THE GENUS CANARIUM IN THE PACIFIC

BY

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RIJKSHERBARIUM, LEIDEN

BERNICE P. BISHOP MUSEUM

BULLETIN 216

HONOLULU, HAWAII

PUBLISHED BY THE MUSEUM

1955

Printed by
Honolulu Star-Bulletin

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Specific...

The Genus Canarium in the Pacific[1]

By P. W. LEENHOUTS
Rijksherbarium, Leiden

INTRODUCTION

Hitherto no compilation has been published regarding that part of the genus *Canarium* which is represented in the Pacific region. The most recent monograph of the genus, that of Engler (DC. Monogr. Phan. 4: 101-151, 1883), is obsolete. In it Engler mentions only 11 specimens of Pacific origin, most of which were collected in New Caledonia. Most valuable are the papers by H. J. Lam on the morphology (Jard. bot. Buitenzorg, Ann. 42: 23-56, 97-226, 1932) and on the taxonomy (Jard. bot. Buitenzorg, Bull. III, 12: 281-561, 1932), though they deal with the adjacent Malay Archipelago and Peninsula. Lam's new subdivision of the genus, based primarily on the stipules, seems more natural than the older subdivisions and has, in a slightly modified form, been followed by me. In addition, there are some smaller papers relative to the Pacific region which are quoted.

Geographically, I have restricted myself to Polynesia, Micronesia, and Melanesia east and north of New Guinea and the adjacent islands (fig. 1). Cultivated species are included in the keys and only briefly mentioned in the taxonomic section. Two Australian species, *C. baileyanum* Leenhouts and *C. muelleri* F. M. Bailey are included, as they are the only non-Pacific representatives of the section *Canariellum*.

In all, 21 species are described, of which five are new to science and two are new names. In addition, two new varieties are described and one variety and one form are new combinations.

I am highly indebted to the directors of the following herbaria for the loan of material.

Arnold Arboretum, Jamaica Plain, Massachusetts (A)
Botanisches Museum, Berlin-Dahlem (B)
Herbarium, Bernice P. Bishop Museum, Honolulu (BISH)
Herbarium Bogoriense, Bogor (BO)
Department of Agriculture and Stock, Brisbane (BRI)
Botanical Institute, Wroclaw (BRSL)
Conservatoire et Jardin botaniques, Genève (G)
Herbarium, Royal Botanic Gardens, Kew (K)
Rijksherbarium, Leiden (L)
National Herbarium of New South Wales, Sydney (NSW)
Muséum national d'Histoire naturelle, Laboratoire de Phanerogamie, Paris (P)
Naturhistorisches Museum, Wien (W)

[1] This is the tenth in a series on the "Revision of Burseraceae of the Malaysian area in a wider sense" Blumea 7 (1-3): 154-170, 413-472, 498-552, 1952-1954.

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My special thanks are due to Professor Dr. H. J. Lam, Director of the Rijksherbarium, and to the staff members of the Rijksherbarium and the Foundation Flora Malesiana, both at Leiden, for their help on many occasions, and to Mr. H. J. T. Tammel for the drawings.

Unless otherwise stated, the descriptions are based on dried material and the material is sterile.

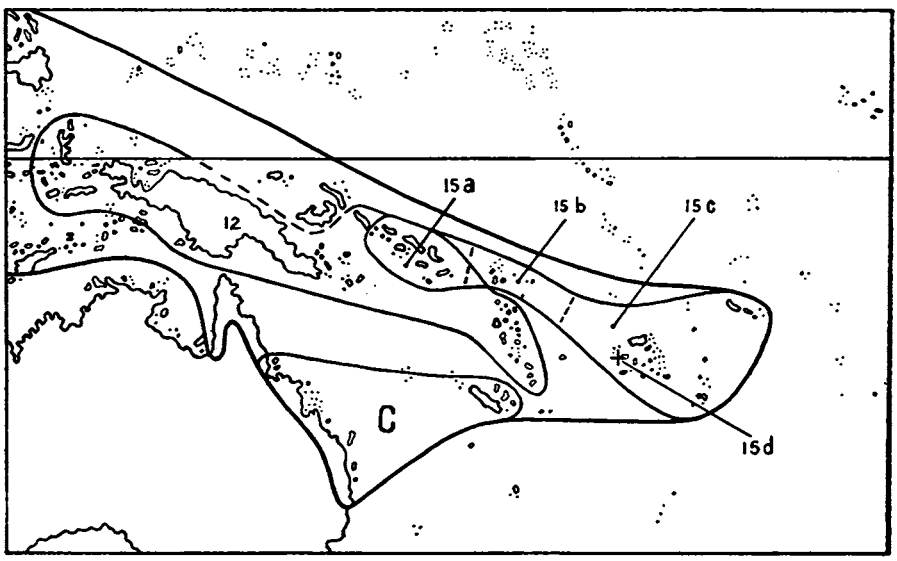

FIGURE 1.—Map, showing distribution of wild *Canarium* in Pacific region (heavy line) and most striking phytogeographic connections in this area: **12**, *C. indicum* connecting eastern Malaysia via New Guinea with the Solomons and New Hebrides; **15, a-d**: *C. harveyi*, showing a connection between Solomons and Fiji-Samoa-Tonga group via Vera Cruz Islands. Direction of distribution from west to east is suggested by the increasing reduction of two of the fruit cells from var. *sapidum* (*a*) via var. *nova-hebridiense* (*b*) to var. *harveyi* (*c*); *d* = var. *scandens*. **C**, section *Canariellum*, demonstrating a probably very old connection between Australia and New Caledonia.

Genus **Canarium** L.

Canarium L. in Stickman, Herb. Amb., 10, 1754 (*Cenarium;* obviously a typographical error); includes *Canariellum* Engler in Engler and Prantl, Nat. Pflanzenfam. **3** (4): 242, 1896.

Full descriptions of the genus may be found in the papers by H. J. Lam (Jard. bot. Buitenzorg, Ann. **42**: 23-56, 97-226, 1932; Bull. III, **12**: 281-561, 1932). In my opinion, the genus is best characterized by the peculiar structure

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of the fruits. If the fruits are unknown, confusion with *Haplolobus*, *Dacryodes*, and *Santiria* is possible.

The type species is *Canarium indicum* L.

About 120 species are found in the tropics of the Old World from Africa to the Pacific region and Australia. Some slightly penetrate into the subtropics. More than half of that number are confined to Malaysia.

Economic uses, as given on labels or in the literature, have been mentioned under the species concerned. In general, the oily seeds of many, probably all, species are eaten; and some species are cultivated for food. The resin is used for many purposes. The wood of most species seems to be rather hard. Only that of *C. oleiferum* Baillon is mentioned as being soft and of little use.

Key to Groups

1a. Stipules or stipule scars present, stipules inserted on branchlet near petiole or partly or entirely on base of petiole (in some cases visible in youngest parts or in buds only) 2

b. No stipules or stipule scars present ..... **Group C.**

2a. Stipules either subulate, scar small and circular, or linear, up to 0.3 cm. wide, abruptly broadened at base, scar long and narrow ..... **Group A.**

b. Stipules either broader and foliaceous or small and auriculate; scars long and narrow or drop-shaped ..... **Group B.**

Group A

Stipules subulate or narrowly lanceolate (up to 0.3 cm. wide), if subulate, scar small and ovate or circular, sometimes almost invisible, if narrowly lanceolate, abruptly broadened at base, scar long and narrow (as in group B). *Medulla of branchlets* with many vascular bundles, usually forming a peripheral cylinder, central part rarely without vascular bundles, these sometimes forming a second cylinder. *Inflorescences* axillary or pseudoterminal, rarely terminal (without terminal leafbud). *Calyx* pilose inside (also when in fruit). *Petals* shortly and appressedly tomentose outside, except at base and margin. *Stamens* mostly free. *Disk* pilose, mostly cupular, in male flowers rarely an ovariodisk, with or without a central canal; in female flower, mostly composed of 6 almost free lobes, rarely cupular. *Pistil* strongly to entirely reduced in male flowers, pilose in female ones. *Fruit* tending to have 2, or rarely 1, of the locules almost completely reduced.

In this group I have united the Pacific species of Lam's section *Regressiva*, subsection *Subulata*. It is my impression that this group is a quite natural one, as is shown in the above description.

Keys to Species of group A

I. Key, based mainly on vegetative parts and fruit (the fruit thus far unknown in *C. vanikoroense* and *C. smithii*).

1a. Stipules narrowly lanceolate, 0.05-0.3 cm. wide, at base abruptly broadened and up to 0.8 cm. wide, attached at conjunction of petiole and branchlet or entirely on basal part of former; semipersistent to persistent, leaving a long and narrow scar or ridge 2

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b. Stipules subulate, attached at base of petiole, up to 5 cm. from branchlet, not infrequently deciduous, leaving a minute ovate or circular scar, in older leaves nearly invisible 4

2a. Leaves 2½-3½-jugate, up to about 30 cm. long. Branchlets slender, up to 0.8 cm. thick. Stipules at base 0.2-0.3 cm. wide. Petioles up to 10 cm. long and 0.3 cm. thick; interjugal parts up to 3 cm. long; leaflets 5-11.5 × 2.5-5 cm. (Fiji) ..... **1. C. linguistipulum.**

b. Leaves 4½-5½-jugate, up to about 55 cm. long. Branchlets not slender, up to 1.3 cm. thick. Stipules at base about 0.8 cm. wide. Petioles 12-16 cm. long, 0.45-0.55 cm. thick; interjugal parts 4.7-6.5 cm. long; leaflets 12-17 × 7-8 cm... 3

3a. Leaflets shining, with 12-16 pairs of secondary nerves, angle 65-85 degrees, venation slender. Stipules persistent, attached at base of petiole at 0.1-0.3 cm. from branchlet, connected with branchlet by ridges, acutely deltoid, 0.6 × 0.15 cm. Leafscars not strongly prominent, crescent-shaped, 0.6 × 0.8 cm. (New Hebrides) ..... **2. C. vanikoroense.**

b. Leaflets dull, secondary nerves 10-12, angle 50-55 degrees, venation coarse. Stipules deciduous, attached at the conjunction of the petiole and the branchlet, narrowly linguiform, obtuse, 0.4 × 0.07 cm. Leafscars rather prominent, broadly ovate to rounded cordate, 0.3 × 0.5 cm. (Admiralty Is., Solomons) ..... **3. C. chinare.**

4a. Inflorescences spicate. Leaves more or less pilose (Solomons) ..... **4. C. asperum.**

b. Inflorescences paniculate. Leaves rarely pilose 5

5a. Leaflets small (max. 8.3 × 4 cm.), above grayish green; secondary nerves 7-8, conspicuously arched and joined at some distance from margin. Branchlets slender (0.3-0.35 cm. thick). Petioles 2.7-5 cm. long, slender (about 0.15 cm. thick); interjugal parts 1.2-2.8 cm. long. All parts more or less pilose (Fiji) ..... **5. C. smithii.**

b. Most of the leaflets larger; secondary nerves 8 or more, rarely all distinctly arched and joined near margin. Branchlets less slender (0.35-1.4 cm. thick). Petioles never shorter than 4 cm., 0.2 cm. thick or more; interjugal parts 2-8 cm. long. Rarely pilose 6

6a. Branchlets more or less angular, 0.7-1.4 cm. thick. Fruit with long, stiff, reddish brown hairs, at least at base and apex; no fruit cells strongly reduced (Carolines, Solomons) ..... **6. C. hirsutum.**

i. Stout. Branchlets 1.2-1.4 cm. thick. Leaves about 6½-jugate; petioles 15-17 cm. long, 0.5-0.6 cm. thick; interjugal parts 4-6.5 cm. long; lateral petiolules 1.2-1.7 cm., terminal ones 2.5-5.5 cm. long. Leaflets 16.5-20 × 5.5-7.5 cm., coriaceous. Fruit subglobose, 3.5 × 2.8 cm.; pericarp 0.4 cm. thick, glabrous, fibrous (Solomons) ..... **forma leeuwenii.**

ii. Slender. Branchlets 0.7-1.1 cm. thick. Leaves 3½-5½ jugate; petioles 8-11 cm. long, 0.3-0.4 cm. thick; interjugal parts 2-4 cm. long; lateral petiolules 0.5-0.8 cm. long, terminal ones 2 cm. long. Leaflets 10-17 × 3.5-5.5 cm., thin coriaceous. Fruit ovoid to ellipsoid, somewhat trigonous at cross-section, 1.4-1.8 × 0.9-1.2 cm.; pericarp about 0.075 cm. thick, wrinkled and apparently more or less fleshy (Carolines) ..... **forma scabrum.**

b. Branchlets terete, up to 1 cm. thick. Fruit glabrous or somewhat pubescent; 2 or, rarely, 1 fruit cell strongly reduced 7

7a. Fruit fusiform, acute at either end, particularly at apex. Fruiting calyx funnel-shaped (Fiji) ..... **7. C. vitiense.**

b. Fruit ovoid to ellipsoid; blunt, particularly at apex. Fruiting calyx plane 8

8a. Lobes of fruiting calyx more or less reflexed. Disk in female flower and in fruiting calyx 6-lobed (Fiji) ..... **8. C. bacciferum.**

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b. Fruiting calyx spreading. Disk in female flower cupular, in fruiting calyx annular 9
9a. Stamens free (Samoa)..... **9. C. samoense.**
b. Stamens connate (Fiji)..... **10. C. pilosum.**

