

**A TENTATIVE LIST OF WILD PACIFIC SAPOTACEAE,  
EXCEPT THOSE FROM NEW CALEDONIA**

by

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(Issued June 15th, 1942).

Several years ago the Director of the Bernice P. Bishop Museum, Honolulu, was kind enough to lend me the Sapotaceous material from the Pacific region preserved in its Herbarium. It has been enumerated underneath together with additional material from other herbaria. These have been quoted by means of the following abbreviations, which are taken from Lanjouw's list, published in *Chronica Botanica* V, 1932, 142.

A. = Arnold Arboretum of Harvard University, Jamaica Plain (Mass.), U. S. A.

B. = Botanisches Museum, Berlin-Dahlem.

Bish. = Bernice P. Bish. Museum, Honolulu, Hawaiian Isl. and some specimens from the private herbarium of Mr O. Degener.

Bz. = Herbarium, Gov. Botanic Gardens, Buitenzorg, Java.

Cal. = California Botanical Gardens, San Francisco.

G. = Institut de Botanique systématique de l'Université de Genève.

GB. = Botanical Garden, Göteborg.

GH. = Gray Herbarium of Harvard University, Cambridge (Mass.), U. S. A.

K. = Royal Botanic Gardens, Kew.

L. = Rijksherbarium, Leiden.

NY. = New York Botanical Garden, New York.

O. = Universitetets Botaniske Museum, Oslo.

P. = Muséum National d'Histoire Naturelle, Lab. de Phanérogamie, Paris.

PRC. = Botanical Institute, Charles University, Praha.

Besides, a number of the specimens quoted are probably represented in other, particularly American herbaria, of which no data were available. I wish to tender my sincere thanks to the directors of the institutions mentioned for their kind assistance.

The present list only comprises wild species from the islands east of Formosa, the Philippines, New Guinea and New Caledonia. It is intended as a working basis for further studies, as some points could not be cleared up on account of lack of material and particularly of type

<sup>1)</sup> The MS. of the present paper was about to be forwarded to the director of the B. P. Bishop Museum, Honolulu, to be presented for publication in one of the Series of that Museum, when the Japanese-American war broke out. As this prevented us from following our original intention, the paper is now published in "Blumea".

specimens. For practical purposes I added keys to the genera and to the species. In a very concise form it has been added as an Appendix to a paper on the distribution of the Sapotaceae in the Pacific Region, read before the Sixth Pacific Science Congress, held at Berkeley, Cal., in 1939 and due to be published in the Proceedings of that Congress. Some of the genera (*Nesoluma*, *Manilkara* and *Northiopsis*), which have been circumstantially dealt with in recent papers, have been treated in a concise way here.

For some parts of this investigation I enjoyed the assistance of the following gentlemen: Mr. B. J. D. Meeuse (*Planchonella*), Mr. J. E. Boeke (*Planchonella sandwicensis*) and Mr. E. van Olden (*Burckella*).

### Key to the genera.

- 1a. Sepals fundamentally arranged in a spiral, mostly 5 or 4, sometimes 6 or even 3, never arranged in two distinct alternate whorls of sepals of the same size . . . 2  
 b. Sepals in two whorls of 2 sepals . . . . . IV. *Burckella*  
 c. Sepals in two whorls of 3 sepals . . . . . 3  
 d. Sepals in two whorls of 4 sepals . . . . . VII. *Mimusops*  
 2a. Sepals (4—)5, about equal in size or the inner ones smaller, petals as many as are the epipetalous stamens and the alternipetalous staminodes; the two latter categories may, however, be wanting. Tertiary nervation transverse or parallel to the secondary nerves; seed with a long and narrow ventral scar. Genus widely spread in East Asia, Malaysia and the Pacific. I. *Planchonella*  
 b. Sepals 4 or 5, more rarely 6 or 3, always unequal in size, the outer ones smaller; petals (4—)8—10(—12), sometimes reduced or wanting, stamens about as many or some of them replaced by petaloid staminodes. Tertiary nervation minutely reticulate; seed with a relatively large, almost circular and basal or basiventral scar. Hawaiian Islands, Tahiti, Tuamotu Islands, Austral Islands . . . II. *Nesoluma*  
 3a. Stamines wanting; stamens twice of thrice the number of the petals or even more . . . . . III. *Palaquium*  
 b. Alternipetalous staminodes extant; stamens as many as petals and opposite them . . . . . 4  
 4a. Dorsal appendages to the petals extant . . . . . V. *Manilkara*  
 b. Dorsal appendages to the petals wanting<sup>1)</sup> . . . . . VI. *Northiopsis*

For general information about the genera I may refer to the following previous publications, which have not been mentioned under the genera separately:

- LAM, H. J., The Sapotaceae of the Dutch East Indies, etc. — Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 1—289.  
 —, Further studies on Malayan Sapotaceae — Ibid. 8, 1927, 381—493.  
 —, Enumeration of the Sapotaceae thusfar known from New Guinea — Nova Guinea XIV, 4, 1932, 549—570.  
 —, Phylogeny of single features — Gard. Bull. Str. Settlm. IX, 1, 1935, 98—112.

### I. *Planchonella* Pierre.

- 1a. Tertiary nervation of the leaves (between the secondary nerves) transverse . . . 2  
 b. Tertiary nervation in general parallel to the secondary nerves or at least not distinctly transverse . . . . . 5

<sup>1)</sup> Also in *Achras* (of which *Achras Zapota* L. is frequently cultivated), but here the fruits are large and fleshy and the seeds are much flattened and with a long and narrow scar.

- 2a. Leaves very rigidly coriaceous . . . . . 3  
 b. Leaves chartaceous or membranous, not very rigid . . . . . 4  
 3a. Leaves lanceolate to oblong, base acute or cuneate, apex acute or shortly acuminate; petioles 2—3 cm long . . . . . 2. *P. firma*  
 b. Leaves oblong or ovate, base broad, subabruptly narrowed, apex more or less rounded or shortly and bluntly acuminate; petioles 3.5—5.5 cm long . . . . . 5. *P. macropoda*  
 4a. Leaves conferted at the tips of the branchlets, membranous; fruit subglobular, 3—5-seeded . . . . . 6. *P. membranacea*  
 b. Leaves scattered along the branchlets, chartaceous; fruit 1—2-seeded, oblong; staminodes with a broadly triangular base, acuminate, rarely ribbon-shaped . . . . . 11. *P. torricellensis*  
 5a. Leaves generally with an acute or acuminate apex; leaves oblong, ovate, elliptic or lanceolate<sup>1)</sup>; fruits often more or less furrowed . . . . . 6  
 b. Leaf-apex usually rounded and broad; leaves mostly obovate . . . . . 9  
 6a. Leaves large, 12—30 cm long, 5—11 cm broad, elliptic to oblong, acuminate at tip; fruits up to 1.5 cm long . . . . . 7  
 b. Leaves smaller, ovate or lanceolate, 4—12(—16) cm long, 1.5—4.5(—6.5) cm broad . . . . . 8  
 7a. Tertiary nervation distinctly parallel to the secondary nerves; leaves large, up to 30 × 11 cm, petioles 3—5 cm; pedicels in flower 0.5 cm long . . . . . 7. *P. micronesica*  
 b. Tertiary nervation not distinctly parallel to the secondary nerves, more or less transverse; leaves smaller, up to 22 × 7.5 cm, petioles 1 cm; pedicels in fruit 0.3—0.5 cm . . . . . 6. *P. membranacea*  
 8a. Fruit small, 1—1.5 cm long, ovoid, furrowed (unless rarely one-seeded), with thin pericarp; staminodes subulate or ribbon-shaped . . . . . 9. *P. oxyedra*  
 b. Fruit small, up to 1.5 cm long, not furrowed; staminodes with broad base and long acumen; leaves often tomentose underneath . . . . . 8. *P. obovata*  
 c. Fruit larger, globular or ovoid, 2.5—3 cm long, 2—3 cm in diam., pericarp thick . . . . . 3. *P. Garberi*  
 9a. Leaves spatulate, narrow, 4.5—8 × 1.3—3 cm, almost sessile, secondary nerves 6—8, angle 35°—50°; fruit ovoid, with acute apex and persistent style, pedicels 0.3—0.4 cm long . . . . . 4. *P. Guillauminii*  
 b. Leaves usually larger or at any rate distinctly petioled; nerves more numerous, their angle larger . . . . . 10  
 10a. Secondary nerves distinctly more conspicuous than the tertiary ones, which are longitudinally reticulate and never as straight as the secondary ones . . . . . 11  
 b. Secondary nerves hardly or not more conspicuous than the tertiary ones, which are as straight as (or almost so) and strictly parallel to the secondary nerves . . . . . 12  
 11a. Fruits small, ovoid or obovoid, rarely more or less globular, always with rounded apex, up to 1.5 cm long and 1 cm in diam., 1—2(—3)-seeded; staminodes very variable but always broad at base and with a long protracted acumen; very polymorphous species . . . . . 8. *P. obovata*  
 b. Fruits larger, mostly globular and 4—5-seeded, more rarely 1—2-seeded and then oblong or obovoid, 2—3 cm long, 2—2.5 cm in diam.; staminodes ribbon-shaped or subulate . . . . . 1. *P. costata*  
 12a. Staminodes ribbon-shaped or subulate; fruits globular or oblong, 2—3 × 2—2.5 cm . . . . . 1. *P. costata*  
 b. Staminodes broad, often petaloid, ovate-elliptic with rounded or subacute tip but never acuminate; fruits very variable, ovoid and beaked to globular or pyriform or obpyriform, 1.5—5 × 1.1—3.5 cm . . . . . 10. *P. sandwicensis*

The Pacific *Planchonella*'s are extremely closely related mutually. Yet, four groups may be distinguished, viz.

I. the *obovata*-group, comprising first of all *P. obovata* (Seychelles to Solomon Isl.), *P. costata* (S. and S.E. Pacific) and *P. sandwicensis*

<sup>1)</sup> *P. obovata*, *sandwicensis* and *Guillauminii* may occasionally have more or less acute leaves; they have, however, to be sought under 5b.

(Hawaiian Isl.). These three species, all of them extremely polymorphous, (and possibly also *P. australis* from Australia) seem to be vicariants in a way; they are characteristic sea-shore trees (except *sandwicensis*) as well as trees of the interior up to about 1000 m alt., and they can only be separated on account of a combination of features. Homologous variations are frequent in many characters. In *P. costata*, var. *austromontana* the nervation is very much like that of *P. sandwicensis*, which is mainly a mountain type.

Some other species with smaller areas and slightly different type, arrange themselves around this central group, viz. *P. micronesica* (Caroline Isl.), *P. membranacea* (Fiji) and *P. Guillauminii* (New Hebrides).

In its general type (nervation) group I is more or less connected with the groups II and III.

II. the *oxyedra*-group, comprising *P. oxyedra* (Malaya to Tonga), which is only variable in some characters and seems particularly related

to *P. costata*, being distinguished by its acute leaves and small fruits; and *P. Garberi* (Fiji, Samoa), which is possibly only a large fruited form of *oxyedra*.

III. the *nitida*-group, comprising *P. nitida* (Bl.) Dub. (India to Celebes and the Philippines) and *P. torricellensis* (New Guinea and Samoa); also *P. laurifolia* (Rich.) Pierre from Australia.

IV. the *firma*-group is the only more separate group of species (§ *Pierriplanchonella* Dub., to which *P. nitida* forms a transition), comprising *P. firma* (Malaya to Moluccas), with some related species in the Philippines, viz. *P. fragans* (Elm.) H. J. Lam and *P. Foxworthyi* (Elm.) H. J. Lam, and in the Mo-

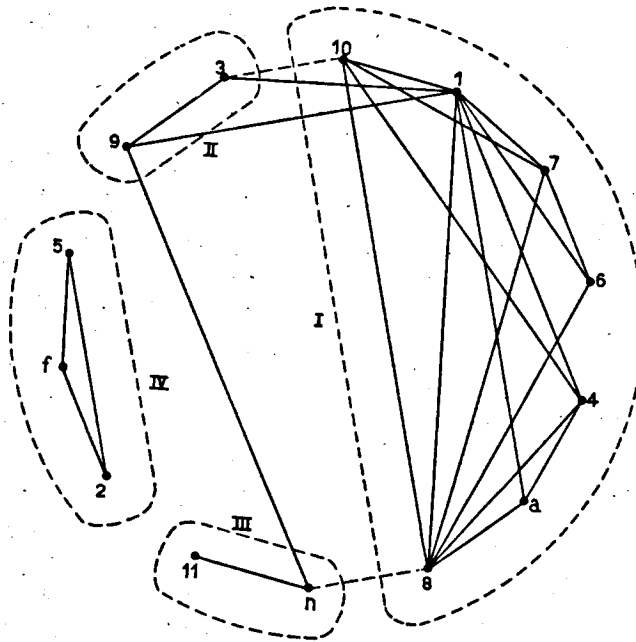


Fig. 1 — Relations of Pacific *Planchonella*-species.

- |                        |                           |
|------------------------|---------------------------|
| 1. <i>costata</i>      | 9. <i>oxyedra</i>         |
| 2. <i>firma</i>        | 10. <i>sandwicensis</i>   |
| 3. <i>Garberi</i>      | 11. <i>torricellensis</i> |
| 4. <i>Guillauminii</i> | a. <i>australis</i>       |
| 5. <i>macropoda</i>    | f. a group of New Guinea  |
| 6. <i>membranacea</i>  | species of the firma-     |
| 7. <i>micronesica</i>  | group                     |
| 8. <i>obovata</i>      | n. <i>nitida</i>          |

luccas, viz. *P. moluccana* (Burek) H. J. Lam, *P. macropoda* (New Guinea

and Solomon Isl.) and a number of endemic species in New Guinea (*P. monticola* [Krause] H. J. Lam, *P. nebulicola* H. J. Lam, *P. sussu* [Engl.] H. J. Lam and *P. lamprophylla* [Krause] H. J. Lam).

*Fig. 1* shows the relationships of the species mentioned.

1. *P. costata* (Endlicher) Pierre in schedula Herb. Par. — *Achras costata* Endl., Prodr. Fl. Norf. 1833, 49 and Icon. Gen. Pl. 1838 t. 83 — *Sapota costata* (Endl.) A. DC. in DC., Prodr. VIII, 1844, 175; Hooker f., Fl. Nov. Zel. I, 1853—1855, 174; Hooker & Thomson, Handb. New Zeal. Flora 1867, 186 — *Sapota? Vitiensis* A. Gray, Am. Acad. V, 1862, 328 — *Achras Novo-Zelandica* F. v. Muell., Fragm. Phytogr. Austr. IX, 1875, 72 — *Sideroxylon costatum* (A. DC.) Benth. & Hook. f., Gen. Pl. II, 2, 1876, 655; Engler in Engl. Bot. Jahrb. 12, 1890, 518 and in Engl. & Prantl, Nat. Pfl. Fam. IV, 1, 1897, 144 — *Sideroxylon vitiense* (Gray) Benth. & Hook. f., Gen. Pl. II, 2, 1876, 655; Drake del Castillo, Ill. Fl. Ins. Mar. Pac. 1892, 229 — *Sideroxylon costatum* (Endl.) F. v. Muell., Syst. Census Austr. Pl. I, 1882; Kirk, For. Fl. New Zeal. 1889, 279, t. 133; Cheeseman, Man. New Zeal. Fl. 1906, 435 — *Sideroxylon tahitense* Nadeaud, Morot's Journ. de Bot. XI, 1897, 111 — *Sideroxylon vitiense* (Gray) Burkill, Journ. Linn. Soc. Lond. 35, 1901, 44 — *Planchonella tahitensis* (Nad.) Dubard, Ann. Mus. Col. Mars. 20, 1912, 50 — *Hormogyne tahitensis* Nadeaud in Dubard, Ann. Mus. Col. Mars. 20, 1912, 50 as a synonym sub *Planchonella tahitensis* — *Sersalisia costata* (Endl.) Domin, Bibl. Bot. 89, 1928, 508 — *Lucuma vitiensis* (Gray) Gillespie, B. P. Bish. Mus. Bull. 74, 1930, 12, fig. 14 — *Sideroxylon* spec. Wilder, B. P. Bish. Mus. Bull. 86, 1931, 87 — *Sideroxylon tannaense* Guillaumin, Journ. Arn. Arb. 13, 1932, 14 — *Planchonella Grayana* St. John, B. P. Bish. Mus. Bull. 120, 1934, 38 — *Hormogyne tahitensis* (Nad.) Pierre MS. in Herb. Paris.

Although several synonyms have been well described and some of them have, in addition, been pictured, none of the descriptions encompasses the polymorphy of the species as interpreted here. An amplified description may therefore precede the enumeration of the exsiccata, on which it is based.

Shrubs to moderate-sized trees with milky juice, 2—16 m high (6—20 m f. Kirk), trunk 0.10—0.75 m in diam. (0.30—0.90, very rarely 1.5 m f. Kirk), growing from the sea coast to an altitude of about 1000 m. Branchlets fairly slender, the youngest parts minutely appressedly ferruginously or greyish tomentose, soon glabrate. Leaves more or less but not densely crowded towards the tips of the branchlets, mostly light-coloured (greenish or brownish) when dry, the young ones with a sparse appressed indumentum on the petiole and underneath, very soon glabrescent, variable in shape and particularly so in size even in the same specimen and large and small leaves often irregularly intermixed, mostly oblong to oblong-obovate with a rounded apex and a decurrent base, rarely subrotundate or with emarginate apex, the size of adult leaves varying between 2.8 and 18 cm, in sterile branchlets even up to 27 cm in length and between 1.5 and 8 cm, in sterile branchlets up to 11 cm in width, the petioles being 0.7 to 5.5 cm long; midrib somewhat prominent below, almost flat above; secondary nerves conspicuous on either side, partic-

ularly below, ascending at an angle of 50°—60°, slender and rather straight, at some distance from the margin forked and more or less irregularly archingly joined, in most of the specimens 8—13 on either side of the midrib and rather wide apart, in some others, however, up to about 26 and closer together; the difference being mainly due to whether one of the tertiary nerves between each pair of secondary ones is more or less well developed and participating in the marginal arches; tertiary nerves only little less conspicuous than the secondary ones, sometimes preponderantly parallel to the secondary ones, but mostly longitudinally reticulate, the reticulation in either case extending beyond the marginal arches. Inflorescences in the axils of the leaves, 1—10-florous, the pedicels 0.2—0.8 cm long and sparsely appressedly pubescent, hardly or not elongate, somewhat incrassate in fruit. Flowerbuds globular, about 0.25 cm in diam. Calyx with 4 or mostly 5 subrotundate sepals, sparsely appressedly pubescent without, with scarious margins, glabrous within, the inner ones often minutely fimbriate. Adult flowers about 0.3 cm long. Corolla white or greenish-white, glabrous, the (4—)5 lobes rounded to subacute, 0.15—0.20 cm long, tube 0.1—0.15 cm. Stamens with ribbon-shaped white filaments, not exsert, inserted about halfway up the tube, anthers ovoid, yellow, staminodes about the same shape as the filaments but shorter and narrower, acute or acuminate, inserted in the throat; in some cases the stamens are sterile and the anthers lacking, but then the filaments are pointed as are the staminodes but slightly longer and inserted in their usual place. Ovary small, about 0.15 cm high and in diam., slightly (4—)5-angular and (4—)5-celled, pubescent with longer hairs on the rim, style very short and broadly conical or cylindrical, truncate, (4—)5-furrowed. Fruit mostly 4—5-seeded and globular, rarely 1—2-seeded and more ovoid or oblong, 2.1—3.2 cm long, 2—2.5 cm in diam., with hard glabrous pericarp enclosing the seeds, which have a comparatively thin testa and a long and narrow scar, about as long as the seed, which measures 1.6—2.4 × 0.7—1.0 × 0.4—0.7 cm. Albumen copious, surrounding the flat cotyledons.

*P. costata* is a fairly polymorphous species, though by no means as polymorphous as *P. sandwicensis*, to which it is closely related. I would distinguish two varieties, *austro-montana* and *vitiensis*.

Var.  $\alpha$  *austro-montana* H. J. Lam, nov. var. — Folia plerumque parva e. 5—6 cm longa, coriacea, obovata, interdum majora oblonga, usque ad 15 cm longa, apice rotundata rare subacuta, basi attenuato-decurrentia; nervi secundarii numerosi approximati, utrinque 11—26, tertiarii secundariis paralleli, vix tenuiores.

Leaves mostly small and about 5—6 cm long, sometimes larger and oblong, up to 15 cm long, coriaceous, obovate, apex rounded or rarely subacute, base attenuate-decurrent, secondary nerves numerous and close together, about 11—26, hardly separable from the almost equally strong and parallel tertiary nerves.

This variety includes *Achras* (*Sapota*, *Sideroxylon*, *Sersalisia*) *costata* (-um) as well as *Achras Novo-Zelandica*; however, I preferred to choose in the present case the name *austro-montana* (instead of *typica*, as is recommended by the International Rules of Botanical Nomenclature) so

as to indicate that this variety is possibly the ecotype of the cooler southern part of the area and at the same time of the higher hills in the more tropical regions, i. e. Fiji. The flowers are, as far as they were available (*A. C. Smith 683* from Fiji), identical to those of the other variety. Both in the size of the leaves and in the number of secondary nerves, the variety is not sharply separated from the other. The large number of secondary nerves is mainly due to the fact that the tertiary nerves are more strictly parallel to the secondary ones and less different in strength. The Fiji-specimens, though in shape and size conformable to the specimens from New Zealand and Norfolk I., are, in a way, forming a transition to var. *vitiensis*, insofar as the tertiary nerves are less strictly parallel and more distinctly weaker than the secondary ones. Their leaves are also slightly more coriaceous.

I did not see any specimen exactly agreeing with Endlicher's picture, in which the leaves are unusually narrow. The scale is not given, but either the leaves are the small type or the flowers are much exaggerated in size. Both Von Mueller and Kirk give descriptions in which the size of the flowers is correctly mentioned. In Endlicher's picture the staminodes seem exceptionally long and, curiously enough, both in this plate and in that by Kirk, the stamens are inserted at a higher level than the staminodes, which is certainly erroneous. In Kirk's plate the flowers are again exaggerated in the branchlet pictured and even slightly so in the flower given in natural size. The corolla is only as much exert as is shown, in case it has got detached and is only held in place by the tips of the sepals, a condition that is often met with.

New Zealand: North Island: *Colenzo* in Herb. *Hooker A° 1854* (fl. and y. fr.; P.); Orewa, Bay of Islands: *Filhol A° 1875*, in Herb. *Kirk* (nat. name "tawa-apou"; fr.; P.); Whangaroa: *Filhol A° 1875* in Herb. *Kirk* (fl.; P.).

Norfolk Island: *Lindley A° 1870* (P.; on one label, probably the field label, the annotation "Norfolk Isl." is found; the sheet is also insofar dubious, since it bears two specimens which differ altogether; one of them is the usual small-leaved form, as is pictured by *Kirk* and bears young fruit; the other one is sterile and possesses large leaves, about  $14 \times 6$  cm).

Fiji: Vanua Levu, Thakaundrove, summit of Mt. Mbatini, 1030 m, in dense thickets: *A. C. Smith 683* (gnarled shrub, 4 m high, flow. 28—29. 11. 1933; Bish., L.), *Id. 705* (shrub, 3 m high, flow. 28—29. 11. 1933; Bish., L.).

Distribution of var.  $\alpha$ : New Zealand (N. of North Island), Norfolk I., Fiji (Vanua Levu). It is uncertain, whether the species also occurs in Australia. *F. von Mueller* (Census, l. c.) mentions that the species (and then probably var.  $\alpha$ ) occurs in New South Wales, *Kirk* (l. c.) mentions Australia as a part of the area.

Var.  $\beta$  *vitiensis* H. J. Lam, nova var. — Folia plerumque magna, 7—15 cm longa, chartacea vel subcoriacea, elliptica vel oblonga ad sublanceolata, minora obovata, basi plus minusve abrupte decurrentia, apice rotundata, interdum obtuse acuta; nervi secundarii haud approximati, utrinque 8—13, rare usque ad 17, tertiarium paulo sed distincte tenuiores, reticulatione nervis secundariis generatim paralleli confluentes.

