of *P. imbricata,* and does not mention the distinctive characters, mentioned by me; also Pilger does not describe the long sterile leaves below the receptacle in his var. *Cumingii.*

The plants from Sumatra deviate from those from the Philippines in the somewhat coarser foliage, whereas the free apex of the carpid is somewhat shorter and less prominent. A sterile specimen from Borneo should perhaps be included in this species; its twigs bear very rigid, subulate, 6—8 mm long leaves, passing into rigid, pinnately leaves towards the apex.

SUMATRA. Atjeh: Gajolanden, Poetjoek Angasan, 2600 m el., *Van Steenis* 8357 partly, v.n.: sangoe (B, f); Goh Lemboeh, 3000 m el., *Van Steenis* 9127, v.n.: sangoe (B, f); G. Kemiri, E. slope, 2900—3314 m el., *Van Steenis* 9649, v.n.: sangoe (B, m).

PHILIPPINES. Luzon: Benguet prov., Mt. Pulog, *For. Bur.* 18049 coll. *Curran, Merritt* and *Zschokke* (B, L, f); *Bur. Sci.* 40550 coll. *Ramos* and *Edaño* (B, S, m); prov. Tayabas and Laguna, Mt. Banajao, *Cuming* 803, type of the species (L, f); *Comisión de la Flora Forestal de Filipinas* 623bis (L, f); *Whitford* 951 (B, f); *Em. Weiss* 3820 partly (B, f); *Loher* 7137 (B, f); *Bur. Sci.* 2387 coll. *Foxworthy* (L, s); *Bur. Sci.* 27926 coll. *Ocampo* (B, s); prov. Tayabas, Lucban, *Elmer* 7465 (B, L, f); Panay: Antique prov., Mt. Midaas, *Yoder* s.n. (B, L, f); Mindanao: distr. Davao, Todoya, Mt. Apo, *Elmer* 11684 (B, L, U, f).

Perhaps also: BORNEO. W. Division: prob. near Sanggau, *Hallier* B. 775 (B, s).

6. Podocarpus cincta Pilger — *Podocarpus cinctus* Pilger, in Bot. Jahrb., 69 (1938) 253; Florin, in Kungl. Svensk. Vet. Akad. Handl., 19, 1 (1940) 23.

Fertile branchlets strongly branched into erect-spreading or spreading twigs, the older twigs with narrowly triangular-subulate, dorsiventrally flattened, strongly keeled, decurrent, up to 6 mm long leaves, the younger twigs densely leaved, the leaves somewhat spreading, straight or slightly incurved, finely subulate, pungent, decurrent with broad base, nearly rhomboidal on transverse section, strongly keeled beneath, concave on each side of the keel, 4—6 mm long. Terminal twigs rarely with incompletely bifarious, narrow, strongly curved leaves. Male flowers unknown. Female flowers terminal on short, straight, lateral twigs with spreading, slightly curved, subulate, 3—4 mm long leaves; sterile leaves surrounding the flower long, erect, falcately incurved and entirely involving the flower, narrow, rhomboidal on transverse section with concave sides; receptacle composed of 2 or more fleshy leaf-bases, of which one is fertile; the sterile one with slightly flattened, obtuse, free margin; carpid overtopping the ovule, strongly keeled on the back. Fruit-bearing twigs 0.5—2 cm long; sterile leaves surrounding the fruit erect, usually curved around the seed, 7—11 mm long; receptacle subcylindrical, 3—4 mm long and 2—3 mm in diam., warty; sterile lamina up to 2 mm long; seed subglobose, smooth, shining, 5—5.5 mm in diam.; apex of carpid slightly prominent, connate with the seed. (Description from all the materials examined.) Cfr. *Fig. 2; Plate IV, 6.*

This species which, according to Clemens, is one of the commonest and largest trees on Mt. Sarawaket, and has a bole 60 cm in diam., resembles *P. Cumingii* most of all, but differs in the more finely subulate, often somewhat more spreading leaves, the almost complete absence of the narrower bifarious leaves, and the apex of the carpid, which is not free.

In the specimen Clemens 5588, there occur, moreover, some detached branchlets with pinnately leaved twigs, which may have been collected from a seedling. The twigs bear very thin, subulate, 6—7 mm long leaves. The pinnately leaved twigs are large, sublanceolate, and 6—9 cm long by 2 cm broad.

NEW GUINEA. N.E. Part: Morobe-distr., Busu River, *Clemens* 5261, type of the species (BD, f); Mt. Sarawaket, Bog Meadow Camp, ca. 2650—3000 m el.,

Clemens 5562 (BD, f); *Clemens* 5588 (BD, f); Mt. Sarawaket, Busu River and vicinity, 2300—2650 m el., *Clemens* 6283 (BD, f).

7. Podocarpus dacrydiifolia Wasscher, n. sp.

Rami ramulis divaricatis, 2.5—5 mm diametro foliis inclusis. Folia fere adiacentia, subulata, basi lata decurrentia, apice incurvato breviter acuteque acuminata, nonnihil dorsiventraliter applanata, sectione transversa nonnihil triangularia, facie superiore subplana, inferiore obtuse carinata, 4—6.5 mm longa, circiter 0.5 mm lata. Flores masculi ignoti. Flores feminei in extremitatibus ramulorum brevium strictorum foliis 3—4 mm longis subulatis; folia sterilia flores involucrantia paulo longiora, nonnihil dorsiventraliter applanata, erecta vel nonnihil divergentia; receptaculum e 2 (vel raro pluribus) squamis carnosis compositum, quarum sterili lamina libera obtusa, fertili carpidio valde carinato; ovulum singulum, raro 2. Ramuli fructiferi 6—8 mm longi, foliis sterilibus fructum involucrantibus ad 10 mm longis seminis medium superantibus, adiacentibus; receptaculum subcylindricum, 3 mm longum, 2.5 mm crassum, verrucosum; semen subglobosum, 5.5 mm diametro, leve, lucens, apice extremitate carpidii nonnihil elevata coronatum.

Twigs with rather remote branchlets, bifariously alternate, 3—5 mm in diam. incl. the leaves, the youngest 2.5 mm in diam. Leaves of the older twigs rather strongly adpressed, somewhat spreading, slightly incurved, very narrowly triangular-subulate, rather thin, flat above, with a rounded keel beneath, 5—6 mm long by 0.75 mm broad; leaves on the younger twigs nearly adpressed, with incurved apex, subulate, decurrent with broad base, acuminate into a pungent tip, somewhat dorsiventrally flattened, slightly triangular in section, nearly flat above, rather strongly keeled beneath, concave at both sides of the keel, 4—6.5 mm long by 0.4—0.6 mm broad; leaves on the youngest shoots sometimes nearly entirely adpressed and very little triangular in section, but more flat and slightly rounded-keeled beneath. Male flowers unknown. Female flowers terminal on short, straight, erect-spreading lateral twigs, covered with 3—4 mm long, subulate, nearly adpressed leaves; sterile leaves below the flowers like the typical leaves as regards the shape, subulate, dorsiventrally flattened, nearly flat above, slightly rounded beneath, long, erect or slightly spreading, incurved around the flower; receptacle composed of 2 or more fleshy scales, the sterile one with falcate, obtuse, free lamina, the fertile one with strongly keeled carpid; ovule 1, rarely 2. Fruit-bearing twigs 6—8 mm long; sterile leaves below the fruit erect, adpressed, up to 10 mm long, reaching to over the middle of the seed; receptacle sub-

cylindrical, 3 mm long and 2.5 mm in diam. Seed subglobose, 5.5 mm in diam., smooth, shining, with the rib of the carpid on the back, and with slightly prominent apex of the carpid on the top. (Description from both collections mentioned below.) Cfr. *Fig. 2; Plate IV, 7.*

According to herbarium labels, *P. dacrydiifolia* is a tree up to 38 m tall, with very straight bole without buttresses and with a thin crown, which occupies about one-half of the total length. The wood is used for house-building. This species which, in sterile condition, agrees most of all *Podocarpus*-species with a *Dacrydium*, differs from *P. compacta* in the less compact ramification and in the thinner and longer subulate, nearly adpressed leaves.

CELEBES. Subdiv. Upper Binoeang, Oeloe Saloe (Pawreang Mts.), 1800 m el., *Boschproefstation* b.b. 13633, v.n.: sareh (B, L, f), type of the species; 2000 m el., *Boschpr.* b.b. 20872, v.n.: dokeh-dokeh (B, s).

8. **Podocarpus compacta** Wasscher, n. sp. — *Dacrydium* spec., Koorders, in Nova Guinea, VIII, 2 (1911) 615, p.p. — *Podocarpus papuanus* (non Ridley 1914) Pilger, in Bot. Jahrb., 68 (1936) 244; Van Steenis, in Colijn, Naar de eeuwige sneeuw (1939) 273.

Rami ramosissimi, ramulis dense fasciculatis, 2.5—5 mm diametro foliis inclusis. Folia divergentia, subulata, incurvata, nonnihil dorsiventraliter applanata, basi lata in ramulum decurrentia, apice in acumen acutum attenuata, 2.5—4 (raro ad 5) mm longa, 0.5—1.5 mm lata, facie inferiore valde carinata, facie superiore basin versus acutius carinata, apicem versus plana, raro foliis quinquefariis lateraliter applanatis transitum ad folia bifaria formantia. Flores masculi ignoti. Flores feminei in extremitatibus ramulorum brevium foliis subulatis; folia sterilia flores involucrantia erecta, incurvata, plerumque dorsiventraliter applanata, nonnunquam magis quadriangula, facie inferiore valde carinata, superiore plana vel acutius carinata; receptaculum e squamis 2 vel 3 carnosis compositum, quarum steriles lamina libera obtusa, fertiles carpidio valde carinato; ovulum singulum, raro 2. Ramuli fructiferi 8—18 mm longi; folia sterilia fructum involucrantia adiacentia vel vix divergentia, 4—10 mm longa, 0.5—1 mm lata; receptaculum subcylindricum, 4 mm longum, 3—4 mm crassum, verrucosum; semen subglobosum, nonnunquam latere carpidii nonnihil applanatum, 6—8 mm diametro, vix lucidum, nonnunquam bullis resinosis, apice extremitate carpidii nonnihil elevata coronatum.

Strongly and densely branched; twigs erect or upturned, 2.5—5 mm in diam incl. the leaves. Leaves spreading, subulate, curved upwards, slightly dorsiventrally flattened, narrowed into the acute

apex, decurrent on the twig with broad base, 2.5—4 (rarely up to 5) mm long by 0.5—1.5 mm broad, strongly keeled beneath, with concave sides, on the upper surface rather sharply keeled towards the base, flattened towards the apex; rarely with intermediary, quinquefarious leaves, which are slightly laterally flattened, somewhat spreading, rarely passing into small, bifarious leaves. Male flowers unknown. Female flowers terminal on short lateral twigs with somewhat smaller subulate leaves than the typical ones; sterile leaves below the flowers erect, strongly or slightly falcate, usually enveloping the whole flower, usually dorsiventrally flattened, sometimes somewhat more quadrangular on transverse section, strongly keeled beneath, with concave sides, flat or rather sharply angulate above; receptacle composed of 2—3 fleshy bracts, the sterile one with free, obtuse, subfalcate lamina, the fertile one with rather large, subelliptical, strongly keeled carpid. Fruit-bearing twigs 8—18 mm long; sterile leaves below the fruit adpressed, rarely slightly spreading, 4—10 mm long by 0.5—1 mm broad; receptacle subcylindrical, 4 mm long and 3—4 mm broad, warty; sterile lamina up to 3 mm long; seed subglobose, sometimes slightly flattened on the side of the carpid, or slightly truncate at the apex, 6—8 mm in diam., with thick rib on the back and with small, or rather strongly prominent apex of the carpid, smooth, sometimes with resinbladders, rather dull. (Description from all the flowering and fruit-bearing specimens mentioned below.) Cfr. *Fig. 2; Plate IV, 8a, 8b.*

According to herbarium labels, the demensions of this species are rather variable. The specimens Lam 1773 and 2154, and Versteeg 2537, are all from shrubs nearly 4 m tall; Brass 4688, however, is from a tree up to 20 m tall, whereas it is remarked on the label of Brass 4284, that it is the largest tree of the high-mountain forest. The bole is irregular (Lam 1773), "below the branches mostly clear and fairly straight, the upper trunk often bent in serpentine manner, bearing heavy main limbs and stiff upturned minor branches" (Brass 4284). The bark is black, rough (Lam 1773), "thick, dark gray, shedding in stiff, irregular scales" (Brass 4284), or "brown, rough, scaly" (Brass 4688). The wood is hard, light brown (Lam 1773), or pale yellowish (Brass 4284). The crown is irregular, with crooked branches (Lam 1773), or "usually spreading, irregular, of thick crooked branches" (Brass 4688). The shape of the young trees is conical (Brass). The ovule is purple with bluish bloom, and the fruit is purple-brown (Lam 1773); ovules and fruits are glaucous green (Brass 4284 and 4688).

This species occurs in the high-mountain forests, at elevations up

to 4300 m, especially from 2500 m to 4000 m el. It differs from *P. papuana* in the long, adpressed, sterile leaves, which involucrate the fruit, and the longer, less thick leaves; from *P. dacrydiifolia* in the much compacter twigs with more spreading and shorter leaves, and from *P. Steupii*, besides in the different sterile leaves involucrating the receptacle, also in the somewhat broader, less rigid leaves. Moreover, this species has the largest seeds of all species of the section *Dacrycarpus*. The sterile leaves surrounding the fruit are always erect and usually entirely adpressed. For the rest there is a rather wide variation. In the specimen Brass 4284, the typical leaves gradually pass into the sterile leaves around the base of the flower, which are rather short and broad and strongly dorsiventrally flattened; this occurs also, but less distinctly, in the specimens Wissel 161 and Brass 4688. In the specimen Pulle 964, however, the typical leaves pass more abruptly into the involucral ones, which are much longer and narrower, and more quadrangular. The other fertile collections are more intermediate between these extremes.

The specimen Brass 4284a is said to have been taken from a seedling, and Brass 4347 and 4348 from young trees. All these plants already have the subulate leaves which also occur in the adult trees, but somewhat shorter and slightly convex above, by which the leaf shape shows some approach towards that of *P. papuana;* the leaves on the older twigs of these specimens are more flat-triangular and more adpressed, flat above, slightly keeled beneath, and 1.5—2 mm broad at the base. Pinnate twigs, however, as occur in seedlings and young sterile plants of *P. imbricata* and *P. papuana*, are absent in these plants.

Some of the plants, collected by von Römer, and all included in the genus *Dacrydium* by Koorders, also belong to *P. compacta.* Though there occur, besides the typical leaves, also leaves up to 6 mm long, the specimens von Römer 736 and 1237 entirely agree with other sterile collections of this species. Von Römer 1231 and 1238 bear, besides more typical ones, also leaves up to 7 mm long, subulate, straight or slightly falcate, very thin, and passing towards the apex into very narrow, 8—9 mm long, strongly falcate, nearly bifariously arranged leaves. In my opinion, it is not impossible that pinnate twigs are wanting in the genus *Dacrydium.* The most deviating plants, Von Römer 1215 and Pulle 965 (a plant 0.5 m tall, with the note: "perhaps youth form of Pulle 964"), have the main twigs covered with fine, narrow, subulate, spreading, usually subfalcate, 6—10 mm long leaves; these main twigs bear bifariously alternating lateral twigs with not exactly bifarious,

strongly falcate, very narrow, 6—10 mm long leaves. These leaves become but little shorter towards the apices and the bases of the twigs, which are 2—7 cm long and 8—16 mm broad, pinnate, and broadly linear in outline. The specimens Versteeg 2436 and Lam 2154 are more or less intermediate between the typical flower- and fruit-bearing plants and the preceding probably young plants. Lam 2154 has a tendency to form pinnate leafy twigs. Therefore it seems probable, that Pulle 965 is a seedling of *P. compacta*, and that, on the other hand, Brass 4284a is not taken from a seedling, but from a more adult tree. If this is not the case, a further distinction of species among the collections below would be necessary.

In the specimens Branderhorst s. n. and De Kock 43, which probably must be included in this species, the majority of the leaves is exactly 5-fariously arranged, spreading, laterally flattened, up to 4 mm long. Sometimes these leaves pass at the apex into nearly bifarious, up to 5 mm long ones.

NEW GUINEA. N.W. Part: Without further locality, *De Kock* 40 (B, f); Mt. Doorman, 3200 m el., *Lam* 2154 (B, s); 3260 m el., *Lam* 1773 (B, f); S.W. Part: without further locality, *Branderhorst* s. n. (B, f); *Branderhorst* 131 (B, f); Hellwig Mts, *Von Römer* 736 (B, L, s), 1215, 1231, 1237 and 1238 (all B, s); Hellwig Mts., 2600 m el., *Pulle* 965 (U, s); Wichmann Mts., 3100 m el., *Pulle* 964 (U, f); Hubrecht Mts., 3100 m el., *Versteeg* 2436 (U, s); Meervallei at Quarles Lake, 3600 m el., *Versteeg* 2537 (U, s); Mt. Carstensz, Grasbergen and rintis to Dajakweide, 3800 m el., *Wissel* 161 (B, f); 3800—4300 m el., *Wissel* 154 (B, s); Mt. Goliath, 3000 m el., *De Kock* 43 (B, s); S.E. Part: Central Division, Mt. Albert Edward, 3680 m el., *Brass* 4284, type of the species (B, BD, f); *Brass* 4284a (B, BD, s); *Brass* 4347 (BD, s); *Brass* 4348 (B BD, s); Wharton Range, Murray Pass, 2840 m el., *Brass* 4688 (B, BD, f).

9. **Podocarpus leptophylla** Wasscher, n. sp.

Ramuli tenuissimi, filiformes, stricti vel graciliter curvati, 0.25—0.4 mm diametro, foliis inclusis 1—2.5 mm diametro. Folia divaricata, paulum sub medio inflexa, tenuiter subulata, valde dorsiventraliter applanata, in apicem tenuissimum acuminata, basi carina dosali in ramulum decurrentia, facie superiore plana vel nonnihil concava, 1.25—2 mm longa, 0.3—0.4 mm lata. Flores et fructus ignoti.

Twigs very slender, filiformous, erect, straight, or elegantly incurved, flexible, the youngest ones 0.25—0.4 mm in diam., 1—2.5 mm in diam. incl. the leaves. Leaves on the older twigs adpressed, narrow-triangular, dorsiventrally flattened, very acute, slightly keeled beneath, 2—3 mm long by 0.6—0.7 mm broad; leaves on the younger twigs nearly horizontally spreading, abruptly or gradually inflexed just below the middle, thinly triangular-subulate, 1.25—2 mm long by 0.3—0.4 mm

broad, shining, strongly dorsiventrally flattened, acuminate into a very fine point, on the lower surface with strong, decurrent keel, sometimes nearly flat towards the apex, on the upper surface flat or slightly concave. Flowers and fruits unknown. (Description from both specimens mentioned below.) Cfr. *Fig. 2; Plate IV, 9.*

Since flowers and fruits are wanting, it cannot be stated with certainty whether these plants belong to *Podocarpus* or to *Dacrydium.* As regards the foliage, however, they mainly agree with certain *Podocarpus* species. At any rate the thin foliage is unique in either genus, and the species is certainly new to science.

NEW GUINEA. N.W. Part: without further locality, *Branderhorst* s.n. (B, s); Mt. Goliath, 3000 m el., *De Kock* 39 (B, s), type of the species.

2. Sect. **Nageia** Endlicher

§ *Dammaroideae* Bennett, in Horsfield, Pl. Jav. rar., 1 (1834) 41. — Sect. *Nageia* Endlicher, Syn. Conif. (1847) 207; Miquel, Fl. Ind. Bat., II, 6 (1859) 1071; Henkel & Hochstetter, Syn. Nadelhölzer (1865) 378; De Boer, Conif. Arch. Ind. (1866) 12; De Kirwan, Conif., 2 (1868) 225;

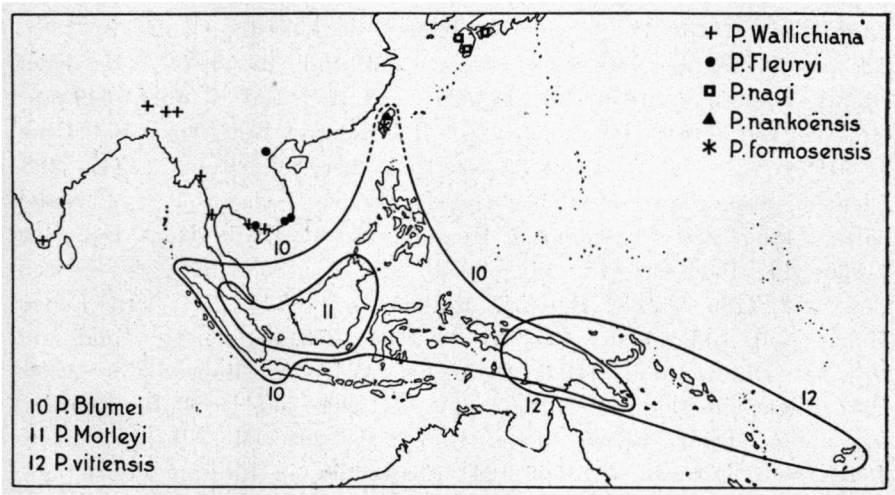

Fig. 3. Areas of the species of the section *Nageia*, and the only Malaysian species of the section *Polypodiopsis.*

Parlatore, in D. C., Prodr., 16, II, 2 (1868) 507; Miquel, in Siebold & Zuccarini, Fl. Jap., 2 (1870) 71; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1899) 104; Beissner, Nadelholzkunde (1891) 16; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 59; in Engl. & Pr., Nat. Pflanzenfam.,

Nachtr. 3 (1908) 3; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 157; Stiles, in Ann. Bot., 26 (1912) 448; Gibbs, in Ann. Bot. 26 (1912) 533; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 242, 245; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 272, 274. — Genus *Nageia* Gordon, Pinetum (1858) 134; ed. 2 (1875) 185; Carrière, Traité gén. Conif., II, ed. 2 (1867) 635.

Male flowers single, or to several fasciculate, on axillary peduncles. Female flowers single in the leaf axils; receptacle with 3—6 pairs of decussate scales, in maturity fleshy or dry; ovule single, much overtopping the carpid; seed globose, rather large, with bony testa. Trees with opposite ramifications; leaves opposite, large, ovate to oblong-lanceolate, with numerous, parallel nerves.

10. Podocarpus Blumei Endlicher — *Podocarpus latifolia* (non Thunberg 1794, nec Wallich 1830) Blume, Enum. pl. Javae, 1 (1827) 89; Hasskarl, in Tijdschr. Nat. Gesch. en Physiol., 9 (1842) 179; Cat. Plant. Hort. Bot. Bog. (1844) 70; Aanteek. Nut (1845) 72 (-us); Junghuhn, Java, 1 (1851) 507; Miquel, in Pl. Junghuhn., 1 (1851) 1 p.p.; Fl. Ind. Bat., II, 6 (1859) 1071 p.p.; idem, Suppl. Sumatra (1860) 252, 589 p.p.; Hasskarl, Neue Schlüssel (1866) 38; De Boer, Conif. Arch. Ind. (1866) 12, 28, 35, 37, 42, 50; de Kirwan, Conif., 2 (1868) 227 p.p.; Kurz, in Natuurk. Tijdschr. Ned. Ind., 27 (1874) 215; Filet, Plantk. Woordenb. (1876) 138; Hooker f., Fl. Brit. Ind., 5 (1888) 649 p.p.; Brandis, Ind. Trees (1906) 695, p.p.; Robinson, in Bull. Torr. Bot. Club, 35 (1908) 63. — *Podocarpus Blumei* Endlicher, Syn. Conif. (1847) 208; Dietrich, Syn. Plant., 5 (1852) 445; Henkel & Hochstetter, Syn. Nadelhölzer (1865) 380; Teysmann & Binnendijk, Cat. Plant. Hort. Bot. Bog. (1866) 14; Parlatore, in D.C., Prodr., 16, 2 (1868) 508; de Kirwan, Conif., 2 (1868) 227; Beccari, Malesia, 1 (1877) 178; Van Eeden, Houts. Ned. Ind. (1886) 135; ed. 3 (1906) 255; Engler, in Engl. und Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Warburg, Monsunia, 1 (1900) 193; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 60, ic. 9, B; Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 261; Merrill, in Philipp. Journ. Sci., 1, suppl. 1 (1906) 24; Foxworthy, in Philipp. Journ. Sci., 2 (1907) 258; De Clercq, Plantk. Woordenb. (1909) 309; Koorders-Schumacher, Syst. Verz., 1, fam. 5 (1910) 2; Koorders, Exkursionsfl. Java, 1 (1911) 67; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 158, t. 28, fig. 2; Koorders & Valeton, Atlas Baumarten Java, 3 (1915) ic. 588; Pilger, in Bot. Jahrb., 54, 1 (1916) 36; 54, 3 (1916) 208; Beekman, in Meded. Proefst. Boschw., 5 (1920) 170, t. 56; Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 2; Ridley, Fl. Mal. Pen., 5 (1925) 281; Pilger, in

Engl. und Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 245, ic. 134, B; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 1 (1927) 108; Lam, Fragmenta Pap., 4 (1928) 103; in Nat. Tijdschr. Ned. Ind., 88 (1928) 217; Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. 1 (1930) 236; Florin, Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 229, 272—274, text fig. 76, d, f, tab. X, 15, tab. XXI, 7; De Voogd, in Trop. Nat., 21 (1932) 219; Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, 13, 1 (1933) 12, 30; Burkill, Dict. Econ. Prod. Mal. Pen., 2 (1935) 1779; Janssonius, Mikrographie, 13 (1936) 488; Pilger, in Bot. Jahrb., 68 (1936) 245; Wasscher, in Backer, Bekn. Fl. Java, 2 (1940) fam. 18, 2. — *Podocarpus agathifolia* Blume, Rumphia, 3 (1847) 217, t. 173; Walpers, Ann. Bot. Syst., 3 (1852) 449. — *Nageia Blumei* Gordon, Pinetum (1858) 135; ed. 2 (1875) 186; Carrière, Traité Conif. (1867) 640; F. von Mueller, Descr. not. Pap. pl., 1 (1875) 93; Kuntze, Rev. Gen. Plant., 2 (1891) 798. — *Podocarpus latifolia* f. *ternatensis* De Boer, Conif. Arch. Ind. (1866) 14. — *Podocarpus* spec., Koorders-Schumacher, Syst. Verz., 2 (1910) 12. — *Podocarpus Wallichianus* (non Presl, 1844) Ridley, in Journ. Str. Br. R. A. Soc., 60 (1911) 57.

Twigs usually opposite, rarely scattered or divaricate, spreading, terete, rather stout, often flattened towards the apex. Terminal buds small, narrowly ovate-conical, acute; bud scales adpressed, narrowly ovate-triangular, very acute-acuminate, up to 3 mm long. Leaves subopposite, the pairs 1.5—8 (usually 2.5—6) cm distant from each other, spreading or horizontally spreading, thick-coriaceous, usually rigid, oblong, oblong-lanceolate or ovate-lanceolate, sometimes more ovate-oblong, usually gradually, sometimes more cuneately narrowed or rounded into the short, slightly flattened petiole, usually rather shortly, sometimes longer acuminate, or more gradually narrowed into the subobtuse or acute apex, 7—23 (usually 8—12) cm long by 2—7 (usually 3—4) cm broad, 2—7.5 (usually 3—4.5) times as long as broad; in young plants the leaves usually narrower, oblong-lanceolate, and very long- and acute-acuminate, flexible; lamina striped, with flat margins, shining on both surfaces. Male flowers in fascicles or in short, spicate inflorescences with 1—7 (usually 3—6) flowers on common peduncles in the leaf axils; common peduncles usually opposite, slender, 1—7 (usually 2—5) cm long, with 2—5 pairs of decussate bracts or scars; flowers in the axils of ovate-triangular, usually acute, often caducous bracts, cylindrical, 5—11 mm long and 2—3 mm in diam.; anthers with short, broad, acute apiculus; pollen grains with 2 air bladders. Female flowers single in the leaf axils, usually opposite; peduncles slender;

receptacle short, with 5—7 spreading, obovate, 3 mm long and 1.5 mm broad scales; fertile scale long, narrowly obovate, excavated, obtuse, 5 mm long and 2—3 mm broad. Peduncles 5—32 (usually 10—20) mm long and 1.5—2 mm in diam., with 1—3 pairs of decussate bracts or scars; receptacle fleshy, subcylindrical, 7—18 (usually 10—14) mm long and 2—7 mm broad, with 5—7 scale-like bracts or scars of them, the upper one opposite to the carpid, the upper ones often more or less spine-shaped; the fertile scale with narrow free margin. Seed globose, up to 20 (usually 15—18) mm in diam., smooth. (Description from all the specimens mentioned below.) Cfr. *Fig. 3.*

According to herbarium labels, *P. Blumei* is a tree up to 40 m tall (up to 48 m according to Koorders and Valeton), and up to 119 cm in diam., with a straight trunk without buttresses, whereas the crown usually occupies ¼ to ½ of the total height. The smallest flowering or fruit-bearing tree was about 14 m tall. The bark yields some white resin or sap (Boschpr. b.b. 17348, b.b. 23823). The male flowers are bright yellow-green (Lörzing 7336), white (Boschpr. b.b. 2450), or dark-dirty yellow (Koorders 39592). The fruit is green (Koorders 39402, 39403, and 39415, Boschpr. b.b. 8842), dark green (Endert 4978), blackish (Boschpr. b.b. 18217), or black (Boschpr. Cel./III. 80), and has a bitter taste (Boschpr. b.b. 18217).