II. Key, based on characters of male flower (thus far unknown in *C. chinare, C. bacciferum,* and *C. linguistipulum*).

1a. Stamens connate (sometimes only at very base)..... 2
b. Stamens free (sometimes partly inserted on disk)..... 5
2a. Stamens connate at base only..... 3
b. Filaments connate for one-fourth of their length or more..... 4
3a. Petals 1 cm. long, much exserted; disk cupular (Fiji)..... **5. C. smithii.**
b. Petals up to 0.45 cm. long, not conspicuously exserted; ovariodisk with or without central canal (Solomons)..... **4. C. asperum.**
4a. Disk cupular, with a rudimentary ovary; petals 1-1.1 cm. long (Fiji)..... **10. C. pilosum.**
b. Ovariodisk, with central canal, without any rudiment of ovary; petals 0.6 cm. long (New Hebrides)..... **2. C. vanikoroense.**
5a. Ovariodisk present..... 6
b. Disk cupular 7
6a. Petals up to 0.45 cm. long (Solomons)..... **4. C. asperum.**
b. Petals 0.8-1 cm. long (Fiji)..... **7. C. vitiense.**
7a. Filaments more or less pilose (Carolines, Solomons)..... **6. C. hirsutum** (for forms, see key I).
b. Filaments glabrous 8
8a. Flowers 0.8 cm., sepals 0.5 cm., petals 0.7 cm. long (Samoa)..... **9. C. samoense.**
b. Flowers 1.2-1.3 cm., sepals 0.7-0.8 cm., petals 0.8-1 cm. long (Fiji)..... **7. C. vitiense.**

1. Canarium linguistipulum, sp. nov. (fig. 2, *a-f*).

Arbor mediocris. *Ramuli* glabri, crassi; medulla cylindro ductorum vasculorum peripheralis suffulta. *Folia* 4½-5½-jugata; stipulae in ramuli petiolique conjunctione insertae ligulatae, basi abrupte dilatatae, 0.7 × 0.2 (apice), 0.8 (basi) cm.; petioli 12-16 cm. longae, medulla nonnullis vasculis parvis peripheralibus nic non nonnullis vasculis centralibus majoribus percursa; foliola 12-17 × 7-8 cm., nervi secundarii 9-13. *Inflorescentiae floresque* ignoti. *Infructescentiae* axillares. Fructuum calyces leviter 3-lobi. *Fructus* ovoidei, basi plus minusve acuti, 3-loculati, 2 loculis fertilibus, tertio paulo minore.

Medium-sized tree (15 m. high, *f. A. C. Smith 6782*). *Branchlets* terete to angular (youngest parts), up to 1.3 cm. thick, glabrous; medulla with peripheral cylinder of vascular bundles. *Leaves* 4½-5½-jugate, about 55 cm. long; stipules inserted at conjunction of branchlet and petiole, lingulate, abruptly broadened at base, 0.7 cm. long, 0.2 (at base 0.8) cm. wide, glabrous, apex blunt, midrib prominent; *petioles* terete, somewhat thickened and canaliculate at base, 12-16 cm. long, 0.45-0.55 cm. thick; medulla with some small peripherally arranged vascular bundles and a few large scattered central ones; interjugal parts 4.7-6.5 cm.; *petiolules* semiterete, flattened to grooved above, lateral ones 2.3-2.5 cm. long, terminal ones 3.5 cm. long; *leaflets* ovate, 12-17 × 7-8 cm., coriaceous, shining at both sides, glabrous, base more or less inequilateral, rounded, decurrent, margins entire, thickened, apex abruptly, bluntly acuminate, acumen 0.3-0.5 × 0.3 cm.; midrib prominulous above, prominent beneath; secondary nerves 9-13 pairs, angle 90-60 degrees, decreasing from base to apex, basal ones more or less straight, curving toward margin, the others much curved, not joined in arches except apical ones, faintly prominulous above, prominent beneath, veinlets coarsely reticulate, prominulous at both sides. *Inflorescences* and flowers unknown. *Infructescences* axillary, racemose to thyrsoid, 25-30 cm. long, with 5-6 fruits; pedicels terete, gradually thickening toward calyx, 2-2.5 cm. long, 0.5 cm. thick;

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fruiting calyces faintly 3-lobed, 1.2-1.5 cm. in diameter, pubescence dense and appressed inside, lobes acutely deltoid, remnants of disk 6-lobed, in the apical part bearing long erect reddish brown hairs. *Fruits* ovoid, more or less acute at base, acute at apex, 3.7 × 2 cm., glabrous except for some scattered hairs near apex, blackish green (*f. A. C. Smith 6782*); pericarp wrinkled, 0.05-0.1 cm. thick; putamen very rugose; mesocarp 0.3-0.5 cm. thick; 3 cells, 2 fertile, 1 slightly reduced.

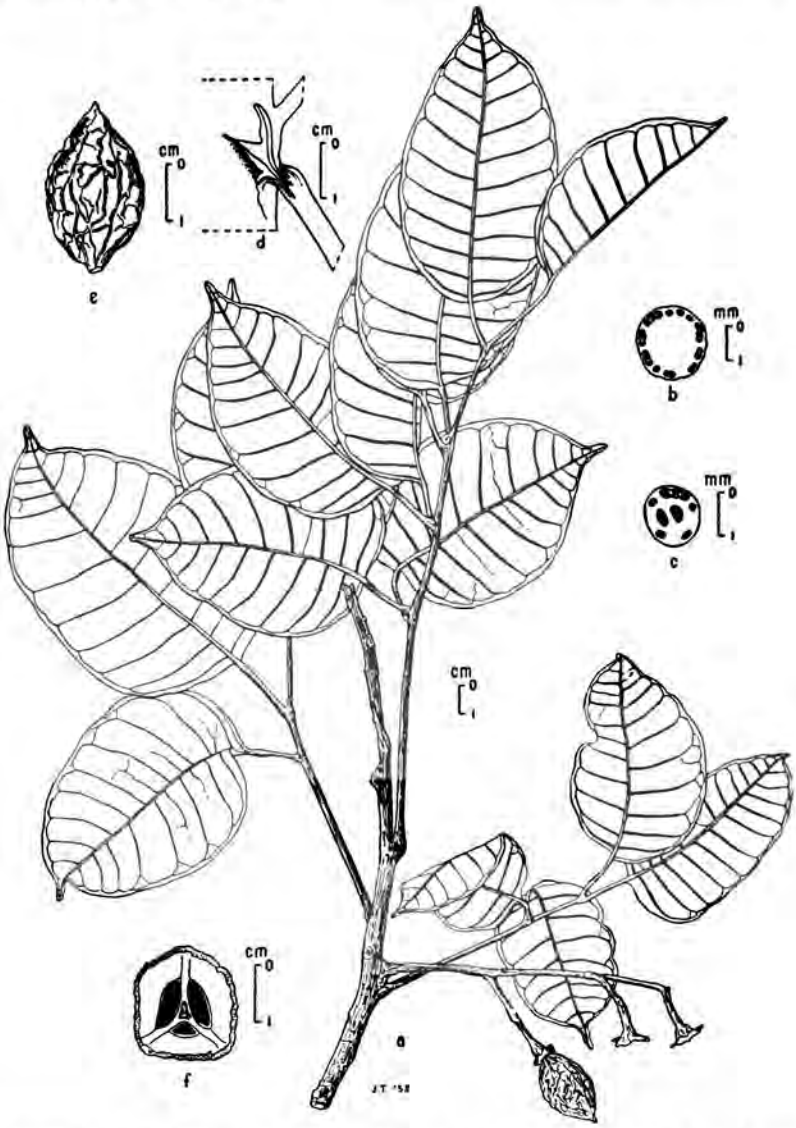

FIGURE 2.—*Canarium linguistipulum:* a, fruiting specimen; b, medulla of branchlet, cross section; c, medulla of petiole, cross section; d, stipule; e, fruit; f, fruit, cross section. (*a-c, e: Smith 6782; d: Tothill 513; f: Tothill 422.*)

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Fiji Islands. Viti Levu: Suva, central road, 1929, fr., *Tothill 422* (K); Quarry near Suva, May 6, 1929, fr., *Tothill 513* (K, type specimen); Nasinu near Suva, alt. 150 m., Oct. 29, 1927, fr., *Gillespie 3616* (BISH). Vanua Levu: Mathuata, alt. 100-250 m., Dec. 1-4, 1947, fr., *A. C. Smith 6782* (A). Habitat: dense forest.

2. Canarium vanikoroense, sp. nov. (fig. 3, *a-e*).

Arbor mediocris vel magna. *Medulla ramulorum* evanescens, cum aliquis ductis vasculosis peripheralibus. *Folia* 2½-3½-jugata; stipulae in basi petioli ramo 0.1-0.3 cm. distante positae, angusto-lanceolatae 0.6 cm. longae; petioli 6.5-10 cm. longi, medulla multis ductis vasculosis dispersa; foliola 8-11.5 × 3.5-5 cm., nervi secundarii 12-14 (-16). *Inflorescentiae* (femineae ignotae) axillares vel pseudoterminales. *Flores* (feminei ignoti) 0.7 cm. longi; sepala ad dimidium conjuncta; stamina 6, filamenta usque ad paulo supra dimidium conjuncta; discus 6-lobatus 0.1 cm. altus velutinus cavitate centrali suffultus; ovarii rudimentum nullum. *Infructescentiae fructusque* ignoti.

Large tree (20 m. high, *f. Kajewski 539*). *Branchlets* subterete, 0.6-0.8 cm. thick, glabrous; medulla disappearing, but for a thin peripheral cylinder with some small vascular bundles. *Leaves* 2½-3½-jugate, 26-28 cm. long, densely and fulvously pilose when young, glabrescent; *stipules* inserted on petiole at a distance of 0.1-0.3 cm. from branchlet, narrowly lanceolate, 0.6 × 0.15 cm. acute, somewhat coriaceous, glabrous; *petioles* terete, faintly broadened and canaliculate near base, 6.5-10 cm. long, 0.25-0.3 cm. thick; medulla not distinct, with several scattered sclerenchymatic vascular bundles, in the specimen examined surrounding two cavities which are probably artificial; interjugal parts 2-3 cm. long; *petiolules* terete, faintly grooved above, lateral ones 1-2.5 cm. long, terminal ones 2.5-3 cm. long; *leaflets* ovate, 8-11.5 × 3.5-5 cm., thinly coriaceous, shining at both sides, glabrous; base of lateral leaflets somewhat inequilateral, truncate to rounded, terminal leaflets equilateral, broadly cuneate, both slightly decurrent; margins entire; apex subabruptly and bluntly acuminate, acumen 0.5-0.8 × 0.25-0.3 cm.; midrib prominulous above, prominent beneath; secondary nerves 12-14 (-16) pairs, angle 85-65 degrees, decreasing from base to apex, basal ones straight, the others faintly curved, slightly arched and joined near margin, prominulous on both surfaces; veinlets regularly and densely reticulate, prominulous on both surfaces. *Inflorescences* (female unknown) axillary to pseudoterminal, subracemose, 12-25 cm. long, consisting of some few-flowered partial inflorescences; peduncles 4-12 cm. long; pedicels 0.5-0.7 cm. long; bracts deciduous. *Flowers* (female unknown) 0.7 cm. long; *sepals* 0.5 cm. long, for 50-60 percent connate, glabrous without, densely appressed pubescent within, lobes broadly deltoid, acuminate; *petals* oblong, 0.6 cm. long, keeled, incrassately inflexed-acuminate, dirty cream-colored (*f. Kajewski 539*), densely appressed pubescent without, glabrous within; *stamens* 6, 0.5 cm. long, filaments for 50-60 percent connate, glabrous, anthers oblong, 0.225 cm. long; disk urceolate, 6-lobed, ± 0.1 cm. high, shortly and densely pubescent, with a narrow central canal; *pistil* none. *Infructescences and fruits* unknown.

New Hebrides. Santa Cruz Islands: Vanikoro Island, alt. 50 m., Sept. 25, 1928, male fl., *Kajewski 539* (A, type specimen). Habitat: rain forest.