Leaves mostly large, 7—15 cm long, chartaceous or subcoriaceous, elliptic or oblong to sublanceolate, the smaller ones obovate, base more or less abruptly decurrent, apex rounded, sometimes bluntly acute; secondary nerves rather wide apart, 8—10, rarely up to 17, the tertiary ones little but distinctly more slender, united into a longitudinally stretched reticulation, parallel to the secondary nerves.

This variety includes the types of *Hormogyne* (*Planchonella*) *tahitensis*, of *Sapota* (*Sideroxylon*, *Lucuma*) *vitiensis* (-se), of *Planchonella Grayana* and of *Sideroxylon tannaense*. Concerning its leaf characters it is fairly polymorphous and not sharply distinguished from the other variety. The type of *Sideroxylon tannaense* shows somewhat acute leaves with few secondary nerves, but it is not essentially different from similar forms, e. g. from Tubuai which possess still more lanceolate leaves (*St. John* 16513—14). It is a curious fact that in many specimens large and small leaves are intermixed and that the small leaves are often not those situated at the tips of the branchlets (e. g. in *Crosby* 99: 6.2 × 3.2 cm with 7 secondary nerves, petiole 0.8 cm and 21 × 11.2 cm, 15 secondary nerves, petiole 4.5 cm; similar conditions are found in *Wilder* 777, 950 and 1115 and in *Smith* 1435).

New Hebrides: Tana: Lenakel, alt. 200 m, common in rain forest: *Kajewski* 104 (tree, 15 m high, 75 cm in diam., fr. eaten by natives; type specimen of *Sideroxylon tannaense*; fl. on 6. III. 1928; A., Cal., K.; leaves rather narrow and blunt at apex; flowers ♀, no anthers extant).

Fiji: U. S. South Pac. Expl. Exp. Capt. *Wilkes*, 1838—1842 (fr.; type specimen of *Sapota? vitiensis*; P., K.; the leaves are oblong with a rounded apex, small and 4.5—6.5(—12) × 1.8—2.7(—4) cm in the Paris specimen, somewhat larger and up to 12 × 5 cm in the Kew one); *Horne* A° 1877—78, nr. 517, fl.; K., L.); Ovalau: *Id.* 517a (small tree, flowers greenish white, fl. Jan. 1878; K.); Vicinity of Levuka, on stream, alt. 400 m: *Gillespie* 4487 (ster. 28. I. 1928; Bish.), rocky knobs, mountains 3 miles N.W. of Levuka: *Id.* 4559 (fr. green with white bloom, 4. II. 1928), rocky coast 3 miles N. of Levuka: *Id.* 4494 (rather large tree, fl. 29. I. 1928; Bish.); Vanua Mbalavu, S. limestone section, alt. 0—100 m, forest near Malatta: *A. C. Smith* 1453 (tree, 8 m high, corolla white, anthers yellow, nat. name "nggalaka", flow. 29. III. 1934; Bish., L.); Fulanga, limestone formation alt. 0—80 m, in forest: *A. C. Smith* 1208 (tree, 7 m high, flow. 22—26. II. 1934, nat. name "nggalaka"; Bish., L.), *Id.* 1154 (tree, 12 m high, fl. buds on 22—26. II. 1934, nat. name "nggalaka"; Bish., L.); Moala, on rocky shore, North coast: *A. C. Smith* 1385 (shrub, 2 m high, corolla and filaments greenish white, flow. on 20—24. III. 1934, nat. name "nggalaka"; Bish., L.), *Id.* 1386 (tree, 6—8 m high, fr. on same date, same nat. name; Bish., L.).

Samoa: Savaii, Falealupo-Tututafao, alt. about 2 m, on shore: *Christophersen* 3517 (tree, 6 m high, nat. name "fao" ♀, ster. 22. 11. 1931; Bish.; leaves oblong and up to 27 × 9.6 cm, petiole up to 6.5 cm).

Tonga, Vavau: *Crosby* s. n. (fr. only; K.), *Id.* 99 (leaves elliptic to somewhat obovate, small to large, 6.2—21 by 3.2—11.2 cm, petioles 0.8—4.5 cm, secondary nerves 7—15; flow.; nat. name "kalaka"; K.), *Id.* 100 (leaves broadly obovate, with sub-emarginate apex, about 8.5 × 6.5, petiole 1.5 cm; flow.; nat. name "kalaka"; K.); Tongatabu, Eau, near summit: *J. J. Lister* s. n. (tree, 6—9 m high, fruits grow to size of tangerine orange, June 1889; leaves large, obovate; K.).

Cook-Islands, Rarotonga: *H. E. and S. Thew Parks* 22356 (y. fr. May—July 1929; Bish., K.); *Bouchier* for *G. P. Wilder* s. n. (flow. Jan. 1932; Bish.); Mt. Tereora, in dark forests, scarce: *T. F. Cheeseman* 806 (tree, 6—12 m high, with dark green handsome foliage, fr. in June 1899; K.), same locality, dry forest, hilly, rocky, alt. 210 m: *G. P. Wilder* 777 (y. fr. 19. 6. 1929, nat. name "moto"; Bish.).

Tuamotus, Makatea: alt. 100 m: *G. P. Wilder* 950 (y. fr. 8. 8. 1929; Bish.); in coral and sand pockets: *Id.* 1115 (tall tree, 15—30 m high, diam. 0.25 m, flow. 17. 9. 1932; nat. name "moto"; there is a fruit accompanying this sheet which, although probably a *Planchonella*, apparently does not belong here, as it is only 1.1 cm in diam., containing two ripe seeds with hard testa, long and narrow scar and embryos with abundant albumen; Bish.).

Tahiti: In the Paris herbarium there is an empty sheet, of which the label as well as the annotations by *Pierre* agree with the description of *Sideroxylon tahitense* Nadeaud; probably the type specimen has got lost. However, there are two other sheets, bearing branchlets and fruits, apparently from the same tree, which I suggest may



represent the lectotype; this specimen may be quoted in the following way: Tahiti, Mt. Baaivi: *Nadeaud* (fr. in May 1897, nat. name "moorea" [or erroneous for the island of this name?]); *type specimen* of *Sideroxylon tahitense*; P.; leaves lanceolate to oblong).

**Tubuai (Austral) Islands:** Rurutu, Arei, in woods on elevated dissected coral limestone, alt. 75 m: *St. John 16738* (broad-topped tree, 7 m high, 0.60 m in diam., fruit ovoid, 4-celled, on 30. 8. 1934, sap milky; Bish., L.); without exact locality: *Id. 16769a* (fr. on 2. 9. 1934; Bish., L.) — Tubuai, Pass N. of Tunarutu, in woods, alt. 150 m: *St. John 16513* (tree, 10 m high, 0.50 cm in diam., flowers and buds, sap milky, fr. green, 22. 8. 1934; largest tree 16 m high, 0.7 m in diam., bark smooth dark brown, sapwood white; Bish., L.; leaves blunt at apex), *Id. 16514* (tree, 8 m high, 0.30 m in diam., sap milky, young flow. buds 22. 8. 1934; Bish., L.; leaves sublanceolate with blunt apex).

**Distribution of var.  $\beta$ :** New Hebrides (Tana), Fiji (Vanua Levu, Ovalau, Vanua Mbalavu, Fulanga, Moala), Samoa (Savaii), Tonga (Vavau, Tongatabu), Cook Islands (Rarotonga), Tuamotus (Makatea), Tahiti, Tubuai (Austral) Isl. (Rurutu, Tubuai).

2. ***P. firma*** (Miq.) Dub., *Ann. Mus. Col. Mars.* 20, 1912, 59; H. J. Lam, *Bull. Jard. bot. Buitenz. Sér. III*, 7, 202, 247, 266 and 8, 1927, 471 and in *Nova Guinea XIV*, 4, 1932, 563.

**Solomon Isl.:** Bougainville, common in rain forest between Lake Luralu and Knoiguru, 1200 m alt.: *Kajewski 2124* (tree, 25 m high, fr. on 20. 8. 1930; A., L.).

**Distribution:** Malay Peninsula through Malaysia to the Solomon Islands.

3. ***P. Garberi*** Christoph., *B. P. Bish. Mus. Bull.* 128, 1935, 170, pro parte.

**Fiji:** Vanua Levu, Mbua, Upper Ndama river valley, alt. 100–300 m, forest: *A. C. Smith 1604* (tree, 8 m high, nat. name "thalavia", fr. Apr. 24–28, 1934; Bish., L.).

**Samoa:** Isl. Ofu, top of Nu'u Islet, 75 m alt.: *Garber 1101* (*type specimen*); Bish.; fr. July 4, 1925).

**Distribution:** Fiji, Samoa.

Possibly only a large-fruited variety of *P. oxyedra* (see there).

4. ***P. Guillauminii*** H. J. Lam, nov. spec. — *Sideroxylon* spec. *Guillaumin*, *Journ. Arn. Arb.* 13, 1932, 14. — *Fig. 2*.

Arbor alta. Ramuli graciles, apices versus densiuscule foliati, apicibus adpresse pubescentibus glabrescentibus. Folia rigida coriacea novella adpresse pubescentia, mox glabrata, spatulata, apice obtusa vel interdum rotundata, e parte latissima sensim in petiolum decurrentia, supra nitidula, subtus opaca, 4.5–8 cm longa, 1.3–2.9 cm lata, petioli 0.3–0.9 cm longi; costa media supra paulo, subtus magis prominens, nervi secundarii utrinque 6–8, tenues, minute sinuosi, angulo 35°–50° de costa adscendentes, margines versus haud distincte arcuatim conjuncti, tertiarii tenuiores, laxae longitudinaliter reticulati, secundariis generatim paralleli. Inflorescentiae floresque ignoti. Fructus in foliorum axillis solitarii, pedicelli minute pubescentes 0.3–0.4 cm longi. Sepala 5 quincuncialiter inserta, patentia, late ovata, c. 0.4 cm longa, extus adpresse pubescentia, intus glabra. Fructus pericarpio laevi et duro, 1–3-spermi, ovati vel oblongi, minute adpresse pubescentes, basi obtusi, apice distincte rostrati in stylum permanentem sensim contracti, 1.7–2 cm longi, 0.7–1.3 cm diam., stylus c. 0.3 cm longus. Semina (omnia fatua), testa dura nitida dorso fusca, partem ventralem versus flavescens, c. 1.6 × 0.7 × 0.6 cm, cicatrice angusta semine aequilonga; embryo ignotum.

A large tree, 15–25 m high, with very hard wood. Branchlets slender, towards the tips fairly densely leaved, the tips and the young

leaves appressedly pubescent but soon glabrous. Leaves rigidly coriaceous, glabrous when adult, spathulate, the apex obtuse or sometimes rotundate, from the broadest part gradually narrowing towards the petiole, more or less shining above, dull underneath, 4.5—8 × 1.3—2.9 cm, the petioles

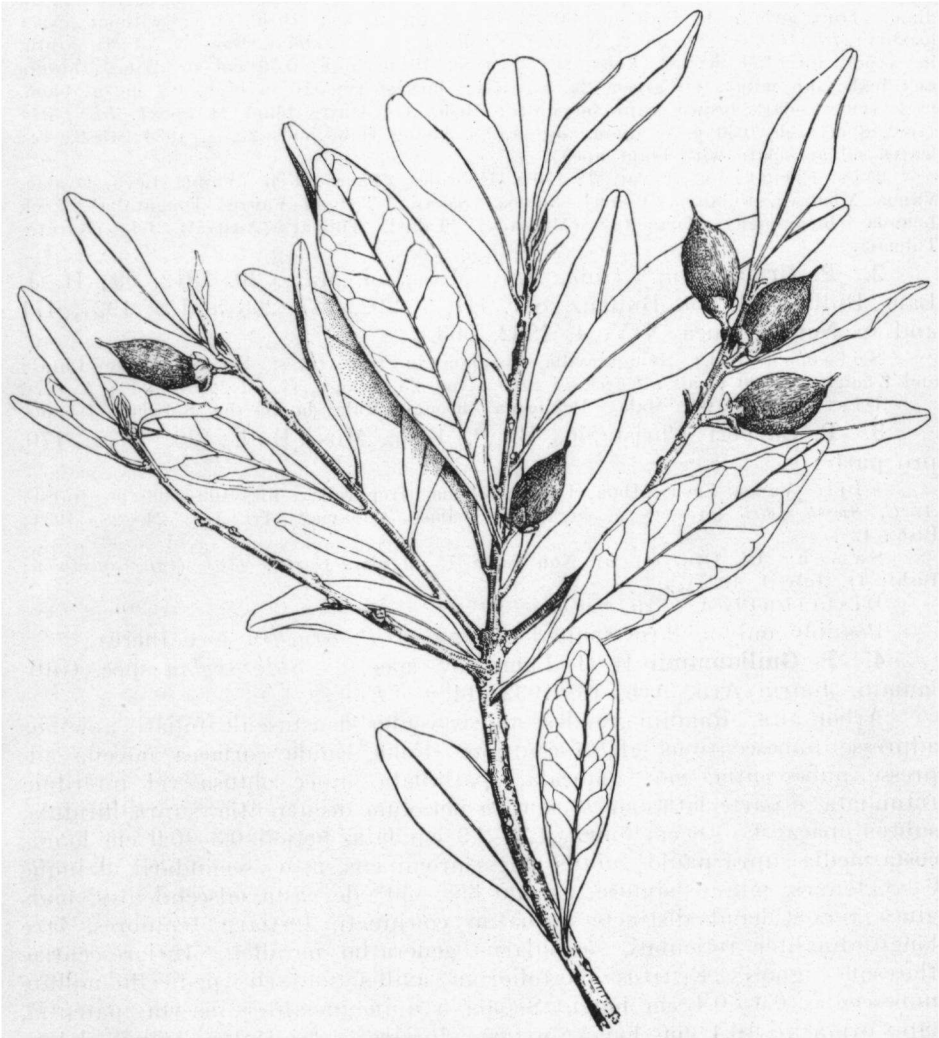


Fig. 2 — *Planchonella Guillauminii*, n. sp. — Branchlets with fruits (after *Kajewski 385*).

0.3—0.9 cm long; midrib prominent on either side, but stronger below, secondary nerves 6—8, slender, minutely sinuous, ascending from the midrib at an angle of 35°—50°, not distinctly archingly joined near the margin, the tertiary nerves still fainter, generally parallel to the secondary ones, longitudinally reticulate. Inflorescences and flowers unknown. Fruit solitary in the leaf-axils, the pedicels minutely pubescent and 0.3—0.4 cm

long. Sepals 5, quincuncially arranged, spreading, broadly ovate and about 0.4 cm long, appressedly pubescent outside, glabrous within. Fruit ovate to oblong, the pericarp hard and smooth but minutely appressedly pubescent, 1—3-seeded, base obtuse, apex distinctly rostrate by the permanent style, 1.7—2 × 0.7—1.3 cm, the style about 0.3 cm long. Seeds (all sterile) with a hard and shining testa, dark brown at back, more yellow towards the ventral side, about 1.6 × 0.7 × 0.6 cm, the scar narrow and about as long as the seed; embryo unknown.

New Hebrides: Eromanga Isl., Dillon bay, 300 m alt., common in rain forest: *Kajewski 385* (tree, 25 m high, with very hard wood, leaves light brown underneath, nat. name "ney-mor", fr. on June 8, 1928; *type specimen*, A., Cal., K.); Aneityum Isl., Anelgauhah bay, 150 m alt., common in rain forest: *Kajewski 936* (tree 15 m high, leaves dark green, good commercial timber for wood, not exposed to weather; y. fr. on March 17, 1929; A., Cal., K.).

Although the embryo is unknown, almost certainly a *Planchonella* of the relation of *P. obovata*. It is furthermore related to *P. australis* (R. Br.) Pierre from Australia and to *P. costata*, being distinguished from all these species by its narrow leaves, its short pedicels and its beaked fruit.

5. *P. macropoda* H. J. Lam, Nova Guinea XIV, 4, 1932, 563, tab. 117.

Solomon Islands: Ysabel Isl., Tatamba, hardwood forests, alt. 50 m: *L. J. Brass 3433* (tall, buttressed tree, with hard, slightly scaly bark and milky sap; leaves dull, stiff, concave, with loose grey minute hairs above and when young, brown hairs underneath; fruit shining black, up to 2.5 cm long and 2 cm in diam.; L.).

Distribution: N.E. New Guinea, Solomon Islands.

Its relation is with *P. firma*, but its leaves are ovate and with much larger petioles.

6. *P. membranacea* H. J. Lam, nov. spec. — *Fig. 3* — *Arbor parva*. Ramuli graciles, apicibus paulo pubescentibus, mox glabrati. Folia pauca ad ramulorum apices conferta, membranacea, oblonga, glabra, basi attenuata decurrentia, apice obtuse acuminata, 16.5—22.5 cm longa, 6.4—7.5 cm lata, petiolis c. 1 cm longis; costa media subtus prominens; nervi secundarii tenues, paulo curvati, angulo c. 60° de costa ascendentes, margines versus diminuti, haud distincte arcuatim conjuncti, tertiarum gracillimi, juxta costam eadem perpendiculares, cetera transversaliter reticulati. Inflorescentiae floresque ignoti. Fructus sub folia in axillis foliorum delapsorum solitarii vel bini, pedicellis brevibus glabris, 0.3—0.5 cm longis. Sepala 5, patentia vel paulo reflexa, quincuncialiter inserta, rotundata, 0.2—0.3 cm longa, exteriora extus glabra, interiora adpresse pubescentia, omnia intus glabra. Fructus ovoidei, pericarpio duro sed plus minusve sulcato glabro, apice styli rudimento minuto c. 0.1 cm longo coronati, c. 2 cm longi, fere 1.5 cm diam., 4—5-spermi. Semina (omnia fatua) fructibus paulo breviora, testa crustacea, cicatrice longa angusta; embryo ignotum.

A small and slender tree. Branchlets slender, the tips somewhat pubescent but soon glabrate. Leaves few in number conferted at the very tips of the branchlets, membranous, oblong and glabrous, the base gradually narrowing and decurrent, the apex bluntly acuminate, 16.5—22.5 × 6.4—7.5 cm, the petioles about 1 cm long; midrib prominent below; secondary nerves slender, somewhat curved, ascending at an angle of about 60°, towards the margins diminishing and not distinctly archingly

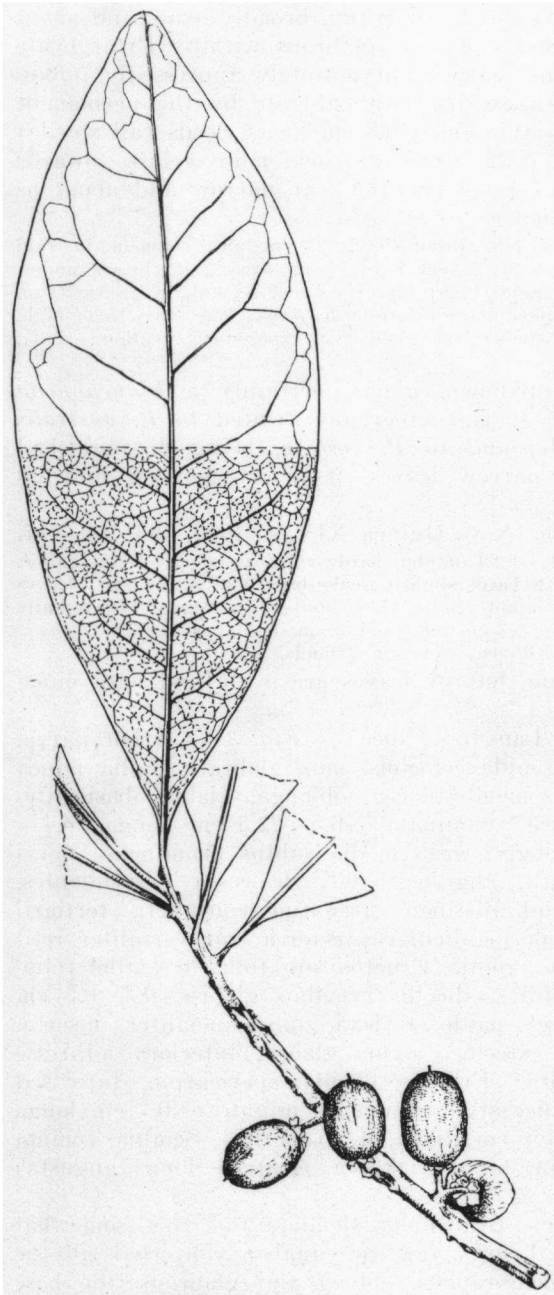


Fig. 3 — *Planchonella membranacea*, n. sp. — Branchlet with fruits (after A. C. Smith 1491).

joined; tertiary nerves close to the midrib at right angles to this, for the rest transversely reticulate. Inflorescences and flowers unknown. Fruit single or two together in the axils of fallen leaves, the pedicels short and glabrous, 0.3—0.5 cm long. Sepals 5, quincuncially arranged, spreading or somewhat reflexed, rotundate, 0.2—0.3 cm long and in diam., the outer ones glabrous, the inner ones appressedly pubescent without, all glabrous within. Fruit ovoid with a hard pericarp but when dry somewhat furrowed, glabrous, at the tip crowned by the remainder of the style, which is about 0.1 cm long, about 2 cm long and almost 1.5 cm in diam., 4—5-seeded. Seeds (all sterile) little shorter than the fruit, with a long and narrow ventral scar. Embryo unknown.

Fiji: Vanua Mbalavu, northern limestone section, alt. 0—200 m, in forest: A. C. Smith 1491 (slender tree, 7 m high, fr. on Apr. 2—3, 1934; type specimen, Bish., L.).

Although the embryo is unknown, almost certainly a *Planchonella*. The species recalls both *P. costata* and *P. micronesica*, but the tertiary nervation is distinctly transverse, a condition which is never found in either of the species mentioned.

7. *P. micronesica* (Kan.)

Kan., nov. comb. in litt. — *Sideroxylon micronesicum* Kanehira, Bot. Mag. Tokyo 46, 1932, 671 and Fl. Micron. 1933, 308, fig. 156 and Journ. Dep. Agr. Kyushu Imp. Univ. 4, 1935, 388.

Caroline Islands: Kusaie: *R. Kanehira 1322* (type specimen; L.).  
Distribution: Carolines.

Related to *P. costata* and *P. obovata*, but distinguished by its furrowed fruit and its acute and slightly acuminate leaves; from *P. costata* it is further distinguished by its smaller fruit.

8. *P. obovata* (R. Br.) H. J. Lam, Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 209, 245, 266 and 8, 1927, 473 and in Nova Guinea XIV, 4, 1932, 565.

Marianas: Saipan, in forest: *Höfer 21* (nat. name "lalaha"; B.) and *85* (large tree, flow. greenish; B.) — Guam: *A. Marche 244* (nat. name "lalaja"; P.); *Thompson 477* (K.).

Caroline Islands: Palau: *Kraemer s.n.* (nat. name "galangel"; B.) — Palau, Babelthuap, Ngarsub, in forest, alt. 200—300 m: *Ledermann 14364* (tree, 15—20 m high, flow. greenish white, nat. name "chalangl"; B.); Korror, coral limestone, 10—100 m alt.: *Id. 14079* (tree, 10—12 m high, fr. black; B.); *Id. 14239* (nat. name "galangel"; B.), *Pater Raymondus 9* and *224* (same nat. name; B.); Garasumao, forest: *M. Takamatsu 1554* (flow. Apr. 30, 1934; Bish., L.); Garudokka, forest: *Id. 1212* (y. fr. Apr. 7, 1936; leaves lanceolate; Bish., L.) — Yap, above Keug: *Volkens 340* (B.) and *533* (or *553?*) (tree, 10 m high, flow. white; type specimen of *Sideroxylon glomeratum* Volk.; B.).