P. Blumei occurs in the old primary and secundary forests, from sea level up to 2100 m el.

In the sterile state it shows, like other species of the section *Nageia,* a great resemblance with the genus *Agathis.* It is, however, easy to distinguish by its acute terminal buds, which in *Agathis* are always globose and broader. Blume was the first to draw attention to this distinctive character (1847). When discussing the taxonomic status of *P. Motleyi,* Dümmer (Journ. Bot., 52, p. 240) pointed to this difference again. At the same occasion he indicated an anatomical difference between *Agathis* and *Podocarpus* Sect. *Nageia, viz.,* in *Podocarpus* the resin canals being situated below the nerves of the leaves, in *Agathis* between them.

The f. *ternatensis* is nothing but a form with very large leaves. Also from other parts of the Malay Peninsula such plants are known, *e. g.,* from Sumatra (Krukoff 238, Boschpr. E. 1357, Yates 2554), Bangka (Teysmann s. n.), Borneo (For. Dep. 4055), Java (Koorders 1268, Backer 8866) and Celebes (Boschpr. Cel./III. 146).

Some plants from the Malay Peninsula were first (1911) included by Ridley in *P. Wallichiana* Presl, later (1925) in *P. Blumei.* The latter

species differs from *P. Wallichiana* (occurring in East India, Burma, French Indo-China), according to Ridley (1925), in the more rigid-coriaceous, more ovate leaves with shorter point. Whereas Blume (1847) mentioned as a difference, *i. a.*, that *P. agathifolia* Bl. (= *P. Blumei*) is dioecious, and *P. Wallichiana* monoecious, Miquel (1851) believed, that Blume's species (*P. latifolia* and *P. agathifolia*) are not different from *P. latifolia* Wall. (= *P. Wallichiana* Presl). According to Pilger's descriptions (1903), *P. Wallichiana* has flexible, ovate or lanceolate-ovate leaves, gradually narrowed and caudate-acuminate towards the acute apex, and with rounded base, whereas the leaves of *P. Blumei* are thick and rigid, elliptical or elliptical-lanceolate, short-, rarely long-acuminate towards the subobtuse or rarely acute apex and gradually narrowed towards the base. I had not the opportunity to examine the plants from the Malay Peninsula. Of *P. Wallichiana* I examined the following specimens: Khasia, Hooker and Thomson s. n. (L, s); Assam, Kings' collector s. n. (L, m); and Tenasserim, Falconer s. n. (L, s). These plants, indeed, have thin-coriaceous and flexible leaves with a long and acute acuminate apex. But also among the specimens from the Malay Archipelago are some with similar, long-acuminate leaves. Especially the leaves of youth forms have such a shape, as, *e. g.*, Koorders 10287 from Sumatra (3—4 m tall), Hasskarl s. n. from Java (pl. jun.), Boschpr. E. 1143 from Java (young tree), and Brass 5880 from New Guinea (young tree 5—10 m tall); but also adult trees sometimes have long-acuminate leaves, *e. g.*, Boschpr. b.b. 15950 (from Bengkoeloe, 36 m tall), and Buurman van Vreeden 49 (from Palembang, 18—20 m tall). On the other hand, young plants do not always possess long-caudate-acuminate leaves, as, *e. g.*, is shown by the fact, that the specimens Van Steenis 3755 and De Voogd 449, both from the G. Pakiwang in South Sumatra, have such leaves too, whereas the specimens Van Steenis 3754 and De Voogd 451, also youth forms, 2 m high, and collected from the same locality, have more ovate, very broad, and shortly acuminate leaves. Therefore, it seems possible that, after further examination, *P. Wallichiana* Presl (1844) and *P. Blumei* Endl. (1847) may appear to be specifically identical.

MALAY PENINSULA. Sungei Kelantan, *Ridley* s. n. (S, s) (according to *Ridley* 1911, l. c., this is in Sumatra); Perak: Kintan, *Low*; Dindings: G. Tungul, *Ridley*; Negri Sembilan: G. Angsi; Johore: Mt. Austin; Bukit Soga; Singapore: Changi (all according to *Ridley* 1925, l. c.).

SUMATRA. Atjeh: subdiv. Tamiang, Tengalon, 400 m el., *Boschproefstation* b.b. 12212, v.n. kajoe tjina itam (B, s); Oostkust (E. coast): N.E. Sibajak, 1200 m el., *Lörzing* 7336 (B, L, m); Karo Plateau, on Mt. Siosar, 1575 m el.,

Lörzing 8628 (B, L, s); subdiv. Simeloengoen, forest reserve Bandar Betsy near Bandar Poelo, 50 m el., *Boschpr.* E. 1352, v.n.: siboeloesomak (B, L, s); Asahan, near Masihi, *Yates* 2554 (B, f); Hoeta Padang Estate, near Kisaran, *Krukoff* 238, v.n. bulusoma (B, S, s); Sigati, 20 m el., *Koorders* 10286 (B, s); 40 m el., *Koorders* 10287 (B, s); Tapiannoeli: subdiv. Sibolga, P. Moesala, 5 m el., *Boschpr.* E. 1357, v.n. laboe rimba (B, L, s); Djambi: Teloek Sialang, *Boschpr.* b.b. 11335, v.n.: kebal ajam (B, s); Bengkoeloe: subdiv. Redjang, Tjoeroep, 800 m el., *Boschpr.* E. 1084, v.n.: medang sepaling abang (B, L, s); subdiv. Redjang, near Talang Remba Air Tidatar, *Boschpr.* b.b. 2450, v.n.: medang sepaling (B, L, m); Kepahiang, 650 m el., *Boschpr.* b.b. 15950, v.n.: kajoe lanang (B, s); Karanganjar, 900 m el., *Boschpr.* b.b. 8842, v.n.: medang sepaling (B, L, s); Palembang: forest Panero Kan, *Buurman van Vreeden* 49, v.n.: sitebel (B, s); subdiv. Banjoeasin, Bajoenglintjir, 15 m el., *Boschpr.* E. 1106, v.n. setebal (B, L, s); subdiv. Pasemahlanden, marga Lb. Boentaboenta, Pg. Seleman, 1200 m el., *Boschpr.* T. B. 200, v.n.: kajoe lanang (B, L, s); Ranau Lake, G. Pakiwang, 700 m el., *Van Steenis* 3754 (B, L, s); *Van Steenis* 3755 (B, s); *De Voogd* 451 (B, s); 900 m el., *De Voogd* 449 (B, s); Lampongsche Districten, div. Semangka, Koeta-Agoeng, 650 m el., *Gusdorf* 312, v.n.: kajoe lanang abang (B, s).

BANGKA. Near Djeboes, *Teysmann* 3278 H. B., v.n.: kajoe mangkeboel (B, s); *Teysmann* 3505 H. B. (U, s); Soengailiat, *Teysmann* s. n., v.n.: mangkeboel (B, L, G, s); *Berkhout* 430, v.n.: memboeloe (B, s); Soengailiat, Mt. Boei, *Teysmann* s. n. (B, G, s); subdiv. Toboali, 300 m el., *Bünnemeijer* 2341 (B, f); subdiv. Zuid-Bangka, Perlang, 5 m el., *Boschpr.* b.b. 10889, v.n.: mentebal (B, s); Rindik, 40 m el., *Boschpr.* b.b. 11307, v.n.: boeloh (B, s).

KARIMATA ARCHIPELAGO. Soengei Tajan, *Teysmann* s. n., v.n.: radja kajoe (B, L, s).

BORNEO. British North Borneo: without further locality, *Wood* 1244 (B, s); Gompa, Kudat, sea level, *For. Dep.* Br. N. Borneo 4055 coll. *Balajadia* (S, s); Mt. Kinabalu, 2200 m el., on Spur E. of Dehobang River, *Clemens* s. n. (B, s); Western Part: Soeka Lanting, *Hallier* B. 231 (B, s); Eastern Part: subdiv. Tidoengsche Landen, Noenoehan, 4 m el., *Boschpr.* b.b. 18217, v.n. kajoe pagi, or demelai (B, f); subdiv. Boeloengan, near Kabirau, S. Simendoeroet, 1000 m el., *Boschpr.* b.b. 11739, v.n.: totokan (B, s); Soengei G. Long Djean, 250 m el., *Boschpr.* b.b. 22647, v.n.: lemhan (B, s); subdiv. West-Koetai, near Poekoes, 100 m el., *Endert* 4978 (B, f); Mahakam, *Amdjah* 51 (B, L, s); Southern Part: subdiv. P. Tjahoe, Boboeat, 150 m el., *Boschpr.* b.b. 10964, v.n.: tarong (B, s).

JAVA. Without further locality, *Blume* s. n. (L, f, s) perhaps originals of *P. latifolia Blume*; *Hasskarl* s. n., pl. junior. (L, s); *Hasskarl* s. n. (L, m); *Junghuhn* s. n. (B, L, s); *Miquel* s. n. (L, m); *Zollinger* 3025 (U, f); West-Java: G. Lajoeng, Tjimara Oedjongkoelon, 150—250 m el., *Koorders* forest no. 51*, herb. no. 1261, v.n.: djerret (B, L, s); G. Tiloe, 200—500 m el., *Koorders* forest no. 50*, herb. no. 1268 (B, s); Pandeglang, Oedjongkoelon, near Moeara Tjiboenar, 150 m el., *Boschpr.* E. 1143 (B, s); G. Salak, coll. ?, v.n. kibima (L, s); *Kollmann* s. n. (ex *Pilger*, 1903, l. c.); 1000 m el., *Koorders* 24181, v.n.: kidamar (B, L, s); *Koorders* 33207 (B, s); Parakansalak, *Koorders* 39404 (B, L, s); 1000 m el., *Koorders* 39403, v.n.: kibima (B, f); forest no. 2501a, herb. no. 39402, v.n.: kibima (B, f); forest no. 2502a, herb. no. 39415, v.n.: kibima (B, f); forest no. 2503a, herb. no. 39409, v.n.: kibima (B, L, s); forest no. 2504a, herb. no. 39413 (B, f); 1100 m el.,

Koorders 39406, v.n.: kibima (B, f); 1350 m el., *Koorders* 39407, v.n.: kibima (B, m); G. Megamendong, *Junghuhn* s.n., v.n.: kibima (L, U, s); G. Pangrango, 1000 m el., *Junghuhn* s.n., v.n.: kibima (L, f); "*Houtsoorten van den Gedeh* no. 204", v.n.: kipoetri (L, s); G. Gedé, near Djaringan, 500—1000 m el., *Backer* 10438 (B, s); Pasir Datar, *Jeswiet* field no. 289, herb. no. 1307 (W, s); G. Sanggaboewana, N. of Tjiandjoer, 1200 m el., *Backer* 23930 (B, s); Takokak (Djampangwetan), *Koorders* 1264 (B, L, s); *Koorders* 1265, 1266, 1267, v.n.: kimalela (B, s); *Koorders* forest no. 2135a, herb. no. 1262 (B, L, s), 1263 (B, s); 11909 (B, L, s), 25599 (B, s), 32768 (B, s), and 39596 (B, L, f); 1200 m el., *Koorders* forest 2446a, herb. no. 39592 (B, m); Bivouac Denoe on Tjipatoedja, 450 m el., *Backer* 8866 (B, L, s); East-Java: Blitar ?, without coll., v.n.: dewan doro (B, s).

PHILIPPINES. Luzon: Cagayan prov., *For. Bur.* 16738 coll. *Curran* (B, s); Isabela prov., *Bur. Sci.* 47333 coll. *Ramos & Edaño* (B, S, f); Apayao subprov., *Bur. Sci.* 28348 coll. *Fenix* (B, f); Bataan prov., *For. Bur.* 1716 coll. *Curran* (B, L, f); Bataan prov., Lamao River, *For. Bur.* 194 coll. *Barnes* (B, f); Sibuyan, Magallanes (Mt. Giting-Giting), *Elmer* 12360 (B, L, U, f).

CELEBES. Subdiv. Gorontalo, 400 m el., *Boschpr.* b.b. 15602, v.n.: molosambonge or tombolilato (B, L, s); subdiv. Malili, Oesoe, 5 m el., *Boschpr.* Cel./III. 80, v.n.: tanragoeli (B, f); *Boschpr.* Cel./III. 143, v.n.: tanranggoeli (B, s); 50 m el., *Boschpr.* Cel./III. 144 and 145 (B, s); 25 m el., *Boschpr.* Cel./III. 146 (B, s); subdiv. Malili, Lampea, 20 m el., *Boschpr.* b.b. 23257, v.n.: kajoe tjina (B, s); subdiv. Malili, Tambarano, 600 m el., *Boschpr.* b.b. 9696, v.n. tandanggoeli (B, L, s); Lepolepo, near Kendari (ex Beccari l.c.).

MOLUCCAS. Ternate: *Teysmann* s.n. (B, L, U, G, f, originals of f. *ternatensis De Boer*); *Teysmann* 5189 H.B. (B, s); Batjan: without coll. (B, s); Laoe Indari, 200 m el., *Boschpr.* b.b. 17348, v.n.: salononaoe or damar laki-laki (B, s); Masoeroeng, 500 m el., *Boschpr.* b.b. 23127 and 23136, v.n.: damar radja laki-laki (B, f); Obi: Sesepe, *Atasrip* 118, v.n.: damar radja (B, L, s); Hol Hoeroe (Manomang) Anggai, 600 m el., *Boschpr.* b.b. 23823, v.n.: damar radja laki laki (B, s); Ceram: Loki, Asaoedi, 700 m el., *Boschpr.* b.b. 17555, v.n.: damar laki-laki (B, s); Seapoetih (Hoalmoal), 400 m el., *Boschpr.* b.b. 19647, v.n.: damar laki (B, s).

NEW GUINEA. N.W. Part: Ramoi and Andai (ex *Beccari* l.c.); Mamberamo River, Idenburg River, near Prauwenbivak, 120 m el., *Lam* 2161 (B, s); N.E. Part: Goromia, 300 m el., *Schlechter* 17395 (BD, s); Etappenberg, 850 m el., *Ledermann* 9027 (BD, m); Morobe distr., Quembang mission, 800 m el., *Clemens* 1231 (BD, s); 650 m el., *Clemens* 2172 (BD, f); Yoangen, 1300 m el., *Clemens* 6607 (BD, s); S.E. Part: Western Division, Wuroi, Oriomo River, 5—10 m el., *Brass* 5878 (B, BD, f), *Brass* 5880 (B, BD, s), *Brass* 5906 (B, m); Central Division, Dieni, Ononge road, 500 m el., *Brass* 3962 (B, s); Sogeri region, *Forbes* 911 (L, s).

Cultivated: in the Bot. Garden, Buitenzorg, V. F. 13 from S. New Guinea (B, s); V. F. 82 and 82a (B, G, s), 98 and 98a (B, s), all from Java; V. F. 91 and 91a from Bangka ? (B, f); V. F. 9 (B, s), of unknown provenance.

Further distribution: Probably Formosa (ex Forbes & Hemsley, in Journ. Linn. Soc. 26, p. 547, sub nom. *P. latifolia Wallich*).

11. Podocarpus Motleyi (Parlatore) Dümmer — *Dammara Motleyi* Parlatore, Enum. Sem. Hort. Bot. Florent. (1862) 26; in Seemann, Journ. Bot., 1 (1863) 36; in D.C., Prodr., XVI, II, 2 (1868) 377. —

Podocarpus Beccarii Parlatore, in D.C., Prodr., XVI, II, 2 (1868) 508; Warburg, Monsunia, 1 (1900) 193; Pilger, in Engl., Pflanzenr. IV, 5 (1903) 59; Merrill, Bibl. enum. Born. pl. (1921) 31; Heyne, Nutt. pl. Ned. Ind., ed. 2 (1927) I, 108; Polak, in Verh. Kon. Akad. Wet. Amsterdam, XXX, 3 (1933) 20, 32; Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, XIII, 1 (1933) 27; Slyper, in Rec. Trav. bot. néerl., 30 (1933) 502, ic. 14. — *Nageia Beccarii* Gordon, Pinetum, ed. 2 (1875) 186; Kuntze, Rev. Gen. Plant., 2 (1891) 798. — *Agathis Motleyi* Warburg, Monsunia, 1 (1900) 185; Merrill, Bibl. enum. Born. pl. (1921) 32. — *Podocarpus* spec., Seward and Ford, in Phil. Trans., 198 (1906) 317. — *Podocarpus Motleyi* Dümmer, in Journ. Bot., 52 (1914) 240; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 245; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 272, 274.

Twigs opposite, rarely scattered, terete, with thickened base, more angulate towards the apex. Terminal buds usually rather large, ovate-acute; bud scales ovate-acute, sometimes long-acuminate, often slightly spreading, to 5 mm long. Leaves subopposite, crowded towards the apices of the twigs, the pairs 6—22 mm distant from each other, thick-coriaceous, very rigid, elliptical, sometimes elliptical-oblong, cuneately narrowed into the very short, thick, slightly flattened petiole, rather shortly narrowed into the rounded, obtuse, sometimes somewhat acute or short-acuminate apex, usually 3—5 cm, rarely to 7.5 cm long by 13—28 mm broad, 1.5—3 times as long as broad; lamina with flat margins, shining on both surfaces. Male flowers single in the leaf axils, sessile, thick-cylindrical, 7—19 mm long and 5—7 mm in diam.; stamens with large, triangular, acute or acuminate apiculus, with membranous margin, slightly keeled; pollen grains with 2 air bladders. Female flowers single in the leaf axils, with short peduncles; receptacle with nearly 7 large, obovate or ovate bracts, with obtuse or slightly acute apex and membranous margin, 3—4 mm long by 2—2.5 mm broad; the fertile bract oblong-obovate, obtuse, excavated, 4 mm long by 2—2.5 mm broad. Peduncles short, to 5 mm long and 1.5—2 mm in diam., with 3—4 pairs of decussate scars; receptacle fleshy, subcylindrical, 8—12 mm long and 3—6 mm broad, with 5—9 free scales or scars of these, the upper ones often more or less spine-shaped; carpid with 1 mm broad, free margin. Seed globose, up to 20 (usually 13—15) mm in diam. (Description from the specimens mentioned below.) Cfr. *Fig. 3; Plate IV, 11a—d.*

According to herbarium labels, *P. Motleyi* is a tree up to 40 m tall, with a straight, terete bole up to 90 cm in diam., and without

buttresses; the crown occupies about one-third of the total length. The bark yields little white resin (Boschpr. b.b. 6368). The fruit is whitish green (Grashoff 1138), or dark green with glaucous bloom (Boschpr. 12T. 1P. 13). In the collection Boschpr. 12T. 1P. 185 a very great part of the receptacles are cleaved longitudinally.

This species occurs in young and old, primary and secondary forests of the lower, flat, often swampy regions, usually little above sea-level. It differs from *P. Blumei* in its solitary, sessile male flowers, the shorter fruit-bearing peduncles, the larger terminal buds and the smaller, more crowded leaves.

MALAY PENINSULA. Dindings: Legari Melintang, *For. Dep.* 16568 coll. *Strugnell*, v.n.: raja kayu (S, f); Johore: S. Kayu, Mawai-Temulang Road, at low el., *Sing.* Field no. 21341 coll. *Corner* (B, S, f).

RIAU ARCHIPELAGO. P. Karimoen, Teloek Lekoep, 1.5 m el., *Boschpr.* b.b. 17229, v.n.: kebal ajam (B, s).

SUMATRA. Oostkust (E. coast): Bengkalis, Batoe Pandjang, 1 m el., *Boschpr.* b.b. 14063 (B, s); Palembang: Banjoeasin- and Koeboestreken, near Banjoenglintjir, 15 m el., *Boschpr.* 12T. 1P. 13, v.n.: kajoe setebal (B, L, f, m); *Boschpr.* 12T. 1P. 185 (B, L, W, f); 20 m el., *Grashoff* 874, v.n.: setobal (B, L, m); Rawas, 150 m el., *Grashoff* 1138, v.n.: kajoe bawah (B, L, f).

BORNEO. Sarawak: *Beccari* P. B. 2649, originals of *P. Beccarii Parl.* (B, f); Western Part: subdiv. Pontianak, Koeboepadi, 5 m el.; *Boschpr.* b.b. 6368, v.n.: kajoe tjina, manoek koeboel (B, s); subdiv. Simpang, Loeboekbatoe, 5 m el., *Boschpr.* b.b. 7364, v.n.: kajoe tjina (B, s); Eastern Part: subdiv. Tidoengsche landen, S. Lebakis, 5 m el., *Boschpr.* b.b. 18328, v.n.: kajoe pagi, kajoe seriboe (B, S, s); Southern Part: subdiv. Poeroek Tjahoe, Tahoedjan, 500 m el., *Boschpr.* b.b. 21151, v.n.: kajoe seriboe (B, f); Bandjermasin, *Motley* (ex *Parlatore* l. c.); subdiv. Sampit, S. Poetjoek, 12 m el., *Boschpr.* b.b. 11613, v.n.: marimboe (B, s).

3. Section **Polypodiopsis** Bertrand

in Ann. Sci. Nat., 5me sér., 20 (1874) 65; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 275, 278; 19, 2 (1940) 8, 25, 71, ic. 2.

Male flowers usually in the axils of decussate bracts on leafless twigs, or rarely in the leaf axils, and moreover terminal on the pinnate twigs. Female flowers in the axils of bracts; receptacle with nearly 5 pairs of decussate, sterile scales; ovule 1, rarely 2, much overtopping the carpid; seed obovate, the testa without woody layer. Trees with decussate ramifications, the uppermost twigs with decussate bracts, the other ones with the leaves decussate but turned in one plane, apparently bifarious, pinnately arranged, small, with a single rib; stomata on both surfaces.

The systematic place of *P. vitiensis* has changed many times.

Seemann first thought that it was a new genus allied to *Podocarpus*. He based his opinion upon the entirely different appearance and the different shape of the seed. Whereas the seed in *Podocarpus* is always subglobose, it is, in *P. vitiensis*, ovate-acuminate and not oblique, but equilateral. By the incomplete fruit materials and the absence of flowers, however, he was obliged to include the species in *Podocarpus*. And, as the leaves bear stomata on both surfaces and have a single rib, he included it in the section *Dacrycarpus*.

Bertrand based, on account of anatomical differences, the new section *Polypodiopsis* upon *P. vitiensis*. Not only is there a resin canal below each vascular bundle, but also one at each side of the midrib near the leaf margins. Moreover, the course of the vascular bundles in the stem is entirely different from those of other *Podocarpus* species. In the species he included also the doubtful *Polypodiopsis Muelleri* Carrière (which, according to J. H. in Kew Bulletin, 1920, p. 372, is *Bauprea Balansae* Brogn. et Gris., a *Proteacea* from New Caledonia), and the equally doubtful *Torreya bogotensis* Linden.

Pilger (1903) provisionally added *P. vitiensis* to the section *Nageia* on account of the opposite leaves, which are broad at the base, though it is different by its narrower leaves and the characters of the male flowers. The female flowers were unknown to him.

Gibbs (1909) first included the species in the section *Stachycarpus* on account of the position of the female and male flowers, and considered it most closely allied to the New Zealand *P. ferruginea* Don. Later (1912) she followed Pilger, in spite of the single rib of the leaves. The stone-cells, which, according to Pilger, only occur in the seed wall of species of the section *Stachycarpus*, are absent in the seeds of *P. vitiensis*; moreover, the peduncle of *P. nagi* shows some resemblance with that of *P. vitiensis*, whereas the ramification of the peduncle, "so accentuated in the Fijian plant, is also to a certain degree represented in section *Nageia*". Besides she writes: "It is therefore thought advisable to follow Pilger, and leave *P. vitiensis* provisionally in sectio *Nageia*, though the very characteristic branching of the peduncle, the four vascular bundles of the ovuligerous scale" (= ephimatium) "and the semi-orbicular ridge, which terminates it, together with the beak-like prolongation of the nucellus into the micropyle, are features which seem to distinguish it from all the other sections".

Florin (1931) re-established the section *Polypodiopsis*. As the most important characters of this section he mentions the single-ribbed leaves, the resin canals, the decussate insertion of the leaves, the alternatingly

left and right torsion of the leaf-cushions, and the constantly right [1]) turn of the leaf bases on plagiotrope shoots of the latest order. Also in the structure of the epidermis this section is very homogeneous. Besides *P. vitiensis*, he also included *P. minor* from New Caledonia, and *P. Rospigliosii* from Peru in it.

I agree with Florin, that this section must be re-established; the section Nageia thus becomes much more homogeneous. If, however, the name *Polypodiopsis* may be valid according to nomenclature rules, is questionable, as the name has evidently been taken from *Polypodiopsis Muelleri*, which is no *Podocarpus*, but a Proteaceous plant.

12. Podocarpus vitiensis Seemann, in Bonplandia, 10 (1862) 365; in Journ. Bot., 1 (1863) 33, t. II; Fl. Vitiensis (1865—73) 266, t. 78; Pilger, in Engl., Pflanzenreich, IV, 5 (1903) 63; Gibbs, in Journ. Linn. Soc., 39 (1909) 182; in Ann. Bot., 26 (1912) 533, t. 49, ic. 14—16, t. 50, ic. 17, 18, t. 53, ic. 72, 73; Stiles, in Ann. Bot., 26 (1912) 455; Pilger, in Bot. Jahrb. 54, 1 (1916) 36; in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 245; Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. 1 (1930) 237; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 192, 229, 274—276, 278, ic. 77, d, e; 19, 2 (1940) 11, 25. — *Nageia vitiensis* Kuntze, Rev. Gen. Plant., 2 (1891) 800.

Branchlets terete, smooth, striped by decurrent lines. Twigs decussate, in pairs at distances of 2.5—4 cm, spreading or erect-spreading, dimorphic (nearly as in *Taxodium*): main twigs terete, or slightly flattened below the ramifications, leafless, alternatingly bearing decussate lateral leafy twigs, and decussate, ovate to orbicular, nearly 2 mm long, deciduous bracts, terminated by a bud; the lateral twigs slender, usually unbranched, rarely branched, with the leaves decussate but turned in one plane, with pinnate appearence, up to 38 (usually 8—15) cm long, terminated by a small bud, which probably never develops. Terminal buds of the main twigs globose or ovate, small, with decussate, ovate, orbicular or obovate, obtuse, 1.5—2 mm long scales; scales of the terminal buds of the leafy twigs somewhat smaller. Leaves decussate, but turned in one plane and pinnately arranged, the pairs at distances of 3—6 mm, of each pair the one leaf with the upper surface, the other with the lower surface directed upwards; all leaves strongly spreading, nearly lanceolate, rather acute towards the obtuse apex, broadly rounded at the base, sessile, decurrent down to the axils of the following pair of leaves, 1.5—3 cm long by 3—5 mm broad,

[1]) see foot-note p. 364.

those in the basal part of the twigs shorter and more oblong; midrib on the morphological upper surface usually broad and flat- or rounded-prominent, on the morphological lower surface slightly and narrowly prominent, flat, or slightly and broadly impressed; lamina slightly shining, with flat or somewhat incurved margins. Male flowers sessile, rarely in the axils of the lowermost leaves, usually on short lateral twigs in the basal portion of the leafy twigs, or on short lateral twigs in the upper portion of the main twigs, these bearing decussate, deciduous, ovate, obtuse bracts, in the axil of which is either a flower or a small twig with a terminal flower and a few decussate flowers; flowers cylindrical, 12—20 mm long and 2—2.5 mm in diam.; stamens with triangular-ovate, obtuse apiculus; pollen grains with 2 air bladders. Female flowers in the axils of bracts, on peduncles 2—8 mm long, sometimes branched, with a few decussate, acute bracts; receptacle with nearly 5 pairs of broadly ovate, sterile, decussate, 2 mm long bracts, and one slightly longer carpid; young seed obovate, narrowed towards the base; seed (after Seemann ex Pilger) obovate, obtuse. (Description from the specimens mentioned below, and a female plant from the Fiji Islands [Gillespie 3712]). Cfr. *Fig. 3.*

According to herbarium labels this species is a tree up to 33 m tall. According to Gibbs l. c., it is "a beautiful tree with splendid shaft clothed in smooth white bark and a crown of spreading branches. The wood is the most valuable timber of the Fiji Islands, being not over hard and very durable". Sometimes there are 2 fertile scales. The young fruit is said to be beautifully magenta-red, with a waxy bloom.