3. Canarium chinare L. H. Grutterink and H. J. Lam, sp. nov. (fig. 4, *a-f*).

Arbor magna. *Ramuli* sparsi pilosi mox glabri; medulla multis ductis peripheralibus et centralibus dispersis percursa. *Folia* 2½-jugata; stipulae mox deciduae in petioli ramulique conjunctione insertae, lineariae obtusae, 0.4 × 0.065 cm.; petioli tereti, 4.6-6.2 cm. longi, medulla nonnullis ductis vasculorum magnis percursa; foliola 5-11 × 2.5-4.5 cm., nervi secundarii 10-12. *Inflorescentiae floresque* ignoti. *Infructescentiae* racemosae axillares; calyces fructigeri 3-lobati, disci rudimentum 6-lobatum supra ciliati. *Fructus* (im-

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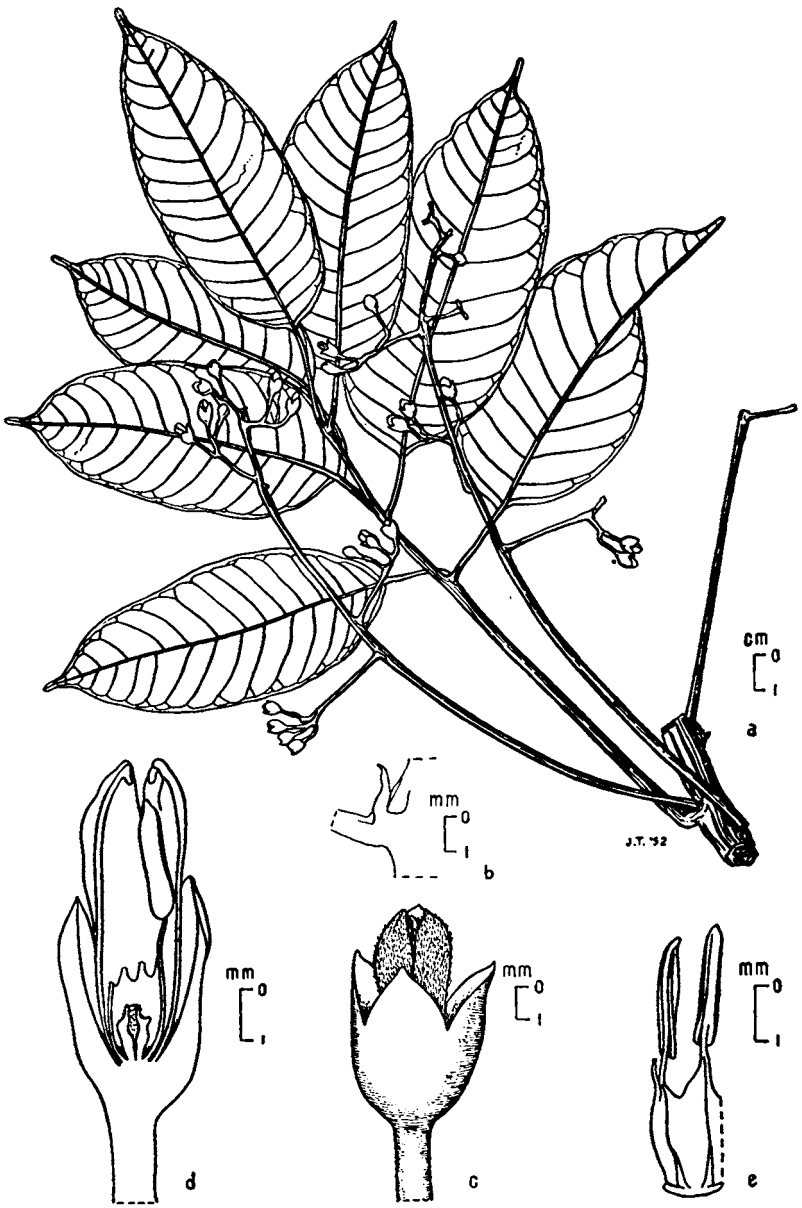

FIGURE 3.—*Canarium vanikoroense:* **a**, male specimen; **b**, stipule; **c**, male flower; **d**, male flower, longitudinal section; **e**, male flower, part of staminal tube. (*a-e: Kajewski 539.*)

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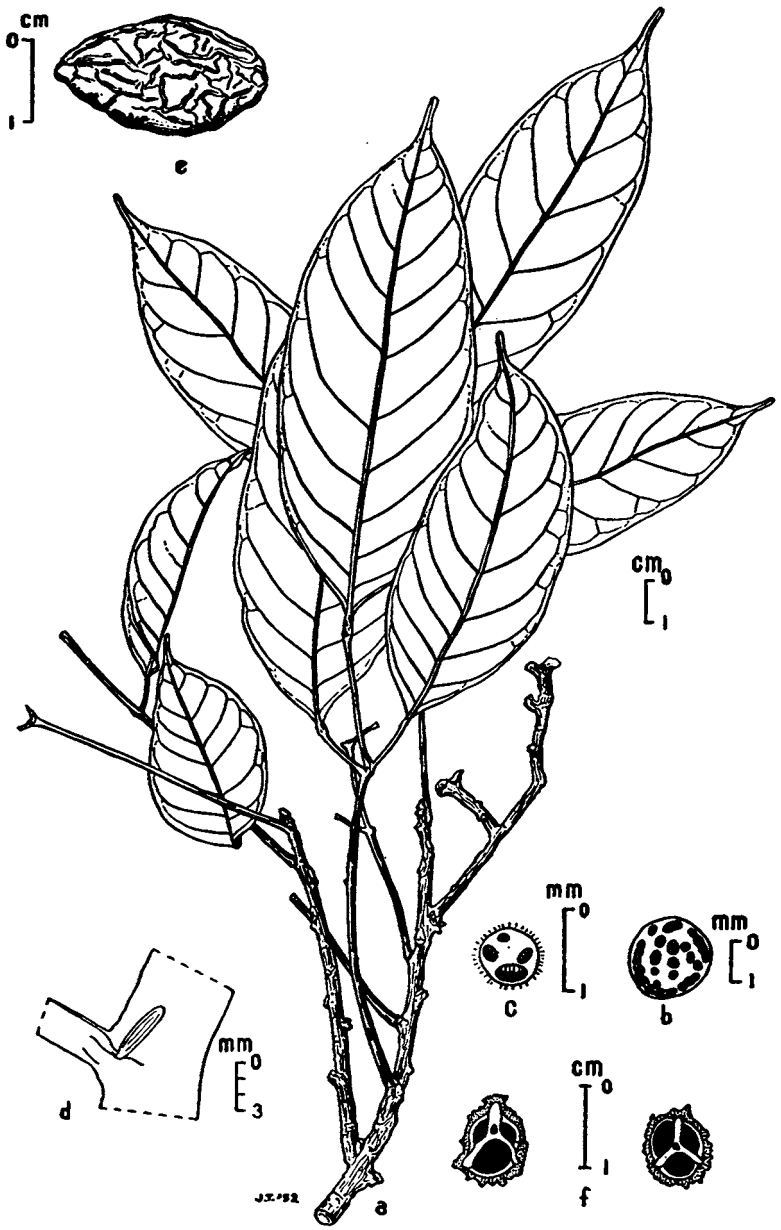

FIGURE 4.—*Canarium chinare:* **a**, fruiting specimen; **b**, medulla of branchlet, cross section; **c**, medulla of petiole, cross section; **d**, stipule; **e**, fruit; **f**, immature (sterile ?) fruits, cross section. (*a-f: Kajewski 2089.*)

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maturi) subovoidei vel fusiformes, 3 loculi subaequimagni vel 2 plus minusve deminuti.

Large tree (25 m., *f. Kajewski 2089*). *Branchlets* terete, 0.5-0.6 cm. thick, youngest parts sparsely appressed pubescent, glabrescent and becoming scabrous; medulla with many amphivasal vascular bundles, peripheral ones forming a cylinder. *Leaves* 2½-4½-jugate, 20-23 cm. long; *stipules* inserted at the conjunction of petiole and branchlet, on a faintly prominent 0.2-0.3 cm. long rim, deciduous, oblong lingulate to subulate, 0.15-0.4 × 0.065 cm., striate, glabrous, blunt; *petioles* terete, somewhat flattened and incrassate at base, 4.6-6.2 cm. long, 0.15-0.2 cm. thick, glabrous; medulla with some large collateral vascular bundles with large resiniferous ducts; interjugal parts 2.5-2.6 cm. long; *petiolules* terete, lateral ones 0.7-1.2 cm., terminal ones 2.4-3 cm. long; *leaflets* oblong-elliptic (to oblong-ovate), 5-11 × 2-4.5 cm., coriaceous, shining above, dull beneath, glabrous; base more or less equilateral, cuneate, margins entire, thickened, apex abruptly and bluntly acuminate, acumen 0.6-0.8 × 0.25-0.4 cm.; midrib prominulous above, very prominent beneath; secondary nerves 10-14 pairs, angle 50-55 degrees, basal ones slightly S-shaped, the others gradually curved toward margin, apical ones always, the rest sometimes, distinctly arched and joined, prominulous above, prominent beneath; veinlets coarsely to densely reticulate. *Inflorescences* and flowers unknown. *Infructescences* axillary, subracemose, 4-8 cm. long, with 1-2 fruits, peduncles ± 2.5 cm. long, pedicels 0.7-1.3 cm. long, ± 0.3 cm. thick; fruiting calyces 3-lobed, 0.8 cm. in diameter, glabrous outside, densely and appressedly yellowish brown pubescent inside, lobes semicircular, acute, remnants of disk 6-lobed, lobes 0.2 × 0.1 cm., bearing long dark-brown cilia. *Fruits* subobovoid, tapering at base, 2.7 × 1.6 cm., subcircular at cross section, black (*f. Kajewski 2089*); pericarp coarsely wrinkled, 0.05-0.2 cm. thick; putamen more or less prominently 3-keeled; mesocarp ± 0.025 cm. thick; 3 subequal cells or 2 of them slightly reduced (fruits immature).

Admiralty Islands: Los Negros, low alt., Feb. 1945, fr., *N. G. F. 558* (L).

Solomon Islands: Bougainville, Koniguru, Buin, alt. 950 m., Aug. 12, 1930, fr., *Kajewski 2089* (A, type specimen; BISH; BO; G; L; P), common. Habitat: rain forest.

Vernacular name: *chinare* (Bougainville).

The wood is said to be rather soft.

4. Canarium asperum Bentham, London Jour. Bot. 2: 215, 1843.—Lam, Jard. bot. Buitenzorg, Bull. III, 12: 461, pl. 10, fig. 66, 1932. (See figure 5, *a-j*.)

ssp. **asperum**.

Large tree, up to 35 m. high (according to Lam). *Branchlets* terete, 0.35-0.6 cm. thick, youngest parts minutely woolly, glabrescent; medulla with many small vascular bundles, some (and rarely all) forming a peripheral cylinder, those in central part either scattered or forming a second cylinder. *Leaves* 2½-3½-jugate, 25-40 cm. long; *stipules* inserted at base of petiole up to 0.3 cm. from branchlet, persistent or caducous, subulate to setiform, 0.2-1 cm. long, pilose; *petioles* terete, broadened and somewhat excavated at base, 3-19 cm. long, 0.2 cm. thick, glabrescent; medulla with many resiniferous vascular bundles; interjugal parts 1.5-3-8.7 cm. long; *petiolules* terete, more or less distinctly grooved above, lateral ones 0.3-1.7 (-2.4) cm. long, terminal ones (1.3-) 2.5-6.5 cm. long; *leaflets* elliptical-ovate to lanceolate, (3.5-) 8.5-20 (-32.5) × (2-) 3.5-8 (-11) cm., more or less brown hirsutely pubescent, especially on lower side and in young leaflets, base slightly inequilateral, subcordate-rotundate to acute, margins entire, serrulate-dentate when young, more or less pilose, apex gradually to subabruptly and subacutely acuminate, acumen up to about 1 × 0.4 cm.; midrib prominent at both sides; secondary nerves (9-) 12-20 pairs, angle 50-80 degrees, basal ones often S-shaped, the others straight to slightly curved, much curved near margin, apical ones clearly, though faintly, arched and joined, prominulous at both sides; tertiary nerves transverse, often a small one intermediate between

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each pair of secondary nerves. *Inflorescence* axillary, spicate to subracemose, seldom narrowly paniculate, male 9-40 cm. long, female 1-20 (-32) cm., more or less hirsutely pubescent to glabrous; pedicels none or (in female flowers) up to 0.35 cm. long; bracts minute. *Flowers* 0.3-0.6 cm. long; *sepals* 0.15-0.35 cm. long, connate for about two-thirds of length, glabrescent without, more or less densely pubescent within, lobes deltoid, acute; *petals* oblong, 0.25-0.45 cm. long, apex subacute, hardly incrassate and slightly or not inflexed, appressed pubescent without, except for base, cream-colored (according to Lam); *stamens* 6, free or nearly so, filaments filiform, 0.15-0.25 cm. long, glabrous, anthers ovate to oblong, acute at apex, 0.1 cm. long; disk of male subglobose, more or less 6-lobed, with or without a central canal, sometimes nearly wanting, up to about 0.1 cm. high, female

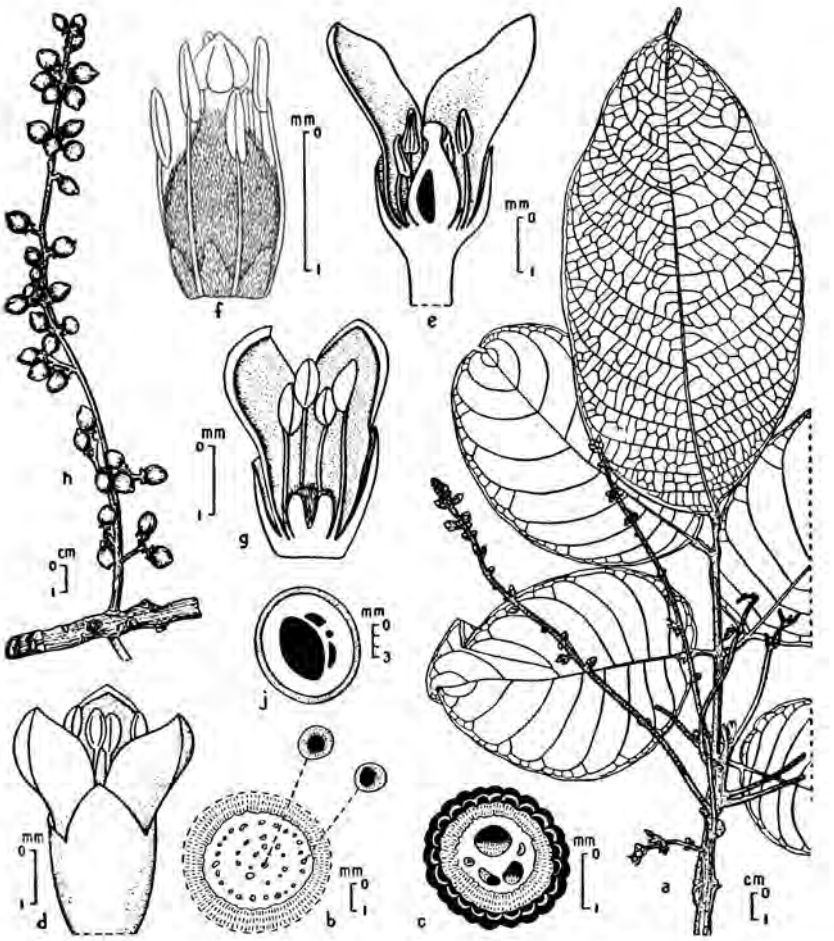

FIGURE 5.—*Canarium asperum:* **a**, female specimen; **b**, medulla of branchlet, cross section; **c**, petiole, cross section; **d**, male flower, **e**, female flower, longitudinal section; **f**, female flower, sepals and petals removed; **g**, male flower, longitudinal section; **h**, infructescence; **j**, fruit, cross section. (*a: Teysmann 12786; b, d-g, j: Hort. bot. Bogor VI B 90 a; c: NIFS bb 9985; h: Ahern 3146.*)