Solomon Islands: Ysabel Isl., Tiratona, rain-forest, alt. 600 m, common: *L. J. Brass 3338* (pyramidal tree attaining 30 m, brown fissured bark, young leaves brown underneath, older grey, flowers greenish, on Dec. 10, 1932, sap milky; A., Bish., L.).

Distribution: from the Seychelles to the Western Pacific.

A widely spread coastal and inland tree, with close relations to many other Pacific species of the genus (*P. costata*, *sandwicensis*, *australis*, *micronesica*, *Guillauminii*).

9. *P. oxyedra* (Miq.) Dub., Ann. Mus. Col. Mars. 20, 1912, 50; H. J. Lam, Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 214, 267 and 8, 1927, 474, fig. 29 — ? *Sapota ? pyrulifera* A. Gray, Am. Acad. V, 1862, 328 — *Planchonella vitiensis* Gill., Bish. Mus. Bull. 74, 1930, 11, fig. 12 — *Sideroxylon aneityense* Guill., Journ. Arn. Arb. 13, 1932, 13 — *Sideroxylon* spec. no. 2 Guill., l. c. 14 — *Planchonella Garberi* Christoph., Bish. Mus. Bull. 128, 1935, 170, pro parte.

Solomon Islands: Ysabel Isl., Tiratona, common in mountain forests, 600 m: *L. J. Brass 3312* (large tree with thick, brown, slightly fissured bark and hard, brown wood; flowers white on Dec. 8, 1932, sap milky; A., Bish., L.).

Fiji: Taveuni, borders of lake East of Somosomo, alt. 700—900 m, dense forest: *A. C. Smith 920* (tree, 6 m high, flow. yellow in Dec. 1933—Jan. 1934; Bish., Bz., L.).

New Hebrides: Aneityum Isl., Anelgauhat Bay, 300 m alt., common in rain forest: *Kojewski 771* (tree, 15 m high, leaves light green, petals greeny white, flow. on Febr. 14, 1929, sweetly scented; type specimen of *Sideroxylon aneityense*; A., Cal., K.); *Id. 945* (tree, 18 m high, y. fr. on March 19, 1929; A., Cal., K.); *Id. 941* (tree, 15 m high, y. fr. on March 19, 1929; A., Cal., K.).

Samoa: Savaii, above Sili, alt. 200 m, forest; *Christophersen 3235* (tree, 6—8 m high, y. fr. green, on Nov. 11, 1931, nat. name "ala'a"; Bish.); same loc., ± 100 m alt., in wet forest: *Christophersen & Hume 3275* (tree, ± 10 m high, flow. on Nov. 11, 1931; nat. name "ala'a"; Bish.); Falealupo, forest, alt. ± 25 m: *Christophersen 2791* (shrub-tree, 3 m high, nat. name "ala'a"; Bish.) and *2775* (tree, 5 m high, same nat. name; ster. 30. 9. 1931; Bish.); Salailua-Lataitai, forest, alt. ± 10 m: *Christophersen 2853* (tree, 15 m high; Bish.) and *2652* (tree, 15 m high, fr. olive green on Sept. 18, 1931; Bish.).

Tonga: Vavau: *Crosby 101* (ster., March 1892; nat. name "kalaka"; K.), *Id. 295* (very young fruit Jan. 1892, latuma tree; K.).

Distribution: from the Malay Peninsula through Malaysia (Philippines incl.) and New Guinea to Fiji (f. *Gillespie*), Samoa and Tonga.

This species is far less polymorphous than *P. obovata*, though there is a certain range in some of its characters, such as the size of the leaves, the pubescence of pedicels and calyces, and the length of the corolla-tube. The last-named character, however, may depend on the age of the flower, which is not easily to be stated in dry specimens, as the flowers seem hardly to open at all.

Most of the Samoa specimens were formerly identified as *P. Garberi* Christoph., l. c. The type specimen of *P. vitiensis* Gill. was not available, but I hardly hesitate to insert this species here on account of its description and figure and of the fact that *A. C. Smith 920* bore the (authentic?) determination *Planchonella vitiensis* Gillespie.

The synonymy of *Sapota? pyrulifera* is not certain, as I did not see the type specimen. However, both Gray's description ("fructu semipollicari") and an annotation on the Kew specimen of *Crosby 101* (? *Sideroxylon* cf. *Sapota pyrulifera* A. Gray) make the identity probable. On the other hand, Gray mentions that the fruits are 1-seeded, which is unusual in *P. oxyedra* and *Christophersen 2775* possesses unusually large leaves (up to 16.5 × 6.5 cm; sterile branchlet).

10. *P. sandwicensis* (A. Gray) Pierre, Not. Bot. Sap. 1890, 36; Dubard, Ann. Mus. Col. Mars. 20, 1912, 32; Skottsberg, Meddel. Göteborgs Bot. Trädgård X, 1936, 152 — *Sapota sandwicensis* A. Gray, Proc. Am. Acad. V, 1862, 328; Seemann, Fl. Vit., 1865—1870, 151 (*S. sandwichensis*); Mann, Proc. Am. Acad. VII, 1868, 188; Wawra, Flora 58, 1875, 252 — *Sideroxylon sandwicense* (A. Gray) Benth. & Hook., Gen. Pl. II, 2, 1876, 655 ex Hillebrand, Fl. Haw. Isl. 1888, 276; Engler, Bot. Jahrb. 12, 1890, 518 and in Engl. & Prantl, Nat. Pfl. Fam. IV, 1, 1897, 144, fig. 77; Drake del Castillo, Ill. Fl. Ins. Mar. Pac. 1892, 228; Rock, Indig. Trees Haw. Isl. 1913, 383, pl. 153 — *Sideroxylon spathulatum* Hillebrand, Fl. Haw. Isl. 1888, 277; Engler, l. c. 1890 and 1897; Rock, l. c. 391 — *S. rhynchospermum* Rock, Torr. Bot. Club Bull. 37, 1910, 295, figs. 2 and 3 a—b and in Report Haw. Bd. Comm. Agr. & For. 1911, 84, pl. 21 and in Indig. Trees Haw. Isl. 1913, 387 — *S. auahiense* Rock, Coll. Haw. Publ. Bot. Bull. 1, 1911, 18, pl. 5 and l. c. 1913, 387, pl. 156—158 — *Myrsine molokaiensis* Léveillé in Fedde, Repert. spec. nov. 10, 1911, 154 — *Suttonia molokaiensis* Léveillé in Fedde, l. c. 10, 1912, 373 — *Planchonella spathulata* (Hill.) Pierre in Dubard, Ann. Mus. Col. Mars. 20, 1912, 52 — *Sideroxylon Ceresolei* Rock, Indig. Trees Haw. Isl. 1913, 385 — *Planchonella aurantium* (Rock) Skottsberg, Meddel. Göteborgs Bot. Trädgård X, 1936, 152 — *P. puulupensis* Baehni & Degener, Fl. Haw. 3, 13. 5. 1938 — *P. densiflora* (Hill.) Pierre MS. in Herb. Par. — *P. Meeboldii* Baehni & Degener MS. in Herb. O. Degener — *P. Remyi* Pierre MS. in Herb. Par.

Trees or more rarely shrubs, with milky juice, up to 12 (acc. to field labels) or even 20 (acc. to Rock) m high, up to 0.6 m in diam. Branchlets slender, terete, greyish, the tips often more or less densely appressedly rusty pubescent, more rarely subglabrous. Leaves estipulate, extremely variable in size, shape, thickness, colour (when dry) and indumentum, mostly oblong, elliptic, ovate, obovate or more rarely almost circular, base always acute, sometimes cuneate or decurrent, apex rounded

to bluntly acute, margins entire, (1.2—)3—15(—31.5, sterile branchlets) cm long, (0.6—)1.3—7.5(—10.3) cm broad, petioles (0.5—)1.2—3.5(—4) cm, blade more or less rigidly chartaceous or subcoriaceous, greenish, yellowish or brown above when dry, when thin often with involute margins, glabrous from the beginning or with a dark or light brown, golden, yellowish or whitish indumentum, particularly in youth and on the lower surface; indumentum more or less dense, woolly or appressed, more or less soon disappearing with age, the upper side always glabrescent; midrib strongly prominent below, secondary nerves numerous, arising at an angle of (45°—)50°—80°(—90°) from the midrib, conspicuous but not very much prominent on either side except on lower one, generally rather straight; sometimes slightly curved, very close to the midrib abruptly descending, very close to the margin united into rather flat arches or intramarginal nerve almost straight; number hardly to be stated on account of the main tertiary nerves being almost as strong as the secondary ones, but number of marginal arches 6 or 7 in the smallest, up to about 50 in the largest leaves; however, these arches may in the middle of the leaf be broken into two smaller ones if a stronger tertiary nerve is reaching the margin; in general there are about 4—12 stronger nerves to the cm, owing to the condition whether one or three of the tertiary nerves are stronger or all tertiary nerves are reticulate (yet generally parallel to the secondary ones). Inflorescences fasciculate in the leaf-axils, mostly 1—4-, rarely up to 7-, or even 12-florous, the fruits mostly solitary or two, very rarely three together; pedicels densely appressedly ferruginously or golden-brown or greyish tomentose, sometimes glabrate in fruit, very variable in length, the flowers and fruits from almost sessile to pedicels up to 3 cm long in flower, up to 3.5 cm in fruit, slender or thick. Sepals 5, quincuncially arranged, densely pubescent outside, glabrous within, almost circular or ovate to deltoid and acute, 0.25—0.5 cm long (buds 0.35—0.6 cm, acute to ovoid), in fruit hardly enlarged but often patent or somewhat reflexed, the calyx up to 1.0 cm in diam. Corolla pale green (*Forbes 1076*), glabrous, somewhat exsert, 0.3—0.6 cm long, the tube 0.1—0.2 cm long, the 5 lobes imbricate, ovate with rounded or broadly and bluntly acute apex, and 0.25—0.4 cm long. Androeceum usually extant, very rarely reduced (*Rock, Sid. auahiense*). Stamens 5, inserted in the throat, filaments about as long as the anthers, often the upper portion curved inward when young, anthers ovoid or cordate to oblong and somewhat mucronate at tip, often dehiscing in the bud; staminodes 5, large and broad, petaloid, oblong or oblong-ovate, the apex rounded or acute and sometimes ligulate (broadened at tip), 0.18—0.25 × 0.05—0.125 cm. Ovary 0.25—0.3 cm high, 5-celled, glabrous or covered with appressed hairs far up the style, at base surrounded by a usually entirely, rarely partly free disc, the rim and surface of which is densely covered with long erect hairs which envelop the whole basal part of the ovary; style columnar or slightly tapering, the stigma rounded or slightly clavate and provided with 5 minute pores; ovules attached in the upper half of the cells. Fruit minutely pubescent or mostly glabrous, the pericarp mostly rather thick, hard when dry, when living apparently either hard or fairly pulpous, very rarely (particularly in 1-seeded fruits)

thin, 5—1-seeded, very variable in size and shape, globular, pyriform or obpyriform to oblong, the apex rounded or distinctly beaked, sometimes slightly furrowed, 1.5—5 cm long and 1.1—3.5 cm in diam., when ripe greyish white yellow, orange or reddish to blackish purple, the flesh mostly yellowish; seeds more or less flattened, pointed or more or less rounded, rarely beaked at both ends, to ovoid (in 1-seeded fruit), variable in size, 1.15—3.7 cm long, 0.6—1.4 cm broad and 0.4—0.7 cm across; scar almost as long as the seed and 0.1—0.2 cm broad; testa usually very hard and bony, 0.1—0.15 cm thick, very rarely thin and flexible; albumen abundant; cotyledons flat and foliaceous; radicle hardly to fairly exsert — *Type specimen: Rémy 478.*

*Planchonella sandwicensis* is one of those extremely polymorphous groups, for which some insular floras, and particularly the Hawaiian Islands, have a certain reputation. I may recall here such cases as that of *Croton Scouleri* from the Galapagos Islands (Am. Journ. Bot. 22<sup>2</sup>, 1935, 69) and of *Nesoluma* (Occ. Pap. B. P. Bish. Mus. XIV, 1938, 127), *Gouldia* (B. P. Bish. Mus. Bull. 147, 1937), *Astelia* (B. P. Bish. Mus. Bull. 117, 1934), *Pittosporum*, etc. of the Hawaiian Islands.

In the case of *Planchonella sandwicensis* the polymorphy is so extreme that it will probably be a hard task to convince local residents that even the most divergent specimens can, at least by morphological methods only, not be separated into different species. I have had the opportunity to examine and compare more herbarium specimens (to be exact, 160) of this species than probably any other systematist, including the type specimen as well as the types of all synonyms. I have studied this single species for more than four years and with a number of systematic methods. I have invited two of my junior collaborators to study the group unbiased by my views, and one of them, Mr. J. E. Boeke, has taken the trouble to work up the material along statistical lines. All our results pointed to the well-known alternative: either many small species with extremely vague boundaries, giving rise to endless discussions about the specific delimitation as well as about the identification of individual specimens, or one single large and polymorphous species. The choice was, after all, not difficult, for *P. sandwicensis*, with all its polymorphy, is, as a whole, sharply distinguished, even from the closely related *P. costata* from the Southern Pacific, by its broad and petaloid staminodes. I have no objection whatsoever against being a species splitter, as long as there actually is something to be adequately split up, and in the present case everything pointed to the conclusion that there isn't. This conclusion needs, however, not necessarily be final, as important means of investigation lay beyond our possible reach, viz. field observations, cytological studies, etc. The former comprise not only ecological studies but also such characters as cannot be sufficiently well investigated in dried material, i. e. particularly the fruit characters. I am fully aware of the fact that I am in a most unfavourable position in comparison with such authors as Rock, who had an opportunity to study the species in the field and who did a great deal of collecting work himself. Although there are, taxonomically speaking, some less felicitous points in his work, it generally makes a trustworthy impression and it is, therefore, a perilous thing





Fig. 4 — Various forms of *Planchonella sandwicensis* (A. Gray) Pierre.

- |  |   |
|--|---|
| A — var. $\alpha$ fa a — R my 478 (type spec. <i>P. sandwicensis</i> ) (nr. 25A) | N — transitional $\alpha$ — $\beta$ — Forbes 2495 (nr. 6)         |
| B — " " " — Rock 8107 (nr. 49)   | P — " " — Forbes 2245 (nr. 107)                                   |
| C — " " " — St. John 11589 (nr. 70)  | Q — var. $\beta$ fa b — Meebold 10663 (nr. 124)                   |
| D — " " " — Rock 8106 (nr. 51)   | R — " " " a — Forbes 1936 (nr. 106)                               |
| E — " " " — Munro 285 (nr. 21)   | S — " " " — Rock (B) (nr. 154)                                    |
| F — " " " — Forbes 2112 (nr. 9)  | T — " " " — Forbes 2073 (nr. 158)                                 |
| G — " " " — " 1773 (nr. 7)   | U — " " " — " 46 (nr. 112)  |
| H — " " " — " 1439 (nr. 8)   | W — " " " — Rock 8684 (nr. 129)                                   |
| K — " " " — Bryan 660 (nr. 86)   | X — " " " — Munro 54 (nr. 169)                                    |
| L — " " " b — St. John 10362 (nr. 73)  | Y — " " " — R my 475 (nr. 172) (type spec. <i>P. spathulata</i> ) |
| M — transitional $\alpha$ — $\beta$ — R my 476 (nr. 98)                          |   |

All figures half of natural size.

to venture and disagree with so thorough an author on fundamental points. The conclusion cannot be but this one, that in the present work we give the results of our merely morphologically taxonomic investigations as a possible working basis for those local botanists, who feel inclined to check our results in the field and to give a final shape to the taxonomy of what I provisionally cannot but consider one species.

Before entering at some length upon the ideas of previous botanists and particularly of Rock, let me now mention the considerations to which our studies of the material have led us.

As has already been pointed out, this material shows an amazing variability in practically all characters (cf. *Fig. 4*). This affects particularly the following points:

Leaves large to small,  
apex rounded to acute,  
chartaceous to coriaceous,  
glabrous to pubescent (indumentum more or less woolly or appressed, and dark rusty brown, bright brown, golden brown or yellow, or silvery grey).

Pedicels long to very short (flowers almost sessile)

Sepals large to small,  
rounded to acute

Fruits large to small

rounded at apex or more or less beaked,  
fleshy or more or less hard and dry.

There are undoubtedly several more characters in which a certain variation may be stated, such as: numbers of flowers in the leaf axil, petals and staminodes rounded to more or less acute, ovary (apart from the disc which is always pilose) glabrous or pubescent, seeds rounded or acute (insufficiently known to me), etc., but those enumerated above are probably the most important ones, and it may be remarked that they all allow smooth gradations between the extremes. At my suggestion, Mr. Boeke choose five sets of them for a statistical investigation, viz. leaves large to small, leaf apex rounded to acute, pedicels long to short, sepals rounded to acute and fruit with rounded or acute apex. His results will be more circumstantially dealt with in a separate paper<sup>1</sup>), but it may be mentioned here that they also pointed to the total absence of any sharp discontinuities, although he could distinguish two main groups. As, however, the extreme types of these groups are so far apart as to make some sort of subdivision desirable for merely practical purposes, the extremes having of old been distinguished as *Sideroxylon sandwicense* and *S. spathulatum* respectively, I recapitulated Boeke's results in a somewhat abbreviated form, with regard to the fact that some characters show a certain undeniable correlation. These correlations are generally the following. Larger leaves with rounded apices are generally found in specimens with long pedicels and rounded sepals. In general, it may be stated that acuteness of the leaf tips correlates with acuteness of the sepals

<sup>1</sup>) Cf. "Blumea" V, No. 1, pp. 47—60.

and, though to a smaller degree, of the petals and the staminodes and possibly even of the fruits. The indumentum shows less clear correlations, but the grey-silvery indumentum seems to occur particularly in the smaller leaves. Meanwhile, these correlations are, of course, by no means strict or exclusive. In fact, it is on account of the many exceptions, that no discontinuities could be stated and most of the characters mentioned show the phenomenon of homologous variations, being exceptions to the rule of the correlations. For instance, specimens with rounded leaf tips and more or less acute sepals are by no means rare (most of them are classified under var.  $\beta$ , see below), but acute-tipped leaves rarely go together with more or less rounded sepals (only 3 specimens, viz. nrs. 86 [ $\alpha$ ], 107 [ $\alpha$ - $\beta$ ] and 102 [ $\beta$ ]; for the signification of the numbers see below.) However this may be, the correlation mentioned enabled me to simplify the scheme and to imply only three characters in order that all specimens can be arranged in a two-dimensional scheme. These characters are the length of the leaves, the shape of the leaf tips and the length of the pedicels. *Fig. 5* contains all specimens quoted underneath, indicated by the number used in Boeke's work. These numbers are corresponding with the specimens in the following way:

1. *C. N. Forbes* 989 — 2. *C. N. Forbes* 648 — 3. *C. N. Forbes* 845 — 4. *C. N. Forbes* 381 — 5. *C. N. Forbes* 1076 — 6. *C. N. Forbes* 2495 — 7. *C. N. Forbes* 1773 — 8. *C. N. Forbes* 1439 — 9. *C. N. Forbes* 2112 — 10. *J. F. Rock* 8002 — 11. *J. F. Rock* 8003 — 12. *J. F. Rock* 8063 — 13. *J. F. Rock* 8510 — 14. *J. F. Rock* 8670 — 15. *H. L. Lyon* 6061 — 16. *J. F. Rock* 17057 — 17. *H. St. John* 10582 — 18. *C. Skottsberg* 1004 — 19. *G. C. Munro* s.n. (June 27, 1915) — 20. *G. C. Munro* 407 — 21. *G. C. Munro* 285 — 22. *G. C. Munro* 264 — 23. *J. F. Rock & Hammond* 8064 — 24. *W. Hillebrand & J. M. Lydgate* s.n. (Maui) — 25A. *J. Rémy* 478 — 25B. *Ballieu* s.n. — 25C. *V. Krajina* 125 — 26. *W. Hillebrand* s.n. (Molokai) — 27. *C. N. Forbes* 138 — 28. *C. N. Forbes* 8 — 29. *C. N. Forbes* 115 — 30. *C. N. Forbes* 1669 — 31. *C. N. Forbes* s.n. (March, 1920) — 34. *C. N. Forbes* 1944 — 37. *C. N. Forbes* 199 — 39. *G. C. Munro* 204 — 41. *G. C. Munro* 53 — 42. *G. C. Munro* 52 — 43. *G. C. Munro* s.n. (Apr. 1915, Haalelepaakai) — 44. *Abbé Faurie* 687 — 45. *Abbé Faurie* 686 — 46. *J. F. Rock* 2198 (= 1495) — 47. *J. F. Rock* 5512 (= 5509) — 49. *J. F. Rock* 8107 — 51. *J. F. Rock* 8106 — 52. *J. F. Rock* 8122 — 54. *G. P. Wilder* 455 — 57. *J. F. Rock* s.n. (Kauai, Oct. 1911) — 58. *J. F. Rock* 2085 — 59. *J. F. Rock* s.n. (Kauai, 1910) — 60. *J. F. Rock* 5507 (= 5509) — 61. *J. F. Rock* 5511 (= 5509) — 62. *J. F. Rock* 1507 (= 1495) — 63. *J. F. Rock* 2197 (= 1495) — 64. *J. F. Rock* 1624 (= 1495) — 65. *G. C. Munro* 263 — 66. *O. Degener*, etc. 11067 — 68. *J. F. Rock* 10150 — 69. *C. M. Cooke* 3 — 70. *H. St. John* 11589 — 72. *H. St. John* 9937 — 73. *H. St. John* 10362 — 74. *A. Meebold* s.n. (Oahu) — 75. *C. N. Forbes* s.n. (Febr. 12—19, 1909) — 77. *C. N. Forbes* 2113 — 78. *E. Y. Hosaka* 992 — 79. *E. Y. Hosaka* 860 — 81. *E. Y. Hosaka* 1015 — 83. *E. Y. Hosaka* 841 — 84. *E. Y. Hosaka* 665 — 85. *G. R. Ewart* III, 61 — 86. *E. H. Bryan Jr.* 660 — 88. *G. W. Russ & D'A. Welch* s.n. (June 22, 1933) — 89. *E. Inouye* s.n. (Nov. 5, 1933) — 90. *J. Rémy* 478a — 92. *E. Christophersen* 3666 — 93. *E. Christophersen* 3664 — 96. *N. H. Krauss* s.n. (Jan. 8, 1933) — 97. *N. H. Krauss* s.n. (May 14, 1933) — 98. *J. Rémy* 476 — 99. *G. C. Munro* 392 — 100. *J. F. Rock* 7077 — 101. *J. F. Rock* 17120 — 102. *J. M. Lydgate* s.n. (Kauai) — 103. *C. N. Forbes* 2040 — 104. *C. N. Forbes* 1882 — 105. *C. N. Forbes* 1927 — 106. *C. N. Forbes* 1936 — 107. *C. N. Forbes* 2245 — 112. *C. N. Forbes* 46 — 113. *C. N. Forbes* 137 — 114. *A. F. Judd* 19 — 115. *W. Hillebrand* s.n. (Oahu) — 116. *H. St. John* 11584 — 118. *C. N. Forbes* 1979 — 119. *C. N. Forbes* 2018 — 120. *C. N. Forbes* 2114 — 122. *G. C. Munro* 394 — 123A. *V. Krajina* 127 — 123B. *V. Krajina* 128 — 124. (*A. Meebold* in) *Herb. Degener* 10663 — 125. *C. Skottsberg* 1820 — 126. *J. F. Rock* 17029 — 127. *J. F. Rock* 10029 — 128. *J. F. Rock* 3971 (= 3966 = 3973) — 129. *J. F. Rock* 8684 — 130. *J. F. Rock* 8668 — 132. *J. F. Rock* (A) — 134. *C. N. Forbes* 31 — 135. *C. N. Forbes* 98 — 136. *C. N. Forbes & J. C. Bridwell* 2460 — 137. *A. Meebold* s.n. (Huehue) — 138. *A.*

# PLANCHONELLA SANDWICENSIS (A. GRAY) PIERRE

ARRANGEMENT OF 159 SPECIMENS ACCORDING TO MEAN LENGTH OF LEAVES, SHAPE OF LEAF-TIPS AND MEAN LENGTH OF PEDICELS.