All the parts of this plant, with the exception of the stamens, are decussately arranged. Furthermore the twig dimorphism is very remarkable. In the herbarium specimens the main twigs bear decussate bracts in the uppermost part, and below these bracts 1—3 pairs of usually leafy, rarely leafless twigs.

According to Seemann (1865), Pilger (1903), and Florin (1940, p. 11), the male flowers are terminal on the leafy twigs. The axis of these twigs is continued into a short peduncle, which bears few sterile, decussate bracts. Rarely a lateral male flower should be found in the axil of one of these bracts. From the Peruvian species *P. Rospigliosii*, however, Florin describes the male flowers arranged in short lateral inflorescences borne by ordinary leafy twigs, as described by me in *P. vitiensis*. *P. minor* has as well lateral inflorescences as terminal flowers; moreover, flowers rarely occur in the axils of the leaves. The latter is also described by me from *P. vitiensis*. It is possible, that the

terminal buds of the leafy twigs, as described by me, also are male flower buds. At any rate, the male flowers of the three closely allied species are hardly different from each other.

NEW GUINEA. S.E. Part: Alola, 1650—2000 m el., *Carr* 14160 (L, m); Lala River, 1650 m el., *Carr* 15666 (L, m).

BISMARCK ARCHIPELAGO. New Ireland (Neu Mecklenburg), near Namatanai, 900—1100 m el., *Peekel* 586 (ex *Florin* 1931 l. c.).

Cultivated: in Hort. Tjibodas, B. 8, from New Guinea (B, m).

Further distribution: Fiji Islands.

4. Section **Eupodocarpus** Endlicher

Sect. I, Bennett, in Horsfield, Pl. Jav. rar., 1 (1838) 39. — Sect. *Eupodocarpus* Endlicher, Syn. Conif. (1847) 208; Miquel, Fl. Ind. Bat., II, 6 (1859) 1072; Henkel & Hochstetter, Syn. Nadelhölzer (1865) 381; De Boer, Conif. Arch. Ind. (1866) 14; Carrière, Traité Conif., II, ed. 2 (1867) 644; Parlatore, in D.C., Prodr., 16 (1868) 509; de Kirwan, Conif., 2 (1868) 224; Miquel, in Siebold et Zuccarini, Fl. Jap., 2 (1870) 69; Gordon, Pinetum, ed. 2 (1875) 326; Eichler, in Engl. & Pr., Nat. Pflanzenfam. II, 1 (1889) 104; Beissner, Nadelholzkunde (1891) 16; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 73; in Engl. & Pr., Nat. Pflanzenfam., Nachtr. 3 (1908) 3; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 160; Stiles, in Ann. Bot., 26 (1912) 448; Gibbs, in Ann. Bot., 26 (1912) 543; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 242, 247; Hickel, in Lecomte, Fl. Gén. Indo-Chine, V, 10 (1931) 1066; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 279, 283.

Male flowers single or in bundles of 2—8 in the leaf axils, sessile or on very short common peduncles, cylindrical or nearly filiformous; stamens with distinct apiculus, rarely absent. Female flowers single, axillary, on short or slender peduncles; receptacle always distinctly developed, usually composed of 2, sometimes of 3 or 4 fleshy scales, which are decussate with 2 subulate, deciduous, sterile bracts at the base ("foliola")[1]; ovules single, rarely 2, much longer than the short, free margin of the fertile scale; seed rather large, globose-elliptical or elliptical, with coriaceous testa. — Trees or shrubs, with scattered oblong to linear leaves with a single rib; stomata on the lower surface.

13. Podocarpus deflexa Ridley — *Podocarpus neriifolia* (non D. Don 1824) Ridley, in Journ. Fed. Mal. St. Mus., VI, 3 (1915) 198. — *Podocarpus deflexus* Ridley, Fl. Mal. Penins., 5 (1925) 283; Florin, in

[1]) sometimes absent in species not occurring in the area dealt with.

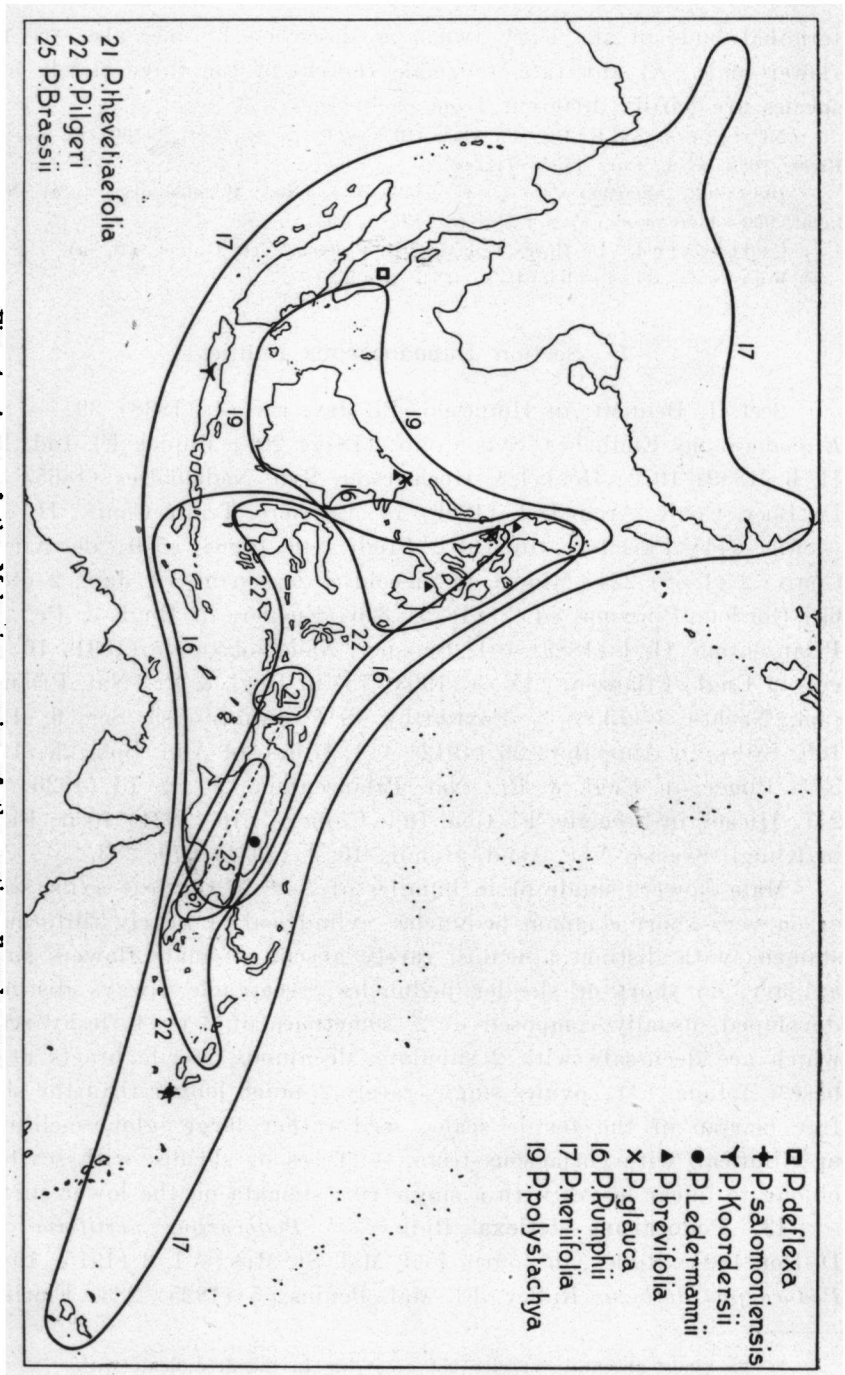

Fig. 4. Areas of the Malaysian species of the section *Eupodocarpus*.

Kungl. Svensk. Vet. Akad. Handl., X, 1 (1931) 279; Van Steenis, in Tijdschr. Kon. Aardrijksk. Genootsch., 55 (1938) 756.

Twigs stout, terete, little branched, the branches more or less verticillate; leaf-scars numerous, prominent, roundish-elliptical, 2—2.5 mm long by 1.5—2 mm broad, vaulted by cushions; scars of the bud-scales long-stretched, 3 mm long by 1 mm broad. Terminal buds large, the part composed by the inner scales, nearly ovate-globose, obtuse; outer bud scales reflexed, nearly lanceolate, acute, to 12 mm long; inner scales adpressed, nearly triangular, very short-acuminate or obtuse. Leaves crowded on the youngest 1—3 vegetation periods, all strongly deflexed, thick-coriaceous, very rigid, narrowly linear-lanceolate, gradually narrowed into the indistinct petiole and the very shortly rounded, rarely acute apex, 10—27 cm long by 7—12 mm broad, 12—25 times as long as broad; midrib rather strongly prominent, narrow, sometimes broader, sharply delimited, and indistinct towards the apex above, sharply prominent at the base, broad and flat towards the apex and rather deeply and broadly channelled beneath; lamina slightly to rather strongly recurved, with a narrow shining marginal line beneath, very shining and longitudinally striped above, dull beneath. Male flower buds 1—3 in the upper leafaxils, sessile, subglobose, obtuse; scales broadly ovate-triangular, obtuse, with broad membranous margin. Male flowers unknown. Female flowers solitary in the upper leafaxils; peduncle 9—15 mm long, 1.5 mm thick; receptacle obconical, somewhat flattened, 9—14 mm long, 4—8 mm thick at the apex, composed of 2—4 fleshy bracts, of which 1 or 2 fertile, in the latter case with two small apices between the two fertile scales; seeds 1 or more, usually 2 in number, elliptical-obovate, somewhat narrowed towards the base, 11—12 mm long, 8—9 mm broad. (Description from all the specimens examined.) Cfr. *Fig. 4.*

According to herbarium labels *P. deflexa* is a small tree 5—7 m tall, with the branches spreading at right angles to the stem (Ridley 1925 l. c.). It is common all over the padangs of Gunong Tahan.

According to Ridley this species should be different from *P. neriifolia*, besides in the deflexed leaves, especially in its sessile receptacle and the larger glaucescent fruit. It is at any rate wrong that *P. deflexa* should have sessile receptacles; in reality these are long-peduncled. Probably Ridley based this distinctive character on a twig fragment with two sessile fruits in the cover of the number Wray & Robinson 5452. These fruits however, do not belong to a Coniferous tree. As little is it true that the fruits of *P. neriifolia* do not reach the di-

mensions of those of *P. deflexa*. *P. deflexa*, however, differs too much from *P. neriifolia* by the different terminal bud, the always deflexed leaves, the leaf shape, and the midrib channelled beneath, not to accept it as specifically different.

MALAY PENINSULA. Pahang: Gunong Tahan, 1800—2000 m el., *Wray & Robinson* 5452, first type (S, f); *Ridley* 16024, second type of the species (S, f); *Sing. Field* 7997 coll. *Md. Nur* (S, s); F. M. S. Mus. Herb. 12121 coll. *Kloss* (S, f); *Corner* s. n. (S, m).

14. Podocarpus salomoniensis Wasscher, n. sp.

Ramuli crassi, teretes, cicatricibus magnis. Gemma terminalis magna, perulis e basi rotundata in acumen subulatum productis, ad 11 mm longis, vel a basi sensim attenuatis, ad 22 mm longis. Folia sparsa, divergentia, divaricata, vel reflexa, crasse coriacea, rigida, anguste lineari-lanceolata, versus apicem acutum, versus basin sensim attenuata, 12—18 cm longa, 6.5—8 mm lata, plerumque 8—23 × longiora quam lata, costa facie superiore valde prominente, facie inferiore latiore, basin versus acute costata, apicem versus planiore, nonnunquam leviter sulcata, marginibus valde revolutis, facie superiore lucida, inferiore minus vel minime lucida. Flores masculi et feminei ignoti. Pedunculi fructiferi divergentes, applanati, 11—15 mm longi; foliola subulata, 4 mm longa; receptaculum obconicum applanatum, 8—9 mm longum, prope apicem 8—11 mm latum et 4—5 mm crassum, e squamis 4 decussatis carnosis compositum, quarum 2 fertiles; semen ellipsoides, 11 mm longum, 8 mm latum.

Twigs stout, terete, with coarse leaf scars and striped by decurrent lines. Terminal buds large; bud scales long subulate-acuminate, usually spreading and incurved at the apex, to 11 mm long, or very gradually narrowed, erect, keeled. Leaves scattered on the youngest two vegetation periods, spreading, divaricate or somewhat deflexed, thick-coriaceous, rigid, often somewhat folded upwards along the midrib in the dried state, straight or slightly falcate, narrowly linear-lanceolate, very gradually narrowed into the broad petiole and the acute apex, 12—18 cm long by 6.5—8 mm broad, usually 18—23 times as long as broad; midrib strongly prominent above, on the underside sharply keeled towards the base, broad, thick and flat towards the apex, sometimes somewhat channelled; lamina strongly recurved at the margin, very shining above, more dull beneath. Male flowers unknown. Female flowers solitary in the upper leaf axils; peduncle slender, flattened, spreading, 11—15 mm long; foliola subulate, acute, about 4 mm long; receptacle obconical, somewhat flattened, 8—9 mm long, 8—

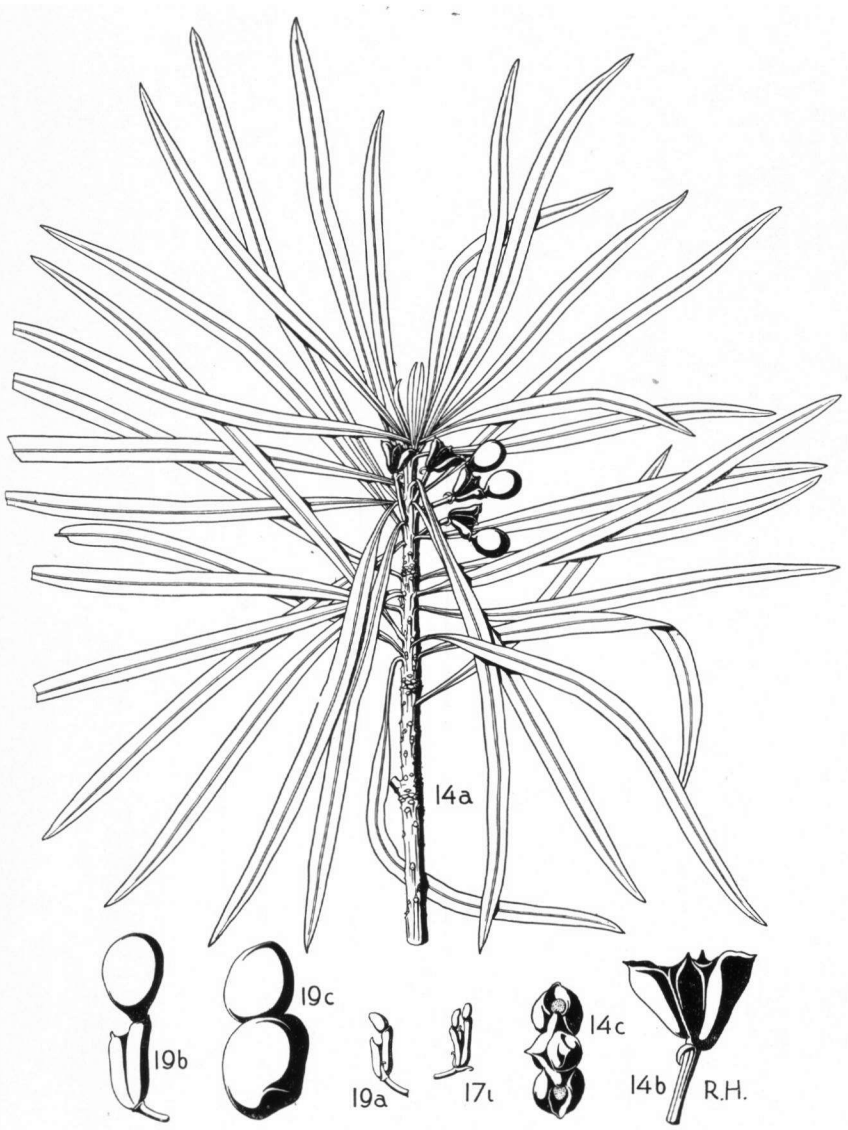

Plate V. Figs. 14a—c: *Podocarpus salomoniensis* (*Brass* 2881); 14a: twig fragment; 14b: receptacle; 14c: receptacle seen from above; 17ι: *P. neriifolia* var. *polyantha*, female flower (*Van Steenis* 3179); 19a—c: *P. polystachya*; 19a: female flower (*Becking* 69); 19b: unripe fruit (*Hort. Bot. Buitenzorg* V.F. 1a); 19c: ripe fruit (*Hort. Bot. Buitenzorg* V.F. 1). Main figure $^{2}/_{5}\times$, details $1^{1}/_{5}\times$.

11 mm broad by 4—5 mm thick at the apex, composed of 4 decussate fleshy bracts, of which the 2 fertile lower ones larger, with narrow, usually obtuse, free margin and embracing the 2 sterile upper ones, which have prominent apices; seed subelliptical, rounded at the apex, somewhat narrowed towards the base, 11 mm long by 8 mm broad. (Description from the type specimen.) Cfr. *Fig. 4; Plate V, 14a—c.*

According to Brass, *P. salomoniensis* is a tree to 15 m tall, with "spreading and rather drooping branches, thin fibrous, fissured, pale brown bark and hard free grained wood". It is remarkable that most of the folia are inserted somewhat (1—1½ mm) below the receptacle. In leaf and fruit shape, the species mainly agrees with *P. deflexa,* but it differs in the non-deflexed leaves, with the midrib usually not channelled beneath and sharply delimited above.

SOLOMON ISLANDS. San Cristoval Island, Hinuahaoro, in mountain forest, 900 m el., *Brass* 2881 (B, f), type of the species.

15. Podocarpus Koordersii Pilger, in Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 268; Koorders-Schumacher, Syst. Verz., 1, Fam. 5 (1910) 5; Koorders, Exkursionsfl. Java, 1 (1911) 66; Koorders & Valeton, Atlas Baumart. Java, 3 (1915) ic. 587; Pilger, in Bot. Jahrb., 54, 1 (1916) 39; in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Florin, in Kungl. Svensk. Vet. Akad. Handl., X, 1 (1931) 279, 283; Wasscher, in Backer, Bekn. Schoolfl. Java, 2 (1940) Fam. 18, 2.

Twigs stout, terete, to 3 subverticillate. Terminal buds globose or ovate-globose, obtuse, 2—4 mm in diam.; bud scales adpressed, mostly ovate or roundish, obtuse, to 3 mm long, thick, strongly carinate, with very narrow membranous margin, the outer ones sometimes somewhat acute. Leaves rather remote, spreading or erect-spreading, thick coriaceous, rigid, straight or somewhat falcate, linear-lanceolate, with the margins parallel over a great part of the length, rather gradually or very gradually narrowed into the broad and thick petiole, rather gradually narrowed into the acute apex, 13—21 cm long by 9—13 mm broad on the flowering twigs, up to 24 cm long and 18 mm broad on the sterile twigs, 12—24 times as long as broad; midrib broad, roundly prominent or prominent as a rather thick line, and slightly keeled towards the apex above, sharply prominent at the base, thick and flat towards the apex beneath; lamina slightly recurved at the margins, very shining above, dull beneath. Male flower buds 3—7 in the leaf axils, sessile, globose or ovate-globose, obtuse, to 3 mm long and 2 mm broad; bud scales ovate, obtuse, with membranous margin, the outer

scales somewhat ovate-triangulate, keeled; flowers narrow-cylindrical, 3—4.5 mm long by 2.5—3 mm in diam.; stamens with short, broad-triangulate, rather obtuse apiculus. Female flowers and fruits unknown. (Description from all the specimens examined.) Cfr. *Fig. 4.*

This species differs from *P. neriifolia* in the round, obtuse leaf buds, the thick coriaceous, linear-lanceolate leaves with the margins parallel, the different shape of the midrib, and the male flowers in bundles of 3—7. In *P. Rumphii*, which it resembles most, the male flowers are solitary. A plant from the Andaman Islands (King's collector 301) (B, m) was included in this species by Koorders and Valeton, but, in my opinion, wrongly. Whether this plant is a form of *P. neriifolia*, I cannot say with certainty.

JAVA. Noesa Kambangan, 50 m el., *Koorders* 1230, v.n.: merakan (B, L, s); 39480 (B, L, m); 39599, v.n.: tjemara (B, L, m); for. no. 1097*, herb. no. 40251, v.n.: tjemara pasir (B, L, m); all these specimens originals of the species.

16. Podocarpus Rumphii Blume. — *Lignum emanum* Rumphius, Herb. Amboin., 3 (1743) 47, t. 26. — *Cerbera nereifolia* Zippelius, ex Macklot, Bijdr. Nat. Wet., 5 (1830) 178, nomen. — *Podocarpus Rumphii* Blume, Rumphia, 3 (1847) 214; Walpers, Ann. Bot. Syst., 3 (1852) 449; Miquel, Fl. Ind. Bat., II, 6 (1859) 1073; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 393; De Boer, Conif. Arch. Ind. (1866) 15, 28, 36, 37, 50; De Sturler, Cat. descr. Esp. Bois (1867) 6; Carrière, Traité gén. Conif., II, ed. 2 (1867) 663; De Kirwan, Conif., 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 515; Gordon, Pinetum, ed. 2 (1875) 346; Filet, Plantk. Woordenb. (1876) 182; Scheffer, in Ann. Jard. Bot. Buitenz., 1 (1876) 52; Beccari, Malesia, 1 (1878) 179; Van Eeden, Houts. Ned. Ind. (1886) 136; ed. 3 (1906) 256; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Warburg, in Bot. Jahrb., 13 (1891) 256; Monsunia, 1 (1900) 192; Schumann & Lauterbach, Fl. deutsch. Schutzgeb. (1901) 155 p.p.; Smith, in Teysmannia, 12 (1902) 162; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 81; Foxworthy, in Philipp. Journ. Sci., 2 (1907) 258; De Clercq, Plantk. Woordenb. (1909) 309; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 164; Pilger, in Bot. Jahrb., 54, 1 (1916) 39; 54, 3 (1916) 210; Gibbs, in Contr. Arfak Mts. (1917) 82, 27, 28, 29; Merrill, Interpr. Rumph. Herb. Amb. (1917) 75; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Heyne, Nutt. pl. Ned. Ind., ed. 2 (1927) I, 109; Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. 1 (1930) 237; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283; Lauterbach, in Bot. Jahrb., 63 (1930) 438, 447. — *Podocarpus bracteata* (non Blume) Dietrich, Syn. Plant.,

5 (1852) 446; Hasskarl, Neue Schlüssel Rumph's Herb. Amb. (1866) 49. — *Nageia Rumphii* F. von Mueller, Descr. not., 1 (1875) 93; Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Podocarpus Blumei* (non Endlicher) Koorders, Dienstr. Minah. (1898) 264. — *Podocarpus philippinensis* Foxworthy, in Philipp. Journ. Sci., 6 (1911) 163, t. 30; Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 3; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283. — *Podocarpus neriifolia* Koorders-Schumacher, Syst. Verz., 3 (1914) 7 p.p.

Twigs several (up to 5) subverticillate, sometimes more scattered, spreading, terete, more angulate between the leaves. Terminal buds either globose to ovate-globose, obtuse, or ovate-acute to conical; bud scales either ovate to broad-ovate, obtuse, the outer ones sometimes somewhat acute, 2—3 mm long, thick, keeled, sometimes with narrow, membranous margin or very thick triangular-subulate, or ovate-triangulate and subulate-acuminate, 3—13 mm long, keeled, sometimes with narrow membranous margin, the inner ones shorter, ovate-triangular, acute. Leaves usually not much crowded, but sometimes slightly so towards the apices of the vegetation periods, in young plants sometimes turned in two rows, more or less spreading, straight or subfalcate, on adult trees thick coriaceous, rigid, linear-lanceloate, with the margins parallel over a great part of the length, rarely somewhat more lanceolate, cuneate or rather gradually narrowed into the short up to 1 cm long petiole, usually shortly, sometimes abruptly, rarely more gradually narrowed into the acute apex, 6—23 cm (usually 9—19 cm) long by 8—23 mm (usually 10—17 mm) broad, 8—17 times as long as broad; midrib on the upper surface slightly impressed in the apical portion, flat or more or less prominent in the basal portion, in the latter case either rounded or with a prominent sharp line, on the lower surface sharply keeled towards the base, more flat towards the apex; lamina with flat or slightly recurved margins, shining above, more dull beneath; in sterile, perhaps young plants, the leaves are often somewhat more gradually narrowed and sometimes slightly acuminate towards the apex, to 31 cm long and to 30 mm broad, sometimes relatively shorter, the midrib often very narrow, sharply keeled above. Male flower buds single in the leaf axils, sessile, subglobose; bud scales ovate, obtuse, the 2 outer ones acute and strongly keeled; flowers narrowly cylindrical, 4 cm long (on cultivated plants to 8 cm), 3 mm in diam.; stamens with nearly ovate-triangular, rather acute apiculus. Female flowers rather remote, on short or rather long,

thick, often somewhat flattened, spreading peduncles; receptacle composed of 2—4 fleshy bracts, of which 1—2 fertile, the sterile ones with short, obtuse or acute apex, the fertile bracts with narrow, obtuse free margin. Peduncle 2—10 mm (rarely to 16 mm) long, 1—1.5 mm broad; foliola subulate, to 3 mm long; receptacle cylindrical or obconical, 6—10 mm long by 3.5—7 mm in diam.; seeds 1—2, globose or elliptical, rounded or somewhat narrowed towards the base, rounded towards the apex, 10—13 mm long by 7—11 mm broad. (Description from all the specimens listed below.) Cfr. *Fig. 4.*

According to herbarium labels *P. Rumphii* is a small or moderate-sized tree up to 30 m tall, of which the crown usually occupies about one half. As a rule, the diameter of the bole is about 50 cm (Koorders to his no. 16537 gives a diam. of 200 cm, but I believe here the girth of the bole is meant). The bast yields some red-yellow sap. The male flower is pale green (Clemens 2352), the female ones are purple (Boschpr. Cel./II. 286), whereas the fruit is green with a powdery cover and is said to be eaten by birds and monkeys. The species occurs from sea level to 1650 m el. The timber is used for house-building, and making furniture and eating utensils.

P. Rumphii differs from *P. neriifolia* in the usually thicker and more abruptly narrowed leaves, of which the margins are parallel, whereas in adult trees the midrib of the leaves is slightly rounded-prominent or not all prominent, and slightly impressed towards the apex. The number of fertile scales in the female flowers is often more than one.

The description above differs in some respects from those by other authors. With rather great certainty it may be said, that the plants from Ambon mentioned below agree with Rumphius' *Lignum emanum*, as we read: "Sunt enim octo decemque pollices longa, transversum digitem lata, crassiuscula et firma obscure viridia, ipsorumque apices ad unam plerumque inclinant partem, levemque gerunt sulcum loco nervi medii, nec ullas notabiles costas." The leaves are, however, usually longer than Rumphius has pictured. The impressed of little prominent midrib is, together with the leafshape, one of the most important characters of the adult leaves of *P. Rumphii*. Blume (1847) and, with him, Miquel (1859) and De Boer, give the following diagnosis of the leaves, based on plants from Ambon and New Guinea (Lobo, Zippelius), which I had not the opportunity to examine: "Folia 5—10 poll. longa, 7—11 lin. lata, elongato-lanceolato-linearia, nervo medio subtus acute supra applanato-v. obtuse prominulo subcarinata apice acute v. acuminato-

angustato subpungentia v. sphacelato-obtiuscula". Parlatore (1868) writes: "Foliis ..... late lanceolatis acuminatis, ... supra nervo longitudinali prominente ..... Folia ..... 15—24 cent. longa, 18—23 mill. lata", whereas Pilger (1903) writes: "Folia lanceolata, superne breviter angustata et ± subcaudato-acuminata, rarius fere aequaliter longe acuminata, acuta, medianus supra obtuse prominulus vel medietate linea magis elevata, acute notatus." The observation of Pilger on the acute prominent midrib must be based upon the leaves of young plants. The collection Teysmann s. n. from Misoöl, Praetorius s. n. and Lauterbach 2446, from New Guinea, and Koorders 16534, from Celebes, which show the same peculiarity, moreover usually have very large leaves, which are sometimes shortly acuminate towards the apex. The specimens Teysmann s. n. from Misoöl, and Boschpr. b.b. 24306 from the Tanimber Islands have longer attenuate leaves. In some of these specimens the midrib is already much less prominent, more rounded and broad towards the base. These plants form a transition towards the other sterile plants, which have likewise broad, but always shortly narrowed leaves, whereas the midrib in these leaves is towards the base like in the former plants, towards the apex, however, little or not at all prominent, and in the uppermost part of the leaves often slightly impressed. I never met with caudate-acuminate leaves, a character used for the distinction of species by Pilger. Beccari collected this species in Ambon, the Kei and Aroe Islands, and New Guinea. I did not see a single of these plants. According to him, it is not impossible, that the name *P. Rumphii* must be placed among the synonyms of *P. bracteata*, together with *P. neglecta* and *P. Teysmannii*. We may, however, assert with certainty, that some of his collections do not belong to *P. Rumphii*, as from Ambon he mentions plants with leaves 1—2.5 cm long and 3—5 mm broad. Though on the one hand it is a fact, that the typical plants of *P. Rumphii* and *P. neriifolia* (= *P. bracteata*) are very different, it must be acknowledged, that the limit between these species is not very sharp, and that there exist intermediate forms. Especially the collections Teysmann 14068, b.b. 9705, De Vriese & Teysmann s. n., and Teysmann 7815 p.p. point towards *P. neriifolia*, as the midrib is rather strongly prominent and sharply delimited, as in the latter species. Sometimes the leaves are also more gradually narrowed towards the apex. The margins of the leaves, however, are always parallel.