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cupular, 3-6-lobed to subtruncate, both pilose; *pistil* male none, female ovary ovoid, 0.25-0.35 cm., pubescent, style short to none, stigma 3-lobed. *Infructescences* (nearly) spicate, about 20 cm. long, with many fruits; pedicels 0.2-0.5-1.1 cm. long, 0.1-0.15 cm. thick; fruiting calyces 3-lobed, pilose, 0.25-0.5 cm. in diameter. *Fruits* ovoid to subglobose, subacute at apex, rounded at base, round to somewhat trigonous, 0.9-1.4 × 0.4-1.1 cm., black (according to Lam); pericarp faintly wrinkled, very thin, glabrous; putamen smooth, rarely somewhat rugose; mesocarp 0.2 cm. thick; 3-celled, 2 cells nearly to entirely reduced.

Type: New Guinea, *Hinds* (K).

Range: Eastern part of Malaya, Philippines, Solomon Islands.

Solomon Islands. Bougainville: Kieta, sea level, Mar. 27, 1930, fr., *Kajewski 1572* (A, BISH, BO, G, L), common; Olomo, Buin, alt. 400 m., Sept., 1932, male fl., *Waterhouse 89* (A, K). Guadalcanal: Ma-mussa, Konga, alt. 300 m., Feb. 7, 1931, fr., *Kajewski 2462* (A, BISH, BO, G, L, P), common. Malaita: Quoimonapu, alt. 300 m., Dec. 12, 1930, male fl., *Kajewski 2356* (A, BISH, BO, G, L, P), common. San Cristoval: Balego-Nagonago, alt. 500 m., Sept. 5, 1932, male fl., *Brass 2824* (A, BISH, BO, L). Habitat: rain forest.

Vernacular names: *romurai* (Bougainville), *busa* (Guadalcanal), *bung-ung-ali* (Malaita).

A second subspecies, ssp. *papuanum* (H. J. Lam) Leenhouts, comb. nov. (=*C. papuanum* H. J. Lam, Jard. bot. Buitenzorg, Ann. **42**: 211, 1932), differing in its paniculate inflorescences, is restricted to New Guinea.

This is a tree with widely spreading crown and few or no buttresses (*f. Kajewski 2350;* Lam, Jard. bot. Buitenzorg, Bull. III, **12**: 460, 1932); rarely, with medium-sized buttresses (*f. Kajewski 2462*). The bark is thin, light gray, to brown. The resin is abundant and burns freely. Guadalcanal natives use it for torches.

5. Canarium smithii, sp. nov. (fig. 6, *a-h*).

Abor parva. *Medulla ramulorum* multis ductis vasculosis parvis peripheralibus suffulta. *Folia* 2½-4½-jugata; stipulae ad petioli basem insertae, subulatae, 0.3-0.4 cm. longae; petioli 2.7-5 cm. longi, medulla cum cylindro ductorum vasculorum peripherali, ductis centralibus paucis; foliola 3.7-8.3 × 2.5-4 cm., nervi secundarii 7-8. *Inflorescentiae* (femineae ignotae) axillares. *Flores* (feminei ignoti) 1 cm. longi; sepala ad 60% connata; stamina 6 basi paulo connata; discus cupuliformis, 0.05 cm. altus, hispidus; pistillum multo reductum. *Infructescentiae fructusque* ignoti.

Small tree (7-8 m., *f. A. C. Smith 6477 and 6708*). *Branchlets* terete, 0.3-0.35 cm. thick, striate and densely ferruginously pubescent when young, glabrescent and becoming scabrous; medulla with many small, more or less confluent, peripherally arranged vascular bundles. *Leaves* 2½-4½-jugate, 11-21 cm. long; *stipules* inserted on base of petiole, subulate, 0.3-0.4 cm. long, densely, shortly and appressedly yellowish brown pubescent, semipersistent; *petioles* terete, thickened and sulcate at base, 2.7-5 cm. long, ± 0.15 cm. thick, sparsely pilose, medulla with some peripherally arranged and a few central vascular bundles; interjugal parts 1.2-2.8 cm. long, sparsely pilose; *petiolules* terete, more or less conspicuously grooved above, lateral ones 0.4-1 cm., terminal ones 1.7-2 cm. long, sparsely pilose; *leaflets* elliptic, 3.7-8.3 × 2.5-4 cm., coriaceous, grayish green above, nitidulous at both sides, densely tomentose when young, glabrescent, base rounded to broadly cuneate, decur-

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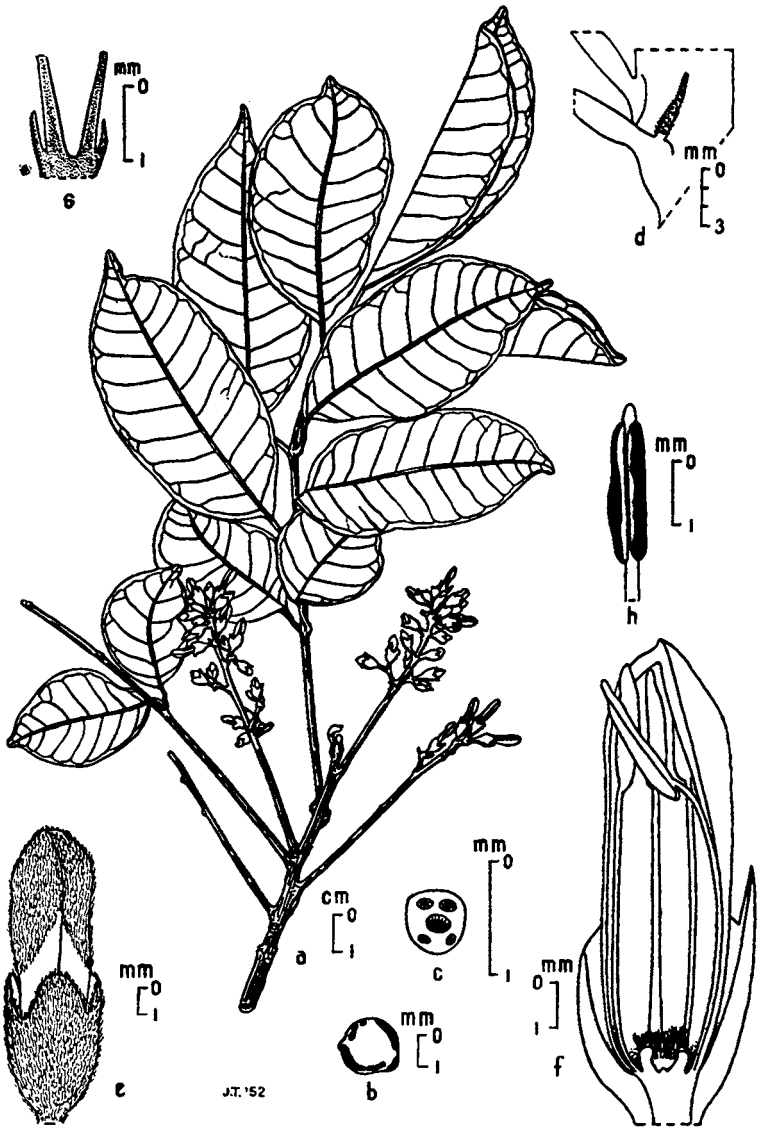

FIGURE 6.—*Canarium smithii:* **a**, male specimen; **b**, medulla of branchlet, cross section; **c**, medulla of petiole, cross section; **d**, stipule; **e**, male flower; **f**, male flower, longitudinal section; **g**, male flower, base of stamens; **h**, male flower, anther. (*a, b, d-h: Smith 6708; c: Smith 6477.*)

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rent, margins entire, apex gradually and bluntly acuminate, acumen 0.4 × 0.4 cm.; midrib prominulous above, rather prominent beneath, secondary nerves 7-8 pairs, angle 70-75 degrees, slightly curved to almost straight, at some distance from margin abruptly and distinctly arched and joined, prominulous above, rather prominent beneath, veinlets coarsely and vaguely reticulate. *Inflorescences* (female unknown) axillary, compact, little-branched, thyrsoid, 3-8 cm. long, shortly and densely pubescent; peduncles 2.6-3.5 cm. long; pedicels 0-0.15 cm. long; bracts deltoid, acute, deciduous, 0.15 × 0.1 cm., densely and appressedly pubescent. *Flowers* (female unknown) 1 cm. long; *sepals* 0.35-0.4 cm. long, 60 percent connate, densely and shortly appressedly pubescent without, densely pubescent within, lobes acutely deltoid; *petals* oblong-obovate, 1 cm. long, tip incrassately inflexed, densely and appressedly tomentose without, glabrous within, white (*f. Smith 6708*); *stamens* 6, slightly connate at base, 0.8 cm. long, filaments ribbon-shaped, tapering to apex, 0.55 cm. long, anthers oblong, shortly and bluntly acuminate, 0.25 cm. long; *disk* cupular, 0.05 cm. high, long pilose; *pistil* much reduced, semiglobular, 0.01 cm. high. *Infructescences and fruits* unknown.

Fiji Islands. Viti Levu: near Nasinu, Naitasiri, June 1945, young sterile branchlet, probably water sprout, *Greenwood 1102* (A). Vanua Levu: Mathuata, summit ridge of Mount Numbuiloa, east of Lambasa, alt. 500-590 m., Oct. 29 to Nov. 6, 1947, male fl., *A. C. Smith 6477* (A); Mathuata, Seangganggga Plateau, vicinity of Natua, alt. 100-200 m., Nov. 25 to Dec. 8, 1947, male fl., *A. C. Smith 6708* (A, type specimen). Habitat: dense forest and patches of forest in open rolling country.

This species is without doubt closely related to *C. vitiense* A. Gray and there is some general resemblance to *C. pilosum* A. W. Bennett and to *C. hirsutum* Willdenow.

The identity of Greenwood's specimen 1102 is not quite certain; but in my opinion, it is an adventitious shoot, larger, more lax, and more pilose than the other specimens. As it looks more like *C. smithii* than like any other Pacific species, it is provisionally inserted here.

6. Canarium hirsutum Willdenow, Sp. Pl. **4** (2): 760, 1805.—Lam, Jard. bot. Buitenzorg, Bull. III, **12**: 466, pl. 11, fig. 67, 1932. (See figure 7, *a-m.*)

Canarium palawense Lauterbach, Engler Bot. Jahrb. **56**: 515, 1921.—Kanehira, Bot. Mag. Tokyo **45**: 288, 1931.—Lam, Jard. bot. Buitenzorg, Ann. **42**: 216, 1932; Jard. bot. Buitenzorg, Bull. III, **12**: 427, 1932.—Kanehira, Fl. Micronesica, 160, fig. 59, 1933; Dept. Agric. Kyushu Imp. Univ., Jour. **4**: 344, 1935.