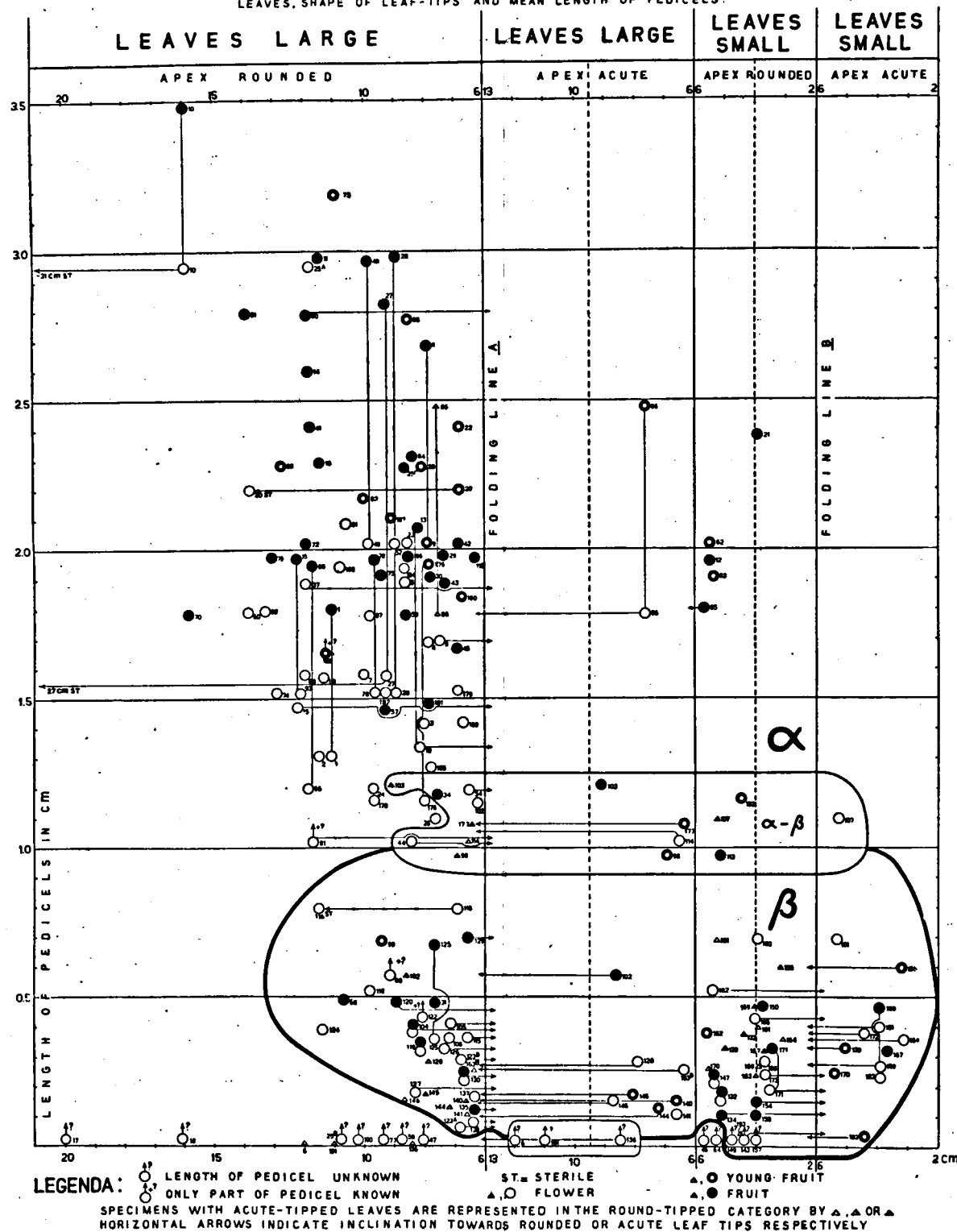


Fig. 5 — N.B. In the legenda it is indicated that plants with acute-tipped leaves bearing flowers or young fruits, are represented by a black triangle. As has been mentioned in the next line underneath, this should, of course, be open or half-black triangles respectively, in accordance with the open or half-black circles for specimens bearing flowers or young fruits and having round-tipped leaves.

The only specimen left out it *Munro 54a* (cf. note on p. 19).

Meebold s. n. (Kilauea) — 139. *Shea & Stevens* s. n. (Jan., 1928) — 140. *C. Skottsberg* 668 — 141. *C. Skottsberg* 1963 — 143. *J. F. Rock* s. n. (March, 1912, Puuwaawaa) — 144. *J. F. Rock* s. n. (Puuwaawaa or Kapua) — 145. *J. F. Rock* 3820 — 146. *J. F. Rock* 3912 — 147. *J. F. Rock* s. n. (Maui, Oct. 1910) — 149. *C. N. Forbes* 118b — 150. *C. N. Forbes* 118 — 152. *J. F. Rock* 6154 — 153. Abbé *Faurie* 435 — 154. *J. F. Rock* (B) — 155. *A. F. Judd* 49 — 157. *C. N. Forbes* 2066 — 158. *C. N. Forbes* 2073 — 161. *C. N. Forbes* 297 — 162. *C. N. Forbes* 108 — 163B. *G. C. Munro* 32 — 164. *W. Hillebrand* s. n. (Lanai) — 165. *G. C. Munro* s. n. (May 12, 1915) — 166. *G. C. Munro* 401 — 167. *G. C. Munro* s. n. (Apr. 6, 1915, Kaa) — 169. *G. C. Munro* 54<sup>1)</sup> — 170. *G. C. Munro* 244 — 171. *J. F. Rock* 8039 — 172. *J. Rémy* 475 — 173. *G. P. Wilder* 88 — 176. *H. St. John* etc. 10724 — 177. *A. F. Judd* s. n. (June 4, 1938) — 178. *Hillebrand* s. n. (leg. 1858, Oahu, Nuuanu) — 179. *Hillebrand* s. n. (Maui, Kanapali, Aug. 1870) — 180. *Hillebrand* s. n. (Maui, Wailuku) — 181. *Knudsen* (herb. *Hillebrand*) s. n. (Kauai) — 182. *Hillebrand* s. n. (leg. 1874) — 183. *Hillebrand* s. n. (leg. 1874, Lanai) — 184. *Hillebrand* s. n. (Lanai, July 1874) — 185. *O. Degener & H. Wiebke* 2278 — 186. *O. Selling* 3689 — 187. *O. Selling* 3674 — 188. *L. M. Cranwell* 3516 — 189. *C. Skottsberg* 2851 — 190. *O. Selling* 3349 — 191. *L. M. Cranwell, O. Selling & C. Skottsberg* 2779 — 192. *O. Selling* 3365 — 193. *L. M. Cranwell, O. Selling & C. Skottsberg* 3210.

The figure shows an arrangement of these 159 specimens according to the average length of the pedicels (ordinate) and to the average length of the leaves (abscissa). Both categories in the abscissa are subdivided into two subcategories: leaf-apex rounded and leaf-apex acute. The items in the subcategories leaf-apex acute have, in addition, been transferred by a small triangle into the subcategories leaf-apex rounded. Those specimens in which pedicels of flowers or fruits were not extant, have been put at the bottom abscissa only, according to the length and the shape of their leaves. In this way it is possible to survey, by means of folding the sheet along the lines A or B respectively: 1. all specimens with rounded leaf-tips (column 2 folded inward, col. 4 outward), which shows at the same time all specimens involved, as the acute-tipped ones are represented by a triangle, and 2. all specimens with acute leaf-tips (col. 1 folded outward, col. 3 inward). As specimens with flowers, young fruits and ripe fruits have been indicated by separate signs, it is shown that the specimens with pedicels longer than about 2 cm are mostly fruiting ones, though not exclusively so (nrs. 10, 25A and 73). It is also evident that the pedicels use to enlarge after flowering time in those specimens in which they are long from the beginning, while the enlargement is scanty or even none in the specimens with subsessile flowers. As a tendency towards acuteness of the leaf tips in rounded leaves is indicated by arrows pointing towards the acute-tipped subcategory and, likewise, a tendency to rounded apices in generally acute-tipped leaves by arrows pointing towards the subcategory with rounded tips, it is shown that, in general, the specimens with shorter pedicels show an inclination to have their leaf-tips more or less acute.

The given arrangement shows an almost continuous band of specimens running from the large-leaved long-pedicelled type to the smaller-leaved short-pedicelled one, leaving entirely blank only the area in which long-pedicelled specimens with small acute leaves would have to be inserted, if there would be any. The impression is suggesting itself that the continuity would even be still more complete, as more material would be

<sup>1)</sup> *Munro 54a*, pasted to the same sheet as *54* and, though from a different locality, bearing the same name, was only detected later. Possibly there is still a third specimen on this sheet (Mahana, fr., Nov. 22, 1913), but this has not been separately considered.

available. Yet, as it is, there is one slight discontinuity just below the 1 em pedicel length line and this yields a welcomed opportunity for the subdivision which is desirable from a merely practical standpoint. It roughly divides the material into what I cannot give a higher taxonomic rank than varieties, which I propose to call  $\alpha$  *typica* and  $\beta$  *spathulata*, the characters of which will be enumerated underneath; and I would probably have chosen the rank of formae, if there would not be a certain geographical difference between the two. Still, there remained some 14 specimens which did not allow themselves to be inserted in either of the two varieties. These have been kept apart as transition forms and a short argumentation for their transitional nature will be added to the quotation of each specimen. In *Fig. 5* these specimens have been encircled by a line. This group underlines the lack of discontinuities in the characters involved. These conditions seem to make it rather improbable that the characters of the fruits and of the seeds will prove to yield essentially different views on the taxonomy. But, as has been said above, this has to be left to an investigation by local botanists. That a museum taxonomist has to be extremely careful in his conclusions is shown by the fact that two small groups of specimens were sufficiently well distinguished to be given the rank of formae (and fruits and seeds might lead to similar considerations), distinguished by me as var.  $\alpha$  *typica* forma *puulupensis* and var.  $\beta$  *spathulata* forma *densiflora*. My attention to this condition was drawn by the fact that Rock (Indigenous Trees of the Hawaiian Islands, 1913, p. 383) bases his key to the five species of *Sideroxylon*, distinguished by him, primarily on the number of flowers in a leaf axil. This character apparently shows no sharp limits either, so that Rock's key is, taxonomically speaking, not very practical. I found the following figures among the 82 flowering or fruiting specimens:

variety nr. of flow. p. leaf axil	$\alpha$	$\alpha-\beta$	$\beta$	Total
1	10	1	7	18
1—3(—4)	22	5	29	56
(1—)4—7	5	—	2	7
6—12	—	—	1	1
Total	37	6	39	82

By far the greatest number showed 1—3, rarely 4 flowers per leaf axil, viz. 32 out of 37  $\alpha$ 's, all transition forms and 36 out of 39  $\beta$ 's, in total 74 out of the 82, procentually about equally distributed over the two varieties. Of the 8 remaining specimens 5 belong to var.  $\alpha$ ; they include the type of *Planchonella puulupensis* (nr. 66) and four more

or less similar specimens, all from Oahu (viz. nrs. 73, 74, 78 and 93). Neither by this nor by any other character this type can be sharply distinguished from the rest of the material, yet they might provisionally be taken together under the name of forma *puulupensis*, exclusively on account of the number of flowers in the leaf axils being (1—)4—7, instead of 1—3(—4) in the forma *typica*. The 3 other specimens, belonging to var.  $\beta$ , include the type of *Planchonella densiflora* (*Sideroxylon spathulatum*, var. *densiflorum*) from Oahu, which is distinguished by densely clustered many-florous inflorescences at the tips of the branchlets. Among the material examined this character is represented by only this single specimen (nr. 115), at least in so extreme a form. The two other specimens of this category (nrs. 124 and 138), including the type of *Planchonella Meeboldii* (Oahu) show unmistakable relations to it, both showing a tendency to crowded inflorescences at the tips of the branchlets, and nr. 138 (from Hawaii) is, in a way, intermediate between *P. densiflora* and *P. Meeboldii*. This small group might therefore provisionally be distinguished under the name of forma *densiflora* with (1—)4—7(—12) flowers in the leaf axils, instead of 1—3(—4) in the forma *typica*. It is almost exactly the short-pedicelled counterpart, the homologous variation, in var.  $\beta$  of the long-pedicelled forma *puulupensis* in var.  $\alpha$ .

However, it must be emphasized again that these formae are probably as little as or even still less distinct than the varieties. It may be expected that there are several more specimens among the material quoted underneath, which should be inserted in one of the formae, but which have not been recognized on account of the absence of flowers or of the scantiness of the material. The latter is suggested by such specimens as *St. John 10362* and *Hosaka 992*, some sheets of which show the *typica*-condition, while others have the number of flowers per leaf-axil, by which forma *puulupensis* is characterized. These conditions again suggest that the delimitation of the formae is still more artificial than that of the varieties and that, as more specimens are available, the discontinuity of the character of the number of pedicels per leaf-axil will gradually disappear, a character which, by the way, seems not to correlate at all with any other. A very striking example of the little value to be attributed to the formae, is given by the specimens collected by A. Meebold at Huehue and at Kilauea crater road respectively. These specimens are strikingly similar in all characters, but the first-named has few, the last-named more flowers per leaf-axil. Accordingly the Huehue specimen had to be inserted in var.  $\beta$ , forma a, the Kilauea specimen in var.  $\beta$ , forma b.

After the taxonomical work was completed, I found what might be considered a geographical confirmation both of the subdivision into two varieties and of their transitional nature. At least, I hope the phenomenon is supporting my views rather than that it is put forward to prove a preconceived opinion. It appears, namely, that var.  $\alpha$  is distinctly dominating in the western islands (Kauai and Oahu) and that it is entirely wanting in Hawaii, whereas var.  $\beta$  is dominating in the last-named island. Going from NW. to SE.,  $\alpha$  gradually loses its preponderance and in about the same rate  $\beta$  increases in number. In the central group of islands (Molokai, Lanai and Maui) the two varieties

are fairly equally represented. These conditions, which indicate a genetical (taxonomical) rather than an ecological origin of the variability, may be stated from the following table, in which the figures are the numbers of specimens found in each island and which, in my opinion, agrees more satisfactorily with the taxonomy of the group than a map on which the areas of Rock's species are drawn:

Island var.	no loc. men- tioned	Kauai	Oahu	Molokai	Lanai	Maui	Hawaii	Total
$\alpha$	2	20	28	2	20	14	—	86
$\alpha-\beta$	—	—	6	3	1	3	1	14
$\beta$	2	1	8	3	16	15	15	60
Total	4	21	42	8	37	32	16	160

Finally I may add a few words on previous subdivisions of the species. Asa Gray (Proc. Am. Ac. V, 1862, 328) recognizes only one species, *Sapota sandwicensis* Gray with two unnamed varieties,  $\alpha$  with large leaves and  $\beta$  with small ones. Var.  $\alpha$  agrees with our var.  $\alpha$  *typica* (Rémy 478), var.  $\beta$  is partly a transition form (Rémy 476), partly var.  $\beta$  *spathulata* (Rémy 475). Hillebrand (Flora Haw. Isl. 1888, 276) mentions two species: *Sideroxylon sandwicensis* (Gray) Benth. & Hook. (= Gray's var.  $\alpha$ ) with its variety *auratum* Hill., and *S. spathulatum* Hill. (= Gray's var.  $\beta$ ) with its variety *densiflorum*. This subdivision fairly well agrees with the views laid down in the present paper but for such minor points as the insertion of the filaments (cf. Hillebrand's key) and the distinction and diagnosis of var. *auratum* of *Sideroxylon sandwicense*. As has already been stated above, the indumentum shows very little correlation with other characters; moreover, the corolla can hardly be "densely ferruginous", as this would be a unicum in the species, and probably in the genus. At least, in the many flowers I examined, I never found a trace of pubescence in the corolla.

Later on, Pierre transferred these two species to his genus *Planchonella*, adding two MS. names which have never been validly published, *P. densiflora* (Hill.) Pierre (= *Sideroxylon spathulatum* Hill. var. *densiflorum* Hill.) and *P. Remyi*.

As more material was collected and more field work done, the progress in the knowledge of the variability of the species is showing itself in the splendid work on the indigenous trees of the Hawaiian Islands by Rock (1913, p. 381—392, Pl. 153—158), who distinguishes no less than five separate species, viz. *Sideroxylon sandwicense* (Gray) Benth. & Hook., *S. rhynchospermum* Rock, *S. auahiense* Rock with its variety *aurantium* Rock, which Skottsberg later on gave specific rank (*Planchonella aurantium*



[Rock] Skotts.), *S. spathulatum* Hill. with its two varieties *densiflorum* Hill. and *molokaiense* (Lév.) Rock (based upon *Myrsine molokaiensis* Lév. and *Suttonia molokaiensis* Lév.) and *S. Ceresolii* (recte *Ceresolei*) Rock.

To these Baehni and Degener later on added their *Planchonella puulupensis*; a seventh species distinguished by the same authors, *P. Meeboldii*, was withheld in expectation of the results of the present paper. Even for a man who has seen a great many dried specimens, the distinction of Rock's species is not very clear. As has already been pointed out above, his key is, taxonomically speaking, little effective and though a careful comparison of his specific descriptions may lead to a general idea of the groups in question, it is certainly insufficient for a doubtless identification of a great part of the specimens. A systematic elaboration which fails to show the way to other botanists, even if the author himself may be perfectly sure to be able to attribute any given specimen to one of his species, either betrays the incompetence of its author or shows that the material did not allow a satisfactory subdivision. I am convinced that the latter condition is found in *Planchonella sandwicensis*, for it be far from me to suggest that Rock's work in this group has been a failure; future investigations have to decide what is trustworthy and lasting in his work as well as in mine. I therefore need not quote the major points of his specific descriptions. It remains to be seen whether the beakedness of the seeds of *Sideroxylon rhynchospermum* is so exclusive as to justify a separate species. The same may be said with respect to *S. Ceresolei*, the radicle of which is said to be usually long. That *S. auhaiense* should be a "good species" is, in my opinion, not proved by the unisexual flowers, by the pale glabrous leaves and by the fact that it grows in company with *S. sandwicense*, but perhaps the fruit may reveal better characters. The two other species, *S. sandwicense* and *S. spathulatum* are more or less in accordance with my two varieties, but provisionally I see no reason for maintaining a var. *molokaiensis* on so vague a distinction.

What Rock means by a "membraneous", "thin papery" or "thin chartaceous" pyrena in which the seeds should be enclosed, is not clear to me, unless the inner surface of the endocarp is referred to. That in *S. spathulatum* the radicle is described as superior, is evidently a slip of the pen. In some cases the staminodes are described by Rock as linear (*S. rhynchospermum*, *S. sandwicense*) but in the many flowers I dissected, I failed to discover any other than more or less petaloid, at any rate always relatively broad staminodes.

As has already been stated above, I am insufficiently familiar with the fruits, seeds and embryos and it needs further investigation on living material to state, whether their features may give rise to any more formae. This is, however, again a slippery ground to tread upon, in which one should beware of the pitfalls of homologous variations as well as of ecotypes. It should not be overlooked that homologous variations are primarily of a genetical, ecotypes of an ecological nature and that confusion or juxtaposition of such heterogeneous units should be avoided in practical taxonomy. In taxonomy the species which shows distinct discontinuities towards other species, remains the primary unit. At any rate, a thorough investigation of living material and in the field may clear up several

points which cannot be detected by herbarium-taxonomy. They should include studies on fruits and seeds and their eventual correlations with other characters, further the response of the characters to various ecological factors, especially important in islands in the trade wind region with their moist windward and their dry leeward slopes. Furthermore the sterility of seeds, since in *Sideroxylon sandwicense* the seeds have often been found abortive, which fact might indicate a sterility of the embryo-sac and therefore a hybrid nature. This points to the desirability of an investigation of the degree of sterility of the pollen. As the precocious dehiscing of the anthers in the bud is often stated — a feature found in many other species of *Planchonella* and of related genera — it might be useful to investigate the way of the fertilization; I presume these plants are more or less, if not exclusively, autogamous, a condition which would naturally favour the variability as eventual mutations can then not escape by hybridization. Finally cytological studies and eventually genetical experiments may throw some more light on the complicated structure of what in the present paper is comprised under the name of *Planchonella sandwicensis*.

Meanwhile, what I have been able to gather from the field labels, will be mentioned at the end of the enumeration of the exsiccatae.

**Var.  $\alpha$  typica**, nova var. (including the type specimens of *Sapota sandwicensis* var.  $\alpha$ , *Sideroxylon sandwicense*, *S. rhynchospermum*, *Planchonella puulupensis* and *P. Remyi*) — Pedicelli longiores, in fructu elongati. Folia majora apice plerumque rotundata, rare acutiuscula. Sepala rotundata vel subacuta. Fructus plerumque majores — Pedicels 1—3, in fruit elongate and up to 3.5 cm long. Leaves mostly longer than 6 cm and with rounded apex, rarely smaller or with acute apex. Sepals rounded but not rarely more or less acute. Fruits mostly large, with rounded apex. Trees, up to 20 m high — *Type specimen*: Rémy 478.

**Forma  $\alpha$  typica**, nova forma — Flores in axillis 1—3(—4) — Flowers 1—3(—4) in a leaf-axil — *Type specimen*: Rémy 478.

**Hawaiian Islands** — without exact locality: *Ballieu s.n.* (ster., P., L.); *Hillebrand s.n.* (leg. 1874, flow.; B.; pasted to same sheet a specimen of var.  $\beta$ ).

**Kauai** — without exact locality: *Rock s.n.* (y. fr. in Oct. 1911; Bish.); *Id. 2198* (= 1495) (ster. on Feb. 14—26, 1909, nat. name "ala"; Bish., L.); *Knudsen* (herb. *Hillebrand*) *s.n.* (fr.; B.) — Kaholuananu: *Forbes 381* (fl. buds in Sept. 1909; Bish.); same loc.: *Rock 2085* (fr. on March, 3—10, 1909; Bish.); same loc.: *Id. s.n.* (fr. in Oct. 1910; Bish.); same loc., alt. 1080 m: *Id. 5507* (= 5509) (fl. in Sept., 1909; Bish.), *5511* (= 5509) (fl., same date, Bish.) and *5512* (= 5509) (ster., same date; Bish.) — Wahiawa Mts.: *Forbes 199* (fl. buds in Aug. 1909; Bish.) — Halemanu: *Rock 1507*, *1624* and *2197* (all. = 1495, y. fr. Feb. 14—16, 1909; Bish.) — Hii Mts.: *Forbes 648* (leaves glabrous and shining, tree milky, fl. buds on Oct. 21, 1916; Bish., L.) — Waimea, Kokee, Na Pali-Kona Forest Reserve: *St. John*, *Hosaka* and six others from Univ. of Haw. *10724* (y. fr. on Dec. 26, 1930; Bish., L.); in the woods near Kokee: *Skottsberg 1004* (ster. on Oct. 28, 1922; Bish.); Waimea Drainage Basin, West side: *Forbes 845* (flow. and buds on July 3 to Aug. 15, 1917; Bish., L.), *Id. 989* (y. fr. in same period; Bish.), *Id. 1076* (frequent, petals pale green, stamens a somewhat rusty color, flow. in same period; Bish.); Waimea, Kaunohua ridge, Kaluapuhi trail: *Skottsberg* (per *J. Wichman*) *2851* (flow. Aug. 13, 1938; GB.).