The terminal bud is always said to be globose-ovate; only Beccari mentions, that the bud scales are always acute. In the fertile materials, examined by me, different forms of leaf buds may be distinguished.

All the plants from Ambon have very solid, subulate, acute bud scales, those from Malili (Celebes), and Clemens 2352 from New Guinea, subulate-acuminate ones. All the other fertile plants, however, have globose, obtuse terminal buds.

The specimens Boschpr. Cel./II. 285, 286, 288 and 325, all from Malili, have very small leaves, *viz.*, 7—10 cm long by 7—9 mm broad, and usually more lanceolate. For the rest there are no other differences, whereas moreover the specimens Cel./II. 287 and b.b. 23265 from the same locality are nearly intermediate between the former plants and the typical, fertile plants.

Most of the plants collected in the Minahassa by Koorders have leaves which are only 6—9 times as long as broad.

Of the specimen Gibbs 5985 (from New Guinea, Arfak Mts, at ca. 2300—3000 m el.), I only saw a single leaf, which was included in *P. Rumphii* by Gibbs, 1917 l. c., but which does not convince me of the correctness of Gibbs' determination.

PHILIPPINES. Luzon: Bataan prov., Limay Peak, *Bur. Sci.* 5174 coll. *Foxworthy*, originals of *P. philippinensis* (B, f); Mt. Mariveles, Lamao, *For. Bur.* 2743 coll. *Borden* (B, S, s); *For. Bur.* 8987 coll. *Curran* (B, f); *For. Bur.* 6326 coll. *Curran* (B, f); Mt. Arayat, *For. Bur.* 17664, 17723 coll. *Curran* (ex *Foxworthy* 1911, l. c.); Ilocos Sur (ex *Merrill* 1923, l. c.); Mindoro (ex *Foxworthy* 1911, l. c.).

BORNEO. Without further locality, *De Vriese* s. n. (B, s); British North Borneo: P. Selangan, Semporna, 60 m el., *For. Dep.* Br. N. Borneo 4146 coll. *Orolfo*, v.n.: kayu china (S, f); *For. Dep.* Br. N. Borneo 4083 coll. *Mail*, v.n.: kayu china (S, f).

CELEBES. Without further locality, *De Vriese & Teysmann* s. n., v.n.: marama (L, s); Minahassa, near Tondano, 900 m el., *Koorders* for. no. 1425*, herb. no. 16534, v.n.: marama (B, L, s); forest Lolomboelan near Pakoecoere, 450 m el., *Koorders* for. no. 2679*, herb. no. 16535, v.n.: marama (B, L, f); G. Klabat, 1000—1300 m, *Koorders* for. no. 772*, herb. no. 16536 (B, s); Lembean, Tondano, 800 m el., *Koorders* for. no. 2874*, herb. no. 16537, v.n.: marama (B, L, s); Pinamorangan, 500 m el., *Koorders* for. no. 950*, herb. no. 16538, v.n.: malambik (B, L, s); subdiv. Malili, Tabarano, 600 m el., *Boschpr.* b.b. 9705, v.n.: sandoe (B, L, s); subdiv. Malili, Oesoe, 200—300 m el., *Boschpr.* Cel./II. 285, v.n.: kajoe sandoe motoetoe (B, f); Cel./II 286 (B, f), 287 (B, s), 288 (B, f), 325, v.n.: sanroe (B, L, f); subdiv. Malili, Pasi Manangoei, 10 m el., *Boschpr.* b.b. 23263, v.n.: kajoe sandroe (B, s); Loka-Bantaèng, *Teysmann* 14068 (B, L, s); S.E.- Celebes, Staring-baai, *Pella* 55, v.n.: tjina (B, f); Singkobale near Towoeli Lake, 300 m el., *Kjellberg* 3973 (B, s).

LESSER SUNDA ISLANDS. Soemba: Tarimbang, *Teysmann* 8832 (B, s); Timor: *Boschpr.* b.b. 6889, v.n.: adjaub nasi (B, s).

MOLUCCAS. Batjan: G. Sibéla, *Warburg* 18245, 18271 and 18284 (ex *Warburg* 1900, l. c., but the first and the latter according to *Pilger* 1903, l. c. *P. neriifolia*); Obi: *Atasrip* 40 (B, L, s); Wooi, 30 m el., *Boschpr.* b.b. 23830, v.n.: kasuari goenoeng, or mamoeliti (B, f); P. Gebé: *Teysmann* 7815 (B, s); Misoöl:

Waigama, *Teysmann* s. n., two different collections (see discussion) (B, L, s); Kaleketmelis, 40 m el., *Boschpr.* b.b. 14385, v.n.: manoelit (B, L, s); Ambon: *Rumphius* (ex *Rumphius* 1743, l. c.); Hoetoe Mortetoe (ex *Smith* 1902, l. c.); G. Salhoetoe (ex *Beccari* 1877, l. c.); Ambon, *Robinson* 309 (B, L, s); G. Hori, Ema, *Teysmann* s. n., v.n.: assoijer (B, L, s); G. Salhoetoe, *Teysmann* s. n. (B, L, m); *Boerlage* 174 (B, s); Hoetoemoeri, *Teysmann* s. n. (B, s); Waai, 120 m el., v.n.: asoër (B, s); Tanimber Islands: Ilgnei-Otimmer, *Boschpr.* b.b. 24306, v.n.: kajoe tjina (B, s); Kei Islands: Groot Kei, cult. in *Hort. Bot. Buitenzorg*, sub no. V F. 20, 20a (B, s); Weri (ex *Beccari* 1877, l. c.); Aroe Islands: Giabu-lengan (ex *Beccari*, l. c.).

NEW GUINEA. Without further locality, *Pr(aetorius)* s. n. (L, s); N.W. Part: Kapaor, Soron and Arfak Mts., Putat (ex *Beccari*, l. c.); Lobo, *Zippelius* s. n. (ex *Blume* 1847, l. c.); Humboldt-baai, Mt. Cycloop, 1550 m el., *Dumas* 10 (B, s); N.E. Part: Suor-Mana, 600 m el., *Lauterbach* 2320 (ex *Pilger* 1903, l. c.); River A, 300 m el., *Lauterbach* 2446 (BD, s); Morobe distr., Yunzaing, 1300—1650 m el., *Clemens* 2352 (BD, m).

Cultivated: in Hort. Bot. Buitenzorg, V. F. 9a from unknown provenance (B, m); V. F. 31, 31a (B, G, f); V. F. 94 (B, m), all from the Moluccas.

17. Podocarpus neriifolia [1]) D. Don, in Lambert, Genus Pinus, ed. 1 (1824) 21; [1]) ed. 2 (1828) II, 122, p.p. (excl. *P. polystachya* et *P. Rumphii*); [1]) Prodr. fl. nep. (1825) 55; Mirbach, in Mém. Mus. hist. nat., 13 (1825) 47, 75; Sprengel, Syst. veg., 3 (1826) 889 (excl. syn. *Lignum emanum*); [1]) Bennett, in Horsfield, Pl. Jav. rar. (1838) 40; [2]) Hasskarl, Cat. Plant. Hort. Bot. Bog. (1844) 70; Endlicher, Syn. Conif. (1847) 215; Parlatore, in Bot. Mag., 78 (1852) t. 4655; Dietrich, Syn. Plant. 5 (1852) 446; Hooker f., Him. Journ., 1 (1854) 256; Walpers, Ann. Bot. Syst., 5 (1858) 800; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 381; Carrière, Traité gén. Conif., II, ed. 2 (1867) 661; [1]) De Kirwan, Conif., 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 514; Brandis, For. Fl. (1874) 541; Gordon, Pinetum, ed. 2 (1875) 343; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Hooker f., Fl. Br. Ind., 5, 3 (1888) 649 (excl. syn. *P. polystachya* et *Lignum Emanum*); Stapf, in Transact. Linn. Soc., sér. 2, Bot., 4 (1894) 249; Warburg, Monsunia, 1 (1900) 193; Kent, in Veitch's Man. Conif. (1900) 152; Gamble, Man. Ind. Timb. (1902) 702, t. 16, ic. 2; Forbes & Hemsley, Journ. Linn. Soc., 26 (1902) 548; [2]) Pilger, in Engl., Pflanzenr., IV, 5 (1903) 80; Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 265; [2]) Perkins, Fragm. Fl. Phil., 1 (1904) 44; Van Eeden, Houts. Ned. Ind., ed. 3 (1906) 256; Brandis, Ind. Trees (1906) 695; [3]) Merrill, in Philipp. Journ. Sci., 1, suppl. 1 (1906) 24; [2]) Foxworthy, in Philipp. Journ. Sci., 2 (1907) 258; De Clercq, Plantk. Woordenb. (1909) 309; Gibbs, in Journ. Linn. Soc., 39 (1909) 183; [2]) Koorders-Schumacher, Syst. Verz., 1, Fam. 5 (1910) 4; 3 (1914) 7, p.p.; [2]) Fox-

worthy, in Philipp. Journ. Sci., 6 (1911) 162; [2]) Ridley, in Journ. Str. Br. Roy. As. Soc., 60 (1911) 57; Koorders, Exkursionsfl. Java, 1 (1911) 65, ic. 3; [2]) Robinson, in Philipp. Journ. Sci., 6 (1911) 192; Hayata, in Journ. Coll. Sci. Imp. Univ. Tokyo, 30, 1 (1911) 307; Dunn & Tutcher, in Kew Bull., add. sér., 10 (1912) 256; Pearson, Commerc. Guide For. Econ. Prod. Ind. (1912) 79; Gibbs, in Ann. Bot., 26 (1912) 549, t. 51, ic. 48—51, t. 53, ic. 78; [2]) Stiles, in Ann. Bot., 26 (1912) 453; Hallier, in Meded. Rijks Herb. Leiden, 14 (1912) 34; [2]) Koorders, in Bot. Jahrb., 50, Suppl. Band (1914) 297; in Nova Guinea, VIII, 2 (1914) 616; Boldingh, Cat. Herb. Pl. Hort. Bot. Bog. (1914) 4; Koorders & Valeton, Atlas Baumarten, 2 (1915) ic. 589; [2]) Pilger, in Bot. Jahrb., 54, 1 (1916) 38; 54, 3 (1916) 210; von Wiesner, Rohst. Pflanzenr., ed. 3, II (1918) 362; Beekman, in Meded. Proefst. Boschw., 5 (1920) 171, t. 56; Lörzing, in Trop. Nat., 10 (1921) 99; [2]) Merrill, Bibl. enum. Born. pl. (1921) 31; Koorders, Fl. Tjibodas, I, 2 (1922) 3; Seifritz, in Bull. Torrey Bot. Club, 50 (1923) 292; [2]) Merrill, Enum. Philipp. Flow. pl., I, 1 (1923) 3; [2]) Ridley, in Journ. Bot., 63 (1925) suppl. 127; [2]) Lane-Poole, For. res. Papua (1925) 73, 23, 26, 27, 34, 40, 50, 64, 72; [2]) Ridley, Fl. Mal. Pen., 5 (1925) 281; [2]) Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 247; Heyne, Nutt. pl. Ned. Ind., ed. 2 (1927) I, 109; Van Steenis, in Trop. Nat., 17 (1928) 206; [2]) Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol., 1 (1930) 237; Van Steenis, in Trop. Nat., 19 (1930) 89; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 76, 279, 283, ic. 7, t. XXX, 2, 3; [2]) Hickel, in Lecomte, Fl. gén. Indo-Chine, V, 10 (1931) 1069; [2]) Witkamp & Posthumus, Versl. Ned. Ind. Ver. Nat. besch. (1932) 81; Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, XIII, 1 (1933) 12, 20; [2]) Merrill, in Contr. Arn. Arb., 8 (1934) 15; in Proc. Fifth Pac. Sci. Congr. Can., 4 (1934) 3269; [2]) H. H. Hu, in Proc. Fifth Pac. Sci. Congr. Can., 4 (1934) 3273, 3283, 3284, 3286; Kawada, in Proc. Fifth Pac. Sci. Congr. Can., 4 (1934) 3297; Steup, in Trop. Nat., 23 (1934) 63; [2]) Burkill, Dict. Econ. Prodr. Mal. Pen., 2 (1935) 1779; Janssonius, Mikrographie, 13 (1936) 491; [2]) Pilger, in Bot. Jahrb., 68 (1936) 491; Van Steenis, in Tijdschr. Kon. Ned. Aardr. Gen., 55 (1938) 762; Docters van Leeuwen, in Nat. Wet. Tijdschr., 21 (1939) 833; Hoogerwerf, 11e Versl. Ned. Ind. Ver. Natuurbesch. (1939) 263; Wasscher, in Backer, Bekn. Fl. Java, 2 (1940) Fam. 18, 3. — *Podocarpus bracteata* Blume, Enum. Pl. Jav., 1 (1827) 88; Bennett, in Horsfield, Pl. jav. rar. (1838) 40; [4]) Hasskarl, Cat. Plant. Hort. Bot. Bog. (1844) 70; Endlicher, Syn. Conif. (1847) 216; Blume, Rumphia, 3 (1847) 214, t. 172, ic. 1; Junghuhn, Java, 1

(1851) 507, 546; Miquel, Pl. Junghuhn., 1 (1851) 2; Fl. Bat. Ind., II, 6 (1859) 1072; Walpers, Ann. Bot. Syst., 3 (1852) 449; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 391; Seemann, Fl. vitiensis (1865—1873) 266; Teysmann & Binnendijk, Cat. Plant. Hort. Bot. Bog. (1866) 14; De Boer, Conif. Arch. Ind. (1866) 16, 28, 35, 36, 37, 42; Carrière, Traité gén. Conif., ed. 2, II (1867) 662; De Kirwan, Conif., 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 515; Gordon, Pinetum, ed. 2 (1875) 328; Filet, Plantk. Woordenb. (1876) 3, 180, 182; Van Eeden, Houts. Ned. Ind. (1886) 135; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Warburg, Monsunia, 1 (1900) 192; Koorders, in Nat. Tijdschr., 62 (1902) 216; Gibbs, in Ann. Bot., 26 (1912) 548, t. 51, ic. 44—47. — *Podocarpus bracteata* var. *brevipes* Blume, Rumphia, 3 (1847) 214; Miquel, Pl. Junghuhn., 1 (1851) 2; Walpers, Ann. Bot. Syst., 3 (1852) 449; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 392; Carrière, Traité gén. Conif., ed. 2 (1867) II, 662; De Kirwan, Conif., 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 515. — *Podocarpus neglecta* Blume, Rumphia, 3 (1847) 213; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 396; De Boer, Conif. Arch. Ind. (1866) 21, 28, 35, 36, 37, 42, 43, t. II, 2; Carrière, Traité gén. Conif., ed. 2, II (1867) 668; De Kirwan, Conif., 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 516; Gordon, Pinetum, ed. 2 (1875) 342; Filet, Plantk. Woordenb. (1876) 180; Van Eeden, Houts. Ned. Ind. (1886) 135; Warburg, Monsunia, 1 (1900) 193. — *Podocarpus discolor* Blume, Rumphia, 3 (1847) 213; Walpers, Ann. Bot. Syst., 3 (1852) 449; Miquel, Fl. Ind. Bat., II, 6 (1859) 1074; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 396; De Boer, Conif. Arch. Ind. (1866) 23, 28, 35, 36, 37, t. III, 1; Carrière, Traité gén. Conif., ed. 2, II (1867) 669; De Kirwan, Conif., 2 (1868) 229; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 518; Gordon, Pinetum, ed. 2 (1875) 333; Filet, Plantk. Woordenb. (1876) 182; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Warburg, Monsunia, 1 (1900) 193. — *Podocarpus leptostachya* Blume, Rumphia, 3 (1847) 214; Walpers, Ann. Bot. Syst., 3 (1852) 449; Miquel, Fl. Ind. Bat., II, 6 (1859) 1073; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 392; De Boer, Conif. Arch. Ind. (1866) 19, 28, 36, 37, t. II, 1; Carrière, Traité gén. Conif., ed. 2, II (1867) 663; De Kirwan, Conif., 2 (1868) 229; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 515; Gordon, Pinetum, ed. 2 (1875) 339; Warburg, Monsunia, 1 (1900) 193. — *Podocarpus Junghuhniana* Miquel, in Pl. Junghuhn., 1 (1851) 2; Junghuhn, Java, 1 (1851) 507; Miquel, Fl. Ind. Bat., II, 6 (1859) 1073; Teysmann &

Binnendijk, Cat. Plant. Hort. Bot. Bog. (1866) 14; Filet, Plantk. Woordenb. (1876) 180; Vidal, Sinopsis Atlas (1883) 43, t. 97, ic. C. — *Nageia bracteata* F. von Mueller, Descr. Not. Pap. pl., 1 (1875) 93; Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Nageia discolor, N. neglecta, N. leptostachya, N. neriifolia* Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Podocarpus neriifolius* var. *brevipes* Pilger, in Engl., Pflanzenr., IV, 5 (1903) 81; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 163. — *Podocarpus polystachyus* (non R. Brown) Lauterbach, in Bot. Jahrb., 44 (1910) 517; Hub. Winkler, in Bot. Jahrb., 50 (1914) Suppl. Band, 204; Ridley, in Journ. Bot., 63, suppl. (1925) 127. — *Podocarpus amarus* (non Blume) Ridley, in Journ. Bot., 63, suppl. (1925) 127 p.p.; Merrill, in Contr. Arn. Arb., 8 (1934) 14. — *Podocarpus Rumphii* (non Blume) Pilger, in Bot. Jahrb., 68 (1936) 246.

[1]) *P. nereifolia,* [2]) *P. neriifolius,* [3]) *P. neriifolium,* [4]) *P. bracteatus.*

Twigs usually several (up to 5) subverticillate, sometimes more scattered, spreading, terete, rather slender. Terminal buds usually ovate-acute or narrow-conical, with the bud scales ovate-triangular and usually long-subulate-acuminate, often with the apex curved outwards, sometimes (in the var. *atjehensis*) entirely deflexed, or very gradually narrowed into the acute apex, erect, 2—20 mm long, usually keeled and sometimes with a narrow membranous margin; sometimes (in the var. *linearis*) ovate, obtuse, with ovate, obtuse or broadly truncate, 3—4 mm long bud scales, or (in the var. *Teysmannii*) subglobose, with ovate-triangular, ovate or orbicular, usually obtuse, up to 3 mm long bud scales, or (in the var. *membranacea*) large, ovate to ovate-conical, with narrowly ovate, rarely acute, entirely membranous, up to 13 mm long bud scales. Leaves scattered, usually rather remote, sometimes more crowded, usually spreading, sometimes erect-spreading, rarely (in the var. *atjehensis*) deflexed, thin-coriaceous and rather flexible, sometimes thicker and more rigid, straight or slightly falcate, narrowly to broadly lanceolate, sometimes (especially in the var. *linearis,* and less strongly in the varieties *polyantha, Teysmannii* and *bracteata*) with the margins parallel, gradually or sometimes more cuneately narrowed into the short or hardly distinct petiole, usually very gradually, sometimes more abruptly narrowed into the acute, rarely mucronate apex, sometimes slightly acuminate, or (in the varieties *Teysmannii* and *polyantha*) more abruptly narrowed and shortly acuminate, 3—24 (usually 7—16) cm long by 5—28 (usually 8—14) mm broad, 3—20 (usually 7—13) times as long as broad; midrib on the upper surface usually strongly prominent, narrow, sharply

delimited, sometimes, especially towards the base, even by means of a furrow on each side, or (in the varieties *Ridleyi* and *timorensis*) not very distinct, flat or slightly impressed, or slightly prominent as a narrow line, on the lower surface sharply keeled towards the base, more flattened towards the apex, rarely slightly channelled or (especially in the var. *polyantha*) with a rather deep furrow; lamina with flat or slightly recurved margins, shining above, more dull beneath. Male flower buds single or in bundles of 2—3 (rarely to 4) in the leaf axils, sessile or rarely on very short, 1—4 mm long, common peduncles, usually small, globose, obovate or ovate, obtuse, sometimes (in the var. *linearis*) larger, ovate-obtuse, or (in the varieties *bracteata, membranacea* and *atjehensis*) large and ovate-acute; bud scales usually adpressed, ovate-obtuse or orbicular, the outer ones sometimes more ovate-triangular and keeled, usually to 2 mm long, or sometimes (in the varieties *bracteata* and *atjehensis*) somewhat spreading, ovate-triangular, acute, to 7 mm long or (in the var. *membranacea*) entirely membranous. Male flowers cylindrical, sometimes nearly filiformous, 2—8.5 cm long by 2.5—3.5 mm in diam. (in the varieties *timorensis* and *atjehensis* up to 4.5 mm); stamens with ovate-triangular, short or rather long, rather obtuse or acute apiculus; pollen grains with 2 air bladders. Female flowers single in the leaf axils, rather remote, usually over a rather short distance on the youngest vegetation period, sometimes (especially in the var. *polyantha*) very numerous all over the youngest vegetation period; peduncles spreading, usually rather long and slender, sometimes shorter, often slightly flattened towards the apex; receptacle composed of 2 fleshy bracts with 1 ovule, rarely (in the var. *polyantha*) of 2—4 fleshy bracts with 1—2 ovules. Peduncles 3—24 (usually 8—20) mm long, sometimes (in the varieties *polyantha* and *Ridleyi*) very short; foliola subulate, 1.5— 6 mm long; receptacle cylindrical or obconical, 5—11 mm long by 2—7 mm thick, the sterile bract usually with a short acute apex, the fertile one with a narrow, free margin; seed elliptical, ovate-elliptical or elliptical-globose, obtuse, often somewhat narrowed towards the base, 9—12 mm long and 6—9 mm broad. (Description from all the specimens mentioned below including the varieties.) Cfr. *Fig. 4.*

According to herbarium labels, *P. neriifolia* is usually a moderate-sized tree, up to 40 m tall, rarely (Boschpr. b.b. 15914 from Schouten Island) up to 60 m tall; the bole is rather stout, with a diam. up to 80 cm (according to Koorders 16533 up to 160 cm, but, in my opinion, the girth is meant here) and without buttresses, but once (Brass 5907) "slightly spured at the base". The crown usually amounts to over

one-third to one-half of the total height. Sometimes (Boschpr. b.b. 20061) the bark appears to yield no sap, sometimes (b.b. 15914, b.b. 21933) little yellow sap, sometimes (b.b. 22455) much yellow sap. The young leaves are "red, conspicuous at a distance" (Clemens 50051), or light brown (Van Steenis 4127); the older leaves are dark green, pale wine-red towards the apex (Koorders 1252). The receptacle is very pale green (Koorders 39401), green (Koorders 1255), orange-yellow (Koorders 16533), red (Clemens 2276), or pale-yellow (Brass 5907), whereas the fruit is bluish pruinose (Boschpr. b.b. 17030), green (b.b. 8823, Clemens 50051), glaucous (Koorders 39401), blue-grey (Koorders 1229), bluish green (Koorders 16533), pale sea-green (Clemens 5434), yellowish (Clemens 2276), or brownish-green (Brass 5907).

The species occurs from sea level up to 2840 m el., usually in mountain forests, sometimes (Sing. Field no. 32288) in swampy forest, in shrub formations at high el. (Boschpr. b.b. 17030 from Sumatra), or along the sea shore (Boschpr. b.b. 20061 from Schouten Island). The wood is used for house-building and for making furniture (Java, Minahassa, Schouten Island) and proas (Schouten Island).

From Java three species were described by Blume, *viz.*, *P. bracteata*, *P. neglecta* and *P. discolor*. To these, Miquel added *P. Junghuhniana*, but this species was united with *P. neglecta* by De Boer. Pilger united *P. neglecta* with *P. bracteata*, and the latter (in this following Hooker, but wrongly according to Warburg), with *P. neriifolia* from Nepal. Also *P. discolor* and *P. leptostachya*, the latter from Borneo, were united with this species by Pilger provisionally. Koorders and Valeton were of one accord in uniting *P. neglecta* with *P. bracteata*. They write (translated from the Dutch, l. c. p. 266): "Some specimens differ in the much smaller, only 45—110 cm long leaves. These specimens undoubtedly belong to *P. neglecta* Bl. But there are, however, so many transitions between these specimens and the type, sometimes even on the same tree, that it seems impossible to us to distinguish them even as a variety. Indeed, already when we compare De Boer's description and picture of *P. neglecta* with Blume's *P. bracteata*, it is evident, that there cannot be a question of specific differences here." Indeed also to me it has appeared impossible, to indicate distinct differences between these two forms as regards the shape and size of the leaves. The female flowers and the fruits do not give any indication either. On the other hand, the differences in the male flowers are too large to pass them by silently. In the entirely developed flowers, however, these differences can hardly be seen any more. Former authors usually

describe the entirely developed flowers, but rarely the flower buds. Of *P. bracteata* Blume says: "Gemmae amentorum masculorum ..... ovoideae, squarrosae, e squamis imbricatis ovatis acuminatis subcarinatis chartaceis vegeto-persistentibus compositae." For *P. neglecta* he gives the following diagnosis: "Amenta antherifera in pedunculis brevibus axillaribus solitariis fasciculata, in juventute squamis perulisve rotundatis concavis membranaceis". Miquel describes *P. Junghuhniana* in the following way: "Gemmae masculae vulgo ternae, arcte confertae, sessiles, obovato-globosae, ima basi bractea lanceolata utrinque solitaria caduca instructae, caeterum bracteis rotundatis margine scariosis nitidis, viscosis? dense imbricatae". In the collections examined by me, flower buds, as described in *P. bracteata,* were found only in plants from Java. In these the buds are large and acute, up to 8 mm long and 4 mm broad; the leaves are rather large and often somewhat linear-lanceolate, 10—17 cm long by 9—14 mm broad and 8—15 times as long as broad. Flower buds, as described for *P. Junghuhniana,* were found in plants collected in all the parts of the Malay Archipelago. These buds are small and subglobose and to 2.5 mm long. The leaves of these plants agree, for the majority, with the descriptions of *P. neglecta* and *P. Junghuhniana.* They are usually 4—12 cm long by 8—16 mm broad, and 4.5—10 times as long as broad. The collections De Voogd 554 from Palembang, Teysmann 11359 from Karimata, and Merrill 1992 from Luzon, have much larger leaves with slightly acuminate apex, as often occur in younger plants. Which of these two bud shapes occurs in *P. neriifolia* from Nepal cannot be stated from the descriptions with certainty. Hooker (1888) gives the following diagnosis of the male flowers: "Male spikes 1 in., solitary or clustered, sessile, cylindric, surrounded at the base by broad acute keeled bracts". This points somewhat towards *P. bracteata,* which name is also given as a synonym. Hooker also gives *P. polystachya* as a synonym, but undoubtedly wrongly. In this species the flower buds are again entirely obtuse with usually obtuse bud scales. Therefore, and for the limited distribution, it seems to me more correct, to separate from *P. neriifolia* provisionally as a variety the plants with large, ovate, acute flower buds. A further examination, also of other parts of the plant, is still necessary. These deviations may be nothing but differences caused by climatological circumstances. Also in some of the new varieties the male flower buds deviate; those of the var. *atjehensis* and the var. *membranacea* mainly agree with those of *P. bracteata,* and those of the var. *Teysmannii* with those of the main form of the species, whereas the

buds of the var. *linearis* are more or less intermediate between these extremes. All the other collections, also those of which it was not possible to conclude from the leaf shape whether they belong to the var. *bracteata*, were included in the main form of the species. And the same was done with two collections, which deviate somewhat in the bud shape, *viz.* Boschpr. b.b. 11192 from Borneo with slightly spreading, short, acute bud scales, and Boschpr. Ja. 1873 from Japara with larger, ovate buds with obtuse scales.