Large tree, up to 30 m. high and 2 m. in diameter (*f. Kajewski 1931*). *Branchlets* subterete to angular, 0.7-1.4 cm. thick, youngest parts shortly tomentose, glabrescent; medulla with some large to many small peripherally arranged vascular bundles. *Leaves* 3½-6½-jugate, up to 60 cm. long; *stipules* caducous to persistent, inserted on petioles at a distance of 0.5-1 cm. from base, subulate, 0.15-0.8 cm. long, densely, shortly, and appressedly pubescent; petioles terete, broadened and flattened at base, 8-17 cm. long, 0.3-0.6 cm. thick, sometimes slightly pilose, glabrescent, medulla with many scattered vascular bundles; interjugal parts 2-6.5 cm. long; *petiolules* terete, sometimes grooved and flattened above, lateral ones 0.5-1.7 cm., terminal ones 2-5.5 cm. long; *leaflets* oblong, oblong-lanceolate or oblong-ovate, 10-20 × 3.5-7.5 cm., (thinly) coriaceous, more or less shining at both sur-

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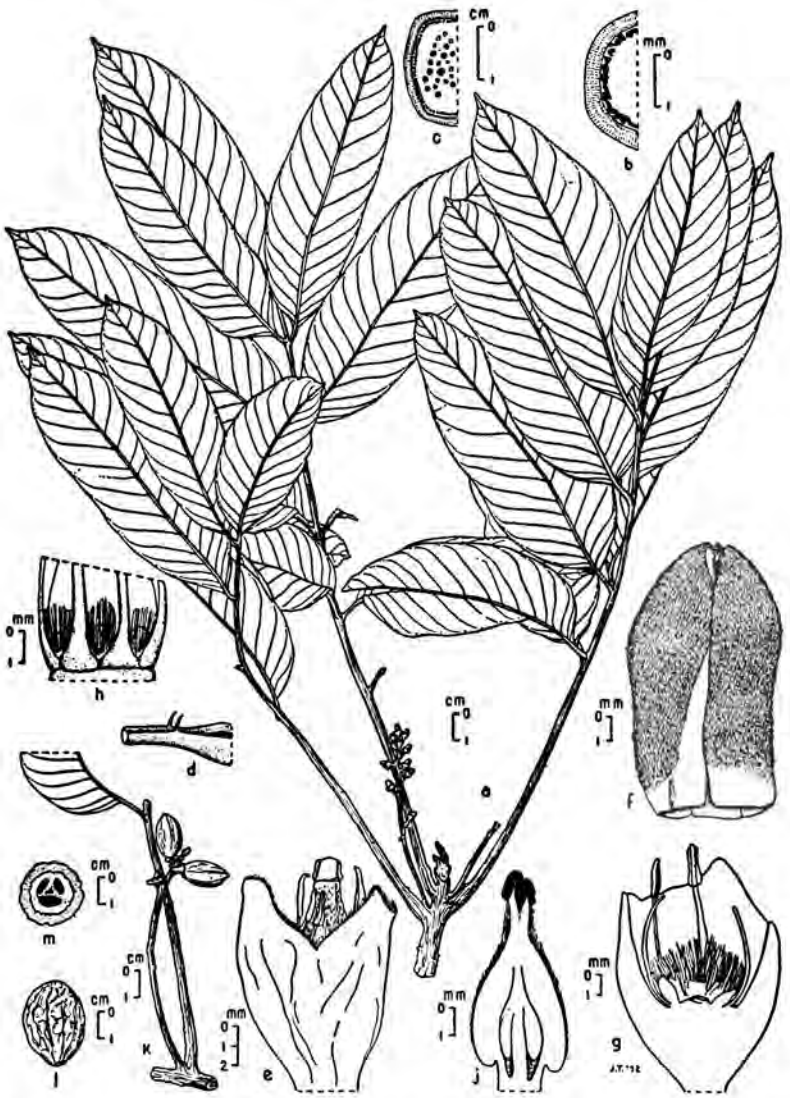

FIGURE 7.—*Canarium hirsutum:* **a**, female specimen; **b**, branchlet, cross section; **c**, petiole, cross section; **d**, stipules; **e**, female flower, petals removed; **f**, female flower, corolla; **g**, female flower, longitudinal section, pistil removed; **h**, female flower, base of stamens; **j**, female flower, pistil, longitudinal section; **k**, infructescence; **l**, fruit; **m**, fruit, cross section. [*a: Kanehira 4945* (f. *scabrum*); *b: Hort. bot. Bogor VI D 7* (f. ***hirsutum***); *c: Docters van Leeuwen 11275* (f. *leeuwenii*); *d: Hort. bot. Bogor VI B 63 a* (f. ***hirsutum***); *e-h, j, l, m: Kajewski 1931* (f. *leeuwenii*); *k: Takamatsu 1526* (f. *scabrum*).]

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faces, glabrescent, base rounded to broadly cuneate, slightly to strongly inequilateral, somewhat decurrent, margins entire, apex gradually to subabruptly, bluntly to acutely, acuminate, acumen 0.3-1 × 0.3-0.5 cm.; midrib prominulous above, prominent beneath, secondary nerves 14-17 (-20) pairs, angle 45-90 degrees at base, 50-65 degrees near apex, basal ones slightly S-shaped, the others curved to almost straight, not distinctly arched and joined near margin, except for apical ones, prominulous above, prominent beneath, veinlets coarsely reticulate, prominulous at both surfaces. *Inflorescences* axillary, densely pubescent, glabrescent, male laxly paniculate, 5-72 cm. long, female racemose, 7-9 cm. long, few-flowered; peduncles (sub)terete, male 2-18 cm. long, female 2-3 cm. long; pedicels 0.1-1 cm. long; bracts deciduous. *Flowers* rather variable, 0.4-1.5 cm. long (male, smaller); *sepals* 0.2-1.1 cm. long, one-half to three-fourths connate, appressedly pubescent on both sides, less densely and ultimately subglabrate outside, lobes broadly deltoid to ovate, acute; *petals* oblong, oblong-elliptic or ovate, 0.6-1.2 × 0.4-0.5 cm., thin to stiff and fleshy, more or less inflexed acuminate, thinly to densely and appressedly pubescent without, except at base, glabrous within; *stamens* 6, free, male 0.7-0.8 cm., female 0.4-0.7 cm. long, in both sexes filaments slender, flattened, thinly and appressedly pilose, male anthers oblong, mucronulate, 0.2 cm. long, appressedly pubescent at back, female hastate, 0.1-0.2 cm. long, glabrous; *disk* 6-lobed, cupular in male flowers, flat in female ones, 0.15-0.25 cm. high, densely covered with erect red-brown hairs; *pistil*, male none, female, ovary ovoid, 0.4-0.8 cm. high, densely pilose, with or without a pseudogynophore, style short to rather long, stigma capitate, 3-lobed. *Infructescences* up to 10 cm. long, with 1-4 fruits; pedicels 0.2-1 cm. long, not or slightly thickened; fruiting calyces broadly infundibular, 3-lobed, lobes somewhat recurved and compressed, 0.4-1.6 cm. in diameter, subglabrous without, densely, shortly, and appressedly pubescent within. *Fruits* very variable, but always at least at base and apex with long-remaining, stiff and irritating, reddish-brown hairs; further details are mentioned under the forms.

Neotype: Moluccas, Morotai, *Tangkilisan 77* (L).

Range: Malay Peninsula and Archipelago, Philippines, Carolines, Solomons.

Habitat: rain forest.

H. J. Lam (Jard. bot. Buitenzorg, Bull. III, 12: 468, 1932) has attempted to subdivide this widely spread and very polymorphous species, mainly basing his division upon characters of the fruit. He mentions eight Malaysian forms, the delimitations of which are very vague. In my opinion, the few Pacific specimens belong to two forms, one of which closely resembles Lam's form *leeuwenii* from New Guinea, the other being the former species *C. palawense* Lauterbach, which is now reduced to form *scabrum* (=*C. hispidum* Blume var. *scabrum* Blume, Bijdr. Fl. Ned. Ind., 1163, 1826).

This form is rather variable but always slender. Fruits ovate to elliptical, rounded triangular, 1.4-1.8 × 0.9-1.2 cm., more or less strongly pilose; pericarp delicately wrinkled, up to 0.075 cm. thick; putamen smooth; mesocarp about 0.15 cm. thick; 3-celled, cells subequal.

Type: Java, *Blume HLB. 898, 319-287, 289* (L).

Range: West Malaya, Philippines, Carolines.

Caroline Islands. Palau Islands: Babeldaob [Babelthuap], on summit of Mount Luis-Almonogui, Apr. 14, 1938, female fl. and fr., *Kanehira and Hatusima 4945* (A); Babelthaop [Babelthuap], Ngarsul, alt. 200-300 m.,

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Feb. 21, 1914, male fl., *Ledermann 14330* (BRSL, neolectotype specimen of *C. palawense* Lauterbach); Arumatin, Apr. 28, 1936, fr., *Takamatsu 1526* (BISH), rare; without exact locality, July and Aug. 1929, fr., *Kanehira 549* (A); without exact locality, July 1933, female fl. and fr., *Kanehira 2317* (P).

Vernacular name: *mashoes* (Palau).

Leeuwenii is a very stout form, especially characterized by its fruits, which are subglobose, 3.5 × 2.8 × 2.8 cm., the remnant of the style small and tubercular, glabrous except for some hairs near the apex, black with a white bloom (*f. Kajewski 1931*); pericarp almost smooth, faintly, coarsely, and reticulately wrinkled, near the base with 6 acute keels, hard and fibrous, about 0.4 cm. thick; putamen rugged; mesocarp 0.2-0.3 cm. thick; 3-celled, 2 sterile cells almost as large as the fertile one.

Type: Netherlands New Guinea, *Docters van Leeuwen 11275* (BO).

Range: New Guinea, Solomons.

Solomon Islands: Bougainville, Kugumaru, Buin, alt. 150 m., July 5, 1930, female fl. and fr., *Kajewski 1931* (A, BISH, BO, G, L, P), common.

Vernacular name: *kim* (Bougainville).

The seeds are eaten by the natives.

The type specimen of *C. palawense* Lauterbach consists of only one leaflet—lanceolate, 20 × 5.5 cm., herbaceous, glabrous, cuneate at base, margins entire, shortly and bluntly acuminate at apex, about 20 pairs of secondary nerves—and a lot of flower parts, entirely in accordance with the usual type of *C. hirsutum* Willdenow.

According to *Kajewski 1931*, form *leeuwenii* apparently fruits and flowers continuously.

7. Canarium vitiense A. Gray, U. S. Exploring Exped., Bot. **1**: 373, 1854 (includes var. *b*).—Seemann, Fl. Vit., 35, 1865.—Horne, A year in Fiji, . . ., 258, 1881.—Engler in DC. Monogr. Phan. **4**: 134, 1883.—Drake del Castillo, Illustrationes florae insularum maris Pacifici, 135, 1886.—Engler in Engler and Prantl, Nat. Pflanzenfam. 3 (4): 241, 1897; ed. 2, **19a**: 449, 1931.— Lam, Jard. bot. Buitenzorg, Ann. **42**: 154, 1932; Jard. bot. Buitenzorg, Bull. III, **12**: 427, 1932. (See figure 8, *a-k*.)

Shrub to medium-sized tree (20 m., *f. A. C. Smith 996*). *Branchlets* terete, 0.35-0.6 cm. thick, youngest parts thinly tomentose, glabrescent; medulla with a peripheral cylinder of many small amphivasal vascular bundles, central part with a few scattered ones. *Leaves* (1½-) 2½-3½ (-4½)-jugate, 16-30 cm. long, densely brown tomentose when very young, glabrescent; *stipules* inserted at or on base of petiole, caducous, subulate, 0.2 cm. long; *petioles* terete, somewhat broadened and flattened at base, (5.5-) 6-7.5 (-9) cm. long, 0.3 cm. thick, at base with evanescent circular stipular scars, medulla with some large collateral vascular bundles with resiniferous ducts; interjugal parts 2-4 (-6) cm.; *petiolules* terete, grooved above, lateral ones 0.5-1.2 cm. long, terminal ones 1.8-3 cm. long; *leaflets* elliptical, 5.5-11.5 × 3.5-5.8 cm., herbaceous to thin coriaceous, nitidulous, glabrous, base equilateral, cuneate to rounded, somewhat decurrent, margins entire, apex more or

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less abruptly and bluntly acuminate, acumen 0.8-1 × 0.4-0.6 cm.; midrib prominulous above, prominent beneath, secondary nerves 8-12 pairs, angle 70-80 degrees, faintly curved, arched and joined near margin, prominulous at both sides, veinlets coarsely reticulate, prominulous at both sides. *Inflorescences,* male, axillary to pseudoterminal, up to 10-flowered, racemose to thyrsoid, 4.5-12 cm. long, youngest parts thinly, minutely, and appressedly pubescent; female, axillary, 3-4 (-6)-flowered, racemose, 3-4 cm. long; peduncles in male terete, 2.5-6 cm. long, in female angular, 1.7-2.5 cm. long; pedicels in male 0.3 cm. long, in female about 0.7 cm.; bracts soon deciduous. *Flowers* of male 1.2-1.3 cm. long, of female, 0.7 cm. long; *sepals,* male, 0.7-0.8 cm. long, one-half to two-thirds connate, lobes