**Oahu**: in the mountains: *Rémy 478a* (fr. in Apr. 1855; *type specimen* of *Planchonella Remyi*; P., L.) — Waianae Range, Mt. Kaala: *Selling 3674* (y. fr. on Sept. 29, 1938; GB.) and *3689* (y. fr. on Sept. 25, 1938; GB.); same locality: *Faurie 686* (y. fr. in Nov. 1909; Bish.); slopes of Mt. Kaala, Mokuleia: *Forbes 1773* (flow.

on Apr. 26 to May 16, 1912; Bish., L.); Mt. Kaala, 600—660 m alt., Waianaeuka: *Krauss s. n.* (fr. on Jan. 8, 1933; Bish.); same loc., E. ridge, 600 m alt.: *St. John 9937* (fr. on Oct. 13, 1929; Bish.); N.E. slope of Mt. Kaala, Mokuleia, second gulch E. of Puu Kaupakuhale, 540—600 m alt.: *Krauss s. n.* (flow. on May 14, 1933; Bish.); Makaleha ridge: *Rook 17057* (fr. on May 2, 1918; Bish.); Mt. Kaala, Mahaka Valley: *Forbes s. n.* (fr. on Feb. 12—19, 1909, Bish.); same loc., lower woods on ridge, 570 m alt.: *St. John 11589* (young tree, 4.5 m high, sap milky, fr. on Apr. 3, 1932; Bish., L.); Lualualei Valley, head of Valley below Puu Kanehoa, open forest, 600—700 m alt.: *Christophersen 3666* (fl. buds on May 25, 1932; tending towards forma b, but only 2—4 flowers per leaf-axil; Bish., L., O.); Ewa distr., in valley running eastward from Puu Kanehoa, 300—650 m alt.: *Krajina 125* (ster. on Oct. 30, 1929; PRC., L.); Waianauiki, near the trail, 840 m alt., in wet forest: *Inouye s. n.* (nat. name "alaa", fr. on Nov. 5, 1933, Bish.); Waianae Valley, Halalua, right branch, 570 m alt.: *Russ & D'A. Weloh s. n.* (fl. on June 22, 1933; Bish.) — Koolau Range, Punaluu: *St. John 10582* (tree, 12 m high, 0.6 m diam., fr. blackish purple on Sept. 28, 1930, juice milky; Bish., L.); Waipio, Kipapa gulch, north ridge, wooded, 360 m alt.: *Hosaka 665* (fr. on July 10, 1932; Bish.); same loc., second north fork, in forest, 540 m alt.: *Id. 841* (y. fr. on Nov. 13, 1932; Bish.); same loc., south ridge, in forest: *Id. 860* (fr. on Nov. 27, 1932; Bish., L.); same loc., south ridge, 510 m alt., wooded: *Id. 1015* (tree, 7.5 m high, fr. on May 6, 1933; Bish.); Ridge E. Nuuanu: *Forbes 1439* (flow. buds on Aug. 2, 1910; Bish.); Nuuanu: *Hillebrand s. n.* (leg. 1858, flow., nat. name "aluu"; B.); Pupukea-Kahuku trail: *Selling 3349* (Sept. 2, 1938; GB.).

M o l o k a i — Gulch of Halawa: Coll. *Hillebrand s. n.* (fl. buds; B., P.); eastern highland, Kawela trail: *Cranwell 3516* (flow. on Sept. 21, 1938; GB.).

L a n a i — without exact locality: *Rémy 478* (type specimen of *Sapota sandwicensis*<sup>1</sup>); P., L.); *Hillebrand s. n.* (July 1870, flow.; type specimen of *Sid. sandwicense*, var. *auratum*; B.) — Mahana Valley: *Rook 8002* (fr. on Aug. 1, 1910; Bish., L.) and *8003* (fr. on same date; Bish.); Mahana ridge, top: *Id. 8122* (flow. and fr.; Bish.); Mahana, open wooded forehills: *Id. 8063* (fr. on July 25, 1910; Bish.); Mahana Valley: *Rook & Hammond 8064* (flow. and fr. on July 22, 1910; Bish.) — Hookio ridge, Pohaku: *Munro 52* (fr.; Bish.), *263* (y. fr. on Dec. 10, 1913; Bish.) and *264* (y. fr. on same date; Bish.); ridge between Hookio gulch and head of Maunalei gulch: *Id. 407* (y. fr. on Feb. 27, 1915; Bish.); Hookio ridge, Haalelepaakai: *Munro 53* (nat. name "aluu" or "kaulu", fr.; Bish.), *285* (fr. on Dec. 26, 1913; Bish.) and *s. n.* (y. fr. on Apr. 6, 1915; Bish.) — Kaiholena ridge: *Munro s. n.* (flow. on June 27, 1915; Bish.); Kaiholena Valley: *Rook 8106* (fr. on Aug. 3, 1910; Bish.); Kaiholena Valley: *Rook 8107* (flow. and fr. on Aug. 3, 1910; Bish., L.) — Mts. near Koele: *Forbes 8* (flow. buds in June 1913; Bish.), *46* (fr. on same date; Bish.) and *138* (fr. on same date; Bish.).

M a u i — West Maui, ridge of Wailuku: *Hillebrand & Lydgate s. n.* (flow. buds; Bish.); same locality: *Hillebrand s. n.* (y. fr.; B.); pasted to same sheet as following specimen; gulch of Kanapali: *Hillebrand s. n.* (Aug. 1870, flow. buds; B.; pasted to same sheet as preceding specimen); ridge north of Pohakea gulch, arid Lantana-Dracaena-plain near rainforest: O. *Degener & H. Wiebke 2278* (flow. on July 23, 1927; B.); Hanaula: *Forbes 115* (y. fr. in June 1910; Bish.); Honokowai Valley, Amalu branch, valley side, 810 m alt.: *Ewart III, 61* (fr. on Dec. 21, 1928; Bish.); Haclaau to Puu Kukui trail, 900 m alt.: *Bryan Jr. 660* (flow. and y. fr. on Dec. 21, 1928; Bish., L.) — East Maui, Nahiku: *Lyon 6061<sup>2</sup>* (fr. — not found on this sheet, H. J. L. — on Jan. 15, 1909; type specimen?! of *Sideroxylon rhynchospermum*; of this, sterile, specimen a photograph has been reproduced in Torr. Bot. Club 37, 1910, 299 as well as in Rock, Indig. Trees Haw. Isl. 1913, Pl. 154; Bish.); Auwahi: *Rook 8670* (fr. in Nov. 1910; Bish., L.); Auwahi, Ulupalakua: *Munro 204* (y. fr. on Dec. 2, 1915; Bish.); Auwahi, south slope of Haleakala: *Forbes 2112* (fr. purple, on March 27, 1920; Bish.,

<sup>1</sup>) The Paris Herbarium contains two sheets labeled *Rémy 478*, one from Oahu with fruits (as mentioned by Gray in Proc. Am. Ac. V, 1862, 328) and one from Lanai with flowers. The latter has been chosen for a lecto-type of the species. Its label mentions the name of *Chrysophyllum sandwicense* Hillebr. (the specific name in a different handwriting), which is obviously an error. This name is therefore a nomen nudum.

<sup>2</sup>) The label was *Rook (C)* but I presume this specimen is identical with *Lyon 6061*.

L.); same loc.: *Id.* 2118 (fr. large, obtuse, pointed, yellow when ripe, March 27, 1920; Bish.); slopes of Haleakala, back of Makawao, 900 m alt.: *Rock 8510* (flow. and fr. in Sept. 1910; Bish.) — Ridge, left side Kipahulu: *Forbes 1669* (fr. on Nov. 18, 1917; Bish.).

Forma **b puulupensis** (Baehni & Degener), nova comb. (including the type of *Planchonella puulupensis*) — Flowers (1—)4—7 in a leaf-axil — *Type specimen: Degener, etc. 11067.*

Oahu: Waianae Range, Lualualei Valley, head of valley below Puu Kanehoa, open forest, 600—700 m alt.: *Christoffersen 3664* (flow. buds on May 25, 1932; Bish., L., O.) — Koolau Range, Puulupe, Kawailoa forest: *Degener, Topping, Martinez & Salucop 11067* (fl. buds on Feb. 25, 1937; *type specimen of Planchonella puulupensis*; Herb. Deg., G., L.); Pupukea, 450 m alt.: *Meebold s.n.* (flow. buds in May 1932; Bish.); Waipio, Kipapa gulch, in forest, 450 m alt.: *Hosaka 992* (tree, 12 m high, flow. buds and fr. on Apr. 30, 1933; Bish., L.); north fork of valley east of Palikea, stream bank, 300 m alt.: *St. John 10362* (tree, 6 m high, y. fr. on Feb. 23, 1930; Bish., L.).

Transitional between var.  $\alpha$  and var.  $\beta$  are the following specimens (pedicels, if any, about 1 cm long):

Oahu — without exact locality: *Judd 19* (flow. on Dec. 18, 1927; Bish.; sepals rounded but leaves more or less acute); Honolulu, new school site: *Wilder 455* (small tree, flow. buds on Feb. 23, 1928; Bish.; sepals somewhat acute, leaves like those of preceding specimen [same tree!]); Honolulu, side of one of the ridges in hills behind Kamehameha Girls' School: *Judd s.n.* (y. fr. on June 4, 1938; Bish., L.; sepals rounded but leaves more or less acute; very much resembling preceding specimens [same tree!]); ridge west of Waialae Valley: *Forbes 1944* (fr. on Oct. 15, 1914; Bish.; sepals rounded but leaves small, somewhat acute and whitish underneath as is pretty frequent in var.  $\beta$ ); ridge between Niu and Wailupe Valley: *Forbes & Bridwell 2460* (ster. on Apr. 11, 1917; Bish.; leaves fairly acute at apex); Manoa Cliff trail: *Forbes 2495* (ster. on May 1, 1917; Bish.; leaves large and very acute).

Molokai — Kamolo, 1000 m alt.: *Faurie 435* (y. fr. in June 1910; *type specimen of Myrsine molokaiensis*; Bish., L.; sepals and leaf tips more or less rounded but leaves very small and whitish underneath); same loc.: *Id.* 687 (very young buds in June 1910; Bish.; sepals more or less rounded, leaves rather long and narrow and more or less acute); Niapulau: *Rock 6154* (flow. on Feb. 22, 1910; Bish.; sepals rounded, but leaves small and whitish underneath).

Lanai — Mts. near Koole: *Forbes 137* (y. fr. in June 1913; Bish.; close to *Forbes 46* of var.  $\alpha$  but pedicels only 1.1 cm long and sepals slightly acute).

Maui — West Maui between Haelaau and Nakalalua on ridge leading to Kukui: *Cranwell, Selling & Skottsberg 2779* (ster., Aug. 1, 1938; GB.; leaves about 11 cm long and acute, petioles up to 5 cm long); Otowalu: *Forbes 2245* (tree, 6 m high, leaves golden, flow. on May 7, 1920; Bish.; sepals rounded and pedicels rather long, but leaves small, narrow and fairly acute) — East Maui, Auwahi, southern slope of Haleakala: *Forbes 2040* (tree, 10.5 m high, leaves smooth, shining above, white green below, fr. reddish-purple, 3-sided globose, obtuse apex, pedicel stout, March 20, 1920; Bish., L.; leaves acute and rather large, and sepals acute, but pedicels 1.2 cm long).

Hawaii — without exact locality: *Rémy 476* (y. fr.; P., L.; sepals and leaves acute, but pedicels in very young fruits 1 cm long and leaves rather large).

Var.  **$\beta$  spathulata** (Hillebrand), nov. comb. (including the type specimens of *Sapota sandwicensis* var.  $\beta$ , *Sideroxylon spathulatum*, *S. auahiense*, *Planchonella spathulata*, *Sideroxylon Ceresolei*, *Planchonella aurantium*, *P. densiflora* and *P. Meeboldii*) — Pedicels 0—0.8 cm long, in fruit not or hardly elongate. Leaves 3—12 cm long, apex rounded or often more or less acute. Sepals almost always acute. Fruits often small and sometimes beaked at apex. Shrubs or small trees, up to 10 m high — *Type specimen: Rémy 475.*

Forma **a typica**, nova forma — Flores in axillis 1—3(—4) — Flowers 1—3(—4) in a leaf-axil — *Type specimen: Rémy 475.*

Hawaiian Islands — without exact locality: *Rock (A)* (flow. buds and fr.: Bish.); *Id. (B)* (fr.; Bish.).

Kauai — Wahiawa Mts., 540 m alt.: *Lydgate s.n.* (y. fr.; Bish.).

Oahu — Waianae Range, Leilehua to Kaala trail, Haleanau: *Cooke* (per *Meineke*) 3 (fr. on Dec. 31, 1926; Bish.); Makaleha-Mokuleia: *Rock 17029* (flow. buds in Apr. 1918; Bish.) — Koolau Range, Pupukea-Kahuku trail: *Selling 3365* (flow. on Sept. 2, 1938; GB.); same locality, lower woods, 330 m alt.: *St. John 11584* (tree, 9 m high, 0.3 m diam., flow. buds on March 6, 1932; Bish., L.); Koolau and Pupukea Forest Reserve: *Skottsberg 1820* (fr. on Sept. 15, 1926; GB., Bish.); Wailupe Valley: *Rock 17120* (old flow. on Apr. 14, 1918; Bish.).

Molokai — slopes of Puu Kolekole: *Forbes 118* (y. fr. in July 1912; Bish., L.) and *118b* (ster. same date; Bish.); Maunaloa below Kamoku, very dry district: *Rock 7077* (flow. in Apr. 1910; Bish.).

Lanai — without exact locality: *Rémy 475* (fl.; type specimen of *Sideroxylon spatulatum*; P., L.); *Hillebrand s.n.* (flow. in July 1870; B.) and *s.n.* (leg. 1874, flow.; B.; pasted to same sheet a specimen of var. a); *Munro 401* (flow. on Apr. 15, 1915; Bish.); *Judd 49* (y. fr. on Feb. 1, 1926; Bish.) — West End of island: *Forbes 297* (flow. in Sept. 1917; Bish.); leeward side of island, dry open hills and plateau, 180 m alt.: *Wilder 88* (tree, 4.5 m high, milk sap used to catch small birds, nat. name "aulu", flow. on July 27, 1924; Bish.) — Mahana, Kaa: *Munro 54* (y. fr. on Apr. 6, 1915; Bish.) and *244* (y. fr. on Nov. 22, 1913; Bish.); Kaa: *Munro s.n.* (ster. on Apr. 6, 1915; Bish.) and *s.n.* (flow. on May 12, 1915; Bish., L.); Kalulu: *Munro 54a* (flow. on Apr. 15, 1915; Bish.; pasted to the same sheet as n. 54) — Mts. near Koele: *Forbes 98* (y. fr. in June 1913; Bish.) and *108* (y. fr. on same date; Bish.) — Paomai, dry forest: *Munro 32* (flow. in Aug. 1913; Bish.) — road to Maunalei gulch: *Rock 8039* (flow. and y. fr. on July 26, 1910; Bish.).

Maui — Lualailua: *Forbes 2018* (old flow. and fr. on March 17, 1920; Bish.); East Maui: *Rock 8684* (fr.; Bish., L.); Auwahi, south slope of Haleakala: *Forbes 1979* (flow. buds on March 14, 1920; Bish.), *2114* (small, pointed, yellow fr. on March 27, 1920; Bish., L.) and *s.n.* (fr. in March 1920; Bish., L.); same loc.: *Rock 8668* (fr. in Nov. 1910; type specimen of *Sideroxylon auahiense*; Bish., L.); south slope of Haleakala, Manawainui: *Forbes 1882* (tree, 4.8 m high, fr. yellow, like an apple, not pointed, on March 7, 1920; Bish., L.); south slope of Haleakala, Lauman Forest: *Forbes 1927* (new leaves purplish-golden or tan; fr. yellow, many, small, flow. and fr. on March 11, 1920; Bish., L.) and *1936* (fr. like a small apple, yellow, same date; Bish., L.); south slope of Haleakala, Kamana: *Forbes 2066* (tree, 10.5 m high, crown nearly as broad, trunk 0.35 m in diam., ster. on March 23, 1920; Bish., L.) and *2073* (tree, 10.5 m high, more than 0.3 m in diam., bark gray, rather smooth, fr. on same date; Bish., L.); Kahikinui: *Rock s.n.* (fr. in Oct. 1910; cotype of *Sideroxylon auahiense*; Bish.); Honuaula, Ulupalakua: *Munro 392* (y. fr. on Feb. 12, 1915; Bish.) and *394* (fr. on same date; Bish.); Makawao, Waihou gulch on N.W. slope of Mt. Habakala, 900 m alt.: *Rock 10150* (fr. — not found on this sheet, H. J. L. — in March 1912; type specimen of *Sideroxylon Ceresolei*; Bish., L.).

Hawaii — N. Kona: *Shea & Stevens s.n.* (y. fr. in Jan. 1928; Bish.); Puuwaawaa: *Forbes 31* (y. fr. on June, 8—14, 1911; Bish.); same loc.: *Rock 3220* (y. flow. buds on June 16, 1909; Bish.), *3971* (= *3966* = *3973*) (fl. buds on same date; Bish., L.) and *s.n.* (ster. in March 1912, type specimen of *Sideroxylon auahiense*. var. *aurantium* and of *Planchonella aurantium*; Bish.); same loc., 660 m alt.: *Skottsberg 668* (y. fr. on Sept. 26, 1922; GB., Bish.); between Lind's and branch road to Puuwaawaa: *Skottsberg 1963* (flow. buds and y. fr. on Sept. 26, 1926; GB., Bish.); N. slope of Mt. Puuwaawaa near Holualoa-Waimea trail, 540—610 m: *Krajina 127* (flow. on May 29, 1930; PRC., L.); Puuwaawaa, near Huehue-Puuanahulu trail, 670—700 m: *Krajina 128* (flow. on May 29, 1930; PRC., L.); same loc., 900 m alt.: *Meebold s.n.* (flow. in May 1932; except number of flowers per leaf-axil almost identical with *Meebold s.n.* from Hawaii, quoted under forma b; Bish.); lava fields near Huehue: *Cranwell, Selling & Skottsberg 3210* (y. fr. on Sept. 11, 1938; GB.) — S. Kona, Kapua: *Rock 10029* (fr. in Feb. 1912, cotype of *Sideroxylon auahiense*, var. *aurantium*; Bish., GH., L.); Puuwaawaa or Kapua: *Rock s.n.* (y. fr.; Bish.) — Puuanahulu, on slope of dry hill near the homesteads: *Rock 3912* (flow. on June 16, 1909, nat. name "alaa"; Bish.).

Forma *b densiflora* (Hillebrand), nova comb. (including the type specimens of *Planchonella densiflora* and of *P. Meeboldii*) — Flowers (1—)4—7(—12) in a leaf-axil — *Type specimen: Hillebrand s. n.*

Oahu — Waianae Range, Kaala: *Hillebrand s. n.* A° 1869 or 1870 (fl.; *type specimen* or *Sideroxylon spathulatum*, var. *densiflorum* and of *Planchonella densiflora*; B., P.); Makaleha Valley: *Meebold* in Herb. *Degener 10663* (flow. in Dec. 1935; *type specimen* of *Planchonella Meeboldii*; Herb. Deg.).

Hawaii — Kilauea Crater road, 1200 m alt.: *Meebold s. n.* (flow. in May 1932; Bish.).

In addition to the above-quoted specimens there are some more which were available and have been examined in an earlier phase of the work. Unfortunately, however, they were returned to their respective owners before the war and under the present conditions it is impossible to check them again. Their specific identification is pretty well certain, but as to their belonging to one of the two varieties there remains some doubt; they will therefore be enumerated separately here:

Probably var.  $\alpha$  *typica*:

Hawaiian Islands — locality no longer known to me: *Krajina 122* (PRC.). Oahu — without exact locality: *Rémy 477* (P.) — Waianae Mts.: *Faurie 635* (May 1910); Puu Hapepa: *Krajina 123* (March 3, 1930; PRC.).

Possibly a transition-form between  $\alpha$  and  $\beta$ :

Kauai — Halemanu, near bottom of Waimea canyon: *Rock 2336* (Bish.).

Probably var.  $\beta$  *spathulata*:

Oahu — Mt. Kaala (*Mann & Brigham 363*; possibly forma *densiflora*; petioles very long; Bish., K.) — Koolauloa, Pupukea, Paumali Forest Reserve: *Krajina 124* (Jan. 12, 1930; possibly forma *densiflora*; PRC.).

The following data have been compiled from the field labels of the specimens quoted:

It seems that var.  $\alpha$ , generally speaking, is the type of the wetter, var.  $\beta$  that of the drier regions, but this is probably only true for the extremes of both types and even *Rock* gives little information as to the exact habitats. Var.  $\alpha$  is a fair-sized tree and seems to grow consociately in certain forests,  $\beta$  is smaller and apparently occurs more scattered. The altitudes mentioned in the labels vary between 300 and 1080 m for var.  $\alpha$ , 180—1200 m for var.  $\beta$ .

The flowering and fruiting times are the following (see page 29) (I = Jan., II = Feb., etc.).

The native names given are: alaa (Kauai, Oahu, Hawaii), or aulu or kaulu (Lanai, Oahu, var.  $\alpha$ ), but only few labels make mention of them.

The fruits are, as has already been mentioned, very variable in several characters. Concerning these only very few data may be taken from the labels. One specimen of var.  $\alpha$  (*Forbes 2113*) mentions that the fruits are "large, obtuse, pointed, yellow when ripe". A specimen, considered to be a transition form between  $\alpha$  and  $\beta$  (*Forbes 2040*) has the fruits "reddish purple, globose with obtuse apex". Of some specimens of var.  $\beta$  from the same locality, one has the fruits "small, pointed, yellow" (*Forbes 2114*), others mention "fruits yellow like an apple, not pointed" (*Forbes 1882*), or "fruits yellow, many, small" (*Forbes 1927*), or "fruit like a small apple, yellow" (*Forbes 1936*).

Among the exsiccatae large and fleshy fruits as well as small and

	var.	Kauai	Oahu	Molokai	Lanai	Maui	Hawaii
flower-buds	$\alpha$	VII-X	II-V, VIII (E.)		VI	VIII	VI, IX
	$\alpha$ - $\beta$ $\beta$		II, VI III-IV			III	
flowers	$\alpha$	VI-IX	IV-VI II, XII		VI-VIII	IX, XII	V-VI, IX
	$\alpha$ - $\beta$ $\beta$		IV (W.), XII (E.)	IV	IV-V, VII-IX	V III	
young fruits	$\alpha$	II, VII- VIII, X, XII	II, XI		II, IV, XII	VI, XI- XII	I, VI, IX
	$\alpha$ - $\beta$ $\beta$		VI-VII	VII	II, IV, VI-VII	II-III, XI	
ripe fruits	$\alpha$		I-II, IV- V, VII, IX-XI			I, III, IX, XI-XII	I-V, VII, IX-XII
	$\alpha$ - $\beta$ $\beta$		X IX, XII			III II-III	
		II, VI-X, XII	I-XII	IV, VII	II, IV-IX, XII	I-III, V-VI, VIII-IX, XI-XII	I-II, V- VI, IX

hard ones are found both in var.  $\alpha$  and in var.  $\beta$ . And though it could be presumed that, at least in some specimens, the fruits are hard and small in youth, large and fleshy when ripe, such as may be the case in the specimen *Forbes 1882*, in which both forms are extant, the fact that often both may contain ripe seeds suggests that the two types may actually represent the ripe state. As to the shape, rounded fruits (whether large and fleshy or small and hard) are found in either of the varieties in more or less equal numbers, but pointed fruits are rare in var.  $\alpha$ . In one specimen of var.  $\alpha$  (*Rock 8002*) they are large and fleshy, in another (*Forbes 46*) they are small and hard. They have the same shape in two transition forms (*Forbes 137* and *Faurie 435*) but for the rest all specimens with small pointed fruits are belonging to var.  $\beta$ .

11. *P. torricellensis* (K. Schum.) H. J. Lam, Nova Guinea XIV, 4, 1932, 562 — *Rapanea torricellensis* K. Schum. in Schumann & Lauterbach, Nachtr. Fl. D. Südsee 1905, 346 — *Sideroxylon acutum* Krause, Engl. Bot. Jahrb. 58, 1923, 479 — *Planchonella samoensis* (Rein.) H. J. Lam, Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 218 (nomen) and in Christophersen, Bull. B. P. Bish. Mus. 154, 1938, 35 (description), fig. 10 — *Planchonella paludosa* H. J. Lam, Bull. Jard. bot. Buitenz. Sér. III, 8, 1927, 469, fig. 28 — *Sideroxylon samoense* Reinecke MS.