For the rest this species is very variable in all its parts. As regards the bud scales, *e. g.*, this appears from the collection Soegandiredja 32 from G. Kentjana, of which the bud scales are sometimes 3 mm, sometimes up to 30 mm long, and from plants from Pangentjongan, among which Koorders 14025 has ovate-acute or very shortly acuminate, up to 4 mm long bud scales, Koorders 1255, on the contrary, very narrowly triangular, up to 18 mm long bud scales. In the sterile specimen Arsin 19594, from Tjibodas, the bud scales are very different on the same branch, varying from short-acuminate to long-subulate-acuminate, or very gradually narrowed, from 2 to 12 mm long. Very rarely the terminal bud is ovate or globose, and obtuse, whereas usually outer scales are mostly acute (Boschpr. b.b. 8740 from Benkoeloe has all the bud scales obtuse).

The proportion of length to width of the leaves varies strongly. As one extreme there occur the plants, described as *P. neglecta*, the leaves of which are 5—6 times as long as broad, and the originals of *P. discolor*, in which they are 3—8 times as long as broad. As the other extreme there occur some plants from Pangentjongan collected by Koorders, and Backer 12481 from Rantja Walini, the leaves of which are up to 15 times as long as broad, and the sterile specimen Houter 24 from Tjerebon, in which this amounts to even 15—20 times. The smallest leaves are those of Boschpr. b.b. 17030 from Sumatra, a mountain form of which the foliage wholly agrees with that of *P. discolor* (2.5—4.5 cm long and 5.5—8 mm broad), Von Römer 1230 from New Guinea (3—6.5 cm long by 5.5—8 mm broad) and Blume s. n. from Java (as *P. neglecta*, 3.5—5.5 cm long by 5—10 mm broad). The longest leaves have the specimens Teysmann 11359 from Karimata, Backer 12481 from Rantja Walini, Ridley 11192 from Johore and Houter 24 from Tjerebon, which are resp. up to 21, 19, 18 and 24 cm long. The leaves of Ridley 11192 from Johore, with a width of 28 mm, are the broadest of the species. Usually the leaves are very gradually narrowed towards the apex, but sometimes they are slightly

acuminate, especially in young plants; rarely are they abruptly short-acuminate into the apex (Teysmann 11359, from Karimata). The smaller, lanceolate leaves are often less gradually narrowed, but never abruptly narrowed as in *P. polystachya.* The midrib is rarely channelled on the lower surface, bud never so broadly as in *P. polystachya*; some of the leaves of the originals of *P. leptostachya* have a furrow instead of the midrib on the lower surface.

The number of vegetation periods that are leaf-bearing is usually 2 or 3, rarely 4 or 5 (*e. g.*, Rant 732, from Ambon, and von Römer 1230, from New Guinea). The leaves of these plants are, moreover, very small and adpressed to the twigs.

The fruit-bearing peduncles are rarely very short; when short peduncles are present, there occur also fruits with long peduncles on the same plants; otherwise than in *P. polystachya,* where all peduncles are short. The var. *brevipes* Blume, based on plants with very short peduncles and narrow, linear-lanceolate leaves, does not deserve to be distinguished, since there are too many transitions towards the main form of the species. In the collection Boschpr. b.b. 20061, from Schouten Island, there occur numerous, shortly peduncled female flowers, scattered over a great portion of the youngest vegetation period as in the var. *polyantha,* but no other deviations can be stated. In not a single specimen of the main form of the species were found receptacles with more than one fertile scale. In a specimen from Java (without exact locality and without collector) the base of one of the foliola was thickened and fleshy and was taken up in the receptacle.

Three specimens, included in *P. polystachya* by other authors, I consider as deviations of *P. neriifolia.* Forbes 2054 from Sumatra has rigid, rather shortly narrowed, lanceolate leaves, slightly folded upwards along the midrib; this reminds of *P. polystachya,* but the peduncles of the fruits are much longer than in this species. The sterile specimen Beccari P. S. 252 deviates strongly in its more abruptly narrowed, but flexible leaves, which are, however, not crowded and not erect-spreading. The specimen Winkler 3057 from Borneo has rigid, erect-spreading, but gradually narrowed leaves.

The specimens Brass 5907, included in *P. Rumphii* by Pilger, and Carr 12842, both from New Guinea, with rather long-lanceolate, rigid, rather shortly narrowed leaves, differ from *P. Rumphii* in the strongly prominent midrib above. Brass 5908, a youth-form of Brass 5907, is not different from other young plants of *P. neriifolia.*

MALAY PENINSULA. P. Penang: Government Hill, 700 m el., *Curtis* 3079

(S, f, m); Balik Pulau, *Ridley* 9422 (S, s); Perak: Thaiping Hills by the Waterfall up to 330 m el., *Wray, Künstler* (ex *Ridley* 1925 l.c.); Selangor: Bukit Hitam, *Kelsall* 2000 (S, f); G. Semangkok, *Sing.* Field No. 8877 coll. *Burkill & Holttum* (S, s); Negri Sembilan: G. Tampin, *Ridley* s.n. (S, s); Pahang: Cameron's Highlands, near Tanah Rata, *Sing.* Field No. 17745 coll. *Henderson* (B, s); Fraser Hill, 1300 m el., *Corner* s.n. (S, s); *For. Dep.* F.M.S. Field 22565 coll. *Deris* (S, m); Fraser Hill, upon the Selangor border, 1300—1400 m el., *For. Dep.* F.M.S. Field No. 7856 coll. *Burkill & Holttum*, v.n.: molukau (S, s); *Sing.* Field No. 11471 coll. *Md. Nur* (S, s); P. Tioman, G. Kajang, 1000—1100 m el., *Sing.* Field No. 18606 coll. *Md. Nur* (S, s); Malacca: Mt. Ophir, *Maingay* (ex *Ridley* 1925 l.c.); Johore: Banang, Batu Pahat, *Ridley* 11192 (S, s); S. Kayu, Mawai-Temalaang Rd., *Sing.* Field No. 32288 coll. *Corner* (S, f).

SIMEULOEE (Simaloer). Dist. Tapah (Dèfajan), *Achmad* 1388 (B, L, U, m); *Achmad* 1688, v.n.: naroe dotan (B, L, S, m).

MENTAWAI ISLANDS. P. Siberoet, Sebai-bai, Kosorai, 100 m el., *Boschpr.* b.b. 17444, v.n.: sirigdig (B, s).

SUMATRA. Without further locality, *Korthals* s.n. (G, L, f); Atjeh: subdiv. Gajo Loeeus, G. Agosan, 1800 m el., *Boschpr.* b.b. 22455, v.n.: beberas (B, m); Oostkust: S.W. of Bandarbaroe, 1100 m el., *Lörzing* 7264 (B, f); N.W. of Lake Toba, near Piso Piso, 1350—1500 m el., *Bangham* 1116 (S, s); subdiv. Karolanden, Pantjoerbatoe, res. Siboeatan, 1400 m el., *Boschpr.* b.b. 2784, v.n.: sitoboe hotang (B, L, f); near Pantjoerbatoe, E. foot of Mt. Siboeatan, 1400 m el., *Lörzing* 7118 (B, s); Tapiannoeli: Toba Plateau, Pansoerbatoe, 900 m el., *Boschpr.* b.b. 6203, v.n.: kajoe hotang (B, L, m); Westkust (W. coast): *Beccari* P.S. 252 (L, s); subdiv. Oud-Agam, S. Daheh, Batas Tjoeli, 1200 m el., *Boschpr.* S.W.K./II. 10, v.n.: madang soegi soegi (B, m); Bengkoeloe: subdiv. Lebong, Bt. Daoen, 2400 m el., shrub formation, *Boschpr.* b.b. 17030 (B, s); subdiv. Redjang, Karanganjar, 900 m el., *Boschpr.* b.b. 8823, v.n.: kajoe tadji (B, f); subdiv. Kroë, Wai mengaboe, 750 m el., *Boschpr.* b.b. 8740, v.n.: minangkas (B, L, m); G. Pesagi, 2300 m el., *Forbes* 2054 (L, f); 1400—2232 m el., *Van Steenis* 3690 (B, s); Palembang: Moearadoea, Tenang, 500 m el., *De Voogd* 554 (B, m); G. Pakiwang, N. slope, 700 m el., *Van Steenis* 3756 (B, s); G. Semendo, 1400 m el., *De Voogd* 1494, v.n.: kajoe tadji (B, L, s); Lampoengsche Distr., div. Semangka, 750 m el., *Gusdorf* 314, v.n.: kajoe tadji koening (B, f).

KARIMATA ISLANDS. Soengei Tajan, *Teysmann* 11359 (B, L, m).

BORNEO. British North Borneo: Mt. Kinabalu, Gurulau spur, 1800 m el., *Clemens* 50691 (B, f); Penibukan ridge, 1200 m el., *Clemens* 50051 (BD, L, f); Sarawak: *Beccari* 2143 (ex *Pilger* 1903, l.c.); *Foxworthy* 444, 377 (ex *Merrill* 1921, l.c.); Western Part: G. Damoes, *Hallier* B. 559 (B, s); subdiv. Sekadau, Pait, 250 m el., *Boschpr.* b.b. 8054, v.n.: seloeang (B, f); Southern Part: without further locality, *Korthals* s.n., originals of *P. leptostachya Blume* (G, L, U, m); between S. Tarik and Kwaru, *Hub. Winkler* 3057 (B, L, m); Eastern Part: subdiv. Berouw, Teloek Daoen, S. Kasei, 75 m el., *Boschpr.* b.b. 12196, v.n.: sensaniet (B, m); subdiv. Boeloengan, near river Binai, *Butten* 3 (U, s); Mara, 300 m el., *Boschpr.* b.b. 10843 (B, s); Salimbatoe, S. Roemali, 150 m el., *Boschpr.* b.b.11192, v.n.: lampega (B, m); subdiv. West-Koetai, Padang Loewai, 90 m el., *Posthumus* 2188, v.n.: endjan (B, s).

JAVA. Without further locality: coll.? (B, f); *Blume* s.n., v.n.: kimerak

(L, B, f); *Blume* s. n., originals of *Podocarpus discolor Blume* (G, L, U, s); *Korthals* s. n. (L, s); *Junghuhn* s. n. (B, s); *Koorders'* Plantae Junghuhnianae ineditae 55 (L, m); *De Vriese* s. n. (G, L, f); *De Vriese* 13 (L, m, f); *De Vriese & Teysmann* s. n. (L, f); "Sombosch", *Reinwardt* s. n. (L, f); "Patandji", *Junghuhn* s. n. (U, f); West-Java: G. Botol, near Nirmala, 1500—1800 m el., *Backer* 10749 (B, f); G. Wiroe, S.W. of Leuwiliang, 700 m el., *Bakhuizen van den Brink* 7792, v.n.: kipoetri (B, L, s); G. Salak, *Koorders* 24180, v.n.: kibeling (B, L, m); G. Salak, near Bodjong, 600—1000 m el., *Koorders* for. no. 1480*, herb. no. 24179, v.n.: kipoetri (B, L, W, f); G. Salak II, 2100 m el., *Van Steenis* 3018 (B, s); G. Salak, G. Soemboel, 1600—1900 m el., *Hoogerwerf* 5 (B, s); G. Salak and G. Telaga-ladang, 1700—2300 m el., *Zollinger* 2019 (U, f); Parakansalak, G. Poetri, near Perbakti, 1000 m el., *Koorders* 39401, v.n.: kipoetri (B, f); Parakansalak, G. Poetri, Tjikramat, *Koorders* 39405 (B, s); Buitenzorg, estate Tjiomas, cultivated, *Backer* 37539 (Pa, s); Poentjak Gedeh, above P. Harendong, 1500 m el., *Van Slooten* 748 (B, s); Megamendoeng, *Zippelius* s. n. (L, s); G. Gedé, native coll. s. n. (B, f); G. Gedé, Tjiparaj, 1200 m el., *Uhl* 6617 (B, m); *Uhl* 6592, v.n.: kipoetri (B, f); Tjibodas, *Arsin* 19594 (B, L, s); *Scheffer* s. n. (B, L, s); *Koorders* for. no. 3031a, herb. no. 1243 (B, L, s), 1244 (B, s), 12627 (B, s), 41778 (B, s); for. no. 3362a, herb. no. 41992, v.n.: kibima (B, s); Tjipadaroeoem, 1850 m el., *Boschpr.* Ja. 1948, v.n.: kipoetri (B, f); 1750 m el., *Boschpr.* Ja. 3988, v.n.: kipoetri (B, s); G. Boerangrang (G. Soenda), *Blume* s. n. (L, f); 1850 m el., *Van Slooten* 471 (B, s); *Bakhuizen van den Brink* 4586 (B, L, f); Bandoeng, *Junghuhn* s. n., v.n.: kipoetri (L, f); Tjinjiroean near Bandoeng, *Docters van Leeuwen-Reijnvaan* s. n. (B, s); Nanggerang (div. Tasikmalaja), 2120 m el., *Boschpr.* Ja. 1356 (B, s); Tjigenteng, Kawah Tjiwidej Reserve, 1425 m el., *Boschpr.* Ja. 1311, v.n.: kipoetri (B, s); Tjigenteng, *Koorders* 1249, v.n.: kipoetri (B, s); *Koorders* 1259 (B, f); *Koorders* for. no. 1439*, herb. no. 33751, v.n.: kipoetri (B, f); for. no. 2195a, herb. no. 1240, v.n.: kibima (B, L, f), 1260 (B, f), 11720 (B, L, f); Tjigoeloedoeg, 1050 m el., *Boschpr.* Ja. 1505, v.n.: kipoetri (B, s); Sanggrawa distr., Djampang koelon, 400 m el., *Koorders* 1252, v.n.: kisèèl (B, s); Tjibeber, *Hasskarl* 377, v.n.: kipoetri aweweh (L, s); G. Masigit, 1650 m el., *Backer* 12407, v.n.: kipoetri (B, s); G. Patoeha, *Blume* s. n. (L, m); G. Patoeha, Telaga Patengan, *Warburg* 2679 (ex *Warburg* 1900, l. c.); Rantja Walini, 1750 m el., *Backer* 12481 (B, f); G. Tiloe, Pengalengan, *Warburg* 11118 (ex *Warburg* 1900, l. c.); Pengalengan, *Junghuhn* s. n. (U, f); 1400 m el., *Junghuhn* s. n., v.n.: merak (L, m); G. Malabar, *Van der Pijl* 229 (B, L, s); G. Kantjena, *Soegandiredja* 32 (B, f); G. Kendang, 1800 m el., *Koens* 183 (B, s); G. Kendeng, near Tjiwidej, *Koorders* 1251, v.n.: kibima (B, s); G. Monteng, *Scheffer* s. n., v.n.: kimerak (B, s); Rioeng Goenoeng, *Scheffer* s. n. (B, f); near Kawak Manoek, *Scheffer* s. n. (B, s); Tjilaki, 1500 m el., *Forbes* 924 (L, f); G. Papandajan, and G. Saroni and ravine of the Tji Paroegpoeg, 2100—2600 m el., *Van Steenis* 4127, v.n.: kipoetri (B, L, s); Telaga-Bodas, *Blume* s. n. (L, s); *Burck* 144, v. n.: kipoetri (B, f); G. Telaga-Bodas, Padjagalang, *Reinwardt* s. n., v.n.: kimarak (L, s); Pangentjongan, G. Telaga-Bodas, *Koorders* 1256, v.n.: kibima (B, L, s); for. no. 2430aa, herb. no. 13847 (B, L, s); 14025, v.n.: kipantjar (B, f); Pangentjongan, N.W. of G. Gloengoeng, 1600 m el., *Koorders* 1215, v.n.: kipantjar (B, f); 1254, v.n.: kipoetri (B, L, s); 1253, v.n.: kipantjar (B, L, f); 1255 (B, L, f); 1800 m el., *Koorders* 1258, v.n.: kipantjar (B, f); Pangentjongan, forest Pasir Ipis, 1400—1500 m el., *Koorders* 13892, v.n.: kipantjar (B, L, f); 14066 (B, L, f); 14200, v.n.: kipantjar, kibima (B, L, f);

for. no. 2438a, herb. no. 13997 (B, L, m); for. no. 2500aa, herb. no. 26560, v.n.: kibima (B, f); Pangentjongan, forest Pasir Tjitjalengka, 1500 m el., *Koorders* 14144, v.n.: kipantjar (B, L, f); 1400 m el., *Koorders* 14206, v.n.: kipantjar, kibima (B, L, f); Pangentjongan, forest Pasir Kajoejoetan, *Koorders* for. no. 579*, herb. no. 26553, v.n.: kibima (B, f); Noesagedé, in the Pendjaloe Lake, 700 m el., *Koorders*, herb. no. 44323 (B, s); Tjerebon, Koeningan, *Houter* 24, 25 and 178, v.n.: kibima, kitadji (B, s); Central-Java: G. Slamet, forest Bentjana, 1360 m el., *Koorders* 1229 (B, f); Dièng, G. Prahoe, *Junghuhn* s.n., v.n.: melella (L, s); Dièng, Telagatezi, *Junghuhn* s.n., v.n.: melella (L, s); N.W. of G. Prahoe, above Soerdjo, 1800 m el., *Koorders* 11248, v.n.: melela (B, s); G. Oengaran, *Junghuhn* s.n., v.n.: marangang (B, L, U, m); *Koorders* for. no. 2420i, herb. no. 1223, v.n.: mlelo (B, L, s); G. Oengaran, Telemojo, 1300 m el., *Koorders* for. no. 1443*, herb. no. 35781 (B, s), 1400 m el., for. no. 2078*, herb. no. 35935, v.n.: maron (B, s); for. no. 2305*, herb. no. 1222, v.n.: kajoe piting (B, L, s); reg. Japara, Soemanding, 800 m el., *Boschpr.* Ja. 1873, v.n.: antoh (B, L, m); East-Java: G. Ardjoeno, Soember Brantas, 1650 m el., *Boschpr.* Ja. 1747, v.n.: tjemoro belah (B, s); G. Tengger, Tosari, forest Sekar koenig, 1600 m el., *Koorders* for. no. 1933*, herb. no. 37925, v.n.: woeloean (B, s); Zuidergebergte, forest Soember Tangkil, 600 m el., *Koorders* for. no. 382*, herb. no. 23733 (B, L, s); G. Ijang, between Bremi and Tama Hidoep, *Van Dillewijn* 183 (Pa, s); G. Ijang, Towan Idoep Lake, 1960 m el., *Altmann* 362 (B, s).

Lesser Sunda Islands. Bali: Peak of Tabanan, 1600 m el., *De Voogd* 1844, v.n.: soa (B, f).

Philippines. Luzon: Benguet prov., *For. Bur.* 10894 coll. *Curran* (L, f); Tayabas prov., Pagbalao, *Merrill* 1992 (S, m); Abra prov.; Polillo; Mindoro; Sibuyan; Mindanao; Jolo (all ex *Merrill* 1923, l.c.).

Celebes. Minahassa, bivouac Pinimorangan near Kajoewatoe, 500 m el., *Koorders* for. no. 1545*, herb. no. 16533, v.n.: marama-rendaj (B, L, f); Tondano, 725 m el., coll. W., s.n. (W, f); subdiv. Donggala, Rarampondo, 1500 m el., *Boschpr.* b.b. 15085, v.n.: marisa, k. (B, L, f); subdiv. Malili, near La Roua, *Boschpr.* b.b. 2414 (B, s); N. Rumbia, Lasuruma River and Mt. Ossu-sohua, 250—755 m el., *Elbert* 3129 (L, s).

Moluccas. Batjan: without coll., v.n.: lewi kajoeang (B, m); G. Sibéla, 1600—2000 m el., *Roepke* 4 (B, s); *Warburg* 18245 and 18284 (ex *Pilger* 1903, l.c.; see also *P. Rumphii*); Masoeroeng, 500 m el., *Boschpr.* b.b. 23143, v.n.: kajoe ratja oetan (B, s); Ambon: G. Salhoetoe, 1030 m el., *Rant* 732 (B, s); Tanimber Islands: Otimmer, 100 m el., *Boschpr.* b.b. 24379, v.n.: kadje sanoedoene (B, s).

Japen Islands. Schouten Island, Soperi, Opiaref, 25 m el., *Boschpr.* b.b. 15914, v.n.: nasbraren, kajoe tjina (B, s); Aipiaimi, Papoema, along the seashore, 0 m el., *Boschpr.* b.b. 20061, v.n.: topangkei (B, m).

New Guinea. N.W. Part: subdiv. West-New Guinea, Kali Kamoendang, 3 m el., *Boschpr.* b.b. 21933, v.n.: kajoe tjina, obereha (B, m); Taniba, *Boschpr.* b.b. 22498, v.n.: ai sina (B, m); Hellwig Mts, summit Mt. Agathodaemon, 2577 m el., *Von Römer* 1230 (B, s); N.E. Part: Zuckerhut, *Ledermann* 7105 (BD, s); Kani Mts., 1000 m el., *Schlechter* 16790 (BD, s); Mt. Gelu, 1700 m el., *Werner* 159 (ex *Pilger* 1916, l.c.); near Passai, *Hellwig* 651 (BD, s); Passai, Sattelberg, *Warburg* 21127 (BD, s); Morobe distr., Sattelberg, 800—1000 m el., *Clemens* 2276 (BD, f); Ogeramnang, 1850 m el., *Clemens* 5434 (BD, f); Ogeramnang to Tobou, 1650—

2000 m el., *Clemens* 6578 (BD, f); Morobe distr., Wareo, 700 m el., *Clemens* 1481 (BD, L, s); S.E. Part: *Okney* s.n. (ex *Koorders* 1914, l.c.); Owen Stanley Range, *Lane-Poole* 238, 275 (ex *Lane-Poole* 1925, l.c.); Koitaki, 500 m el., *Carr* 12842 (BD, L, f); Isuarava, 1600 m el., *Carr* 15395 (BD, m); Western Division, Wuroi, Oriomo River, 10—20 m el., *Brass* 5907 (B, BD, f); *Brass* 5908 (B, BD, s); Central Division, Wharton Range, Murray Pass, 2840 m el., *Brass* 4605 (B, BD, f).

SOLOMON ISLANDS. Malaita Island: interior from Quoimonapu, 300 m el., *Kajewski* 2370, v.n.: dingali (B, f, m).

Cultivated: in Hort. Bot. Buitenzorg, sub no. V. F. 3 (B, s); V. F. 21 (B, s); V. F. 33, 33a, from Java (B, s); V. F. 35, from Java (B, m); V. F. 45, from S. New Guinea (B, s); V.F. 67, 67a, 75a, 78, from Java (B, s); 8 [XII. B. (VI)], (B, s).

Further distribution: Eastern Himalaya, Khasia, Burma, Andaman Islands (ex *Hooker* 1888, l.c.); French Indo-China, from Tonkin to Cochin-China (ex *Hickel* 1931, l.c.); China from Yunnan to Kiangsu (ex *H. H. Hu* 1934, l.c.); Hongkong (ex *Dunn & Tutcher* 1912, l.c.); Formosa (ex *Hayata* 1911, l.c.); Fiji Islands (ex *Gibbs* 1909, l.c.).

P. neriifolia var. **β bracteata** (Blume) Wasscher, n. comb. — *Podocarpus bracteata* Blume, Enum. Pl. Javan., 1 (1827) 88; (see for the other literature under the species).

Terminal buds narrow-conical, acute; bud scales usually long, very gradually narrowed, usually erect, acute. Leaves spreading, linear-lanceolate or lanceolate, rather gradually narrowed towards the base, very gradually attenuate into the acute apex, 10—17 cm long by 9—14 mm broad, 8—15 times as long as broad; midrib on the upper surface distinct, narrowly prominent, sharply delimited, sometimes even by means of a furrow on each side. Male flower buds single or to 3 in the leaf axils, sessile, large, to 8 mm long and 4 mm broad, ovate-acute; bud scales often somewhat spreading, ovate-triangular, acute, the outer ones keeled. (Description from the specimens mentioned below).

This variety differs from the main form of the species in the large, ovate-acute, male flower buds, with squarrose, ovate-triangular, acute bud scales. See also the discussion after the description of the species. To this variety probably also belong some plants with entirely developed flowers and of which the buds, as a consequence, are too old to be judged about. The flowers of these plants are long-cylindrical or filiformous, 2.5—8.5 cm (according to Blume 1847, l.c., up to 10 cm) long, and 2.5—3.5 mm in diam.; the lower portion of the axis of the flower is usually strongly elongate, thus forming a 5—10 mm long portion with remote, usually membranous scales only.

JAVA. Without exact locality, *Blume* s.n. (L, m); *Perottet* s.n. (L, m); G. Megamendoeng, *Blume* s.n. (L, m); G. Boerangrang, *Blume* s.n. (L, m); G. Kendeng,

Scheffer s. n., v.n.: kipoetri (B, m); G. Goentoer, 1600 m el., *Danser* 6792 (B, m); G. Ardjoeno, 1800 m el., *Koorders* for. no. 1929*, herb. no. 38198 (B, L, m).

Perhaps also (with developed flowers):

JAVA. Without exact locality, *Hasskarl* s. n. (L, m); G. Megamendoeng, *Blume* s. n. (L, m); Tjigenteng, *Koorders* 1250, v.n.: kipoetri (B, m); Pangentjongan, *Koorders* for. no. 295*, herb. no. 26540, v.n.: kibima (B, m).

P. neriifolia var. γ **membranacea** Wasscher, n. var.

Gemma terminalis magna, ovata vel ovato-conica, ad 15 mm longa, perulis plerumque anguste ovatis, ad 13 mm longis, omnino membranaceis. Folia lanceolata, 6—10 cm longa, 7—10 mm lata, 7—10 × longiora quam lata. Alabastra mascula singula in axillis, ovata vel ovato-conica, acuta, ad 7 mm longa, perulis ut gemmae terminalis.

Terminal buds large, ovate or ovate-conical, to 15 mm long and 7 mm broad; the outer bud scales triangular, stout, shortly acuminate, keeled, to 3 mm long, the inner ones narrowly ovate, obtuse, entirely membranous, to 13 mm long. Leaves more or less spreading, rather thick-coriaceous, rigid, lanceolate, gradually narrowed towards the base and the apex, 6—10 cm long by 7—10 mm broad, 7—10 times as long as broad; midrib distinct, narrowly prominent above. Male flower buds single in the leaf axils, ovate or ovate-conical, acute, to 7 mm long; bud scales wholly membranous as in the terminal buds. (Description from both collections mentioned below).

This variety differs from the main form of the species by the membranous scales of the terminal buds and the ovate-acute male flower buds.

CELEBES. Upper-Binoeang, estate Tamalanti, *Boschpr.* b.b. 20204 (B, s); Masamba, estate Peororoa, 1300 m el., *Boschpr.* b.b. 24158 (B, m), type of the variety.

P. neriifolia var. δ **atjehensis** Wasscher, n. var.

Gemma terminalis plerumque magna, perulis exterioribus sensim angustatis vel in acumen subulatum productis, saepe omnino reflexis, ad 20 mm longis, interioribus adjacentibus, acutis. Folia maxima parte reflexa, angustissime lanceolata, 7—18 cm longa, 5—8.5 mm lata, 10—20 × (plerumque 13—16 ×) longiora quam lata. Alabastra mascula singula in axillis, acute ovata, perulis acutis, ad 5 mm longis. Flores masculi 2—3 mm longi, 4—4.5 mm in diametro.

Terminal buds large, sometimes nearly globose, sometimes narrower; the outer bud scales sometimes deflexed, narrow-triangular, very gradually narrowed or subulate-acuminate from an ovate base, up to 20 mm long, the inner ones more ovate-triangular, acute or very shortly acuminate, adpressed, sometimes with the apex curved outwards, often with narrow membranous margin. Leaves rather crowded, deflexed for

the greater portion, sometimes partly more or less spreading on the youngest vegetation period, rather thick-coriaceous, rigid, very narrowly lanceolate, very gradually narrowed towards the base and the acute, sometimes mucronate-acute apex, 7—18 cm long by 5—8.5 mm broad, 10—20 (usually 13—16) times as long as broad; midrib strongly prominent, narrow, sharply delimited above. Male flower buds single in the leaf axils, sessile, rather large, ovate-acute; bud scales acute, often subulate-acuminate, up to 5 mm long, the inner ones more ovate-obtuse; male flowers rather thick-cylindrical, 2—3 cm long and 4—4.5 mm in diam. Female flowers solitary in the leaf axils on slender peduncles. Peduncles 8—16 mm long, flattened and broadened towards the apex; foliola large, 3.5—6 mm long; receptacle subcylindrical or narrowly obconical, 7—9 mm long by 3—4 mm broad; seed subelliptical, obtuse, 9—10 mm long by 7—8 mm broad. (Description from both collections mentioned below).