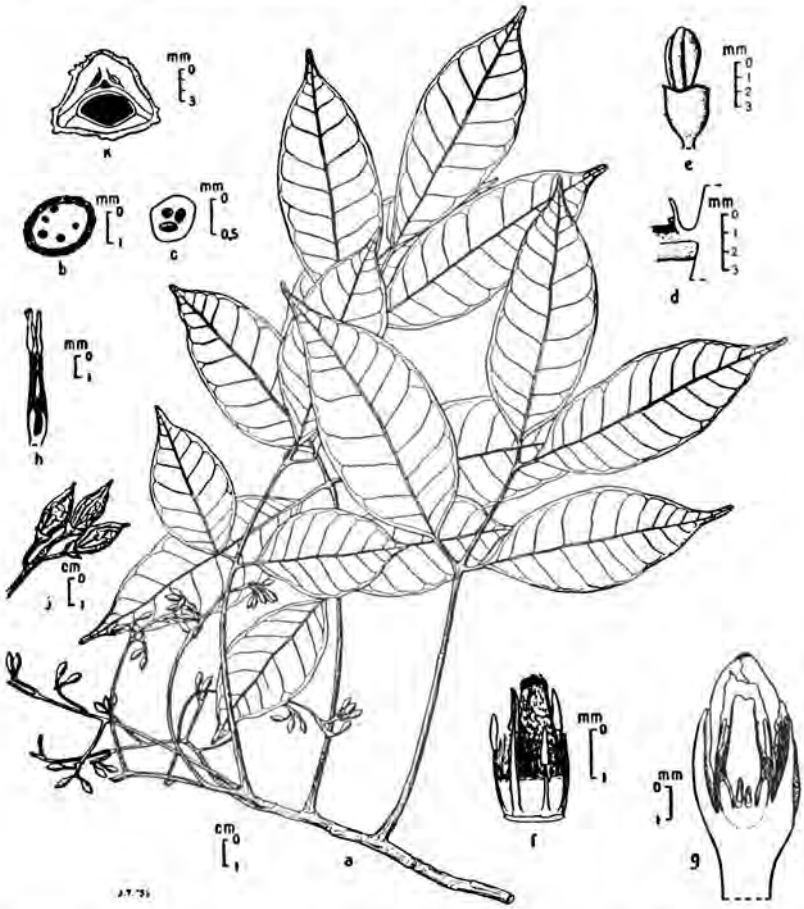

FIGURE 8.—*Canarium vitiense:* **a,** male specimen; **b,** medulla of branchlet, cross section; **c,** medulla of petiole, cross section; **d,** stipules; **e,** male flower; **f,** female flower, stamens and pistil; **g,** female flower, longitudinal section; **h,** stamens and disk of male flower, longitudinal section; **j,** part of infructescence; **k,** fruit, cross section. (*a: Gillespie 4447; b: Smith 996; c, j: Seemann 97; d, k: Wilkes; e-g: Horne 354; h: Gillespie 4553.*)

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acute-ovate, female, 0.5 cm. long, for two-thirds connate, lobes broadly deltoid, blunt, in both sexes thinly pilose outside, densely, shortly, and appressedly pilose inside; *petals* oblong, male 0.8-1 cm. long, female 0.7 cm. long, in both sexes densely and shortly pilose outside, glabrous inside, somewhat fleshy; *stamens* 6, somewhat coherent with disk at base, of male 0.8 cm. long, filaments ribbon-shaped, much dilated at base, 0.5 cm. long, glabrous, anthers oblong, 0.3 cm. long, of female 0.2-0.3 cm. long (seen in buds only!), filaments as in male ones, anthers oblong, mucronate, 0.1 cm. long; disk of male extremely variable, 0.1 cm. high, faintly 6-lobed and cupular or an ovariodisk present, in the upper part always with long, stiff, spreading, golden brown hairs, female 6-lobed, 0.075 cm. high, not very thin, long, yellow-brown ciliate; *pistil* of male strongly reduced (about 0.025 cm. high, pilose) to none (or adnate to disk into an ovariodisk), female 0.25 cm. high, densely and shortly pilose, ovary ovoid, tapering at base, faintly 3-lobed, slightly tapering into the cylindrical style with a 3-lobed stigma. *Infructescences* racemose, 7-12 cm. long, glabrous, with (1-) 4-6 fruits; pedicels 1-1.5 cm. long, 0.2 cm. thick, not thickened toward calyx; fruiting calyces funnel-shaped, the sepals about one-half connate, 0.5-0.6 cm. high, 0.8-1.2 cm. in diameter, indurated, glabrescent outside, densely and more or less appressedly pilose inside, and with clearly visible disk, calyx lobes broadly deltoid, acute. *Fruits* fusiform, broadly acute at base, acuminate at apex, 1.7-3 × 1-1.5 cm., glabrous except for some hairs at apex; pericarp coarsely wrinkled, about 0.1 cm. thick; putamen irregularly deltoid in cross section, with some slight ridges; mesocarp about 0.15 cm. thick; 3-celled, 2 cells strongly reduced.

Fiji Islands. Viti Levu: Suva, Nahesi, June 1878, fr., *Horne 686* (K), common. Ovalau: near summit of ridge west of Levuka, alt. 600 m., Jan. 20, 1928, male fl., *Gillespie 4447* (BISH, K); wooded stream valley above Levuka Reservoir, alt. 500 m., Jan. 30, 1928, female fl., *Gillespie 4521* (A, P); vicinity of Levuka, overland trail to west coast, Jan. 21, 1928, male fl., *Gillespie 4553* (A, B, K); Port Kinnaird, July 1860, fr., *Seemann 97* (G, K). Vanua Levu: mountains of Macuata [Mathuata] coast, 1838 to 1842, fr., *Wilkes Exped.* (GH, type specimen, not seen; K; P); Mathuata, summit ridge of Mount Numbuiloa, east of Lambasa, alt. 500-590 m., Oct. 29 to Nov. 6, 1947, fr., *A. C. Smith 6468* (A). Koro: alt. 200-300 m., Jan. 29 to Feb. 5, 1934, fr., *A. C. Smith 996* (BISH, K, L). Without exact locality: 1877 to 1878, fr., *Horne 218* (K); 1877 to 1878, female fl., *Horne 354* (K). Habitat: dense forest.

Some literature mentioning *C. vitiense* A. Gray has not been listed, as many *Canarium* and *Haplolobus* specimens collected in the Fiji Islands have been incorrectly quoted under this name. Unless collectors' numbers or some details are mentioned, the species cannot correctly be interpreted. As an example, I may mention Sykes (The forests of the Colony of Fiji, Legislative Council of Fiji, Council paper **9**: 47, 1933), who gives details of economic importance only. The fruit is edible.

8. Canarium bacciferum, sp. nov. (fig. 9, *a-e*).

Canarium vitiense auct. non A. Gray, Degener, Naturalist's south Pacific Expedition: Fiji, 266, 295, 1949.

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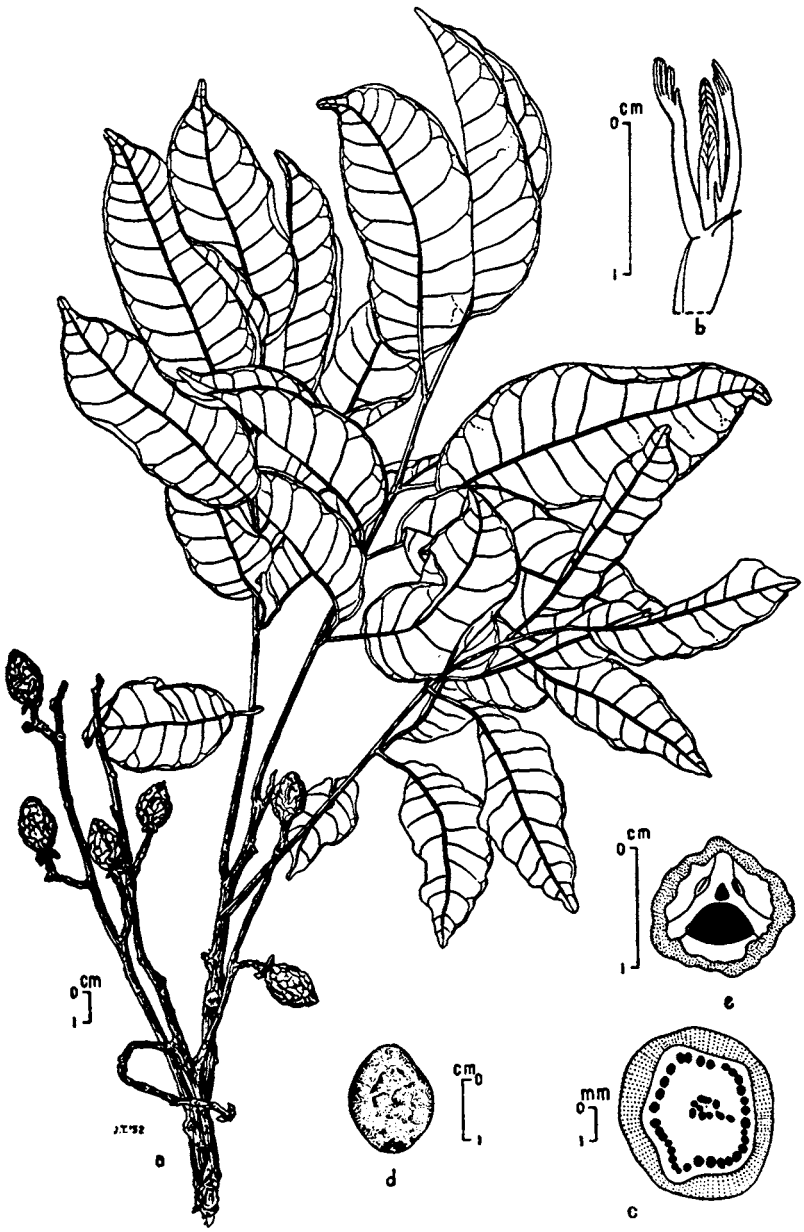

FIGURE 9.—*Canarium bacciferum:* **a,** fruiting specimen; **b,** leaf bud with stipules; **c,** medulla and wood of branchlet, cross section; **d,** fruit; **e,** fruit, cross section. (*a: Degener 15429; b, d, Smith 5856; c, e: Gillespie 4359.*)

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Arbor parva vel mediocris. *Ramuli* glabri asperi lenticellati; medulla multis ductis vasculosis parvis suffulta, aut omnes sparsi, aut ducti peripherales ad lignum intus adpressi et centrales dispersi, aut etiam ducti centrales in cylindro positi. *Folia* 3½-5½ (-6½)-jugata; stipulae in basi petioli positae, mox deciduae, subulatae, 0.15 cm. longae; petioli 5.5-8 cm. longi, medulla nonnullis fasciculis vasculosis magnis centralibus, parvis peripheralibis percursa; foliola 4.5-13 × 3-5.75 cm., nervi secundarii 8-13 (-16). *Inflorescentiae floresque* ignotae. *Infructescentiae* axillares; calyces fructigeri subtrilobati, disci rudimento piloso 6-lobati. *Fructus* ovoidei vel semiglobosi, putamen 3-loculari, 2 locis multo reductis.

Small to moderate-sized tree (17 m., *f. Greenwood 940, A. C. Smith 6275*). *Branchlets* terete, 0.5-0.7 cm. thick, glabrous, becoming scabrous, lenticellate; medulla with many small vascular bundles, peripheral ones not infrequently, central ones sometimes, cylindrically arranged. *Leaves* 3½-5½ (-6½)-jugate, 20-35 cm. long, sparsely pilose, soon glabrescent; *stipules* inserted at base of petiole, deciduous, subulate, 0.15 cm. long; *petioles* terete, somewhat thickened and flattened at base, 5.5-8 cm. long, 0.2-0.3 (-0.4) cm. thick, medulla with some large central and some small peripheral vascular bundles; interjugal parts 2.5-5.5 cm. long; *petiolules* terete, somewhat flattened above, canaliculate toward apex, lateral ones 0.8-1.7 cm. long, terminal ones 2-3.5 cm. long; *leaflets* elliptic, 4.5-13 × 3-5.75 cm., subcoriaceous, nitidulous at both surfaces, glabrous, lateral ones hardly to fairly strongly inequilateral at base, one-half rounded, terminal ones broadly cuneate, margins entire, apex gradually to rather abruptly, bluntly acuminate, acumen ± 0.7 × 0.6 cm.; midrib prominulous above, prominent beneath, secondary nerves 8-13 (-16) pairs, angle 85-60 degrees, decreasing from base to apex, basal ones faintly S-shaped, the others straight to more or less strongly curved, not infrequently rather straggling, close to margin abruptly curved, apical ones arched and joined, prominulous at both sides, veinlets coarsely reticulate, prominulous at both sides. *Inflorescences and flowers* unknown. *Infructescences* axillary, racemose to subracemose, 7-20 cm. long, with 3 to 8 fruits; pedicels up to 1 cm. long, about 0.25 cm. thick, not thickened at apex; fruiting calyces faintly 3-lobed, 0.7-0.8 cm. in diameter, glabrous without, shortly, densely, and appressedly yellowish brown pubescent within, lobes spreading to reflexed, remainder of a deeply 6-lobed pilose disk present. *Fruits* ovoid to almost globose, blunt at either end (rarely more or less acute), 1.6-2.2 × 1.4-1.7 cm., deep purple to black (*f. A. C. Smith 6275*); pericarp faintly to moderately wrinkled, fleshy, ± 0.2 cm. thick; putamen circular in cross section, rugose; mesocarp 0.2 cm. thick; 3-celled, 2 cells much reduced.

Fiji Islands. Viti Levu: Mataimeravula, Rewasa, June 3, 1941, fr., *Degener 15429* (A, BISH, K); Nadarivatu [Nandarivatu], alt. 850 m., Dec. 9, 1927, fr., *Gillespie 4248* (BISH); Tholo North Province, vicinity of Nandarivatu, alt. 900 m., Dec. 10, 1927, fr., *Gillespie 4267* (P); Tholo North Province, Nandarivatu, alt. 1,000 m., Dec. 10, 1927, fr., *Gillespie 4359* (BISH); Mba, vicinity of Nandarivatu, alt. 800-900 m., June 26 to Oct. 2, 1947, fr., *A. C. Smith 5856* (A); Mba, slopes of escarpment north of Nandarivatu, alt. 550-800 m., Sept. 15 to 29, 1947, fr., *A. C. Smith 6275* (A, type specimen); mountains near Lautoka, alt. 550 m., Sept. 24, 1944, fr., *Greenwood 940* (A, BISH, K). Ovalau: vicinity of Levuka, Feb. 1, 1928, fr., *Gillespie 4542* (B, BISH, K). Habitat: dense forest.