Samoa: Upolu, Mulifanua forest: *Reinecke 177* (flow. in Nov. 1893; type specimen of *Sideroxylon samoense*; B., K.); sine loc., common everywhere in the forests: *Horne 2* (large tree,  $\pm$  18 m high, trunk almost black, up to 12 m high and 0.75 m in diam., flow. on 7. 2. 1878, nat. name "mamalana"; K.); sine loc.: *Whitmee 224* (flow.; K.); Olononoï (recte Oliononoï, Upolu): *Vaupel 324* (fr. on 1. 7. 1905; B.); Savaii, Aopo: *Vaupel 612* (B.); Savaii, Salailua-Lataitai, forest,  $\pm$  10 m alt.: *Christophersen 2628* (tree, 15 m high, flow. on 18. 9. 1931; Bish., L.).

Distribution: New Guinea, Samoa.

The localities of the specimens known suggest that the species is probably also occurring in interjacent regions, the more so as it is very close to *P. nitida* (Bl.) Dub. which covers a large area from British India to the Moluccas and the Lesser Sunda Islands inclusive. In fact, the difference seems hardly less than gradual and the only important point seems to be that in *P. nitida* the inflorescences are borne on leafless shoots, being situated in the axils of bracts instead of leaves as is the usual condition in the family. However, even in *P. nitida* the latter condition is by no means rare, though not usual. For the rest the leaves of *P. torricellensis* are mostly smaller than those of *P. nitida* and dark brown when dry (instead of greenish), and the fruits are mostly 1-seeded. Some specimens from New Guinea not quoted here, are therefore somewhat doubtful, as one of them is sterile and the other bears only a few fruits in leaf-axils. Their general habit, however, points to *P. torricellensis* rather than to *P. nitida*, but some specimens from the Lesser Sunda Islands are of almost the same type, yet have with similar doubt, been inserted in *P. nitida* on account of their locality.

The species is also very close to *P. laurifolia* (Richard) Pierre (Australia), but in that species the petals are truncate and the staminodes are rounded, not acuminate.



II. *Nesoluma* Baill.

- 1a. Leaves generally small and elliptic or ovate or slightly obovate with more or less broadly cuneate or subrotundate base and rounded apex, pubescent or not when young, brown or more rarely somewhat greenish yellow when dry; shape, size, and pubescence of leaves extremely variable, from oblanceolate to ovate and broadly elliptic, generally about 4—8 cm long and 2—4.5 cm broad, if up to 12 cm long then 4—6.5 cm broad, and with rounded apex; reticulation variable, minutely areolate to more irregularly reticulate; fruit 1—1.5 cm long, about 1 cm in diam. . . . . 2. *N. polynesianum*
- b. Leaves larger, oblong-ovate to oblong, narrowing toward the apex, which is blunt, generally 6—13(—16) cm long, 3—5.5 cm broad; reticulation minutely areolate, areoles circular; fruit 1.5—2.5 cm long . . . . . 2
- 2a. Leaves oblong-ovate to oblong, light yellowish green when dry (always?), petioles 1.5—2.5 cm long; fruit 1.5—1.9 cm long, 0.7—1 cm in diam. . . . . 3. *N. St.-Johnianum*
- b. Leaves ovate to elliptic-ovate, dark brown when dry (always?), petioles 2—4 cm long; fruit 2.5 cm long, 1.7 cm in diam. . . . . 1. *N. Nadeaudii*

1. *N. Nadeaudii* (Drake) Pierre in H. J. Lam, B. P. Bish. Mus. Occ. Pap. XIV, nr. 9, 1938, 154.

Distribution: Tahiti.

2. *N. polynesianum* (Hillebr.) Baill., Bull. Soc. Linn. Par. 2, 1891, 964; H. J. Lam, l. c. 1938, 145. To be added to the literature and Synonymy; sub *Chrysophyllum polynesianum* Hillebr.: J. F. Rock, Indig. Trees Haw. Isl. 1913, 380 — *Isonandra polynesica* Benth. & Hook., Gen. Pl. II, 2, 1876, 658 ex Drake del Castillo, Ill. Fl. Ins. Mar. Pac., 1892, 229.

For the varieties and formae see our above-quoted paper (1938).

Distribution: Hawaiian Isl. (Maui to Oahu), Austral Isl. (Baevavae, Rapa).

3. *N. St.-Johnianum* H. J. Lam & B. Meeuse in H. J. Lam, l. c. 1938, 153.

Distribution: Tuamotu Isl. (Henderson I.).

III. *Palaquium* Blanco

- 1a. Leaves 18—32 cm long, 10—15 cm broad . . . . . 2
- b. Leaves 5—14 cm long, 2.5—7 cm broad . . . . . 4
- 2a. Pedicels about 1 cm long; leaves with more or less broad base; fruits oblong-obovate, 3.8 × 1.8 cm, rounded at tip . . . . . 1. *P. erythrospermum*
- b. Pedicels 3.5—6 cm long; fruits pointed . . . . . 3
- 3a. Pedicels 3.5—4.5 cm long; leaf-base broad to acute; leaves dark brown when dry . . . . . 7. *P. Stehlinii*
- b. Pedicels 4—6 cm long; leaf-base cuneate and decurrent; dried leaves greyish above, light-brown underneath . . . . . 4. *P. karrak*
- 4a. Petioles less than 1 cm long; leaves obovate, the secondary nerves about 7, little curved and hardly conspicuous; pedicels 1 cm long . . . . . 2. *P. fidjense*
- b. Petioles 1.5—3.5 cm long, pedicels 2.5—3.5 cm . . . . . 5
- 5a. Secondary nerves 5—6, strongly curved, leaves chartaceous, ovate . . . . . 6. *P. oxyspermum*
- b. Secondary nerves 8—12; leaves rigid . . . . . 6
- 6a. Innovations, pedicels and calyces reddish pubescent; style much exsert . . . . . 5. *P. neo-ebudicum*
- b. Innovations, pedicels and calyces entirely glabrous; style hardly exsert . . . . . 3. *P. Hornei*

1. *P. erythrospermum* H. J. Lam, nova spec. — *Fig. 6* — Arbor alta. Folia glabra, oblongo-obovata, basi lata subabrupte in petiolum contracta, apice rotundata vel breviter obtuse acuminata, marginibus plus minusve undulata, 19—26 cm longa, 10—15 cm lata, petiolis solidis 2—3 cm longis;

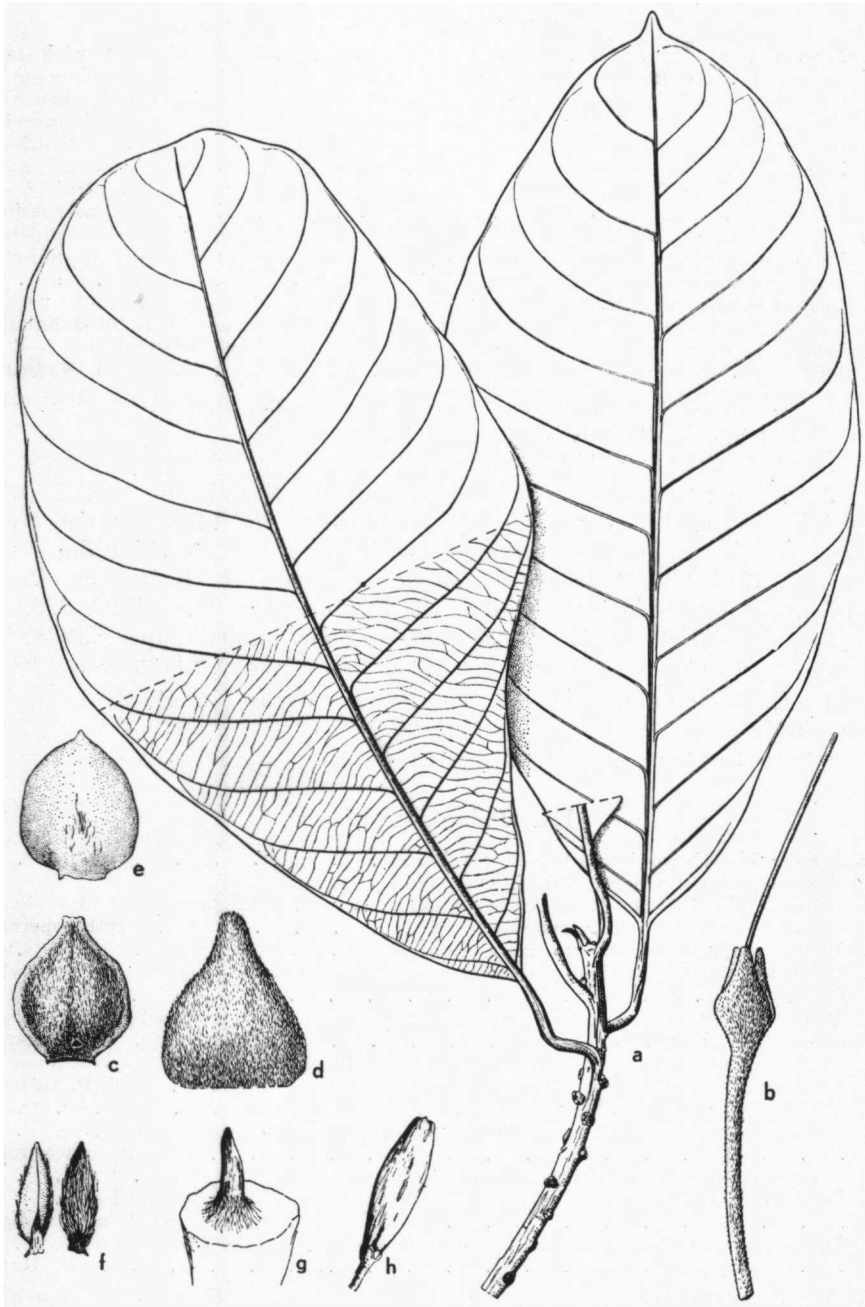


Fig. 6 — *Palaquium erythrospermum*, n. sp. — a. branchlet with leaves; b. old flower; c. inner sepal, outside; d. outer sepal, outside; e. petal, outside; f. stamens, dorsal side (right) and ventral side (left); g. ovary; h. fruit (after *Kajewski 1908*).

costa subtus valde prominens; nervi secundarii subtus prominentes, utrinque 12—15, angulo 65°—70° adscendentes, margines versus curvati et diminuti, haud arcuatim conjuncti; nervi tertiarii pertenuis cum reticulatione transversa. Inflorescentiae in ramulis vetustioribus vel sub folia axillares, alabastrorum pedicelli graciles, 0.9—1.2 cm longi, cum sepalibus adpresse ferrugineo-tomentosi; sepala 3 + 3 obtuse acuminato-ovata, intus glabra, 0.3 cm longa; corolla deest; stamina in alabastris c. 14 (?), antheris extus pilosis. Ovarium 6-loculatum, tomentosum, abrupte in stylum filiformem glabrum post anthesin 1 cm longum contractum. Fructus oblongi glabri, maturi 3.8 cm longi, 1.8 cm diametro, 1-spermi, semina 1 cm diametro.

A large tree. Leaves glabrous, oblong-obovate, base broad, subabruptly contracted into the petiole, apex rotundate or shortly and bluntly acuminate, margins somewhat undulate, 19—26 × 10—15 cm, petioles stout, 2—3 cm long; midrib strongly prominent below; secondary nerves prominent below, 12—15, ascending at an angle of 65°—70°, towards the margins curved and diminished, not distinctly archingly joined; tertiary nerves transverse, very slender. Inflorescences on warts along the older branchlets, the pedicels of the buds slender and 0.9—1.2 cm long, appressedly ferruginously tomentose as are the sepals outside. Sepals 3 + 3, bluntly acuminate-ovate, glabrous inside, 0.3 cm long; corolla not extant; stamens in the bud about 14 (?), the anthers pilose outside. Ovary 6-celled, tomentose, the glabrous style filiform and about 1 cm long (old flower). Fruit oblong, glabrous, 3.8 × 1.8 cm when ripe, 1-seeded; diam. of seed 1 cm.

Solomon Isl.: Bougainville, Kugumaru, common in rain forest, alt. 150 m: *Kajewski 1903* (tree, up to 25 m high, with a milky sap, fr. on 2. 7. 1930, growing singly on stems with a red fleshy seed inside; nat. name "ooko-woru"; type specimen; A., L.).

Undoubtedly very close to *P. obtusifolium* Burck (E. Malaysia) or perhaps even identical with that species but provisionally kept separate because of its smaller flowers.

2. *P. fidjense* Pierre in Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, 10.

Fiji: Vanua Levu, Thakaundrove, Yanawai Riv. region, in dense forest on Mt. Kasi, alt. 300—430 m: *A. C. Smith 1805* (tree, 15 m high, flow. buds brown, on May 10—11, 1934; Bish.; L.).

Distribution: Fiji.

Probably this species, but in the very young bud the ovary is glabrous and the leaves are 7—8 × 3.5—4 cm. The leaves are slightly larger than in the type specimen (*Horne 1117*), of a fragment of which I made some annotations during a stay in the Paris Herbarium, viz. 7.5 × 3.3, petiole 0.2—0.8 cm, but the shape is the same.

3. *P. Hornei* (Hartog) Dubard, Bull. Soc. bot. Fr. 56, 1909, Mém. 16, 10 — *Dichopsis Hornei* Hartog in Baker, Journ. Linn. Soc. 20, 1883, 367.

Fiji: Vanua Levu, Thakaundrove, Yanawai Riv. region, in dense forest on Mt. Kasi, alt. 300—430 m: *A. C. Smith 1793* (tree, 12—20 m high, corolla and stamens white, good timber for building, nat. name "mbulu", flow. on May 10—11, 1934; Bish., L.).

Distribution: Fiji.

Type specimen (*Horne 717*) not seen, but the specimen quoted fits

the description and agrees with a specimen preserved in the Paris Herbarium (possibly a fragment of the type specimen), but as to its larger leaves (up to  $14.5 \times 6$  cm, petiole 3 cm).

4. *P. karrak* Kanehira, Bot. Mag. Tokyo 45, 1931, 339 and Fl. Micron. 1933, 305, fig. 153.

Distribution: Caroline Isl. (Ponape).

Type specimen (*Kanehira* 794) checked (NY.). Some specimens, collected by *Ledermann* (nos. 13299, 13555 and 13796) preserved in the Berlin Herbarium under the name of *Palaquium leuconeurum* H. J. Lam (ined.) probably belong to this species. Probably related to *P. Hornei*.

5. *P. neo-ebudicum* Guillaumin, Journ. Arn. Arb. 13, 1932, 15.

Distribution: New Hebrides (Aneityum, Eromanga).

No specimen seen (*Kajewski* 344 and 756).

6. *P. oxyspermum* H. J. Lam, nov. spec. — *Palaquium* spec., Christophersen, Bull. B. P. Bish. Mus. 128, 1935, 170 — Fig. 7.

Arbor alta. Folia glabra, ovata, basi breviter angustata, apice obtusa, 9—13.5 cm longa, 4—7 cm lata, petiolis 2—3.5 cm longis; costa nervique subtus paulo prominentes, nervi secundarii utrinque 5—7, angulo c.  $60^\circ$  de costa adscendentes, margines versus valde curvati, diminuti, haud distincte arcuatum conjuncti; nervi tertiarum tenues, cum reticulatione transversa. Flores fructusque ignoti. Fructuum pedicelli crassi, 2.7—2.8 cm longi. Semina magna paulo curvato-oblonga, basi obtusa, apice acute rostrata  $\pm$  deplanata, 5.9—6.8 cm longa, 2.2—2.5 cm diametro, cicatrice valde extensa, testae parte nitida tantum 0.55—0.65 cm lata, longitudine fere ea seminis aequali. Embryo exalbuminosum, cotyledones percrassi, radice infera acuta.

A tree, about 25 m high. Leaves glabrous, thinly coriaceous, ovate with shortly contracted base and blunt apex, 9—13.5 by 4—7 cm, the petioles 2—3.5 cm long, midrib and secondary nerves somewhat prominent below, secondary nerves 5—7, ascending at an angle of about  $60^\circ$ , much curved and gradually diminishing towards the margins, not distinctly archingly joined; tertiary nerves and reticulation transverse. Flowers and fruits unknown. Fruit pedicels thick, 2.7—2.8 cm long. Seeds very large, somewhat curved and oblong, blunt at base, acutely rostrate and somewhat flattened at apex,  $5.9\text{--}6.8 \times 2.2\text{--}2.5$  cm, the dull scar extremely large, the shining portion of the testa only 0.55—0.65 cm broad and almost as long as the seed. Embryo exalbuminous, the cotyledons very thick, radicle inferior and acute.

Samoa: Savaii, Le To, above Salailua, in forest, alt. 750 m: *Christophersen 2884* (tree, about 25 m high, leaves and fruit picked up on the ground, fr. on Oct. 21, 1931; type specimen, Bish., L.); Upolu, Malololelei, alt. 700 m: *Christophersen 29* (tree, fr. not ripe [not seen by me, H. J. L.] on Aug. 5, 1929; Bish., NY.).

In its leaf characters this species shows a resemblance with the specimen identified as *P. fidjense* and quoted above, but the leaves are distinctly ovate, and larger.

7. *P. Stehlinii* Christoph., B. P. Bish. Mus. Bull. 128, 1935, 168, fig. 24.

Samoa: Savaii, in forest above Sili, alt.  $\pm$  300 m: *Christophersen 3255* (tree,  $\pm$  15 m high; type specimen; Bish., L.); N.W. Sili, on bank of rivulet: *Vaupel 341* (fr. on 18. 5. 1906; B.).

Distribution: Samoa. Also in Tonga! (cf. sub *Burckella Amicorum*).

The specimen *Vaupel 341* most probably belongs here. The leaf-base is slightly more acute than in the type specimen. The fruit pedicels are

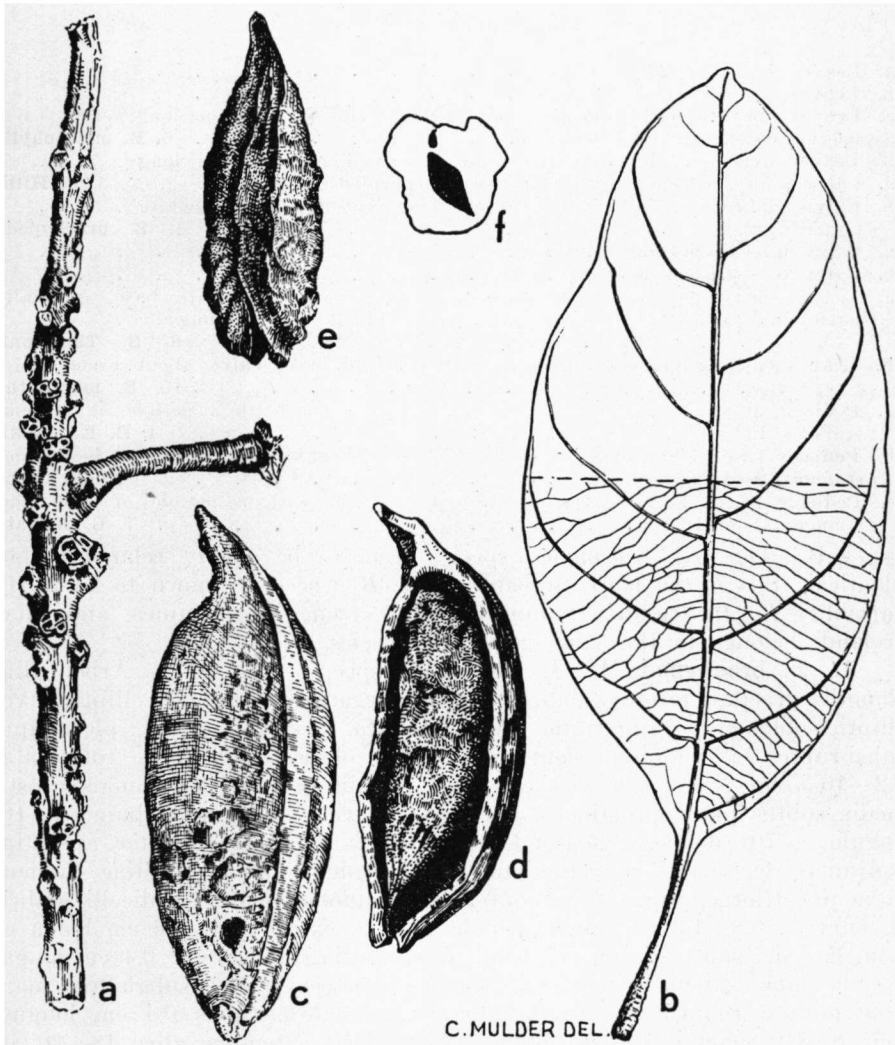


Fig. 7 — *Palaquium oxyspermum*, n. sp. — a. branchlet with fruit-pedicel; b. leaf; c. seed, semi-dorsal view, showing the narrow shining part of the testa; d. seed, longitudinal section, showing position of embryo; e. embryo (upside down); f. ditto, cross-section, showing the cotyledons (after *Christophersen 2884*).

4.5—5 cm long, the fruit is oblong and pointed at apex and usually somewhat curved, glabrous but dull and with a somewhat verrucose surface, 5—7.5 cm long and 2—2.5 cm in diam. Seeds very insufficiently known, probably 2—3 in a fruit.

Its relation is probably with the preceding species and, through it, with *P. obtusifolium* Burek (and *P. obovatum* [Griff.] Engl.), both from Malaysia, but the flowers and fruits are considerably larger.

#### IV. *Burckella* Pierre

- |   |                          |
|---|--------------------------|
| 1a. Leaves 4—10 by 2.5—5 cm . . . . .   | 2                        |
| b. Leaves 10—25 by 5—10 cm . . . . .  | 4                        |
| 2a. Leaves obovate with cuneate base; pedicels (1.5—)2—3.5 cm long; calyx 0.5—0.6 m, corolla 1.2—1.4 cm . . . . .                                 | 6. <i>B. microphylla</i> |
| b. Leaves ovate or elliptic with broad base, pedicels 1—2 cm long . . . . .   | 3                        |
| 3a. Calyx pilose, 0.3 cm long, corolla 0.6 cm, purplish . . . . .   | 3. <i>B. Hillii</i>      |
| b. Calyx glabrous or nearly so, 0.6 cm long, corolla 1.5 cm, white . . . . .  | 1. <i>B. brachypoda</i>  |
| 4a. Calyx 0.7—1 cm long . . . . .   | 5                        |
| b. Calyx 0.3—0.5 cm long . . . . .  | 6                        |
| 5a. Leaves rusty pubescent underneath, obovate with a cuneate base, gradually narrowing from the broadest part; calyx about 0.7 cm long . . . . . | 8. <i>B. Thurstonii</i>  |
| b. Leaves entirely glabrous, obovate with a broad base; calyx about 1 cm long . . . . .   | 5. <i>B. macrantha</i>   |
| 6a. Pedicels about 1 cm long, leaves up to 15 × 9 cm, with a petiole of 1.5 cm; stamens 12 . . . . .  | 4. <i>B. Kajewskii</i>   |
| b. Pedicels 1.1—1.7 cm long, leaves 10—25 × 6—10 cm, with a petiole of 1—3.5 cm; stamens 9—16 . . . . .   | 2. <i>B. Cocco</i>       |
| c. Pedicels 2 cm long, leaves 10—17 × 4.5—6 cm, with a petiole of 2—3 cm; stamens about 12 . . . . .  | 7. <i>B. obovata</i>     |

N.B. The tree last-named species seem to be closely related if not identical; this is the more probable, since *B. Cocco* is known to be fairly variable. *B. Hollrungii* (Schum.) Pierre from New Guinea and New Ireland, belongs to the same group of species.