According to Van Steenis' herbarium labels this variety is a characteristic small tree, about 5 m tall, the young foliage of which is beautifully pink. It yields a white, glutinous resin. The fruit is white- or bluish-pruinose. This variety occurs in mossy forests and shrub formations at the higher elevations. It differs from the main form of the species in its deflexed, very narrowly lanceolate leaves, the larger terminal buds with partly deflexed scales, the larger, ovate-acute male flower buds with subulate-acuminate outer scales and the thicker male flowers.

SUMATRA. Atjeh: Gajolanden, G. Leuser, 2250—2750 m el., *Van Steenis* 8470 (B, f); G. Kemiri, 2900—3314 m el., *Van Steenis* 9614 (B, f, m), type of the variety.

P. neriifolia var. ε **timorensis** Wasscher, n. var. — *Podocarpus polystachya* (non R. Brown 1838) De Voogd, in Trop. Nat., 27 (1938) 63.

Folia approximata, divergentia vel erecta, crassiuscule coriacea, breviter lanceolata, subabrupte in acumen acutum, nonnunquam pungens, attenuata, 3.5—6.5 cm longa, 8—11 mm lata, 4—6 × longiora quam lata, costa facie superiore nonnunquam linea elevata angusta, plerumque plana vel leviter impressa. Flores masculi 1—3 in axillis, 2—2.5 cm longa, 4 mm diametro.

Terminal buds acute; bud scales from an ovate-triangular base long-subulate-acuminate, strongly keeled, to 7 mm long. Leaves rather crowded, spreading or erect-spreading, rather thick-coriaceous, rigid, rather short-acuminate, gradually or cuneately narrowed into the very short petiole, rather shortly narrowed into the acute apex, sometimes with an apiculus to 2 mm long, 3.5—6.5 cm long by 8—11 mm broad,

4—6 times as long as broad; midrib on the upper surface usually flat or even slightly impressed, sometimes prominent as a narrow line, on the lower surface broader, keeled towards the base; lamina with slightly thickened and very shining margins. Male flowers 1—3 in the upper leaf axils, crowded just below the terminal bud, sessile, cylindrical, 2—2.5 cm long and 4 mm in diam., at the base with some sterile, ovate-triangular, acute or rather obtuse, keeled bracts, with narrow membranous margin; stamens with short, ovate-triangular, rather obtuse apiculus. Female flowers and fruits unknown. (Description from the type specimen.)

This variety differs from the main form of the species in the indistinct, not or hardly prominent midrib, and the leaves shorter-narrowed towards the apex and often with a mucro, whereas the male flowers are thicker. The collection mentioned below is taken from a 15 m tall tree with drooping branches.

TIMOR. G. Moetis, 2000 m el., *De Voogd* 2301, common between 1500 and 2000 m el. (B, m), type of the variety.

P. neriifolia var. ζ **linearis** Wasscher, n. var.

Gemma terminalis ovata, perulis plerumque ovatis, obtusis vel late truncatis, 3—4 mm longis, 2.5—3 mm latis. Folia lineari-lanceolatis, marginibus parallelis, 10—18 cm longis, 7—12 (raro ad 16) mm latis, 10—20 × longiora quam lata, costa supra angusta vel linea angusta prominente. Alabastra mascula singula in axillis, magna, ovata, obtusa, 4—6 mm longa, 3—4 mm lata, perulis plerumque ovatis, obtusis.

Terminal buds ovate, obtuse; bud scales ovate, obtuse or broadly truncate at the apex, 3—4 mm long by 2.5—3 mm broad, the outer ones sometimes more acute or very shortly acuminate, keeled and sometimes with broad membranous margin. Leaves spreading, linear-lanceolate, with the margins parallel over a great part of the length, usually gradually narrowed towards the base, rather shortly or gradually narrowed towards the apex, 10—18 cm long by 7—12 (rarely to 16) mm broad, 10—20 times as long as broad; midrib narrow, prominent as a narrow line above. Male flower buds single in the leaf axils, large, ovate, obtuse, 4—6 mm long by 3—4 mm broad; bud scales ovate, the outer ones shorter and ovate-triangular and strongly keeled, the inner ones with membranous margin. Male and female flowers and fruits unknown. (Description from the specimens mentioned below).

This variety differs from the main form of the species in the narrower leaves with the margins parallel, the obtuse terminal buds and the large, ovate, male flower buds.

JAVA. G. Gedé, native collector 337, v.n.: kipoetri (B, s), type of the variety; Djember, Tjoeramanis Simpolan, *Koorders* for. no. 4185w, herb. no. 1236 (B, L, s), 21091 (B, L, m), and 38501 (B, s), v.n.: bangkol; *Koorders* 1237 (B, L, s).

Cultivated: in Hort. Bot. Buitenzorg, v.n.: kibima (B, s).

P. neriifolia var. η **Ridleyi** Wasscher, n. var.

Folia crassa coriacea, lanceolata, sensim ab infra medium ad apicem acutum angustata, 5—12 cm longa, 6—12 mm lata, 7—13 × longiora quam lata, costa supra paulum distincta, plana vel leviter impressa, nonnunquam linea angusta prominente, infra prominente, saepe leviter sulcata. Alabastra mascula plerumque terna in axillis, ovata, obtusa, parva. Pedunculus fructifer brevissimus, 1—3 mm longus.

Terminal buds ovate-acute or conical; bud scales ovate-triangular, subulate-acuminate, keeled, to 13 mm long. Leaves spreading, thick-coriaceous, straight or slightly falcate, lanceolate, rather gradually narrowed into the short petiole, very gradually narrowed from below the middle to the acute apex, 5—12 (rarely to 14) cm long by 6—12 (rarely to 14) mm broad, 7—13 times as long as broad; midrib on the upper surface not very distinct, flat or even slightly impressed, sometimes prominent as a narrow line, on the lower surface distinct, broader, keeled, often shallow channelled. Male flower buds usually in bundles of 3, sessile, ovate, small, obtuse; bud scales ovate, obtuse, the outer ones more acute and keeled, 2 mm long; male flowers cylindrical, to 2.5 mm long. Female flowers single in the leaf axils. Peduncles very short, 1—3 mm long, spreading; foliola subulate, to 2.5 mm long; receptacle short-cylindrical, 5 mm long and 3 mm broad; young fruit ovate-elliptical, obtuse. (Description from the specimens from the Malay Peninsula).

According to Holttum this variety is one of the commonest trees on G. Blumut, striking in its yellow-green leaves. It differs from the main form of the species in its thicker leaves which are still more gradually narrowed into the apex, the usually impressed or not prominent midrib and the very short peduncles of the fruit. From *P. Rumphii* it may easily be distinguished by the long-narrowed leaves.

MALAY PENINSULA. Malacca: Mt. Ophir, 650—1000 m el., *Ridley* 3158 (S, f); *Ridley* 10016, type of the variety (S, m); Johore: G. Blumut, 1000 m el., *Sing.* Field no. 10720 coll. *Holttum* (S, B, f).

Perhaps also:

BORNEO. Western Part: G. Semedoem, *Hallier*, B. 720 (B, L, S, U, m).

P. neriifolia var. ϑ **Teysmannii** (Miquel) Wasscher, n. comb. — *Podocarpus Teysmannii* Miquel, Fl. Ind. Bat., II, 6 (1859) 1072; suppl. Sum. (1860) 252, 589; De Boer, Conif. Arch. Ind. (1866) 14, 28, 36,

37, t. 1; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 516; Gordon, Pinetum, ed. 2 (1875) 348; Filet, Plantk. Woordenb. (1876) 278; Warburg, Monsunia, 1 (1900) 193; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 81; Merrill, Bibl. enum. Born. pl. (1921) 31; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283. — *Nageia Teysmannii* Kuntze, Rev. Gen. Plant., 2 (1891) 800.

Terminal buds globose; the outer bud scales thick, ovate-triangular or nearly orbicular, slightly acute or sometimes subobtuse, up to 3 mm long, rarely thick-subulately narrowed, up to 5 mm long, the inner ones ovate, obtuse, with membranous margin. Leaves rather remote, somewhat crowded towards the apices of the vegetation periods, usually spreading, rather thick-coriaceous, broad-lanceolate, the margins often parallel, gradually or sometimes cuneately narrowed into the distinct, broad petiole, usually rather abruptly narrowed and shortly acuminate into the acute or sometimes slightly rounded apex, 8.5—17 cm long by 16—26 mm broad, 5—9 times as long as broad; midrib on the upper surface thick- and rather broadly prominent, slightly rounded and sharply delimited, on the lower surface broad, keeled towards the base, rather flat and sometimes slightly channelled towards the apex. Male flower buds single in the leaf axils, globose or ovate-globose, to 3 mm long; bud scales subovate, sometimes ovate-triangular, obtuse, with membranous margin. Male and female flowers and fruits unknown. (Description from the type specimens).

This variety differs from the main form of the species in the globose, obtuse, terminal buds, the broad-lanceolate, shortly acuminate leaves and the large male flower buds. The type specimens are remarkably different from *P. neriifolia*, but the other collections show, in some respects, an approach towards the main form. The plant from Bangka, *e. g.*, has leaves, of which the older ones agree with those of the type specimens, whereas some of the youngest leaves are not different from those of *P. neriifolia*. The scales of the terminal buds of the plant from Lingga are rather acute and the leaves are thinner, whereas of the collection Boschpr. b.b. 4001 the buds are globose, and the leaves are much less typical as in the plants from Sibolga. Therefore, *P. Teysmannii* may be at best a variety of *P. neriifolia*.

SUMATRA. Tapiannoeli: Sibolga, sea shore, *Teysmann* 513 H.B., v.n.: sikoejoe laut (B, L, U, m), originals of *P. Teysmannii Miq.*; *Zollinger* 1646 (ex *Pilger* 1903, l.c.); Westkust (W. coast): subdiv. Painan, Br. Belanti, 425 m el., *Boschpr.* b.b. 4001, v.n.: kalek rotan (B, L, m).

LINGGA ARCHIPELAGO. P. Lingga, G. Tanda, *Teysmann* s.n. (B, L, s).

BANGKA. Soengeiliat, G. Boei, *Teysmann* s. n., v.n.: kajoe sembilang (B, G, s).
BORNEO. Sarawak: Beccari (ex *Parlatore* l. c.).

P. neriifolia var. ι **polyantha** Wasscher, n. var.

Folia lanceolata vel late lanceolata, marginibus saepe parallelis, apicem versus abrupte vel magis sensim attenuata, saepe breviter acuminata, 6—16 cm longa, 13—20 mm lata, 4.5—8 × longiora quam lata, facie inferiore saepe sulca loco costae. Flores feminei numerosi secus ramulos proximi anni; receptaculum e squamis 2—4 carnosis compositum; ovulum singulum, vel 2. Pedunculus fructifer brevissimus, 1.5—5 mm longus.

Terminal buds conical, acute; bud scales from an ovate base usually abruptly contracted into a long acumen, up to 5 mm long, rarely gradually narrowed and to 12 mm long. Leaves spreading, more or less coriaceous, straight or slightly falcate, lanceolate, or broad-lanceolate, the margins usually parallel, short-cuneately or rather gradually narrowed into the short petiole, often abruptly and shortly acuminate into the acute apex, 6—16 cm long by 13—20 mm broad, 4.5—8 times as long as broad; midrib on the upper surface prominent, narrow and sharp, almost keeled, often indistinct near the apex, on the lower surface usually with a narrow and deep furrow (in the leaves of young plants sometimes broader prominent, flat). Male flowers unknown. Female flowers numerous, all over the youngest vegetation periods, in the axils of bracts as well as in those of the leaves and above the leaf scars; the few bracts sessile with broad base, acute, to 1.5 cm long by 2.5 mm broad; peduncles short, spreading; foliola subulate, to 3 mm long; receptacle composed of 2—4 fleshy scales, of which 1—2 fertile, often somewhat curved. Peduncles thick, 1.5—5 mm long; receptacle short- and thick-cylindrical, 6—7 mm long and 4—5 mm broad; seed elliptical-ovate, 10 mm long and 6 mm in diam. (Description from the specimens mentioned below.) Cfr. *Plate V 17* ι.

According to herbarium labels, this variety is a tree up to 40 m tall, with slender, straight bole. The crown is attached to the bole rather high, and is small, very strongly branched and very dense (Grashoff 1030), rounded ovate, very large and dense, with remarkably light-green foliage (Van Steenis 3179). The female flowers are fragant and have a rather sharp taste (Boschpr. 192T. 3P. 567). To this collection belongs also a seedling with root nodules.

The var. *polyantha* differs from the main form of the species in the larger number of female flowers, which often bear 2 ovules, in the usually shorter and more abruptly narrowed and shortly acuminate

leaves, often with a furrow on the lower surface; moreover, these plants are the only ones, which have bracts below the female flowers.

SUMATRA. Palembang: div. Rawas, 100 m el., *Grashoff* 1030, v.n.: kajoe tjina (B, L, s); subdiv. Lematang Ilir, ds. G. Megang, 75 m el., *Boschpr.* 192T. 3P. 567, v.n.: kajoe tadji (B, L, W, f), type of the variety; near Banding-agoeng along the road to Simpang, N. of the Ranau Lake, 600 m el., *Van Steenis* 3179 (B, L, U, W, f).

18. Podocarpus Ledermannii Pilger, in Bot. Jahrb., 54, 3 (1916) 210; in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 279, 283.

Twigs solitary or subopposite, spreading, rather slender. Terminal buds narrowly ovate-conical, acute; bud scales narrowly triangular or lanceolate-subulate, very acute, to 6 mm long. Leaves scattered, usually rather remote, more crowded below the terminal buds, somewhat coriaceous and rigid, oblong-lanceolate or narrowly oblong, usually shortly subcaudate-acuminate into the acute apex, short-cuneate or rounded-cuneate at the base, with the petiole distinct and 3—5 mm long, 3.5—5 times as long as broad, 6—12 cm long by 17—28 mm broad; midrib narrow, strongly prominent and sharply delimited above, keeled towards the base and more flat towards the apex beneath; lamina with flat or slightly recurved margins, shining above, dull beneath. Male flower buds 2—3 on very short, 0.5—1.5 mm long common peduncles, small, ovate-acute; bud scales ovate-triangular, acute or shortly acuminate, keeled, to 2 mm long, with membranous margin, the inner ones somewhat obtuse; male flowers cylindrical; stamens with ovate-triangular, rather obtuse to acute apiculus. Female flowers and fruits unknown. (Description from Ledermann's specimens). Cfr. *Fig. 4.*

According to herbarium labels, *P. Ledermannii* is a tree 5—20 m tall, with greyish to brownish bark and open, thin crown; the not completely ripe male flowers are white or pale yellow. The tree occurs in light mountain forests.

This species is most closely allied to *P. neriifolia*, perhaps it represents only a form of this polymorphic species. It differs in the more oblong leaves with somewhat caudate-acuminate apex. From *P. Rumphii* it differs moreover in the strongly prominent midrib and the male flowers usually placed in bundles of 3.

NEW GUINEA. N.E. Part: Kaiserin-Augusta-Fluss-Expedition, Lordberg, 1000 m el., *Ledermann* 9878, 9943, 9996 (all BD, m), and 10064a (BD, s), originals of the species.

19. Podocarpus polystachya R. Brown. — *Podocarpus neriifolia* [1]) D. Don, in Lambert, Genus Pinus, ed. 1 (1824) 21 p.p.; [1]) ed. 2

(1828) II, 122, p.p.; Hooker f., Fl. Brit. Ind., 5, 3 (1888) 649 p.p. — *Podocarpus polystachya* R. Brown, ex Mirbach, in Mém. Mus. hist. nat., 13 (1825) 47, 54, nomen; Bennett, in Horsfield, Pl. Jav. rar. (1838) 40, nomen; Endlicher, Syn. Conif. (1847) 215; Miquel, Fl. Ind. Bat., II, 6 (1859) 1072; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 392; Carrière, Traité gén. Conif., ed. 2, II (1867) 662; De Kirwan, Conif. 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 515; Gordon, Pinetum, ed. 2 (1875) 345; Filet, Plantk. Woordenb. (1876) 182; Warburg, Monsunia, 1 (1900) 192; [2]) Pilger, in Engl., Pflanzenr., IV, 5 (1903) 79; Merrill, in Philipp. Journ. Sci., 3 (1908) 394; [2]) Ridley, in Journ. Str. Br. Roy. As. Soc., 60 (1911) 58; [2]) Foxworthy, in Philipp. Journ. Sci., 6 (1911) 161; Gibbs, in Ann. Bot., 26 (1912) 546, t. 50, ic. 35—37, t. 51, ic. 38—43; [2]) Stiles, in Ann. Bot., 26 (1912) 455, 459; [2]) Gibbs, in Journ. Linn. Soc., 42 (1914) 13; [2]) Stapf, in Journ. Linn. Soc., 42 (1914) 194; [2]) Pilger, in Bot. Jahrb., 54, 1 (1916) 38; [2]) Merrill, Bibl. enum. Born. pl. (1921) 31; Enum. Philipp. Flow. Pl., 1 (1923) 4; [2]) Ridley, Fl. Mal. Pen., 5 (1925) 282, ic. 228; Lam, in Hand. IV Ned. Ind. Natuurwet. Congr. (1926) 393; [2]) Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 247; Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. 1 (1930) 237; [2]) Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283; [2]) Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, XII, 2 (1932) 185; Polak, in Verh. Kon. Akad. Wet. Amst., 30, 3 (1933) t. L, ic. 24; Merrill, in Proc. Fifth Pac. Congr. Can., 4 (1934) 3269; [2]) Burkill, Dict. Econ. Prod. Mal. Pen., 2 (1935) 1779; Wasscher, in Backer, Bekn. Fl. Java, 2 (1940) fam. 18, 3. — *Podocarpus littoralis* Teysmann, in Nat. Tijdschr. Ned. Ind., 36 (1876) 237; Wigman, in Teysmannia, 15 (1904) 9. — *Nageia polystachya* Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Podocarpus neglecta* (non Blume) Ridley, in Agric. Bull. Str. and F. M. S., 1 (1902) 289; 5 (1906) 251; in Bull. Kol. Mus. Haarlem, 27 (1903) 105.

[1]) *P. nereifolia.* [2]) *P. polystachyus.*

Twigs to 5 subverticillate, usually straight, spreading under wide angle, terete. Terminal buds ovate, acute, sometimes narrowly conical; bud scales either from an ovate base rigidly subulate-acuminate, sometimes with reflexed apex, or very long and gradually narrowed and erect, usually 2½—4 mm, rarely up to 10 mm long, keeled. Leaves scattered, usually strongly crowded at the apex of the branchlets, erect or erect-spreading, coriaceous, rather rigid, usually linear-lanceolate, sometimes lanceolate or narrow-lanceolate, rather abruptly or gradually

narrowed into the very short petiole, usually very abruptly narrowed towards the apex, the apex rather obtuse to acute, sometimes mucronate or with a short, obtuse apiculus, 3—10 cm long by 6—10 (rarely 4—12) mm broad, 6—9 (rarely 5—12) times as long as broad; midrib narrow, strongly prominent, sharply delimited above, somewhat keeled towards the base, broad towards the apex, broad- and shallow-channelled beneath; lamina with flat margins, shining and often striped above, more dull beneath. Male flower buds in bundles of 3—5 in the upper leaf axils, sessile, globose or ovate-globose, obtuse; bud scales roundish or ovate, usually obtuse, rarely rather acute, to 2 mm long, with membranous, lacerated margin; flowers cylindrical, 2—4.5 cm long, 2.5—3 mm in diam.; stamens with short, broad-triangular, rather acute apiculus; pollen grains with 2 air bladders. Female flowers solitary in the upper leaf axils, usually several together crowded just below the terminal bud, with short peduncles; receptacle composed of 2 fleshy bracts. Peduncles divaricate, or spreading under a wide angle or rarely somewhat reflexed, thick, very short, 1—4 mm long; receptacle erect or erect-spreading, subcylindrical, the sterile posterior bract with short, acute apex, 1—1.5 mm shorter than the anterior fertile bract, which is up to 10 mm long; foliola subulate, 2 mm long; seed elliptical, sometimes somewhat oblique, 9 mm long by 7 mm broad, with hard, bony testa; albumen white, with long embryo, 6 mm long by 1 mm in diam., cotyledons 2, 1.5 mm long, directed upwards. (Description from all the materials examined.) Cfr. *Fig. 4, Plate V 19a—c.*

According to herbarium labels, *P. polystachya* is usually a small tree, to 18 m tall, with a bole to 43 cm in diam., and often branched from near the base. The female flower is green (Bünnemeijer 7685), white (Becking 69) or purple (Boschpr. b.b. 2476), whereas the fruit is black-purple (Bünnemeijer 7685) or red (Boschpr. b.b. 2476). The male flowers are greenish white (Cult. in Hort. Bot. Singapore). This species is one of the few that occur especially at low elevations and only rarely in somewhat mountainous regions. It often grows on the seashore or along rivers, sometimes on grounds which are periodically or continually flooded, *e. g.*, in mangrove swamps, or between granite rocks along the seashore.

The materials available are rather homogeneous, though there are a few deviating specimens. A plant, *e. g.*, from Bangka, Djeboes (Teysmann s. n.) has leaves, which are scattered all over the twigs, much longer and nearly linear; the leaves are to 13 cm long, 7—11 mm broad and 10—12 times as long as broad. Probably this collection

represents a young sapling. Of another plant, from Riau, Tandjoeng Pinang (Teysmann s. n.), the leaves are small and narrow, and not abruptly, but usually rather gradually narrowed towards the apex, and to 13.5 times as long as broad. The leaves of some other plants show the normal shape, but are much smaller and only 3—6 cm long and 4—7 mm broad; some of these plants, however, have leaves of the normal size besides. Still other plants, *viz.*, Bünnemeijer 2351, from Bangka, Burkill 853, from P. Tinggi, and Labohm 1214, from Borneo, have leaves, the shape of which approaches that of *P. neriifolia* by the more gradually narrowed apex and by the midrib less distinctly channelled beneath. In the specimen Clemens 9659, the peduncles are moreover somewhat longer than usually.

On two plants female flowers occur with two fertile scales on the receptacle instead of one. On Ridley 1441 (Pahang) the two ovules are placed opposite to each other, whereas a free, small apex occurs between the two ovuligerous scales. On a plant from Awang Bangkal (unknown coll. 2360) only one of the two ovules is developed to a seed, whereas the other one has remained small.

P. polystachya was united with the species *P. neriifolia* by Hooker fil. It differs, however, from the latter species in the short, crowded peduncles, the bundles of 3—5 male flowers, the erect-spreading crowded leaves with abruptly narrowed apex, and the broad-channelled midrib beneath.

MALAY PENINSULA. Pahang: Kwantan, *For. Dep.* 3555 coll. *Lanubak*, v.n.: jati laut (S, m, f); Kwantan, edge of mangrove Kuala Rumpin, *For. Dep.* 4159 coll. *Watson*, v.n.: jati (S, m); Kuala Pahang, mangrove swamp, *Ridley* 1441 (S, m, f); Rantau Panjang, *For. Dep.* 15441 coll. *Bidin*, v.n.: jati laut (S, f); Sungei Bebar, *For. Dep.* 14979 coll. *Mahamud*, v.n.: jati laut (S, f); P. Tioman, Telok Paya, sea shore, sea level, *Sing.* Field no. 8420 coll. *Henderson* (B, S, f); Johore: Sungei Tukong estate, *Gordon Spare* 959 (S, m); P. Tinggi, *Sing.* Field no. 853 coll. *Burkill* (S, s); Singapore: *Cantley* 113 (S, m); Serangoon, *Ridley* 3367 (S, m); Labrador, *Sing.* Field no. 32795 coll. *Corner* (S, f); Changi, *Ridley* 4823 (S, m); Kranji, *Ridley* s. n., 165 and 4823b (S, f); Singapore, *Wallich* 6052B; *Jelinek* in Exp. Novara (ex *Pilger* 1903 l. c.); Changi beach, *Ridley* 6001 (ex *Ridley* 1911, l. c.).

RIAU ARCHIPELAGO. Br. Belobang, 2 m el., *Bünnemeijer* 7685, v.n.: batang tada (B, f); Tandjoeng Pinang, sea shore, *Teysmann* s. n. (B, L, s).

LINGGA ARCHIPELAGO. Tandjoeng Djakong, *Teysmann* s. n. (B, L, m); P. Temiang, Gg. Benaja, 5 m el., *Bünnemeijer* 7636, v.n.: kajoe karamat (B, L, f); P. Singkep, Batoepetjan, M. Toewa, 1 m el., sea shore, flooded by silt water, *Boschpr.* b.b. 5888, v.n.: mentada (B, s); P. Singkep, S. Manggoe, 8 m el., *Boschpr.* b.b. 5614, v.n.: pentada (B, m).

BANGKA. *Coll. unknown*, no. 16B, v.n.: poenjoek (L, s); Djeboes, *Teysmann*

s. n., v.n.: poenjok (B, G, m); *Teysmann* s. n., v.n.: poenjok (B, G, s); Djeboes, Klabatbaai, sea shore, *Teysmann* s. n. (B, G, f); Soengeiliat, sea shore, *Tesymann* s. n., v.n.: poenjoo (B, G, f); between Pangkalpinang and Blinjoe, 5—10 m el., young bloekar, *Huitema* 12, v.n.: kajoe poenjoe poenjoe (B, s); subdiv. Toboali, 10 m el., sea shore among granite rocks, *Bünnemeijer* 2351 (B, m).

BELLITON. Mangrove near Sidjoek, *Ham* 49, v.n.: kajoe tjina (B, s); Mine distr. Dendang, Gg. Gersik (Membalong), 2 m el., *Boschpr.* b.b. 12428, v.n.: poenjo (B, s).

ANAMBA AND NATOENA ISLANDS. P. Djemadja, Padang nr. Letong, sea level, *Sing.* Field no. 20333 coll. *Henderson* (B, S, m).

KARIMATA ARCHIPELAGO. Soengei Tajan, *Teysmann* 11360, v.n.: mentadeh (B, L, f).

BORNEO. British North Borneo: Kudat, *Fraser* 48 (ex *Stapf*, l. c.); Jesselton, *Clemens* 9659 (B, f); Jesselton, on sandstone banks of beach near harbour, *Clemens* 51171 (L, f); Jesselton, near the harbour, *Gibbs* 2592 (ex *Stapf*, l. c.); P. Labuan, on the sea shore, *Motley* 360 (ex *Stapf*, l. c.); Sarawak: *Beccari* 591, 2213, 2513 (ex *Stapf*, l. c.); *Bur. Sci.* 2353 nat. coll. (ex *Merrill* 1921, l. c.); island Satang Basa, rocky beach, *Foxworthy* 417 (ex *Foxworthy* 1911, l. c.); Western Part: Palo, S. Rijan, 0 m el., mangrove, *Becking* 69, v.n.: kajoe tjina (B, f); Singkawang, Pasir Pandjang, beach, *Dunselman* 166 (B, f); subdiv. Beneden Matan, S. Memboeloeh, 0 m el., periodically flooded by brackish water, *Boschpr.* b.b. 14403, v.n.: tentada (B, f); Southern Part: Bandjermasin, *Motley* 604 (ex *Stapf* l. c.); subdiv. Martapoera, S. Langsat, Karingintan, *Eamli* 2338, v.n.: sarai (B, f); Awang Bangkal, *unknown coll.* no. 2360, v.n.: sarai (B, f); mountanous grounds, *Boschpr.* b.b. 2476, v.n.: sarai (B, f); G. Boekit Besar, *Labohm* 1214, v.n.: kajoe-sarai (B, L, f).

JAVA. Meester Cornelis, cultivated, *Backer* s. n. (B, m).

TALAUD ISLANDS. Karakelang, G. Piapi (ex *Lam* 1926, l. c.).

PHILIPPINES. Batanes Islands (ex *Merrill* 1908, l. c.); Luzon: prov. Ilocos Norte, Burgos, *Bur. Sci.* 27146 coll. *Ramos* (B, L, f); Tayabas prov., *Bur. Sci.* 26902 coll. *Edaño* (L, S, m); *Bur. Sci.* 13202 coll. *Foxworthy & Ramos* (ex *Foxworthy* 1911, l. c.); Bucas Island: *Merrill* 5268 (B, L, f); Palawan: *Bur. Sci.* 904 coll. *Foxworthy* (B, m, f); *For. Bur.* 3854 coll. *Curran* (B, L, m).

Cultivated: in Hort. Bot. Singapore (S, f, s); *Ridley* 13304 (S, f); *Ridley* s.n. (S, m); in Hort. Bot. Buitenzorg, *Pulle* s. n., (U, f); no. V. F. 1, 1a from Lingga Arch. (B, L, W, f); V. F. 17, 17a from Lingga Arch. (B, L, U, W, m).