Vernacular names: *kauloa, nggaunggau* (Viti Levu).

This species is closely related to *C. vitiense* A. Gray, but differs from it mainly in its ovoid to globular fruits and the fruiting calyces which are not

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funnel-shaped. It is a rather small tree with smooth, gray bark and pale, watery latex. The timber is used in building native houses.

9. **Canarium samoense** Engler in DC. Monogr. Phan. **4**: 134, 1883; in Engler and Prantl, Nat. Pflanzenfam. **3** (4): 241, 1897; ed. 2, **19a**: 449, 1931.—Lam, Jard. bot. Buitenzorg, Ann. **42**: 216, 1932; Jard. bot. Buitenzorg, Bull. III, **12**: 427, 1932.—Christophersen, B. P. Bishop Mus., Bull. 128: 113, 1935.—Yuncker, B. P. Bishop Mus., Bull. **184**: 44, 1945. (See figure 10, *a-h.*)

Canarium, sp. nov., Horne, A year in Fiji, . . ., 285, 1881.

Rather large tree (up to 20 m., *f. Horne 5*). *Branchlets* terete, 0.9 cm. thick, glabrous; medulla with many small vascular bundles, the peripheral ones more or less cylindrically arranged. *Leaves* 3½-6½-jugate, 34-40 or more cm. long; *stipules* inserted at base of petiole, deciduous, probably small and subulate; *petioles* terete, somewhat flattened and compressed at base, 6.5-13 cm. long, 0.25-0.3 cm. thick, with small circular stipule scars at base, medulla with some large central and a few small peripheral collateral vascular bundles; interjugal parts 2-4.5 cm. long; *petiolules* semiterete, deeply grooved above, lateral ones 0.6-1.2 cm. long, terminal ones 1-3 cm. long; *leaflets* broadly elliptic to elliptic oblong, somewhat inequilateral, 7.5-14 × 3.5-4.5 cm., chartaceous (to coriaceous), glabrous, base slightly inequilateral, rounded to cuneate, somewhat decurrent, margins entire, apex gradually and bluntly acuminate, acumen 0.8-1.7 × 0.3-0.5 cm.; midrib prominulous above, prominent beneath, secondary nerves (8-) 13-16 pairs, angle 70-80 degrees, faintly curved, more or less abruptly and distinctly arched and joined at some distance from margin, prominulous at either side, veinlets coarsely reticulate, prominulous at both sides. *Inflorescences* (female unknown) axillary, few-flowered, 6-11 cm. long; peduncles angular, 2-4.5 cm. long, glabrous; pedicels about 0.2 cm. long; bracts deciduous. *Flowers* (female unknown) 0.8 cm. long; *sepals* 0.5 cm. long, half connate, glabrescent without, densely appressedly pubescent within, lobes bluntly deltoid; *petals* oblong, about 0.7 cm. long, somewhat keeled, inflexed-acuminate, densely, appressedly pubescent without, except at base and margins; *stamens* 6, free, 0.5 cm. long, filaments ribbon-shaped, tapering toward apex, 0.3 cm. long, anthers hastate, 0.2 cm. long; *disk* cupular, fleshy, about 0.15 cm. high, glabrous; *pistil* none. *Infructescences* axillary, racemose, 6-13 cm. long, with 1-3 fruits; pedicels 1 cm. long, 0.2-0.25 cm. thick, not thickened at apex; fruiting calyces flatly spreading, 3-lobed, 1 cm. in diameter, glabrous without, densely pilose within, with annular disk. *Fruits* elliptical to ovoid, somewhat triangular, 2.5 × 1.3-1.5 cm., acuminate at apex, glabrous; pericarp strongly wrinkled, 0.1-0.2 cm. thick; putamen very rugged; mesocarp 0.2 cm. thick; 3-celled, 2 cells strongly reduced.

Samoa Islands. Savaii: near Tufutafoe, alt. ± 10 m., Sept. 30, 1931, male fl., *Christophersen 2770* (BISH, K). Upolu: forest below Malololelei, alt. 500 m., Aug. 16, 1929, fr., *Christophersen 290* (BISH, P); forest near Moa-Moa, alt. 200 m., June 29, 1931, *Christophersen 1833* (A, L); mountain region, Mar. 1880, fr., *Graeffe 1385* (K). Without exact locality: fr., *Powell 311* (K, type specimen); 1878, male fl., *Horne 5* (K).

Vernacular names: *ma'ali, mali-mali.*

According to Horne, "The trunk of this tree exudes when wounded a fragrant resin, which the Samoans say they use to embalm dead ladies."

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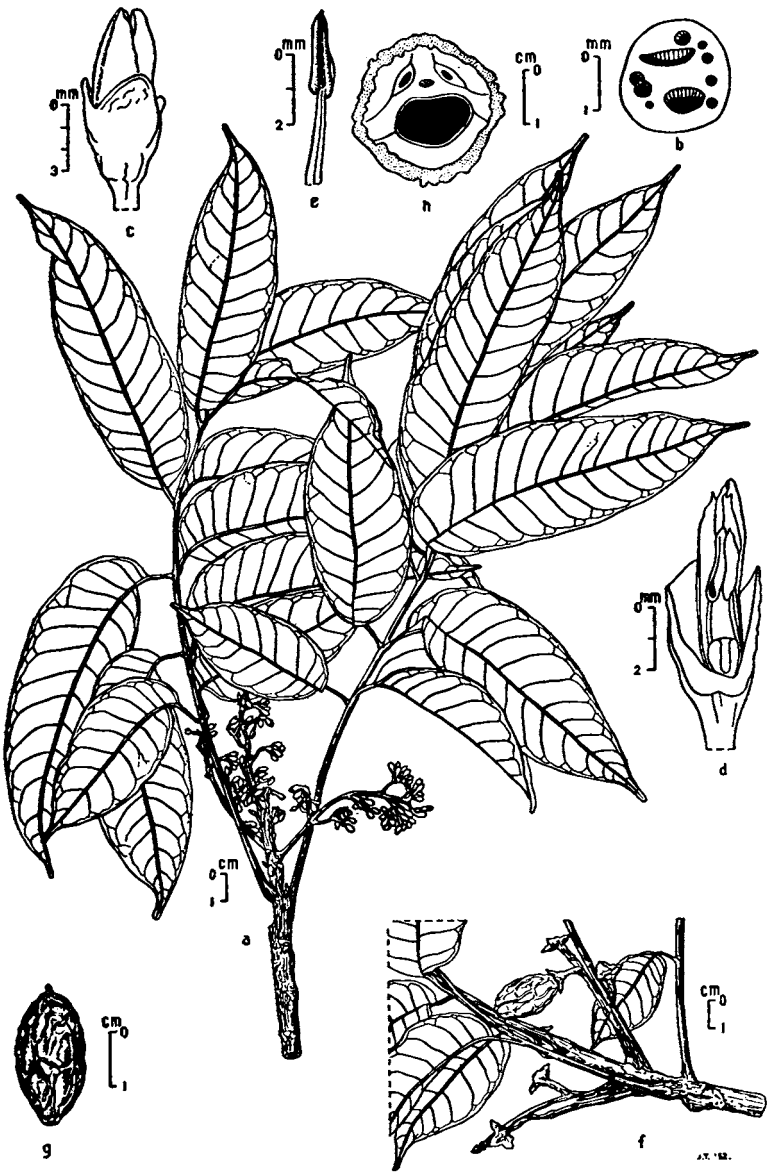

FIGURE 10.—*Canarium samoense:* **a**, male specimen; **b**, petiole, cross section; **c**, male flower; **d**, male flower, longitudinal section; **e**, male flower, stamen; **f**, fruiting specimen; **g**, fruit; **h**, fruit, cross section. (*a: Christophersen 2770; b: Christophersen 1833; c-e: Horne 5; f, g: Christophersen 290; h: Powell 311.*)

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10. Canarium pilosum A. W. Bennett in Hooker f., Fl. Brit. Ind. 1: 533, 1875.—Lam, Jard. bot. Buitenzorg, Bull. III, 12: 472, pl. 11, fig. 68, 1932. (See figure 11, *a-h.*)

Moderate-sized to rather large tree (up to 28 m. high, according to Lam). *Branchlets* terete, about 0.5-1 cm. thick, young parts long remaining densely woolly pubescent; medulla with a peripheral cylinder of vascular bundles, rarely also some in central part. *Leaves* (1½-) 2½-4½ (-6½)-jugate, 20-25 cm. long, more or less pubescent in all parts, glabrescent, rarely entirely glabrous; *stipules* inserted at conjunction of petiole and branchlet, or on the petiole at a distance of up to 2.2 cm. from branchlet, persistent to caducous, sub-

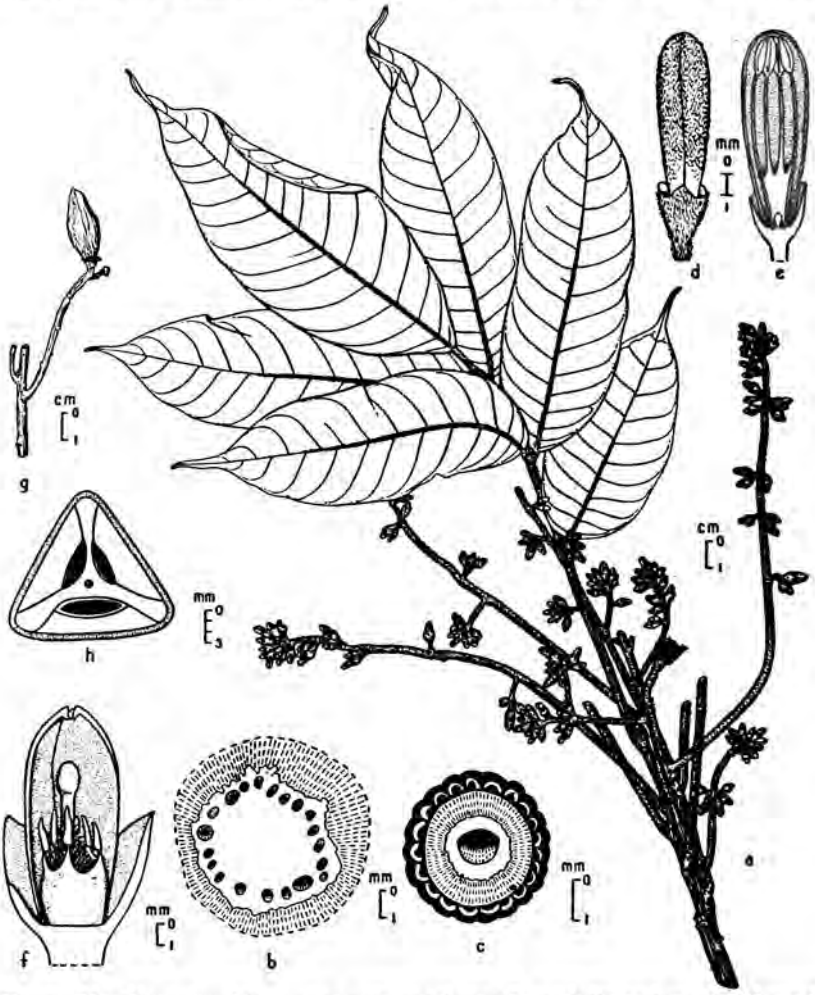

FIGURE 11.—*Canarium pilosum:* **a**, male specimen; **b**, medulla and wood of branchlet, cross section; **c**, petiole, cross section; **d**, male flower; **e**, male flower, longitudinal section; **f**, female flower, longitudinal section; **g**, part of infructescence; **h**, fruit, cross section. (*a: Achmad 845; b, c: Ridley 4654; d, e: King coll. 7901; f: Haskim 287; g: Dumas 1632.*)

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ulate or setiform, 0.25-1.3 cm. long, pubescent; *petioles* terete, much flattened at base, 4-12 cm. long, 0.25-0.3 cm. thick, medulla with one single to many vascular bundles; interjugal parts 2-6 (-9) cm. long; *petiolules* somewhat compressed, narrowly canaliculate above, lateral ones (0.1-) 0.4-1.4 cm., terminal ones 0.5-3 (-6) cm. long; *leaflets* ovate to oblong-lanceolate, (3.5-) 6-18 (-25) × (1.6-) 2.8-6.5 (-9.5) cm., coriaceous, upper side glabrous or pubescent on midrib only, lower side woolly pubescent to glabrous, base hardly inequilateral, rotundate to broadly acute, slightly decurrent, margins minutely serrulate (especially in young specimens) to entire, apex gradually to subabruptly, short and bluntly to long and acutely, acuminate; midrib prominulous above, very prominent beneath, secondary nerves 8-15, angle decreasing from base to apex from 80 to 50 degrees, basal nerves faintly S-shaped, the others curved, often more or less distinctly arched and joined near margin, prominulous to prominent at both sides, veinlets very minute, reticulate, not prominent. *Inflorescences* axillary to pseudoterminal or terminal, male narrowly paniculate, 4-26 cm. long, female more racemose, 1.5-10 cm. long, in both sexes pubescent, more or less glabrescent, rather few-florous; bracts deciduous; pedicels 0.1-0.2 cm. long. *Flowers* 1-1.2 cm. long; *sepals*, male, 0.2-0.4 cm. long, connate for more than two-thirds length, female, 0.5-0.6 cm. long, connate for about two-thirds of their length, in both sexes woolly pubescent outside, appressedly pubescent inside, lobes broadly deltoid; *petals* oblong-obovate, narrow and much exserted, 1-1.1 cm. long in male flowers, broader (up to 0.4 cm.) and less exserted in female flowers, densely pubescent outside except at base, apex of male hardly or not incrassate and inflexed, of female, distinctly inflexed; *stamens* 6, of male connate for about one-fourth to one-third of their length, 0.6-0.8 cm. long, filaments filiform, glabrous, anthers acutely ovoid, 0.2-0.25 cm. long, of female nearly entirely connate, 0.4 cm. long, glabrous, anthers oblong, acute, 0.1 cm. long; *disk* cupular, pilose, minute, especially in male flowers; *pistil* in male very small, pubescent, in female narrowly oblong, 0.7 cm. long, erectly pilose, with a rather slender style and a relatively small, capitate, 3-lobed stigma. *Infructescences* 1.5-10 cm. long, with a few fruits only; pedicels 0.2-0.9 cm. long, 0.2-0.4 cm. thick; fruiting calyces spreading, distinctly 3-lobed, 0.6-1.3 cm. in diameter, more or less woolly pubescent or glabrous without, sericeous within. *Fruits* oblong, ellipsoid or ovoid, apex usually characteristically narrowed, sometimes truncate or bluntly to acutely pointed, usually more or less distinctly trigonous or 6-angular, (1.7-) 2.3-3.3 × 0.8-) 1-1.4 (-1.6) cm., glabrous except sometimes at apex; pericarp smooth, thin; putamen smooth to faintly keeled; mesocarp 0.2-0.3 cm. thick; 3-celled, 2 cells usually more or less strongly reduced.