1. *B. brachypoda* H. J. Lam, nova spec. — *Fig. 8* — Arbor alta. Ramuli graciles teretes glabri. Folia pergamacea glabra, elliptica vel elliptico-oblonga vel interdum paulo obovata, basi late acuta, plerumque subabrupte in petiolum contracta, apice obtusa, interdum rotundata, 4.2—10.5 cm longa, 2.6—5.3 cm lata, petiolis 0.7—1.5 cm longis; costa media subtus paulo prominens, nervi secundarii pertenuis, utrinque 6—10, angulo c. 70° de costa adscendentes, mox furcati, irregulariter arcuatim conjuncti, tertiarum laxae reticulata, vix conspicui. Inflorescentiae fasciculatae pauciflorae, supra folia confertae, pseudoterminales; pedicelli glabri, ± curvati, 0.8—1.9 cm longi. Sepala 2 + 2, exteriora c. 0.6 cm longa et lata, late deltoidea, glabra vel paulo pubescentia, interiora c. 0.4 cm longa, 0.5 cm lata, subquadrangularia, sparse pubescentia vel subglabra, margine minute fimbriata. Corolla alba extus glabra, tubus 0.4 cm longus, lobi 8—10 oblongi 1.1 cm longi, 0.4 cm lati. Stamina alba 18—20 in fauce uniserialiter inserta, filamentis brevi-pilosis, c. 0.3 cm longis, antheris oblongo-acuminatis 0.2 cm longis, glabris vel dorso paucis pilis suffultis. Ovarium glabrum 4—5-loculare, 0.3 cm diam., in stylum subulatum glabrum 2.1—2.3 cm longum abrupte contractum. Fructus ignotus.

A large buttressed forest tree, 25—35 cm high. Branchlets slender and glabrous. Leaves pergamaceous, glabrous, elliptical or elliptical-oblong or sometimes somewhat obovate, the base broadly acute and mostly subabruptly narrowed towards the petiole, apex obtuse or sometimes

rotundate, 4.2—10.5 × 2.6—5.3 cm, the petioles 0.7—1.5 cm long; midrib somewhat prominent below, the secondary nerves slender, 6—10, ascending at an angle of 65°—70°, rather far from the margin (0.5—0.9 cm) furcate and irregularly archingly joined, the tertiary ones almost in-

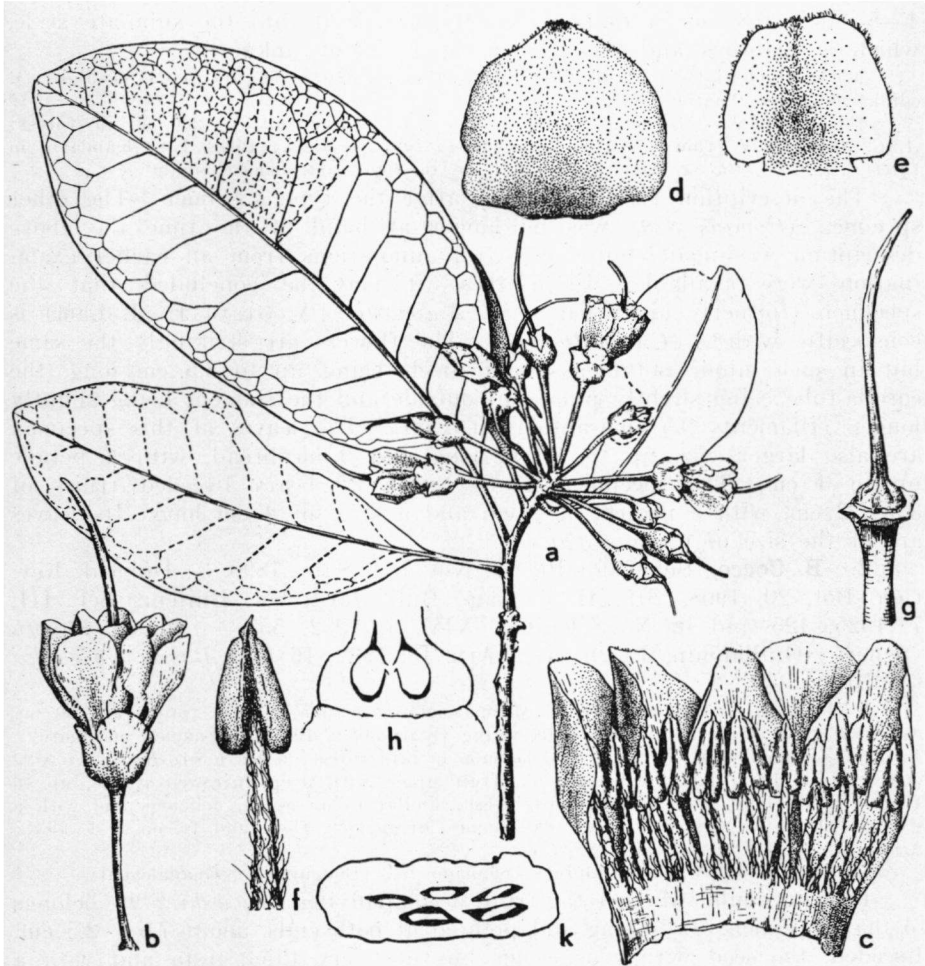


Fig. 8 — *Burokella macropoda*, n. sp. — a. flowering branchlet; b. flower; c. corolla, opened; d. sepal, outside; e. ditto, inside; f. stamen; g. ovary and style; h. ovary, longitudinal section; k. ditto, cross-section (after A. C. Smith 1474).

conspicuous, laxely reticulate, near the midrib a few parallel to the secondary ones. Inflorescences few-florous, but pseudoterminally conferted at the tips of the branchlets above the leaves and thus about 10—20 flowers together; pedicels glabrous, ± curved, 0.8—1.9 cm long. Sepals 2 + 2, glabrous or slightly pubescent without, the outer ones broadly deltoid and about 0.6 cm long and broad, the inner ones roughly

quadrangular with a minutely fimbriate margin. Corolla white, glabrous without, the tube about 0.4 cm long, the 8 lobes oblong and about  $1.1 \times 0.4$  cm. Stamens in one row inserted in the throat, 18—20, the white filaments shortly pilose and about 0.3 cm long, the anthers oblong-acuminate, glabrous or with some hairs on the back. Ovary glabrous, 4—5-celled, 0.3 cm in diam., abruptly narrowed into the subulate style, which is glabrous and 2.1—2.3 cm long. Fruit unknown.

New Hebrides: Banks Isl.: Rev. *Comins 320* (tree up to 21 m high, fr. edible, nat. name "natu"; K.).

Fiji: Vanua Mbalavu, Northern limestone section, alt. 0—200 m, in forest: *A. C. Smith 1474* (flow. on April 2—3, 1934; type specimen; Bish., L.); Kandavu, in forest: *A. C. Smith 82* (tree, 15 m high, fr. in Sept., nat. name "mbulu").

The description has been made after the type specimen. The other specimen (*Comins 320*) was no longer at hand at the time the above description was made, but fairly full annotations from an earlier examination were available. From these it may be concluded that the specimen (formerly identified as *B. Amicorum* [A. Gray] H. J. Lam) is conspecific with *A. C. Smith 1474*. The flowers are strikingly the same but in such minor points as the pedicels being up to 3.5 cm long, the corolla-tube being slightly pubescent outside and the stamens being slightly longer (filaments 0.5 cm, anthers 0.3 cm). The leaves of this specimen are also larger, viz. up to 15 cm long and 9 cm broad, with a petiole up to 3 cm. The specimen *A. C. Smith 82* bears 1-seeded fruits of  $3.5 \times 2$  cm, with a pedicel of 2 cm and a style of 4 cm long. Its leaves are of the size of *Comins 320*.

2. **B. Cocco** (Scheffer) Pierre, Not. bot. Sap., 1890, 3; Dubard, Rev. Gén. Bot. 20, 1908, 201; H. J. Lam, Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 125 and in Nova Guinea XIV, 4, 1932, 555 — *Bassia Bawun* (Scheff.) Guillaumin, Journ. Arn. Arb. 13, 1932, 16 (sub *Bassia Kajewskii* Guill.).

Solomon Isl.: Bougainville, Marmaromino, common in rain forest, alt. 50 m: *Kajewski 2205* (tree, up to 25 m high, young fr. on 30. 9. 1930, nat. name "maranatu"; A., L.) — Guadalcanal, Berande riv., common in rain forest on sea level: *Kajewski 2399* (tree, up to 20 m high, pedicels pink, fruit green with deep furrowed ridges, up to 4 or 5 inches long, with a deep white flesh, similar to an apple, delicious and with a strong distinct flavour of its own, nat. name "un-garno", flow. and fr. on 1. 1. 1931; A., L.).

Distribution: New Guinea, Solomon Isl. (Bougainville, Guadalcanal).

I am in doubt, whether the fruit, accompanying *Kajewski 2399*, belongs to that specimen. It is long and pointed at both ends, about  $7.6 \times 2.5$  cm, 1-seeded, the seed with crustaceous but not very thick testa and with a scar almost as long as the seed and occupying more than one half of its circumference, the shining part keeled (cf. *B. Hollrungii*); embryo exalbuminous.

Close to or possibly even identical with *B. Hollrungii* (Schum.) Pierre (New Guinea, New Ireland, Kerawara Isl.).

3. **B. Hillii** (J. G. Baker) H. J. Lam, nov. comb. — *Payena Hillii* J. G. Baker, Journ. Linn. Soc. Bot. 20, 1883, 338.

Distribution: Fiji.

According to the description related to *B. brachypoda* and *B. microphylla*, but distinguished by its considerably smaller (and purplish-brown)



flowers (calyx pilose and only 0.3 cm, corolla twice as long), with sessile anthers (young flowers?), from the latter, moreover, by its oblong, apparently not obovate leaves. No specimen examined. The type specimen is *Horne 484*.

4. *B. Kajewskii* (Guill.) H. J. Lam, nov. comb. — *Bassia Kajewskii* Guillaumin, Journ. Arn. Arb. 13, 1932, 15.

Distribution: New Hebrides (Tana).

Guillaumin's very incomplete description makes it impossible to check this species with any other. According to its author it should be related to *B. Cocco*. It seems not impossible that it is conspecific with that species. The fruit is eaten by the natives. No specimen examined. The type specimen is *Kajewski 43*.

5. *B. macrantha* H. J. Lam, nova spec. — *Fig. 9* — Arbor mediocris. Ramuli crassi rugosi. Folia ad ramulorum apices conferta, glabra, tenuiter coriacea, obovata vel oblongo-obovata, basi lata sensim in petiolum angustata, apice rotundata, 11—15 cm longa, 4.8—6.8 cm lata, petioli 2—28 cm longi; costa media subtus valde prominens, nervi secundarii tenues, utrinque 10—12, angulo c. 65° de costa adscendentes, margines versus curvati et diminuti, haud distincte arcuatim conjuncti; nervi tertiarii saepe uno crassiore inter 2 secundarios adscendente, cetera laxe reticulati plus minusve transversi. Inflorescentiae floresque ignoti. Florum vetustiorum pedicelli nonnulli supra folia inserti crassi, glabrescentes, 1.8—2 cm longi. Calyx extus dense adpresse pubescens, 1 cm longa, 0.8 cm lata, sepala 2 + 2, intus glabra. Ovarium glabrum, 5-loculatum, in stylum subulatum 3.7—4 cm longum contractum. Fructis ignoti.

A moderate-sized tree. Branchlets thick (1 cm) and scarred. Leaves conferted at their tips, thinly coriaceous, glabrous, obovate to oblong-obovate, the base broad and gradually narrowed into the petiole, apex rounded, 11—15 × 4.8—6.8 cm, petioles 2—2.8 cm long; midrib much prominent beneath; secondary nerves slender, about 10—12, ascending at an angle of about 65°, curved and diminished towards the margins and not distinctly archingly joined; tertiary nerves often one ascending between each pair of secondary ones, for the rest laxely reticulate and more or less transverse. Inflorescences and flowers unknown. Old flowers inserted above the leaves, 2 together, the pedicels rather thick, glabrescent, 1.8—2 cm long, the strong calyx densely appressedly pubescent without, 1 cm long and 0.8 cm wide, sepals 2 + 2, glabrous within. Ovary glabrous, 5-celled, narrowed into a filiform style of 3.7—4 cm long.

Fiji: Vanua Levu, Thakaundrove, Natewa Peninsula, Uluingala, alt. 600—820 m, dense forest: *A. C. Smith 1980* (tree, 14 m high, old flow. on June 15, 1934; *type specimen*; Bish., L.).

Although incompletely known, I venture to describe this as a new species, as I could not identify it with one of the other species known to me. It seems to be pretty close to *B. Thurstonii* but the leaves are entirely glabrous and with a broader base, not gradually narrowing from the broadest part downwards. The species is particularly distinguished by its large calyx.

6. *B. microphylla* H. J. Lam & E. van Olden in Christophersen, B. P. Bish. Mus. Bull. 154, 1938, 34, pl. 1B.

**Distribution:** Samoa (Savaii), Tonga (Vavau, Tongatabu).

Its relation is with *B. brachypoda*, but the leaves are smaller and narrower and always obovate; also, apparently, with *B. Hillii* (see there). The type specimen is *Crosby 102* (K.).

7. *B. obovata* (Forster) Pierre, Not. bot. Sap. 1890, 4; Dubard, Rev.

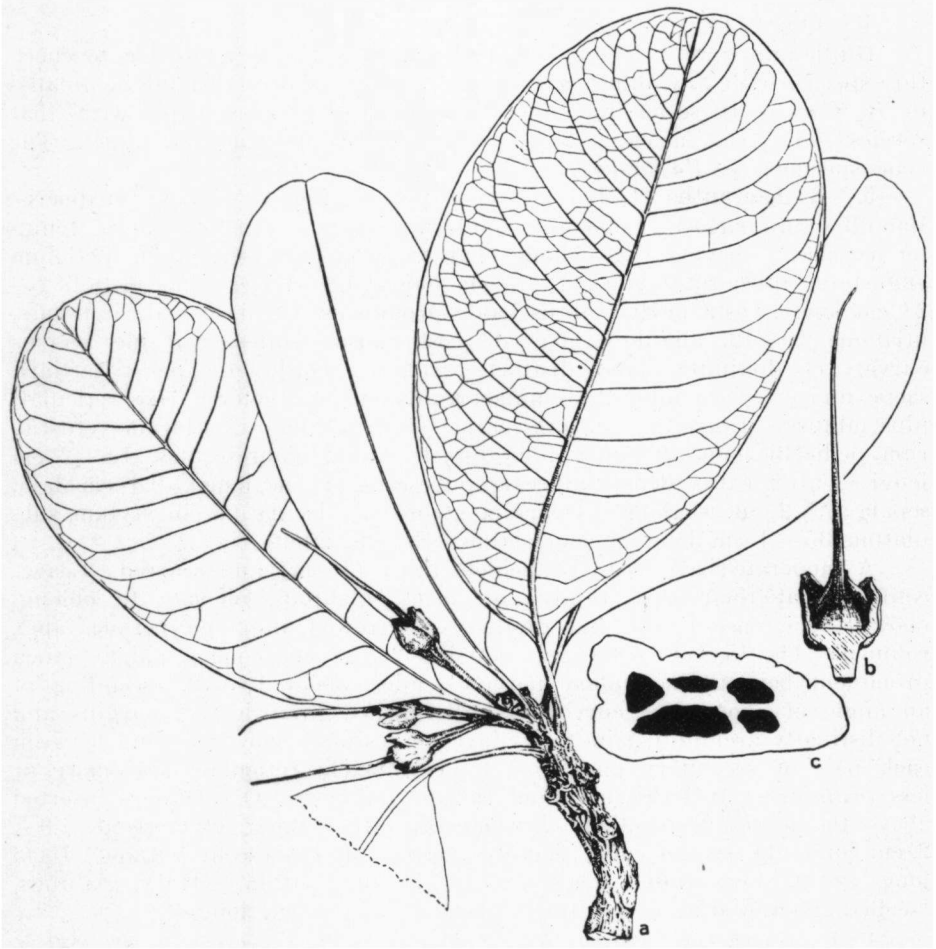


Fig. 9 — *Burckella macrantha*, n. sp. — a. branchlet with old flowers; b. flower without corolla, opened so as to show ovary and style; c. ovary, cross-section (after A. C. Smith 1980).

Gén. bot. 20, 1908, 201 — *Bassia obovata* Forster, Fl. Ins. Austr. Prodr. 1786, 35; Guillaumin, Journ. Arn. Arb. 13, 1932, 16.

Leaves conferted at the tips of the rather thick branchlets, glabrous, obovate with cuneate base and broad, shortly and bluntly acuminate apex, 10—17 by 4.5—6 cm, petioles 2—3 cm long; midrib prominent below, secondary nerves almost inconspicuous above, distinct underneath, 11—13,

ascending at an angle of about 65°, straight, archingly joined near the margin; tertiary nerves ascendent near the midrib, towards the margins reticulate. Inflorescences few-floruous, in the axils of the uppermost leaves, the pedicels about 2 cm long, appressedly pubescent. Calyx pubescent, 0.3 cm long. Corolla pubescent outside, tube 0.4 cm long, the 6—7(—?) lobes 0.6—0.8 cm, throat pilose. Stamens about 12, the filaments pilose, as are the tips of the anthers, which are 0.4 cm long. Ovary glabrous, 4-celled, the style about 2 cm long. Fruit unknown.

Distribution: New Hebrides (Tana; according to *Guillaumin* also in Aneityum, Efate and Banks).

Description of the type specimen (*Forster*) in the Kew Herbarium. Apparently closely related to *B. Cocco* (or even identical with that species?).

8. *B. Thurstonii* (Hemsley) H. J. Lam, Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 259; Gillespie, B. P. Bish. Mus. Bull. 74, 1930, 12, fig. 13 — *Bassia Thurstonii* Hemsl. in Hooker, Ic. Pl. 26, 1899, t. 2569.

Distribution: Fiji.

Well distinguished by its large, profusely pilose flowers and its numerous ( $\pm$  40) stamens. Type specimen (*Thurston*, Aug. 1874, herb. Kew) checked.

To be excluded:

*B. Amicorum* (A. Gray) H. J. Lam, in Christophersen, B. P. Bish. Mus. Bull. 154, 1938, 35 — *Bassia Amicorum* A. Gray, Proc. Am. Acad. 5, 1861—62, 327 — *Madhuca amicorum* (A. Gray) Macbride, Contrib. Gray Herb. N. S., 53, 1918, 18.

The type specimen — I examined a fragment of the type from the Paris Herbarium — is probably a mystification. The leaves are almost certainly those of *Planchonella costata (tahitensis)*, the detached flower accompanying the sheet is undoubtedly that of some *Palaquium* species, although thusfar no species of that genus has been reported from Tonga. This explains Gray's description: "corolla glabra 6-partita..... staminibus 18", as well as an annotation by Pierre with the name *Palaquium amicorum* Pierre.

The pedicel of the single flower extant is appressedly pubescent and 4.8 cm long; sepals appressedly pubescent outside, glabrous within, acute and 0.6 cm long; corolla glabrous, about 1.4 cm long (of which the tube measures about 0.3 cm), petals oblong; stamens glabrous, in approximately one row, filaments slender, anthers oblong-acuminate, 0.4—0.5 cm. Ovary densely pubescent, 6-celled, the style filiform and 2.8 cm long. This description fits pretty well that of *Palaquium Stehlinii* from Samoa, but that species should not necessarily be also a native of Tonga; the flowers may have been washed ashore as well, as the specimen has been collected on the beach.

V. *Manilkara* Adanson

- 1a. Flowers small, calyx 0.4—0.7 cm long . . . . . 2
- b. Flowers larger, calyx 0.8—1.4 cm long . . . . . 4
- 2a. Leaves broadly obovate, 5—9 by 3.5—6.5 cm, base broad, apex conspicuously

- emarginate; secondary nerves 15—17; pedicels of fruits 1 cm long; fruit about  $1.8 \times 0.8$  cm . . . . . 2. *M. emarginata*
- b. Leaves narrowly obovate, rarely broader than 4 cm, base narrowly cuneate, apex rounded to subacute or slightly emarginate . . . . . 3
- 3a. Secondary nerves, though faint, distinguishable from the tertiary ones and at the margin archingly joined; ovary with shallow glabrous adnate disc at the base; scar of the seed small, elliptic, basiventral, about  $0.3 \times 0.2$  cm . . . . . 1. *M. dissecta*
- b. Nervation striate, all nerves about as faint, close to the margin united to form a distinct intramarginal nerve; ovary without disc; scar of the seed long and narrow, ventral, about  $0.8 \times 0.2$  cm . . . . . 5. *M. udoido*
- 4a. Secondary nerves practically inconspicuous, the tertiary nervation minutely areolate; leaves dark brown when dry; calyx 1.1—1.4 cm long; dorsal appendages to the petals about  $2/3$  their length; staminodes large and fimbriate . . . . . 3. *M. samoensis*
- b. Secondary nerves, though faint, distinctly conspicuous; leaves light greyish-brown or greenish when dry . . . . . 5
- 5a. Tertiary nervation longitudinally reticulate, parallel to the secondary nerves; calyx 0.85—1 cm long; dorsal appendages to the petals  $2/3$  their length; staminodes large and fimbriate, about half as long as the petals; ovary with shallow glabrous adnate disc at the base . . . . . 4. *M. Smithiana*
- b. Tertiary nervation areolate; calyx 1.1—1.2 cm long; dorsal appendages about  $1/4$ — $1/5$  the length of the petals; staminodes, if any, small and subentire, about  $1/5$ — $1/6$  the length of the petals; ovary without disc . . . . . 6. *M. vitiensis*

1. *M. dissecta* (L. f.) Dubard, Ann. Mus. Col. Mars. 23, 1915, 13; Guillaumin, Journ. Arn. Arb. 13, 1932, 15; H. J. Lam, Blumea 4, 1941, 325, fig. 1 (synonyms given there are: *Achras dissecta* L. f., *Mimusops dissecta* R. Br., *Mimusops Pancheri* Baillon, *Manilkara Pancheri* [Baillon] Dubard).

There are two varieties:

Var.  $\alpha$  *typica* Maas Geesteranus in H. J. Lam, l. c. 1941, 327 — Leaves glabrous even when young. Pedicels subglabrous, in flower 1.7—2.1, in fruit 2.5—2.8 cm long. Fruits ovoid or subglobose, 0.5—0.7 cm in diam.

Var.  $\beta$  *Pancheri* (Baill.) Maas Geesteranus, l. c. — Leaves tomentose below, subglabrescent. Pedicels pubescent, in flower 2.2—2.7, in fruit 2.7—3.7 cm long. Fruits oblong, 0.45—0.5 cm in diam.

Distribution: Samoa, Tonga, New Caledonia.

2. *M. emarginata* H. J. Lam, Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 241 and in Blumea 4, 1941, 342.

Insufficiently known and not certain whether actually wild.

Distribution: Hawaii (Oahu).

3. *M. samoensis* H. J. Lam & B. Meeuse, Blumea 4, 1941, 338, fig. 10.

Distribution: Samoa.

4. *M. Smithiana* H. J. Lam & R. Maas Geesteranus, Blumea 4, 1941, 328, fig. 2.

Distribution: Fiji (Vanua Mbalavu).

5. *M. udoido* Kanehira, Bot. Mag. Tokyo 47, 1933, 677 and Fl. Micron. 1933, 304, fig. 154; H. J. Lam, Blumea 4, 1941, 333, fig. 6.

Distribution: Caroline Isl. (Palao).

6. *M. vitiensis* (H. J. Lam & E. van Olden) B. Meeuse in H. J. Lam, Blumea 4, 1941, 339, fig. 11 (synonym given there is *Northia vitiensis* H. J. Lam & E. van Olden).

Distribution: Fiji.

## VI. Northiopsis Kanehira

1. **N. Hoshinoi** (Kanehira) Kanehira, Fl. Micron. 1933, 402, fig. 152, Bot. Mag. Tokyo 47, 1933, 677 and Journ. Dept. Agr. Kyushu Imp. Univ. 4, 1935, 388; H. J. Lam, Blumea 4, 1941, 344 — *Northia Hoshinoi* Kanehira, Bot. Mag. Tokyo 46, 1932, 489.