P. polystachya var. **β rigida** Wasscher, n. var.

Folia crasse coriacea, rigidissima, magis lanceolata vel oblongo-lanceolata quam in specie, marginibus non parallelis, 3—7.5 cm longa, 8—14 mm lata, 4—6 × longiora quam lata, costa facie superiore crassa, acriter delimitata, facie inferiore leviter lateque sulcata.

Leaves thick-coriaceous, very rigid, more lanceolate or oblong-lanceolate, with the margins not parallel, 3—7.5 cm long by 8—14 mm broad, 4—6 times as long as broad; midrib strongly prominent, sharply delimited above, very distinctly, broadly and shallowly channelled

beneath; lamina with somewhat recurved margins. (Description from the type specimen.)

This variety differs from the main form of the species in its different leaf shape. Probably it also occurs at higher elevations.

The 2 other collections are less typical than the plant from Karimata; Bünnemeijer 7870 has leaves up to 10.5 cm long, up to 12 mm broad, and less coriaceous; the fruit is not different from that of the main form. The leaves of Hallier B. 2373 are lanceolate and very rigid, and have distinctly channelled midribs; they are up to 10 cm long and up to 12 mm broad. Both collections show an approach towards *P. neriifolia,* but differ in the erect-spreading leaves, with less narrowed apex and channelled midribs.

RIAU ARCHIPELAGO. P. Karimon, G. Djantan, 430 m el., *Bünnemeijer* 7870, v.n.: petada (B, f).

KARIMATA ARCHIPELAGO. G. Djoengdjoeng, *Teysmann* 11358, v.n.: mentadeh darat (B, L, s), type specimens of the variety.

BORNEO. Western Part: G. Kelam, *Hallier* B. 2373 (B, L, s).

20. Podocarpus macrophylla D. Don ssp. **maki** Siebold, Naamlijst (1844) 35, n. 273. For synonyms and literature see Pilger, in Engl., Pflanzenr., IV, 5 (1903) 80.

Twigs subverticillate, spreading, terete. Terminal buds ovate-acute; bud scales ovate-triangular, subulate-acuminate, often with the apex curved outwards, keeled, to 4 mm long. Leaves scattered, usually strongly crowded at the apex of the twigs, erect, somewhat spreading, thin-coriaceous, rather rigid, narrow-lanceolate, usually somewhat spathulate, very gradually narrowed towards the sessile base, more abruptly so into, or rounded above, the usually obtuse, rarely somewhat acute apex, 3—7.5 (rarely to 10) cm long by 4—7 mm broad, 7—12 times as long as broad; on the upper surface the midrib prominent, narrow, sometimes little sharply delimited, often indistinct towards the apex, on the lower surface somewhat broader, slightly keeled towards the base, more flat towards the apex, sometimes slightly channelled; lamina with rather strongly recurved margins, slightly shining above, dull beneath. Male flower buds in bundles of 3—5, especially in the upper leaf axils, sessile, ovate-globose, obtuse; bud scales ovate or ovate-triangular, with membranous, lacerate margin, the outer ones usually somewhat acute, the inner ones obtuse; male flowers narrowly cylindrical, nearly filiformous, 3—4 cm long and 2—3 mm in diam.; stamens with triangular, acute apiculus, with membranous margin. Female flowers single in the upper leaf axils, usually several together crowded just below the terminal bud, with rather long peduncles; receptacle

composed of 2—3 fleshy bracts. Peduncles erect-spreading, somewhat flattened, 5—14 mm long and 1.5 mm broad above; foliola subulate, 2—6 mm long; receptacle subcylindrical, 6—16 mm long by 2.5—8 mm in diam.; seeds 1, rarely 2, globose-elliptical, rounded at the apex and the base, 8—10 mm long by 7—8 mm broad. [Description from plants from the Malay Archipelago (cultivated) and Japan].

According to herbarium labels, this subspecies is a small tree, according to Boschpr. b.b. 15553 with an acute-conical crown. From *P. polystachya*, with which it mainly agrees, it is easily to be distinguish by the narrower leaves with very gradually narrowed base, often rounded, obtuse apex, and recurved margins, moreover by the thinner male flowers and the longer peduncles of the female flowers.

BORNEO. Western Part: Poentianak, sea level, *Boschpr.* b.b. 15553, cultivated? (B, m).

Cultivated: in Hort. Bot. Singapore (S, f, s); Hort. Bot. Penang (S, f, s); Hort. Bot. Buitenzorg, no. V.F. 16—16a, 19—19a, 22—22a, 29—29a, 93, all from Japan (all B, s).

Further distribution: Japan; China (cultivated). Moreover cultivated in Java (according to *Pilger*, l.c.)

21. **Podocarpus thevetiaefolia** Zippelius, in Alg. Konst- en Letterbode (1829) 298, nomen; in Flora, 12 (1829) 287, nomen; Blume, in Rumphia, 3 (1847) 213; Walpers, Ann. Bot. Syst., 3 (1852) 449; Miquel, Fl. Ind. Bat., II, 6 (1859) 1074; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 397; De Boer, Conif. Arch. Ind. (1866) 22, 28, 36, 37, t. II, 3; De Kirwan, Conif., 2 (1868) 229; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 518; Gordon, Pinetum, ed. 2 (1875) 349; Scheffer, in Ann. Jard. Bot. Buitenz., 1 (1876) 52; Beccari, Malesia, 1 (1877) 180; Warburg, in Bot. Jahrb., 13 (1891) 256; Monsunia, 1 (1900) 192; [1]) Pilger, in Engl., Pflanzenr., IV, 5 (1903) 79; [1]) in Bot. Jahrb., 54, 3 (1916) 209; [1]) Lane-Poole, For. Res. Pap. (1925) 74, 41; [1]) Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; [1]) Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283. — *Nageia thevetiaefolia* F. von Mueller, Descr. not. Pap. pl., 1 (1875) 93; Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Podocarpus polystachya* (non R. Brown) Engler, in Bot. Jahrb., 7 (1886) 445.

[1]) *P. thevetiifolius.*

Twigs solitary or some of them verticillate, spreading, straight or curved, slender; usually moreover numerous short twigs, 2—12 mm long, sprouting from the branches. Terminal buds very small, ovate-acute; bud scales adpressed, ovate-triangular, acute, 1.5 mm long, keeled. Leaves scattered, rather remote, but crowded and almost subverticillate

below the apices of the branchlets, usually 3—6 subverticillate on the short twigs, spreading or divaricate, thin-coriaceous, rather flexible, narrow-lanceolate, or linear-lanceolate, sometimes (especially on the short twigs) somewhat spathulate, gradually narrowed into the short or indistinct petiole, usually abruptly narrowed, or rounded or more gradually narrowed towards the acute or obtuse, rarely mucronate apex, 2.5—8 cm long by 5—9 mm broad; midrib on the upper surface usually not or hardly prominent, or sometimes slightly broad-impressed towards the apex; on the lower surface more distinct, somewhat keeled towards the base, not or slightly prominent, flat or rounded towards the apex; lamina with almost flat margins, shining and striped above, somewhat shining beneath, with distinct, narrow, shining line along the margins. Male and female flowers unknown. Peduncles single in the upper leaf axils, slender, 3—8 mm long; receptacle (according to Blume) twice as thick as the seed; seed elliptical, 10 mm long by 6 mm broad. (Description from all the specimens examined.) Cfr. *Fig. 4.*

P. thevetiaefolia differs from the allied species in the usually obtuse, sometimes acute leaves, with the midrib not or hardly prominent, sometimes impressed on the upper surface. According to Lane-Poole, it is a small tree, nearly 23 m tall, with a bole of nearly 16 m. On the summit of Mt. Obree it is said to occur in a dwarfed form. Also some plants, collected near Ansoes, and other ones, with much smaller leaves, from the summits of the Arfak Mts., both with very acute and very strongly acuminate bud scales, were included in this species by Beccari. I had not the opportunity of examining any of this plants.

NEW GUINEA. N.W. Part: Lobo, *Zippelius* s.n. (B, G, L, U, f), originals of the species; Sekar, *Naumann* N.G. 43 (BD, f); Sekar, on the rocky sea shore, *Warburg* 21128 (BD, s).

22. **Podocarpus Pilgeri** Foxworthy — *Podocarpus celebica* (non Hemsley 1896) Warburg, Monsunia, 1 (1900) 192; (*-us*) Pilger, in Engl., Pflanzenreich, IV, 5 (1903) 78, cum f. *montana.* — *Podocarpus Pilgeri* Foxworthy, in Philipp. Journ. Sci., 2 (1907) Bot. 259; in Philipp. Journ. Sci., 6 (1911) Bot. 160; Pilger, in Bot. Jahrb., 54, 1 (1916) 38; Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 3; 4 (1926) 96; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283. — *Podocarpus costalis* Foxworthy, in Philipp. Journ. Sci., 6 (1911) Bot. 161 p.p.; Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 2 p.p.; Lam, in Nat.

Tijdschr. N. I., 88 (1928) 303; Fragmenta Papuana, 5 (1928) 166. — *Podocarpus Schlechteri* Pilger, in Bot. Jahrb., 54, 3 (1916) 209; in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Lauterbach, in Bot. Jahrb., 63 (1930) 474; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283; Pilger, in Bot. Jahrb., 68 (1936) 246.

Twigs scattered or to 5 subverticillate, sometimes branched from the twigs, spreading, straight or curved, terete, slender, sometimes with thickened base. Terminal buds ovate-acute to narrowly conical; bud scales usually narrowly ovate-triangular, sometimes more lanceolate, acute, sometimes short- to rather long-acuminate, keeled, to 4.5 mm long. Leaves rather remote, often crowded and subverticillate near the apex of the vegetation periodes and below the terminal buds, spreading, thin- to very thick-coriaceous, very rigid or slightly so, flat or sometimes folded upwards along the midrib, broadly linear-lanceolate, oblong-lanceolate to oblong, or short- or rather long-lanceolate, very gradually to cuneately narrowed into the short petiole, either abruptly rounded towards the obtuse apex, sometimes with a short, obtuse apiculus, or abruptly to rather gradually narrowed in the rather acute apex, sometimes with a short, obtuse apiculus, or abruptly to rather gradually narrowed in the rather acute apex, sometimes with a thin mucro, 1.5—8 cm long by 4—13 mm broad, 2.5—7 times as long as broad; midrib on the upper surface strongly prominent, narrow, sharply delimited, on the lower surface often somewhat keeled towards the base, not or slightly prominent, flat or round, sometimes slightly channelled towards the apex; lamina with flat or slightly recurved margins, more or less shining above, more dull beneath, usually striped on both surfaces. Male flower buds single in the leaf axils, sessile or nearly so, rather small, ovate-globose; bud scales ovate and obtuse, or more ovate-triangular and acute or slightly acuminate; male flowers cylindrical, 1.5—5 cm long and 2—3.5 mm in diam.; stamens with triangular or ovate, acute or rather obtuse apiculus, with membranous margin. Female flowers single in the leaf axils, rather remote, with rather short, slender peduncles; receptacle composed of 2 fleshy bracts, the fertile scale with obtuse free margin, the sterile one with acute apex. Peduncles slender, somewhat flattened, 3—12 mm long; receptacle subcylindrical, 5—12 mm long by 3—7 mm broad; foliola small, subulate, 1.5—2 mm long; seed elliptical-ovate or elliptical-globose, obtuse, 8—8.5 mm long and 7 mm broad. (Description from all the specimens examined.) Cfr. *Fig. 4.*

P. Pilgeri is, according to herbarium labels, usually a small tree or shrub 4—15 m tall; according to Clemens, however, a tall

tree. The bark is brown (Ledermann), and yields much red-brown sap (Boschpr. b.b. 23816). The crown is widely branched (Lam 2163), sparsely leaved (Ledermann 11447), or small and dense (Ledermann 12755). The male flowers are yellow-white (Ledermann 11447), the fruit green with bluish bloom (Ledermann 12755), or red (Ledermann 12755). The species mainly grows in the higher parts of the mountains, especially between 1400 and 3000 m el. It differs from its nearest allies, *P. thevetiaefolia* and *P. costalis*, in the strongly prominent mid-rib. From *P. polystachya* it may be distinguished by the longer peduncles of the female flowers, the solitary male flowers, and the leaf shape.

As regards the leaf shape, this species shows a large variability. One extreme is represented by Warburg's type specimens. The leaves of this are broadly linear-lanceolate to elliptical, and usually rounded at the apex. With these plants agree those from Mt. Banajao, Luzon, which were included in *P. costalis* by Foxworthy, and those from Mt. Bantaèng (Celebes) collected by Teysmann, and from Mt. Doorman (New Guinea). Warburg 16890, Pilger's type specimen of the forma *montana*, and the collections Boschpr. b.b. 17672 and Abendanon s. n. from Celebes, and For. Bur. 4673 from Mindanao, which all are plants from very high mountain summits, have thicker and much more rigid, often more short-lanceolate leaves with more acute apex, whereas the twigs are more densely leaved. The other extreme is represented by the plants with narrower, more lanceolate leaves, which are drawn out into a fine point, *e. g.*, the collections Carr 13721, Brass 4034 and Schlechter 18781 from New Guinea, Merrill 241 from Negros, and Elmer 14086 from Mindanao. Also the other specimens which were included in the species *P. Schlechteri* by Pilger usually have smaller, more lanceolate leaves. Between these extremes there occur, of course, many intermediates, often even on one branch. The flowers and fruits, however, are always the same.

The specimen Boschpr. b.b. 22572, from New Guinea, is taken from a young tree or shrub, with the short twigs very strongly bent to and fro, and with very small, thin-coriaceous, nearly spathulate leaves with obtuse apex. The leaves are 1—2.5 cm long by 2.5—5 mm broad, and 3.5—5 times as long as broad. I have not taken up the latter specimen in the description in order to make it not unnecessarily vague. Yet I believe it must be included in the species too. In some respects, the plant from Obi may be regarded as an intermediate between the latter plant and the other collections. It has, however, long internodes, and

the small, lanceolate leaves are all crowded at the apices of the vegetation periods. This collection also comprises a seedling, the roots of which bear root nodules.

PHILIPPINES. Luzon: prov. Laguna and Tayabas, Mt. Banajao, 1700—2200 m el., *Bur. Sci.* 19581 coll. *Ramos* (L, f); *Bur. Sci.* 2393 coll. *Foxworthy* (B, s); *Elmer* 7778 (B, L, f); Mindoro, Mt. Halcon, 2150 m el., *Merrill* 5754 (ex *Foxworthy* 1911, l.c.); Negros, Mt. Canlaon, 1450 m el., *Merrill* 241 (U, s); Mindanao, subprov. Bukidnon, Mt. Lipa, *Bur. Sci.* 38500 coll. *Ramos & Edaño* (B, L, f); prov. Misamis, Mt. Malindang, 2790 m el., *For. Bur.* 4673 coll. *Mearns & Hutchinson* (B, L, s); prov. Agusan, Cabadbaran, Mt. Urdaneta, *Elmer* 14086 (B, L, U, m).

CELEBES. Central Celebes, Boeloe Palaka, *Abendanon* s.n. (B, L, s); South Celebes, Wawo Kraèng, *Warburg* 16891, type of *P. celebica Warburg* (BD, s); Wawo Kraèng, summit, ca. 2850 m el., *Warburg* 16890, type of *P. celebica* f. *montana Pilger* (BD, s); Wawo Kraèng, Tjamba-Manipi, *Warburg* 16433 (BD, s); subdiv. Gowa, summit of the Bawa Karaèng, 2800 m el., naked rock, *Boschpr.* b.b. 17672, v.n.: aho-aho (B, s); Gowa, Lembaja, 1800 m el., *Boschpr.* b.b. 20233, v.n.: aho (B, m); Gowa, Lembaja, Beroe, above 2000 m el., *Boschpr.* b.b. 20437, v.n.: aho, aho aho, aho gana (B, s); Bantaèng Peak, *Everett* 37 (S, s); Lanjienga, *Teysmann* 14121, v.n.: santigi romang (B, L, s); *Teysmann* 14191, v.n.: tjantigi (B, L, s).

MOLUCCAS. Obi, Hol Djikodolong Kawashi, 700 m el., *Boschpr.* b.b. 23816 (B, s).

NEW GUINEA. N.W. Part: Mt. Genofa, 1000 m el., *Boschpr.* b.b. 22572 (B, s); ridge to Mt. Doorman, 1750 m el., *Lam* 2163 (B, s); N.E. Part: Bismarck Mts, 2000 m el., *Schlechter* 18780 (BD, m); *Schlechter* 18781 (BD, f); Kaiserin Augusta Fluss Exp., Hunsteinspitze, 1300 m el., *Ledermann* 11399 (BD, f); *Ledermann* 11447 (BD, m); Felsspitze, 1400—1500 m el., *Ledermann* 12755 (BD, f), among the latter 5 collections the originals of *P. Schlechteri Pilger*; Morobe distr., Ogeramnang, 1875 m el., *Clemens* 4569 (BD, m); 1900 m el., *Clemens* 4696 (BD, f); S.E. Part: Boridi, 1900 m el., *Carr* 14556 (L, m); *Carr* 14563 (BD, s); above the Gap, 2550 m el., *Carr* 13721 (BD, L, m); Central Division, Mt. Tafa, 2300 m el., *Brass* 4034 (BD, s).

SOLOMON ISLANDS. Ysabel Island, Mt. Sasari, 1100 m el., *Brass* 3265 (B, s).

23. Podocarpus brevifolia (Stapf) Foxworthy — *Podocarpus neriifolia* D. Don var. *brevifolia* Stapf, in Transact. Linn. Soc., Bot., sér. 2, IV (1894) 249, 87; (-*us*) Pilger, in Engler, Pflanzenr., IV, 5 (1905) 93. — *Podocarpus bracteata* var. *brevifolia* Stapf, in Transact. Linn. Soc., Bot., sér. 2, IV (1894) 103. — *Podocarpus brevifolius* Foxworthy, in Philipp. Journ. Sci., 6 (1911) 160, t. 29, ic. 2; Gibbs, in Journ. Linn. Soc., Bot., 42 (1914) 30, 31, 32, 35, 36, 41; Stapf, in Journ. Linn. Soc., Bot., 42 (1914) 194; Pilger, in Bot. Jahrb., 54, 1 (1916) 40; Merrill, Bibl. enum. Born. pl. (1921) 31; Enum. Philipp. Flow. Pl., 1 (1923) 1; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 279, 283.

Twigs usually to 3—4 verticillate, spreading or erect-spreading, with very short, 1—5 cm long vegetation periods, rather stout. Terminal buds acute; bud scales usually narrow-triangular, sometimes ovate

or broad-triangular, acute or short-acuminate, rarely somewhat obtuse, keeled, 3—7 mm long, usually persistent for a great portion on 3—7 vegetation periods. Leaves scattered on at least 3—5 vegetation periods, very densely crowded, erect, adpressed on the twigs, imbricate, thick-coriaceous, very rigid, flat, or, especially towards the base, slightly folded upwards along the midrib, straight or very slightly falcate, lanceolate, sometimes more lanceolate-oblong or narrow-lanceolate, usually rather gradually, sometimes long- or rather short-narrowed in the acute or rarely slightly rounded apex, gradually or rather short-narrowed into the short and broad petiole, sometimes sessile with broad base, 1.5—5.5 cm long by 4—7 mm broad, 3—8 (usually 4—6) times as long as broad; midrib on the upper surface distinct, prominent, narrow, indistinct towards the apex, on the lower surface broader, usually somewhat keeled towards the base, for the rest more flat, rarely thick and rounded, often slightly shallow- and broad-channelled; lamina usually with rather strongly recurved margins, sometimes rather flat, somewhat shining above, more dull beneath. Male flowers single in the upper leaf axils, sessile, thick-cylindrical, 2—3 cm long and 4—5.5 mm in diam, at the base with some sterile bud scales, of which the outer ones often somewhat acute, keeled, to 2 mm long, the inner ones ovate, obtuse, more membranous, to 4 mm long and 3 mm broad; stamens with rather long, ovate or ligulate, obtuse apiculus; pollen grains with 2 air bladders. Female flowers single in the leaf axils, several crowded in a short zone just below the terminal buds; peduncles short, broad, strongly flattened, erect-spreading; receptacle composed of 2 fleshy bracts, the fertile one turned towards the twig, with obtuse, free margin, the sterile one with rather long, free apex. Peduncles 2—4 mm long; foliola subulate to narrow-triangular, rather broad, acute, keeled, 3—5 mm long; receptacle subcylindrical, 5—6.5 mm long by 2.5—4 mm broad; seed (unripe) elliptical, somewhat narrowed towards the base and the apex, obtuse, 9 mm long by 4 mm broad. (Description from all the specimens examined.) Cfr. *Fig. 4.*

According to herbarium labels, *P. brevifolia* is a shrub or small tree, especially growing in dwarfed-tree forests on the summits of high mountains. The male flowers are light green (Clemens 27826 = 27103). It is a very distinct species in its adpressed, small, lanceolate, thick-coriaceous leaves.

PHILIPPINES. Luzon: Zambales prov., Tapulao, 1800 m el., *For. Bur.* 9511 coll. *Curran & Merritt* (B, f); *Bur. Sci.* 5002 coll. *Ramos* (ex *Foxworthy* l. c.); Mindanao, Bukidnon, 2000 m el., (ex *Merrill* 1923, l. c.).

BORNEO. British North Borneo: Mt. Kinabalu, 3330—3630 m el., *Low* (ex *Stapf* 1894, l.c.); *Haviland* 1093 (S, m), originals of the species; above Lobang, 2000—4000 m el., *Gibbs* 4166 (ex *Stapf* 1914, l.c., also Maraiparai spur, ca. 1350—1700 m el.); Paka Cave to Low's Peak, *Clemens* 10657 (B, f); above Paka, ca. 3650—4100 m el., *Clemens* 27826 = 27103, (B, m); *Clemens* 27825 = 27103 (L, m); *Clemens* 28901 (B, L, f); Gurulau spur, 3650—4000 m el., *Clemens* 50825 (L, m).

24. Podocarpus glauca Foxworthy, in Philipp. Journ. Sci., 2 (1907) Bot., 258; 6 (1911) Bot., 159, t. 29, ic. 1; Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 3; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 262, 263, 265, 266 (all *P. glauc*us).

Twigs solitary or usually to 3—5 verticillate, spreading, straight or curved, with very short, 1.5—5 cm long vegetation periods. Terminal buds narrowly ovate-conical, rarely ovate; bud scales usually narrow-triangular, sometimes narrowly ovate-triangular, acute, often slightly long-acuminate, rigid, keeled, 3—5 mm long, usually deciduous. Leaves scattered, densely crowded, erect, sometimes slightly erect-spreading, adpressed to the twigs, nearly imbricate, thick-coriaceous, very rigid, somewhat rounded downwards, oblong to short-lanceolate, rather gradually narrowed into the hardly distinct petiole, abruptly narrowed or rounded towards the rather obtuse apex, 10—22 mm long by 3.5—6 mm broad, 3—5 times as long as broad; midrib on the upper surface distinct, prominent, narrow, indistinct towards the apex, on the lower surface broader, thick-prominent, round or flat, often shallowly channelled; lamina with strongly recurved margins, shining above, dull beneath, with exception of the shining midrib. Male flower buds single in the leaf axils, sessile, narrowly ovate-acute or narrowly ovate-conical; bud scales narrow-triangular, acute, or from an ovate-triangular base rather strongly acuminate, rigid, keeled, to 4 mm long; male flowers cylindrical, rather slender, 1—3 cm long and 2—3 mm in diam.; stamens with rather long, triangular or ligulate, rather obtuse or acute apiculus. Female flowers single in the leaf axils, some of them crowded just below the terminal bud; peduncles very short, to 1 mm long; foliola subulate-triangular, keeled, to 2.5 mm long; receptacle erect, composed of 2 fleshy, curved bracts, about 3 mm long, the sterile bract with short, acute apex; ovule subelliptical, narrowed towards the base and the apex, obtuse; ripe seed unknown. (Description from all the specimens examined.) Cfr. *Fig. 4.*

According to herbarium labels *P. glauca* is a small tree nearly up to 17 m tall. It is only known from Mt. Halcon, Mindoro, at 2400 m

el., and is based upon the only specimen Merrill 5672, which I had not the opportunity to examine. The collections mentioned below agree with Foxworthy's description, though the midrib is prominent on the upper surface, whereas Foxworthy describes it as not being prominent above. In spite of this, the collections of Mt. Kinabalu must, in my opinion, be included in this species provisionally. *P. glauca* was provisionally included in the section *Stachycarpus* by Foxworthy, but it is not clear why he did so. By Pilger, however, it was included rightly in the section *Eupodocarpus*.

The collection Clemens s. n. deviates from the description above by leaves which are more lanceolate, 2—3.5 cm long, 4—7 times as long as broad, whereas the apex is rather gradually or short-narrowed, rather acute or obtuse; but the leaves are strongly recurved at the margins and have the same olivaceous colour as the other specimens.

P. glauca is much allied to *P. brevifolia*, but differs in the smaller, more oblong leaves, with rounded, obtuse apex and strongly recurved margins.

PHILIPPINES. Mindoro: Mt. Halcon, 2400 m el., *Merrill* 5672 (ex *Foxworthy* l. c.).

BORNEO. British North Borneo: Mt. Kinabalu Marai Parai, 1700 m el., *Clemens* 32021 (B, L, m); Colombon basin, W. crest of Numeruk ridge, 1700 m el., *Clemens* 40001 (B, L, m); Penibukan ridge, 1500 m el., *Sing.* Field No. 26450 coll. *Carr* (S, f); 1300—1700 m el., *Clemens* s. n. (B, L, s).

25. Podocarpus Brassii Pilger, in Bot. Jahrb., 68 (1936) 246.

Twigs usually to 3—8 subverticillate, spreading, stout, straight, terete, rigid, sulcate and striped. Terminal buds large, subglobose; bud scales numerous, often spreading, sometimes partly persistent on some vegetation periods, lanceolate or narrow-triangular, sometimes ovate-triangular, acute, gradually narrowed or slightly acuminate, keeled, with membranous margin, up to 8 mm long. Leaves scattered, more or less crowded, or even imbricate, usually erect-spreading, very thick-coriaceous, very rigid, elliptical-oblong, shortly lanceolate or broadly lanceolate-spathulate, rather shortly narrowed or somewhat rounded into the short, broad petiole, shortly narrowed, often slightly rounded towards the apex, usually with short apiculus, sometimes mucronate, 10—18 mm, rarely to 20 mm long by 3—7 mm broad, usually 2—4, rarely up to 5 times as long as broad (the more lanceolate leaves of young plants with a thin mucro and up to 4 cm long); midrib narrow, strongly prominent, often indistinct towards the apex above, broader, usually thick-prominent, rounded or flat beneath; lamina with flat or

slightly recurved margins, usually shining above, more dull beneath, with the exception of the shining midrib and a rather broad zone along the margins. Male flower buds single in the upper leaf axils, sessile, rather large, ovate-acute; bud scales slightly spreading, ovate-triangular or narrow-triangular, acute or the inner ones rather obtuse, keeled, with narrow, membranous margin, up to 6 mm long; male flowers thick-cylindrical, 2—3.5 mm long and 3—7 mm in diam.; stamens with rather long, triangular, rather acute apiculus; pollen grains with 2 air bladders. Female flowers solitary in the upper leaf axils. Peduncles short, thick, erect-spreading, terete or somewhat flattened, 2—9 mm long; foliola narrow-triangular, acute, 3 mm long; receptacle subcylindrical or obconical, 5—9 mm long by 2.5—7 mm broad, composed of 2—3 fleshy bracts, of which 1—2 sterile and 1—2 fertile, the sterile ones with free apex, the fertile ones with rather broad or narrow, rather acute free margin; seed elliptical or elliptical-globose, slightly rounded or narrowed towards the base and the apex, 7—10 mm long by 5—6 mm broad. (Description from the specimens mentioned below.) Cfr. *Fig. 4.*

The data on the herbarium labels about the dimensions and shape of this species diverge rather strongly. The specimen Pulle 1023, *e. g.*, is a shrub 2 m tall, often procumbent; Versteeg 2505 is a tree 3 m tall; Lam 1789 a widely branched, 5 m tall shrub; the specimens collected by Brass are 10—12 m tall trees with roundish, densely branched crown; the specimen Clemens s.n. a large tree nearly 27 m tall. The female flowers are glaucous (Brass 4396), the fruit brown, with blue receptacle (Pulle 1023) or greenish purple, with bluish waxy bloom (Lam 1789).

P. Brassii, which is allied to *P. brevifolia*, is easily to recognise by the small, very rigid and thick-coriaceous leaves, with thick- and broad-prominent midrib beneath and the rather broad, shining line along the margins. Usually the peduncles are less flattened than those of *P. brevifolia*. It is a high-mountain species, collected on elevations higher than 3000 m.

NEW GUINEA. N.W. Part: Mt. Doorman, 3200 m el., *Lam* 1789 (B, f); S.W. Part: Wichmann Mts, summit, 3100 m el., *Pulle* 1023 (U, f, m); valley near Meerbivak, 3600 m el., *Versteeg* 2505 (U, m); N.E. Part: Morobe distr., Mt. Sarawaket, 3300 m el., *Clemens* s.n. (B, f); S.E. Part: Central division, Mt. Albert Edward, 3680 m el., *Brass* 4395 (B, BD, f), *Brass* 4395a (BD, s), *Brass* 4396 (B, BD, m), type specimens of the species.

Species recorded for the area, but not confirmed by herbarium materials.

Podocarpus nagi (*Thunberg*) *Pilger*, a species of the section *Nageia*, is said by *Van Eeden* (Houts. Ned. Ind., 1886, p. 136; ed. 3, 1906, p. 256, under the name *P. Nageia R. Brown*), to be cultivated in Java. I only saw specimens from the Buitenzorg Botanic Garden.

Podocarpus elata R. Brown, an Australian species of the section *Eupodocarpus*, is mentioned by *Engler* (Bot. Jahrb., 7, 1886, p. 445) for the area. He included in this species a specimen from Kupang Bay, Timor, collected by *Naumann*. *Pilger*, however, did not mention this specimen in his monograph and apparently it cannot be found in the Berlin-Dahlem Herbarium, as, on special request, I did not receive it for examination.

Doubtful species.

Podocarpus *spec. Stapf*, in Journ. Linn. Soc., Bot., 42 (1914) 194. This represents *Gibbs'* no. 4089 from Mt. Kinabalu, at 5000—8000 ft. el., of which "the leaves are, in shape and size, intermediate between those of *P. brevifolius* and *P. polystachyus*, but thinner and much more loosely arranged than in either". I did not see this specimen. In my opinion it is a form of the alliance of *P. Pilgeri*.

Podocarpus *spec. Stapf*, in Journ. Linn. Soc., Bot., 42 (1914) 194; *Gibbs*, *ibidem*, p. 30 and 32. This record, based upon *Gibbs'* no. 4092 from Mt. Kinabalu, 5—8000 ft, is "a tree, 7—10 m high. A very striking species with fairly crowded leaves, oblong-linear, obtuse or sub-obtuse at the base, 1.5—2 cm long, 3.5—4.5 mm broad, with the recurved margins, the midrib raised above and rather broad and flat beneath". I did not see this specimen either, but I think, it must be included in *P. glauca*.

Species to be excluded from the genus.

Podocarpus falciformis Parlatore, in D.C., Prodr., 16, 2 (1868) 685; *Gordon*, Pinetum (1875) 336; *Eendle*, in Journ. Bot., 34 (1896) 355; *Warburg*, Monsunia, 1 (1900) 193 = **Dacrydium falciforme** (*Parlatore*) *Pilger*, in *Engl.*, Pflanzenreich, IV, 5 (1903) 45.

Podocarpus koraiana Siebold, in Ann. Soc. Hort. Pays-Bas (1844) 34. This species, cultivated in Java according to *Van Eeden* [Houts. Ned. Ind. (1886) 136; ed. 3 (1906) 256], is, after its name, **Cephalotaxus drupacea** *Siebold & Zuccarini*, **f. fastigiata** *Pilger*, in *Engl.*, Pflanzenreich, IV, 5 (1903) 103, but this plant does not occur in Java, neither wild nor cultivated.

Podocarpus palembanica Miquel, Fl. Ind. Bat., suppl. Sumatra (1860) 252, 289, is, according to *De Boer*, Conif. Arch. Ind. (1866) 4, no Conifer: "Haec species ad sterile exemplar descripta et tanquam Podocarpi species ex horto bogoriensi missa, accuratius denuo examinata Coniferarum ligni structuram non ostendit, ad alium ordinem probaliter referenda hic igitur silentio praetereunda". Moreover, *Miquel* mentions lateral ribs in the leaves, which never occur in *Podocarpus*. I do not know where *Miquel's* specimens are preserved now.

Podocarpus celebica Hemsley, in Kew Bull. (1896) 39; *Pilger*, in Bot. Jahrb., 54, 1 (1917) 38. The type specimen *Everett* 35 (S, s) from G. Bantaèng (Celebes),

which I had the opportunity of examining, appeared to be **Taxus baccata** ssp. **Wallichiana** (*Zuccarini*) *Pilger*. To the same conclusion came already *Florin*, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 226.

Index of the collectors' numbers

as far as examined by the author, referring to the species by means of their serial number in this paper.

Abendanon: s. n. (2); s. n. (22) — *Achmad:* 1388 (17); 1688 (17) — *Altmann:* 362 (17) — *Amdjah:* 51 (10) — *Arens & Wurth:* s. n. (2, 1) — *Arsin:* 19594 (17); 19690 (2) — *Atasrip:* 40 (16); 118 (10).

Backer: s. n. (2); s. n. (19); 461 (2); 3358 (2); 4922 (2); 5406 (2); 8866 (10); 9604 (2); 10438 (10); 10749 (17); 11050 (2); 12407 (17); 12481 (17); 14329 (2); 14742 (2); 15121 (2); 16157 (2); 21819 (2); 22582 (2); 23017 (2); 23930 (10); 30723 (1); 31326 (2); 31376 (2); 37539 (17) — *Bakhuizen van den Brink:* 740 (2); 1811 (2); 1936 (2); 4422 (2); 4586 (17); 4606 (2); 5981 (1); 7792 (17) — *Bakhuizen van den Brink fil.:* 726 (2); 2553 (2); 3012 (1) — *Bangham:* 1074 (2); 1116 (17) — *Barnes:* 10907 (2) — *Becoari:* P. B. 2649 (11); P. S. 49 (2); P. S. 252 (17); P. S. 295 (1) — *Becking:* 69 (19) — *Den Berger:* 549 (2); 550 (1); 637 (2) — *Berkhout:* 430 (10) — *Blume:* s. n. [1, 2, 2β, 10, 17 (7 ×), 17β (4 ×)] — *De Boer:* 6603 (2) — *Boerlage:* s.n. [2 (2 ×)]; 174 (16).

Boschproefstation, b.b. nummers: 2414 (17); 2436 (2); 2450 (10); 2476 (19); 2768 (2); 2778 (1); 2784 (17); 2924 (1); 4001 (17,γ); 4130 (2); 4866 (2); 5401 (1); 5440 (1); 5443 (2); 5460 (2); 5614 (19); 5888 (19); 6203 (17); 6235 (2); 6368 (11); 6889 (16); 6904 (2); 6934 (2); 7192 (1); 7346 (11); 7708 (2); 8054 (17); 8130 (1); 8351 (1); 8532 (2); 8737 (2); 8740 (17); 8823 (17); 8842 (10); 9003 (2); 9696 (10); 9705 (16); 10123 (16); 10843 (17); 10889 (10); 10964 (10); 11192 (17); 11307 (10); 11335 (10); 11613 (11); 11629 (2); 11739 (10); 11784 (1); 11803 (2); 12196 (17); 12212 (10); 12428 (19); 12602 (2); 13633 (7); 14063 (11) 14385 (16); 14403 (19); 14898 (2); 15085 (17); 15155 (2); 15504 (2); 15553 (20); 15602 (10); 15950 (10); 16997 (1); 17030 (17); 17229 (11); 17269 (2); 17348 (10); 17444((17); 17555 (10); 17582 (1); 17672 (22); 18217 (10); 18328 (11); 18743 (1); 18752 (2); 19559 (2); 19563 (2); 19647 (10); 20061 (17); 20061 (17); 20202 (2); 20204 (17γ); 20233 (22); 20391 (1); 20437 (22); 20785 (1); 20872 (7); 21151 (11); 21274 (2); 21497 (1); 21933 (17); 22247 (1); 22449 (1); 22455 (17); 22498 (17); 22572 (22); 22582 (1); 22647 (10); 22857 (4); 23127 (10); 23136 (10); 23143 (17); 23242 (1); 23257 (10); 23263 (16); 23538 (2); 23816 (22); 23823 (10); 23830 (16); 24158 (17γ); 24173 (2); 24209 (2); 24306 (16); 24914 (17).

Cel. numbers:

II. 285, 286, 287, 288 and 325 (16); III. 80, 143, 144, 145 and 146 (10).

Ja. numbers:

1311 (17); 1356 (17); 1505 (17); 1747 (17); 1873 (17); 1908 (1); 1909 (1); 1925 (2); 3614 (2); 1948 (17); 3986 (2); 3988 (17); 4001 (2).

Other numbers:

E. 1084 (10); 1106 (10); 1143 (10); 1352 (10); 1357 (10); S.W.K./II. 10 (17); T.B. 200 (10); T.B. 214 (1); T.B. 449 (2); 12 T. 1 P. 13 (11); 12 T. 1 P. 185 (11); 192 T. 3 P. 567 (17,).

Botanic Garden Buitenzorg: without number (17, 17ζ, 19); XI. B. 24 (2); XI. B. XVI. 56 (2); 8 [XII. B. (VI)] (17); V. F. 1, 1a (19); 3 (17); 9 (10); 9a (16); 13 (10); 16, 16a (20); 17, 17a (19); 19, 19a (20); 20, 20a (16); 21 (17); 22, 22a (20); 24 (2); 27 (1); 28 (2); 29, 29a (20); 31, 31a (16); 33, 33a, 35, 45, 67, 67a, 75a, 78 (17); 82, 82a, 91, 91a (10); 93 (20); 94 (16); 98, 98a (10) — *Botanic Garden Penang:* without number (20) — *Botanic Garden Sibolangit:* 23 (2); 24 (1) — *Botanic Garden Singapore:* without number (2, 19, 20) — *Botanic Garden Tjibodas:* R. 8 (12) — *Branderhorst:* s. n. (8); s. n. (9); 131 (8) — *Brascamp:* 18 (2) — *Brass:* 2881 (14); 3962 (10); 4034 (22); 4284 (8); 4284a (8); 4347 (8); 4348 (8); 4395 (25); 4935a (25); 4396 (25); 4605 (17); 4688 (8); 4768 (2); 4962 (3); 5115 (2); 5878 (10); 5880 (10); 5906 (10); 5907 (17); 5908 (17) — *Bremekamp:* s. n. (1) — *Bruggeman:* 3716 (2) — *Bünnemeijer:* 2341 (10); 2351 (19); 4022 (2); 4340 (2); 7636 (19); 7685 (19); 7870 (19β); 11855 (2); 11903 (2); 11977 (2); 12019 (2) — *Burck:* s. n. (2); 144 (17) — *Bureau of Science, Manila:* 904 (19); 2387 (5); 2393 (22); 4405 (2); 5174 (16); 8328 (2); 19581 (22); 26902 (19); 27146 (19); 27926 (5); 28348 (10); 38500 (22); 45005 (5); 47333 (10) — *Burger:* 6336 (2) — *Burn Murdoch:* 11964 (2) — *Buurman van Vreeden:* 49 (10) — *Bijhouwer:* 105 (2); 222 (2).

Cantley: 113 (19) — *Carr:* 12842 (17); 13264 (2); 13486 (1); 13721 (22); 14160 (12); 14194 (2); 14556 (22); 14563 (22); 14765 (1); 15395 (17); 15666 (12) — *Clason-Laarman:* 184 (2) — *Clemens:* s. n. (10); s. n. (24); s. n. (25); 1231 (10); 1481 (17); 2172 (10); 2276 (17); 2352 (16); 3113 (1); 3323 (2); 3854bis (1); 4569 (22); 4669 (22); 5261 (6); 5325 (1); 5434 (17); 5473 (2); 5562 (6); 5588 (6); 6283 (6); 6578 (17); 6607 (10); 9659 (19); 10636 (2γ); 10657 (23); 16251d (2); 21066 (2); 27092—27854 (2γ); 27854 (2γ); 27826—27103 (23); 28631 (2); 28901 (23); 28910 (2γ); 29779 (2); 29914 (2γ); 32021 (24); 32316 (2γ); 32317 (2γ); 32318 (2γ); 33618 (2); 40001 (24); 50051 (17); 50691 (17); 50825 (23); 51171 (19); 51201 (2γ); 51635 (2) — *Comisión de la Flora Forestal de Filipinas:* 623bis (5) — *Corner:* s. n. (13); s. n. (17) — *Cuming:* 803 (5) — *Curtis:* 3079 (17).

Danser: 5886 (2); 6100 (1); 6792 (17β) — *Diepenhorst:* s. n. (2) — *Van Dillewijn:* 175 (2); 183 (17) — *Dooters van Leeuwen-Reijnvaan:* s. n. (17); 2529 (2β); 12264 (2β) — *Dorgelo:* S. 248 (2) — *Dumas:* 10 (16) — *Dunselman:* 166 (19)

Elbert: 52 (2); 982 (1); 996 (1); 3129 (17) — *Elmer:* 4546 (2); 6551 (2); 7465 (5); 7778 (22); 11539 (1); 11682 (1); 11684 (5); 12360 (10); 14086 (22) — *Endert:* 3682 (2); 4978 (10) — *Everett:* 35, see p. 471; 37 (22); 42 (2).

Falconer: s. n., see p. 419 — *F. M. S. Museum Herb.:* 12121 (13) — *Forbes:* 692 (17); 911 (10); 924 (17); 2054 (17); 3855 (2) — *Forestry Bureau:* 194 (10); 1716 (10); 2743 (16); 3854 (19); 4666 (2); 4673 (22); 6326 (16); 8987 (16); 9511 (23); 10829 (2); 10894 (17); 10895 (1); 14498 (2); 16738 (10); 18049 (5) — *Forest Department* Federated Malay States: 4159 (19); 7856 (17); 10937 (2); 13645 (2); 14979 (19); 15441 (19); 16568 (11); 22563 (2); 22565 (17); 28284 (2) — *Forest Department* (British North Borneo): 4055 (10); 4083 (16); 4146 (16).

Galoengi-Schnepper: 10 (1) — *Gibbs:* 5540 (3); 5985 (16) — *Gillespie:* 3712 (12) — *Gjellerup:* 1148 (2) — *Gordon Spare:* 959 (19) — *Grashoff:* 874 (11); 1030 (17,); 1138 (11) — *Gründler:* 2266 (2); 4191 (2) — *Gusdorf:* 312 (10); 314 (17).

De Haan: 13 (17) — *Hallier:* 183 (1); 427 (2); 653 (2); B.-numbers: 231 (10); 458 (2); 559 (17); 720 (17η); 775 (5); 2373 (19β) — *Ham:* 49 (19) — *Hasskarl:* s.n. (10); s.n. (10); s.n. (17β); 377 (17) — *Haviland:* 1093 (23); 1094K (2γ); 1095 (2γ) — *Hellwig:* 651 (17) — *Holttum:* s.n. (2γ) — *Hoogerwerf:* 5 (17) — *Hooker & Thomson:* s.n., see p. 419 — *Houter:* 14 (2); 24 (17); 25 (17); 178 (17) — *Houtsoorten van den Gedeh:* 107 (1); 204 (10); 637 (1) — *Houtvester Sum. Oostkust:* 17 (1) — *How:* 72870 (1) — *Huitema:* 12 (19).

Iboet: 547 (2).

Jeswiet: 257 (2); field no. 289, herb. no. 1307 (10) — *Jeswiet & Hagedoorn:* 450 (2) — *Jochems:* 24 (2) — *Junghuhn:* s.n. (11 ×) (2); s.n. (5 ×) (2β); s.n. (3 ×) (10); s.n. (10 ×) (17).

Kelsall: 1094 (2); 2000 (17) — *Kings' collector:* s.n., see p. 419; 301, see p. 432 — *Kjellberg:* 3792 (2); 3973 (16) — *Kobus:* s.n. (2) — *De Kock:* 39 (8); 40 (8); 43 (8) — *Koens:* 183 (17).

Koorders:

Herbarium numbers, followed by β

1215 (17); 1216 (1); 1217 (1); 1218 (1); 1219 (1); 1220 (1); 1221 (1); 1222 (17); 1223 (17); 1224 (1); 1225 (1); 1226 (1); 1227 (1); 1228 (1); 1229 (17); 1230 (15); 1231 (1); 1232 (1); 1233 (1); 1234 (1); 1235 (1); 1236 (17ζ); 1237 (17ζ); 1238 (1); 1239 (1); 1240 (17); 1241 (1); 1242 (1); 1243 (17); 1244 (17); 1245 (1); 1246 (1); 1247 (1); 1248 (1); 1249 (17); 1250 (17β); 1251 (17); 1252 (17); 1253 (17); 1254 (17); 1255 (17); 1256 (17); 1257 (1); 1258 (17); 1259 (17); 1260 (17); 1261 (10); 1262 (10); 1263 (10); 1264 (10); 1265 (10); 1266 (10); 1267 (10); 1268 (10); 1269 (2); 1270 (2); 1271 (2); 1272 (2); 1273 (2); 1274 (2); 1275 (2); 1276 (2); 1277 (2); 1278 (2); 1279 (2); 1280 (2); 1281 (2); 1282 (2); 1283 (2); 1284 (2); 1285 (2); 1286 (2); 1287 (2); 1288 (2); 1289 (2); 1290 (2); 1291 (2); 1292 (2); 1293 (2); 1294 (2); 1295 (2); 1296 (2); 1297 (2); 1298 (2); 1299 (2); 10286 (10); 10287 (10); 10906 (2); 10944 (1); 11246 (2); 11247 (1); 11248 (17); 11282 (2); 11720 (17); 11908 (1); 11909 (10); 12581 (2); 12599 (2); 12607 (1); 12608 (2); 12618 (2); 12627 (17); 13847 (17); 13855 (1); 13892 (17); 13997 (17); 14025 (17); 14026 (1); 14066 (17); 14122 (2); 14141 (2); 14143 (1); 14144 (17); 14159 (2); 14185 (1); 14195 (1); 14200 (17); 14201 (1); 14202 (1); 14206 (17); 14321 (2); 14323 (2); 14326 (1); 14376 (1); 14377 (1); 14378 (1); 14379 (1); 14380 (1); 14381 (1); 14382 (1); 15534 (2); 15535 (2); 15544 (1); 15582 (2); 15748 (1); 15751 (1); 15752 (1); 16533 (17); 16534 (16); 16535 (16); 16536 (16); 16537 (16); 16538 (16); 21091 (17ζ); 21092 (1); 21093 (1); 23340 (1); 23733 (17); 24179 (17); 24180 (17); 24181 (10); 24182 (2); 25577 (1); 25599 (10); 25819 (2); 25922 (2); 26540 (17β); 26553 (17); 26560 (17); 26576 (1); 26785 (1); 27704 (2); 27705 (2); 28503 (1); 28505 (2); 28506 (1); 28507 (2); 28508 (1); 29187 (1); 29188 (2); 29189 (2); 32439 (1); 32478 (1); 32768 (10); 33207 (10); 33751 (17); 35781 (17); 35782 (2); 35935 (17); 37111 (2); 37922 (2); 37923 (2); 37924 (1); 37925 (17); 38187 (2); 38188 (2); 38189 (1); 38198 (17β); 38501 (17ζ); 38626 (2); 38650 (1); 38652 (2); 38669 (2); 38783 (1); 39352 (1); 39364 (2); 39366 (2); 39392 (1); 39401 (17); 39402 (10); 39403 (10); 39404 (10); 39405 (17); 39406 (10); 39407 (10); 39409 (10); 39413 (10); 39415 (10); 39480 (15); 39596 (10); 39599 (15); 39623 (1); 40251 (15); 41778 (17); 41790 (2); 41806 (1); 41820 (2);

41843 (2); 41921 (2); 41951 (2); 41972 (2); 41992 (17); 42038 (1); 44321 (2); 44322 (1); 44323 (17).

Forst or tree numbers:

followed by a:

2124 (1); 2135 (10); 2170 (2); 2195 (17); 2197 (1); 2212 (1); 2215 (1); 2216 (1); 2416 (1); 2438 (17); 2446 (10); 2501 (10); 2502 (10); 2503 (10); 2504 (10); 3031 (17); 3053 (2); 3073 (2); 3074 (1); 3090 (2); 3127 (2); 3233 (2); 3235 (1); 3276 (2); 3295 (2); 3305 (1); 3312 (2); 3342 (2); 3362 (17); 3408 (1); 3417 (2).

followed by aa:

2461 (1); 2430 (17); 2433 (1); 2442 (1); 2454 (1); 2500 (17).

followed by f:

2050 (2); 2099 (1); 2118 (1); 2120 (2); 2126 (2).

followed by i:

2268 (1); 2291 (1); 2380 (2); 2420 (17); 2423 (17); 2432 (1).

followed by t:

4016 (1); 4117 (1); 4178 (1); 4185 (1); 4202 (1); 9401 (2); 9408 (2); 9412 (2); 9426 (1); 9431 (2); 9432 (2).

followed by w:

4185 (17ζ).

followed by *:

20 (17); 50 (10); 51 (10); 99 (1); 295 (17β); 362 (2); 365 (1); 382 (17); 579 (17); 580 (1); 705 (2); 728 (2); 772 (16); 885 (2); 889 (1); 960 (16); 1097 (15); 1425 (16); 1439 (17); 1443 (17); 1480 (17); 1545 (17); 1863 (2); 1928 (1); 1929 (17β); 1933 (17); 1985 (2); 2019 (2); 2056 (2); 2078 (17); 2094 (1); 2305 (17); 2328 (2); 2396 (2); 2578 (2); 2679 (16); 2874 (16); 3243 (2); 3446 (1).

Koorders' Plantae Junghuhnianae ineditae: 55 (17) — *Korthals:* s.n. (2) (3×); s.n. (17) (3×) — *Krukoff:* 238 (10) — *Kuhl & van Hasselt:* s.n. (1); s.n. (1); s.n. (2).

Labohm: 1214 (19) — *Lam:* 1773 (8); 1789 (25); 2153 (3); 2154 (8); 2159 (3); 2160 (2); 2161 (10); 2163 (22) — *Lauterbach:* 2446 (16) — *Ledermann:* 7105 (17); 9027 (10); 9421 (1); 9878 (18); 9943 (18); 9996 (18); 11064a (18); 11399 (22); 11447 (22); 12755 (22); 13000 (1) — *Leefmans:* s.n. (2); 31 (2) — *Loher:* 7137 (5) — *Lorentz:* 1699 (3) — *Lörzing:* 868 (2); 6676 (2); 7117 (2); 7118 (17); 7119 (1); 7264 (17); 7336 (10); 8299 (2); 8627 (2); 8628 (10); 8936 (2) — *Van der Meer Mohr:* 9 (2) — *Merrill:* 241 (22); 1992 (17); 5268 (19) — *Miquel:* s.n. (10) — *De Monchy:* s.n. (2) — *Mousset:* 334 (2).

Native collector: s.n. (1); s.n. (17); 337 (17ζ) — *Naumann:* N.G. 43 (21).

Opziener Pengalengan: X (1); XIII (2).

Palmer & Bryant: 988 (2) — *Peekel:* 588 (2) — *Pella:* 55 (16) — *Perottet:* s.n. (1?β) — *Posthumus:* 2188 (17); 3235 (2) — *Praetorius:* s.n. (16) — *Pringgo Atmodjo:* 82 (2); 90 p.p. (2); 526 (1) — *Pulle:* s.n. (2); s.n. (19); 964 (8); 965 (8); 1023 (25) — *Van der Pijl:* 229 (17).

Raap: 713 (2) — *de Raat:* s.n. (2) — *Ramli:* 2338 (19) — *Rant:* 732 (17) — *Rappard:* P. 19 (2); S. 28 (2) — *Reinwardt:* s.n. (1); s.n. (2); s.n. (17) (2×) — *Rensch:* 692 (2); 1162 (2); 1307 (2) — *Ridley:* s.n. (10); s.n. (19); s.n. (17) — 165 (19); 1441 (19); 3158 (17η); 3367 (19); 3716 (2); 4823 (19); 4823b (19);

9422 (17); 10016 (17η); 11192 (17); 16024 (13) — *Robinson:* 309 (16) — *Roepke:* 4 (17) — *von Römer:* 736 (8); 746 (2); 751 (2); 1215 (8); 1230 (17); 1231 (8); 1237 (8); 1238 (8) — *Rutten:* 3 (17) — *Van Eijckevorsel:* 66 (2).

Sapei: 147 (2) — *Sapiin:* s.n. (2) (2×) — *Sarip:* 371 (2) — *Scheffer:* s.n. (2); s.n. (17) (4×); s.n. (17β) — *Schiffner:* 1473, 1474, 1475 (2) — *Schlechter:* 16790 (17); 17395 (10); 18780 (22); 18781 (22) — *Siegel:* s.n. (2) — *Singapore Field no.:* 853 (19); 7997 (13); 8420 (19); 8877 (17); 10720 (17η); 11471 (17); 17745 (17); 18606 (17); 18608 (2); 20333 (19); 21341 (11); 23931 (2); 26450 (24); 27010 (2); 27735 (2); 28052 (2γ) — *Van Slooten:* 471 (17); 748 (17) — *Smith & Kant:* 350 (2) — *Snepvangers:* s.n. (2) — *Soegandiredja:* 32 (17) — *Van Steenis:* 1882 (2); 3018 (17); 3179 (17ι); 3690 (17); 3695 (2); 3754 (10); 3755 (10); 3756 (17); 4127 (17); 4135 (2β) 4778 (2β); 6290 (2); 8357 p.p. (5); 8357 p.p. (2β); 8380 (2β); 8423 (2β); 8459 (2β); 8470 (17δ); 8986 (2β); 9127 (5); 9614 (17δ); 9642 (2β); 9649 (5); 9712 (2); 9957 (2); 10812 (2); 10844 (1).

Toxopeus: s.n. (1); 485 (2) — *Teysmann:* s.n. (10) (4×); s.n. (16) (5×); s.n. (17ϑ) (2×); s.n. (19) (6×); 513 H.B. (17ϑ); 517 H.B. (1); 518 H.B. (2); 3278 H.B. (10); 3505 H.B. (10); 5189 H.B. (10); 7815 (16); 8832 (16); 11358 (19β); 11359 (17); 11360 (19); 13984 (2); 13988 (2); 14068 (16); 14069 (1); 14121 (22); 14191 (22).

Uhl: 6592 (17); 6617 (17).

Vermeulen: 50 (2) — *Versteeg* 2436 (δ); 2505 (25); 2537 (8) — *De Voogd:* 119 (2); 134 (2); 449 (10); 451 (10); 554 (17); 1494 (17); 1649 (1); 1844 (17); 2301 (17γ) — *De Vriesè:* s.n. (2); s.n. (17); s.n. (16) — *De Vriese & Teysmann:* s.n.: (16); s.n. (17).

W.: s.n. (17) — *Waits:* s.n. (2) — *Warburg:* 16433 (22); 16890 (22); 16891 (22); 21127 (17); 21128 (21) — *Weiss:* 3820 p.p. (2); 3820 p.p. (5) — *Whitford:* 951 (5) — *Winckel:* s.n. (2) (2×) — *Wind:* 6506 (1) — *Winkler:* 3057 (17) — *Wissel:* 154 (8); 161 (8) — *Wood:* 1244 (10) — *Wray & Robinson:* 5432 (13).

Yates: 1987 (2); 2148 (2); 2554 (10) — *Yoder:* s.n. (5).

Zippelius: s.n. (17); s.n. (21) — *Zollinger:* 2019 (17); 2229 (2); 2262 (2); 3025 (10) — *Zwart:* 6517 (2β).

Index to vernacular names

referring to the species by means of their serial number.

Remark: It is characteristic for the Malay and allied languages, that names as *kajoe tjina, kibima, pohon aroe* &c., in which the first part *kajoe, ki, pohon,* &c., means tree, are often abbreviated to *tjina, bima, aroe,* &c., whereas in other cases any name of a tree, not beginning with one of these words may be provided with it; in this way, *e.g., tjemara* becoming *kajoe tjemara,* &c. This has to be taken in consideration when consulting this index.

tjemoro belah 17.
tjemoro bini 2.
tjemoro godong 2.
tjemoro rante 2.
tjemoro tikoeng 1, 2.
tjemoro toekoeng 2.
tjempa(n)dak 1.
tjimba-tjimba 4.
tjina (kajoe) 10, 11, 16, 17, 17*, 19.
tjina itam (kajoe) 10.
tjoemara 2.
toean (kajoe) 1.
toeni (haoe) 2.
tombolilato 10.
topangkei 17.
totokan 10.
towar 1.
winong 1.
woeloean 17.

Index to scientific names and synonyms.

Occasionally mentioned names have been omitted. Names accepted for the area are in **thick** types, synonyms in *italics*, new names and combinations are marked with an asterisk.