Distribution: Caroline Isl. (Ponape), Samoa (Savaii).

## VII. Mimusops L.

1. **M. Elengi** L., Sp. Pl. ed. I, 1753, 349; H. J. Lam, Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 234, 244, 245, 268 and 8, 1927, 479.

Var.  $\beta$  *parvifolia* (R. Br.) H. J. Lam, l.c. 1925, 236; Guillaumin, Journ. Arn. Arb. 13, 1932, 14 (sub *M. parvifolia* R. Br.).

Solomon Islands: Ysabel Isl., Maringe, rain forest on limestone hills, 100 m alt.: L. J. Brass 3297 (medium-sized tree with white flowers and green fruit on Dec. 7, 1932; A., Bish., L.) — Florida Isl. (N'gela), hills, rain forest, alt. 75 m, common: Id. 3512 (tree, about 15 m high, flower buds on Jan. 25, 1933; A., Bish., L.).

Distribution of the species: British India to W. Pacific; of the variety: Malaysia and W. Pacific (Solomon Isl., New Hebrides, Loyalty Isl., New Caledonia).

## List of Collectors

*Note.* In the list given underneath have been enumerated the numbers (s. n. = sine numero) quoted in the present paper and in addition those published earlier in Bull. B. P. Bish. Mus. 154, 1938, 34—35 (*Burckella microphylla*) Blumea IV, 1941, 323—358 (*Manilkara* and *Northiopsis*).

For *Nesoluma* the list in Occasional Papers B. P. Bish. Mus. XIV, 1938, Nr. 9, 156—157 should be consulted.

The genera and species have been indicated by their number of sequence.

*Balansa* 1821 (V, 1,  $\beta$ ); 3470 (V, 1,  $\beta$ ) — *Ballieu* s. n. (I, 10,  $\alpha$ , a) — *Bouchier* for *Wilder*, G. P. s. n. (V, 1,  $\beta$ ) — *Brass*, L. J. 3297 (VII, 1,  $\beta$ ); 3312 (I, 9); 3338 (I, 8); 3433 (I, 5); 3512 (VII, 1,  $\beta$ ) — *Bridwell*, J. C., see *Forbes*, C. N. — *Brigham*, see *Mann* — *Bryan Jr.*, E. H. 660 (I, 10,  $\alpha$ , a).

*Cheeseman*, T. F. 806 (I, 1,  $\beta$ ) — *Christophersen*, E. 29 (III, 6); 2628 (I, 11); 2652 (I, 9); 2660 (*Stehlin*) (VI, 1); 2775 (I, 9); 2791 (I, 9); 2853 (I, 9); 2884 (III, 6); 3235 (I, 9); 3255 (III, 7); 3317 (I, 1,  $\beta$ ); 3319 (VI, 1); 3364 (I, 10,  $\alpha$ , b); 3666 (I, 10,  $\alpha$ , a) — *Christophersen*, E. & *Hume* 2474 (IV, 6); 3275 (I, 9) — *Colenzo* s. n. (Herb. Hook.) (I, 1,  $\alpha$ ) — *Comins* 320 (IV, 1) — *Cooke*, C. M. (per *Meinecke*) 3 (I, 10,  $\beta$ , a) — *Cranwell*, L. M. 3516 (I, 10,  $\alpha$ , a) — *Cranwell*, L. M., O. *Selling* & C. *Skottsberg* 2779 (I, 10,  $\alpha$ - $\beta$ ); 3210 (I, 10,  $\beta$ , a) — *Crosby*, C. S. 100 (I, 1,  $\beta$ ); 101 (I, 9); 102 (IV, 6); 295 (I, 9); s. n. (I, 1,  $\beta$ ) — *Curran* 132 (V, 2).

*Degener*, O. 11067 (I, 10,  $\alpha$ , b); see also *Meebold*, A. — *Degener*, O. & *Wiebbe* 2278 (I, 10,  $\alpha$ , a).

*Ewart*, G. E. III, 61 (I, 10,  $\alpha$ , a).

*Faurie*, *Abbé* 435 (I, 10,  $\alpha$ - $\beta$ ); 685 (I, 10,  $\alpha$ ); 686 (I, 10,  $\alpha$ , a); 687 (I, 10,  $\alpha$ - $\beta$ ) — *Filhol* s. n. (Herb. Kirk) (I, 1,  $\alpha$ ) — *Forbes*, C. N. 8 (I, 10,  $\alpha$ , a); 31 (I, 10,  $\beta$ , a); 46 (I, 10,  $\alpha$ , a); 98 (I, 10,  $\beta$ , a); 108 (I, 10,  $\beta$ , a); 115 (I, 10,  $\alpha$ , a); 118 (I, 10,  $\beta$ , a); 118b (I, 10,  $\beta$ , a); 137 (I, 10,  $\alpha$ - $\beta$ ); 138 (I, 10,  $\alpha$ , a); 199 (I, 10,  $\alpha$ , a); 297 (I, 10,  $\beta$ , a); 381 (I, 10,  $\alpha$ , a); 648 (I, 10,  $\alpha$ , a); 845 (I, 10,  $\alpha$ , a); 989 (I, 10,  $\alpha$ , a); 1076 (I, 10,  $\alpha$ , a); 1439 (I, 10,  $\alpha$ , a); 1669 (I, 10,  $\alpha$ , a); 1773 (I, 10,  $\alpha$ , a); 1882 (I, 10,  $\beta$ , a); 1927 (I, 10,  $\beta$ , a); 1936 (I, 10,  $\beta$ , a); 1944 (I, 10,  $\alpha$ - $\beta$ ); 1979 (I, 10,  $\beta$ , a); 2112 (I, 10,  $\beta$ , a); 2040 (I, 10,  $\alpha$ - $\beta$ ); 2066 (I, 10,  $\beta$ , a); 2073 (I, 10,  $\beta$ , a); 2112 (I, 10,  $\alpha$ , a); 2113 (I, 10,  $\alpha$ , a); 2114 (I, 10,  $\beta$ , a); 2245 (I, 10,  $\alpha$ - $\beta$ ); 2495 (I, 10,  $\alpha$ - $\beta$ ); s. n. (Feb. 12—19, 1909) (I, 10,  $\alpha$ , a); s. n. (Aug. 1913)

(I, 10,  $\beta$ ); s. n. (March 1920) (I, 10,  $\beta$ , a) — *Forbes, C. N. and J. C. Bridwell* 2460 (I, 10,  $\alpha$ - $\beta$ ) — *Forster* s. n. (IV, 7); s. n. (V, 1,  $\alpha$ ).

*Garber* 1101 (I, 3) — *Germain* s. n. (V, 1,  $\beta$ ) — *Gillespie* 4487 (I, 1,  $\beta$ ); 4494 (I, 1,  $\beta$ ); 4559 (I, 1,  $\beta$ ).

*Hammond*, see *Rock, J. F. — Hillebrand, W.* s. n. (leg. Oahu, Nuanu, 1858) (I, 10,  $\alpha$ , a); s. n. (Oahu, 1869 or 1870) (I, 10,  $\beta$ , b); s. n. (Lanai, July 1870) (I, 10,  $\sigma$ , a); s. n. (Lanai, July 1870) (I, 10,  $\beta$ , a); s. n. (Maui) (I, 10,  $\alpha$ , a); s. n. (Maui, Aug. 1870) (I, 10,  $\beta$ , a); s. n. (leg. 1874) (I, 10,  $\alpha$ , a); s. n. (leg. Lanai, 1874) (I, 10,  $\beta$ , a); s. n. (Molokai) (I, 10,  $\alpha$ , a); see also *Knudsen — Hillebrand, W. & J. M. Lydgate* s. n. (Maui) (I, 10,  $\alpha$ , a) — *Höfer* 21 (I, 8) — *Horne* 2 (I, 11); 317 (I, 1,  $\beta$ ); 317a (I, 1,  $\beta$ ); 484 (IV, 3); 717 (III, 3); 1117 (III, 2) — *Hosaka, E. Y.* 665 (I, 10,  $\alpha$ , a); 841 (I, 10,  $\alpha$ , a); 860 (I, 10,  $\alpha$ , a); 992 (I, 10,  $\alpha$ , b); 1015 (I, 10,  $\alpha$ , a) — *Hoshino* 2138 (VI, 1) — *Hume*, see *Christophersen, E.*

*Inouye, R. S.* s. n. (Nov. 5, 1933) (I, 10,  $\alpha$ , a).

*Judd A. F.* 19 (I, 10,  $\alpha$ - $\beta$ ); 49 (I, 10,  $\beta$ , a); s. n. (June 4, 1938) (I, 10,  $\alpha$ - $\beta$ ).

*Kajewski* 43 (IV, 4); 104 (I, 1,  $\beta$ ); 344 (III, 5); 385 (I, 4); 756 (III, 5); 771 (I, 9); 936 (I, 4); 941 (I, 9); 945 (I, 9); 1903 (III, 1); 2124 (I, 2); 2205 (IV, 2); 2399 (IV, 2) — *Kanehira, R.* 794 (III, 4); 1322 (I, 7) — *Knudsen* s. n. (Herb. Hillebrand) (I, 10,  $\alpha$ , a) — *Kraemer* s. n. (I, 8); s. n. (V, 5) — *Krajina, V.* 122 (I, 10,  $\alpha$ ); 123 (I, 10,  $\alpha$ ); 124 (I, 10,  $\beta$ ); 125 (I, 10,  $\alpha$ , a); 127 (I, 10,  $\beta$ , a); 128 (I, 10,  $\beta$ , a) — *Krauss, N. H.* s. n. (Jan. 8, 1933) (I, 10,  $\alpha$ , a); s. n. (May 14, 1933) (I, 10,  $\alpha$ , a).

*Ledermann* 13299 (III, 4); 13555 (III, 4); 13796 (III, 4); 14079 (I, 8); 14364 (I, 8); 14491 (V, 5); 14510 (V, 5) — *Lindley* s. n. (I, 1,  $\alpha$ ) — *Lister, J. J.* s. n. (I, 1,  $\beta$ ); s. n. (IV, 6) — *Lydgate, J. M.* s. n. (Kauai) (I, 10,  $\beta$ , a); see also *Hillebrand, W. — Lyon, H. L.* 6061 (I, 10,  $\alpha$ , a).

*Mann & Brigham* 363 (I, 10,  $\beta$ ) — *Marche, A.* 244 (I, 8) — *Meebold, A.* s. n. (Oahu) (I, 10,  $\alpha$ , b); s. n. (Huehue) (I, 10,  $\beta$ , a); s. n. (Kilauea) (I, 10,  $\beta$ , b); in Herb. Degener 10663 (I, 10,  $\beta$ , b) — *Meinecke*, see *Cooke — Milne* 430 (V, 1,  $\beta$ ) — *Munro, G. C.* 32 (I, 10,  $\beta$ , a); 52 (I, 10,  $\alpha$ , a); 53 (I, 10,  $\alpha$ , a); 54 and 54a (I, 10,  $\beta$ , a); 204 (I, 10,  $\alpha$ , a); 244 (I, 10,  $\beta$ , a); 263 (I, 10,  $\alpha$ , a); 264 (I, 10,  $\alpha$ , a); 285 (I, 10,  $\alpha$ , a); 392 (I, 10,  $\beta$ , a); 394 (I, 10,  $\beta$ , a); 401 (I, 10,  $\beta$ , a); 407 (I, 10,  $\sigma$ , a); s. n. (Apr. 6, 1915, Haalelepaakai) (I, 10,  $\alpha$ , a); s. n. (April 6, 1915, Kaa) (I, 10,  $\beta$ , a); s. n. (May 12, 1915) (I, 10,  $\beta$ , a); s. n. (June 27, 1915) (I, 10,  $\alpha$ , a).

*Nadeaud* s. n. (I, 1,  $\beta$ ) — *Nisida, S.* 2776 (V, 5).

*Pancher* s. n. (V, 1,  $\beta$ ) — *Parks, H. E. & S. Thew* 22356 (I, 1,  $\beta$ ) — *Pelletier* 39 (V, 1,  $\alpha$ ) — *Powell, T.* 187 (V, 1,  $\alpha$ ).

*Raymundus, Pater* 9 (I, 8); 224 (I, 8) — *Reinecke* 177 (I, 11) — *Rémy, J.* 475 (I, 10,  $\beta$ , a); 476 (I, 10,  $\alpha$ - $\beta$ ); 477 (I, 10,  $\alpha$ ); 478 (I, 10,  $\alpha$ , a); 478a (I, 10,  $\alpha$ , a) — *Rock, J. F.* (A) (I, 10,  $\beta$ , a); (B) (I, 10,  $\beta$ , a); (C) (I, 10,  $\alpha$ , a); 1507 (= 1495) (I, 10,  $\alpha$ , a); 1624 (= 1495) (I, 10,  $\alpha$ , a); 2085 (I, 10,  $\alpha$ , a); 2197 (= 1495) (I, 10,  $\alpha$ , a); 2198 (= 1495) (I, 10,  $\alpha$ , a); 2336 (I, 10,  $\alpha$ - $\beta$ ); 3820 (I, 10,  $\beta$ , a); 3912 (I, 10,  $\beta$ , a); 3971 (= 3966 = 3973) (I, 10,  $\beta$ , a); 5507 (= 5509) (I, 10,  $\alpha$ , a); 5511 (= 5509) (I, 10,  $\alpha$ , a); 5512 (= 5509) (I, 10,  $\alpha$ , a); 6154 (I, 10,  $\alpha$ - $\beta$ ); 7077 (I, 10,  $\beta$ , a); 8002 (I, 10,  $\sigma$ , a); 8003 (I, 10,  $\alpha$ , a); 8039 (I, 10,  $\beta$ , a); 8063 (I, 10,  $\alpha$ , a); 8106 (I, 10,  $\sigma$ , a); 8107 (I, 10,  $\alpha$ , a); 8122 (I, 10,  $\alpha$ , a); 8510 (I, 10,  $\alpha$ , a); 8668 (I, 10,  $\beta$ , a); 8670 (I, 10,  $\alpha$ , a); 8684 (I, 10,  $\beta$ , a); 10029 (I, 10,  $\beta$ , a); 10150 (I, 10,  $\beta$ , a); 17029 (I, 10,  $\beta$ , a); 17057 (I, 10,  $\alpha$ , a); 17120 (I, 10,  $\beta$ , a); s. n. (Kauai, 1910) (I, 10,  $\alpha$ , a); s. n. (Maui, Oct. 1910) (I, 10,  $\beta$ , a); s. n. (Kauai, Oct. 1911) (I, 10,  $\alpha$ , a); s. n. (Puuwaawaa, March 1912) (I, 10,  $\beta$ , a); s. n. (Puuwaawaa or Kapua) (I, 10,  $\beta$ , a) — *Rock, J. F. & Hammond* 8064 (I, 10,  $\alpha$ , a) — *Russ, G. W. & D'A Welch* s. n. (June 22, 1933) (I, 10,  $\alpha$ , a).

*Shea & Stevens* s. n. (Jan., 1928) (I, 10,  $\beta$ , a) — *Selling, O.* 3349 (I, 10,  $\alpha$ , a); 3365 (I, 10,  $\beta$ , a); 3674 (I, 10,  $\alpha$ , a); 3689 (I, 10,  $\alpha$ , a); see also *Cranwell, L. M. — Skottsberg, C.* 668 (I, 10,  $\beta$ , a); 1004 (I, 10,  $\alpha$ , a); 1820 (I, 10,  $\beta$ , a); 1963 (I, 10,  $\beta$ , a); 2851 (per *J. Wichman*) (I, 10,  $\alpha$ , a); see also *Cranwell, L. M. — Smith, A. C.* 82 (IV, 1); 683 (I, 1,  $\alpha$ ); 705 (I, 1,  $\alpha$ ); 920 (I, 9); 1154 (I, 1,  $\beta$ ); 1208 (I, 1,  $\beta$ ); 1385 (I, 1,  $\beta$ ); 1386 (I, 1,  $\beta$ ); 1450 (V, 4); 1453 (I, 1,  $\beta$ ); 1461 (V, 6); 1474 (IV, 1); 1491 (I, 6); 1604 (I, 3); 1793 (III, 3); 1805 (III, 2); 1980 (IV, 5) — *Stehlin*, see *Christophersen, E.* — *Stevens*, see *Shea — St. John, H.* 9937 (I, 10,  $\alpha$ , a);

10362 (I, 10,  $\alpha$ , a); 10582 (I, 10,  $\alpha$ , a); 10724 (I, 10,  $\alpha$ , a); 11584 (I, 10,  $\beta$ , a); 11589 (I, 10,  $\alpha$ , a); 16513 (I, 1,  $\beta$ ); 16514 (I, 1,  $\beta$ ); 16738 (I, 1,  $\beta$ ); 16769a (I, 1,  $\epsilon$ ).

*Takamatsu*, M. 1212 (I, 8); 1554 (I, 8); 1751 (V, 5) — *Thompson* 477 (I, 8) — *Thurston* s.n. (IV, 8).

U. S. South Pac. Expl. Exp. Capt. *Wilkes* s.n. (I, 1,  $\beta$ ); s.n. (V, 1,  $\alpha$ ).

*Vaupel* 324 (I, 11); 341 (III, 7); 504 (IV, 6); 612 (I, 11) — *Volkens* 340 (I, 8); 533 (553f) (I, 8).

*Welch*, D.A. see *Russ*, G. W. — *Whitmee* 224 (I, 11); 226 (V, 3) — *Wichman*, J., see *Skottsberg* — *Wilder*, G. P. 88 (I, 10,  $\beta$ , a); 455 (I, 10,  $\alpha$ - $\beta$ ); 777 (I, 1,  $\beta$ ); 950 (I, 1,  $\beta$ ); 1115 (I, 1,  $\beta$ ); see also *Bouchier*.

### Index of latin names

*Note.* Accepted names in roman, synonyms in italics. New species are denoted by an asterisk. Genera and species have been indicated by their number of sequence. Only those have been enumerated, which have been quoted in the present paper. For further synonymy see our previous publications in Bull. Jard. bot. Buitenzorg, Sér. III, VII, 1925 and VIII, 1927; Nova Guinea XIV, 4, 1932; B. P. Bish. Mus. Occ. Pap. XIV, Nr. 9, 1938 and Blumea IV, nr. 2, 1941.

#### ACHRAS

*costata* Endl. (I, 1); *dissecta* L. f. (V, 1); *novo-zelandica* F. Muell. (I, 1).

#### BASSIA

*Amicorum* A. Gray (IV, excl.); *Bawun* (Scheff.) Guill. (IV, 2); *Kajewskii* Guill. (IV, 4); *obovata* Forst. (IV, 7); *Thurstonii* Hemsl. (IV, 8).

#### BURCKELLA

*Amicorum* (A. Gray) H. J. Lam (IV, excl.); \**brachypoda* H. J. Lam (IV, 1); *Cocco* (Scheff.) Pierre (IV, 2); *Hillii* (J. G. Baker) H. J. Lam (IV, 3); *Kajewskii* (Guill.) H. J. Lam (IV, 4); \**macrantha* H. J. Lam (IV, 5); *microphylla* H. J. Lam & E. v. Olden (IV, 6); *obovata* (Forst.) Pierre (IV, 7); *Thurstonii* (Hemsl.) H. J. Lam (IV, 8).

#### CHRYSOPHYLLUM

*polynescicum* Hill. (II, 2); *sandwicense* Hill. (I, 10).

#### DICHOPSIS

*Hornei* Hart. (III, 3).

#### HORMOGYNE

*tahitensis* Nad. (I, 1); *tahitensis* (Nad.) Pierre (I, 1).

#### ISONANDRA

*polynescica* Benth. & Hook. (II, 2).

#### LUCUMA

*vitiensis* (Gray) Gill. (I, 1).

#### MADHUCA

*Amicorum* (A. Gray) Macbr. (IV, excl.).

#### MANILKARA

*dissecta* (L. f.) Dub. (V, 1); *emarginata* H. J. Lam (V, 2); *Pancheri* (Baill.) Dub. (V, 1); *samoensis* H. J. Lam & B. Meeuse (V, 3); *Smithiana* H. J. Lam & R. Maas Geesteranus (V, 4); *udoido* Kan. (V, 5); *vitiensis* (H. J. Lam & E. van Olden) B. Meeuse (V, 6).

#### MIMUSOPS

*dissecta* R. Br. (V, 1); *Elengi* L. (VII, 1); *Pancheri* Baill. (V, 1).

#### MYRSINE

*molokaiensis* Lév. (I, 10).

## NESOLUMA

*Nadeaudii* (Drake) Pierre (II, 1); *polynesianum* (Hill.) Baill. (II, 2); *St. Johnianum* H. J. Lam & B. Meeuse (II, 3).

## NORTHIA

*Hoshinoi* Kan. (VI, 1); *vitiensis* H. J. Lam & E. van Olden (V, 6).

## NORTHIOPSIS

*Hoshinoi* (Kan.) Kan. (VI, 1).

## PALAQUIUM

*amicorum* Pierre (IV, excl.); *\*erythrospermum* H. J. Lam (III, 1); *fidjiense* Pierre (III, 2); *Hornei* (Hart.) Dub. (III, 3); *karrak* Kan. (III, 4); *leuconeurum* H. J. Lam (III, 4); *neo-ebudicum* Guill. (III, 5); *\*oxypermum* H. J. Lam (III, 6); *Stehlinii* Christoph. (III, 7).

## PAYENA

*Hilli* J. G. Baker (IV, 3).

## PLANCHONELLA

*aurantium* (Rock) Skotts. (I, 10); *costata* (Endl.) Pierre (I, 1); *densiflora* (Hill.) Pierre (I, 10); *firma* (Miq.) Dub. (I, 2); *Garberi* Christoph. (I, 3); *Garberi* Christoph. p. p. (I, 9); *Grayana* St. John (I, 1); *\*Guillauminii* H. J. Lam (I, 4); *macropoda* H. J. Lam (I, 5); *Meeboldii* Baehni & Degener (I, 10); *\*membranacea* H. J. Lam (I, 6); *miconesica* (Kan.) Kan. (I, 7); *obovata* (R. Br.) H. J. Lam (I, 8); *oxyedra* (Miq.) Dub. (I, 9); *paludosa* H. J. Lam (I, 11); *puulupensis* Baehni & Degener (I, 10); *Remyi* Pierre (I, 10); *samoensis* (Rein.) H. J. Lam (I, 11); *sandwicensis* (A. Gray) Pierre (I, 10); *spathulata* (Hill.) Pierre (I, 10); *tahitensis* (Nad.) Dub. (I, 1); *torricellensis* (K. Schum.) H. J. Lam (I, 11); *vitiensis* Gill. (I, 9).

## RAPANEA

*torricellensis* K. Schum. (I, 11).

## SAPOTA

*costata* (Endl.) A. DC. (I, 1); *pyrulifera* A. Gray (I, 9); *sandwicensis* A. Gray (I, 10); *vitiensis* A. Gray (I, 1).

## SERSALISIA

*costata* (Endl.) Dom. (I, 1).

## SIDEROXYLON

*acutum* Krause (I, 11); *aneityense* Guill. (I, 9); *auahiense* Rock (I, 10); *Ceresolei* Rock (I, 10); *costatum* (A. DC.) Benth. & Hook. (I, 1); *costatum* (Endl.) F. v. Muell. (I, 1); *miconesicum* Kan. (I, 7); *rhynchospermum* Rock (I, 10); *samoense* Rein. (I, 11); *sandwicense* (A. Gray) Benth. & Hook. (I, 10); *spathulatum* Hillebr. (I, 10); *tahitense* Nad. (I, 1); *tannaense* Guill. (I, 1); *vitiense* (Gray) Benth. & Hook. (I, 1); *vitiense* (Gray) Burk. (I, 1).

## SUTTONIA

*molokaiensis* Lév. (I, 10).

A geographical list of Sapotaceous species occurring in the separate islands or island groups may be found in our earlier paper, published in the Proceedings of the Sixth Pacific Science Congress, Berkeley 1939.