Type: Malacca, *Maingay 302* (K).

Range: Malay Peninsula, Sumatra, Borneo, Fiji.

a. ssp. **pilosum.**

var. *typicum* H. J. Lam, Jard. bot. Buitenzorg, Bull. III, 12: 472, pl. 11, fig. 68, 1932.

Range: Malay Peninsula, Sumatra, Borneo, Fiji Islands.

Fiji Islands: Viti Levu, vicinity of Nasinu, 9 miles from Suva, alt. 150 m., Oct. 21, 1927, *Gillespie 3434* (BISH).

The discontinuous area of this species, though not entirely unparalleled, is somewhat puzzling. The center seems to lie in western Malaysia, though the tree is probably not really either frequent or rare there. The Fiji specimen is the only one seen by me which was collected east of Borneo. The disjunction may be due to gaps in our knowledge, or the Fiji specimen may be a cultivated one.

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Group B

Stipules foliaceous or auriculate. *Medulla of branchlets* with many vascular bundles, arranged more or less in a peripheral cylinder and with or without some bundles scattered in the central part. *Inflorescences* usually terminal, rarely axillary or pseudoterminal. *Stamens* free or somewhat adnate to disk. *Male flowers* with a 0.1 cm. high, mostly cushion-shaped ovariodisk, with a central canal, mostly without any trace of an ovary. *Female flowers* with a shallow receptacle, adnate to disk; ovary with a short pseudogynophore. *Fruits* with a strong tendency to the reduction of two locules.

In this group I have united the Pacific species of Lam's section *Regressiva*, his subsection *Auriculata*, and his section *Progressiva*. In my opinion, the *Auriculata* are, rather, related to the *Progressiva*. This group of Pacific species seems to be a quite natural one.

Key to Species of Group B

1a. Stipules persistent, inserted on branchlet at conjunction of petiole and branchlet or partly so, rarely entirely on base of petiole; scar long and narrow 2
b. Stipules not rarely deciduous, inserted on petiole, at a distance of 0.1-1.5 cm. from base; scar drop-shaped 4
2a. Stipules lingulate, acute, about 0.5 cm. wide, inserted on base of petiole (cultivated) ..... **11. C. ovatum.**
b. Stipules foliaceous, with rounded apex, 0.5-4 cm. wide, inserted on branchlet near petiole base, more rarely partly upon the latter 3
3a. Stipules persistent, serrate, 1.5-6 × 1.2-4 cm., stout species (Solomons, New Hebrides) ..... **12. C. indicum.**
b. Stipules deciduous to semipersistent, entire, 1-4.8 × 0.5-1.7 cm., slender species (cultivated) ..... **13. C. vulgare**
4a. Stipules small, 0.3 × 0.4-0.7 cm., nearly always persistent, shriveled auriculate; scar ± transverse (Solomons) ..... **14. C. salomonense.**
b. Stipules larger, at least 0.4 × 0.2 cm., deciduous, flatly auriculate; scar longitudinal 5
5a. Secondary nerves 8-13 (-17) pairs; inflorescences rarely terminal; bracts deltoid, 0.15-0.2 cm. long; calyx 0.25 cm. long (Solomons, New Hebrides, Fiji, Tonga, Samoa, Niue) ..... **15. C. harveyi.**
b. Secondary nerves 18-20 pairs; inflorescences terminal; bracts ovate, acuminate, 0.55 × 0.3 cm.; calyx 0.4 cm. long (cultivated) ..... **16. C. maluense.**

11. Canarium ovatum Engler in DC. Monogr. Phan. **4**: 110, 1883.—Kanehira, Bot. Mag. Tokyo **45**: 288, 1931.—Lam, Jard. bot. Buitenzorg, Bull. III, **12**: 533, 1932.—Kanehira, Fl. Micronesica, 434, 1933; Dept. Agric. Kyushu Imp. Univ., Jour. **4**: 344, 1935.

Range: Philippines; Pacific region, probably cultivated.

According to Kanehira, this species was cultivated at Ponape in the Caroline Islands (*Kanehira 739*). I did not see it from there.

12. Canarium indicum L., Amoen. Acad. **4**: 143, 1759.—Safford, U. S. Nat. Herb., Contrib. **9**: 210, 1905. (See figure 12, *a-k*.)

Canarium vulgare I and II Rumphius, Herb. Amb. **2**: 145, pl. 47 (for the most part), 1741.

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Canarium commune L., Mant. pl. 1: 127, 1767.—Willdenow, Sp. Pl. 4 (2): 759, 805 (includes var. *zephyrinum*).—Konig, Ann. Bot. Konig and Sims 1: 360, 1805.—De Candolle, Prodr. 2: 79, 1825.—Blume, Bijdr. Fl. Ned. Ind., 1161 (in part), 1826.—Very probably Roxburgh, Fl. Ind. 3: 137, 1832.—Merrill, Interpret. Herb. Amb., 301, 1917.

Canarium mehenbethene Gaertner, Fruct. et Semen. Pl. 2: 98, 1791.—Lam, Jard. bot. Buitenzorg, Bull. III, 12: 515, 1932.—Also in most modern literature.

Canarium moluccanum Blume, Mus. bot. Lugd.-Bat. 1: 216, 1850.

Canarium zephyrinum Rumphius ex Blume, Mus. bot. Lugd.-Bat. 1: 217, 1850.

Canarium shortlandicum Rechinger, Fedde Repert. 11: 184, 1912; Denkschr. K. Akad. Wiss. Wien 89: 454, 462, 564, pl. 2, a, b, 1914.—Lam, Jard. bot. Buitenzorg, Ann. 42: 216, 1932.

Canarium nungi Guillaumin, Jour. Arnold Arb. 12: 236, fig. 2A, 1931.—Lam, Jard. bot. Buitenzorg, Ann. 42: 216, 1932; Jard. bot. Buitenzorg, Bull. III, 12: 427, 1932.—Guillaumin, Mus. colon. Marseille, Ann. VI, 55-56 (5-6): 28, 1948.

var. **indicum.**

Large tree (up to 40 m. high, according to Lam, Jard. bot. Buitenzorg, Bull. III, 12: 427, 1932). *Branchlets* terete, 0.7-1.3 cm. thick, puberulent when young, glabrescent; medulla with a peripheral cylinder of small vascular bundles close to inner side of wood, central part with a second cylinder or some scattered vascular bundles. *Leaves* 3½-7½-jugate, 35-45 cm. long; *stipules* persistent, inserted at conjunction of branchlet and petiole, rather variable in shape and size, ovate to more or less oblong, striate to reticulate, 1.5-6 × 1.2-4 cm., often slightly cordate at base, minutely pulverulent to glabrate, margins coarsely to minutely fimbriate-dentate; *petioles* terete, hardly or not flattened at base, 3.5-11 cm. long, 0.3-0.5 (-0.7) cm. thick, medulla with many collateral vascular bundles, the smaller ones peripherally arranged, a few large ones in central part; interjugal parts 1.5-6 cm.; *petiolules* terete, faintly canaliculate above, lateral ones 0.7-3 cm. long, terminal ones 1.5-4.5 cm. long; *leaflets* oblong-obovate, oblong or oblong-lanceolate, (5.5-) 7-24 × (2-) 3.5-11 cm., herbaceous to coriaceous, nitidulous above, dull beneath, glabrous, base inequilaterally rounded to broadly acute, margins entire, apex gradually or subabruptly and bluntly acuminate; midrib prominulous above, prominent beneath, (8-) 10-15 (-20) pairs of secondary nerves, angle decreasing from base to apex from 80-85 degrees to 65-55 degrees, straight to faintly curved, basal ones often S-shaped, not or faintly arched and joined near margin, except for apical ones, prominulous above, prominent beneath, veinlets without distinct characteristics, not clearly visible. *Inflorescences* terminal, broadly paniculate, 15-40 cm. long, minutely pubescent; peduncles more or less angular, up to about 0.7 cm. thick; flowers sessile or nearly so, especially the male ones; bracts deciduous, especially in male flowers, 1-1.2 × 0.6-0.8 cm., enclosing cymules. *Flowers*, male, about 1 cm. long, female, up to 1.5 cm. long and with a shallow receptacle; *sepals*, male, 0.5-0.7 cm. long, female, 0.7-1 cm. long, in both sexes connate for about two-thirds of their length, densely and appressedly pubescent at both sides; *petals* ovate, male, 0.7 × 0.4 cm., female, oblong, apex more acute, 1-1.3 × 0.6 cm., in both sexes densely pubescent without, except margins and very base, glabrous within, apex somewhat incrassate and little inflexed—especially in female flowers (cream-colored, according to Lam); *stamens* 6, glabrous except for some occasional longitudinal rows of bristles on anthers in male flowers, male

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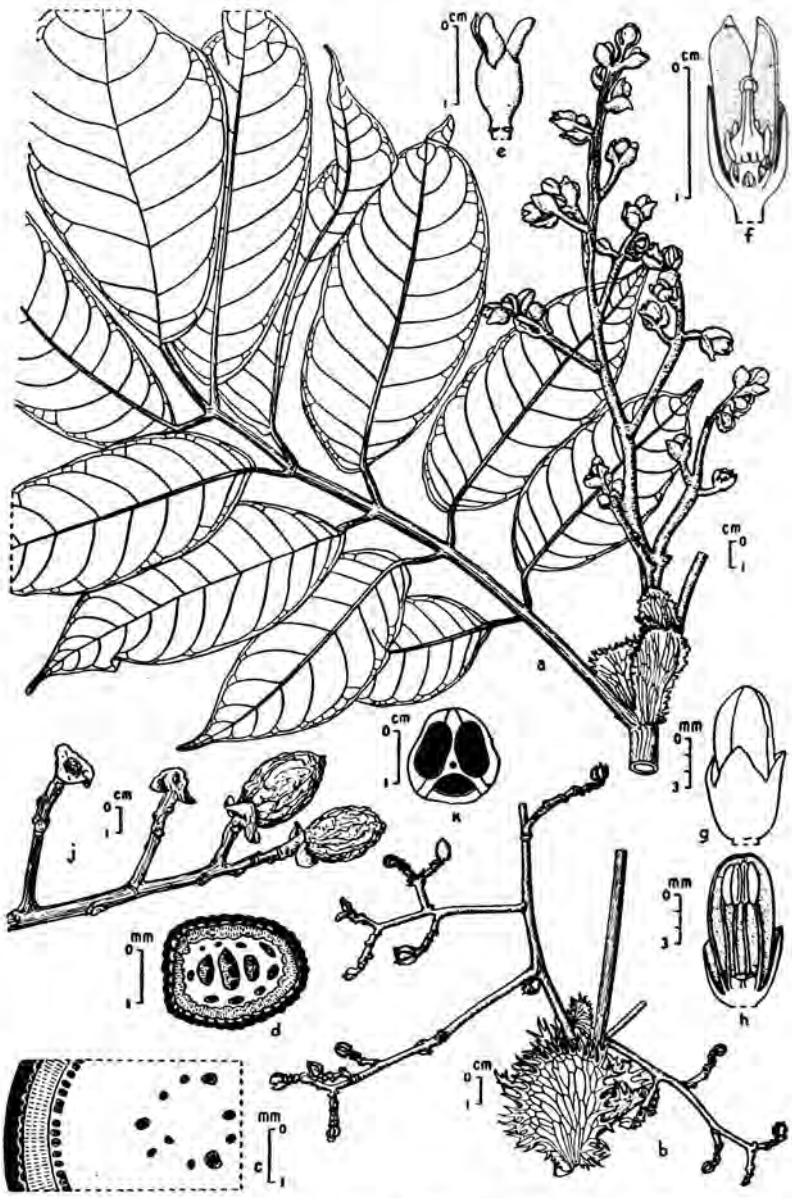

FIGURE 12.—*Canarium indicum:* **a**, female specimen; **b**, male specimen; **c**, part of cross section of branchlet; **d**, petiole, cross section; **e**, female flower; **f**, female flower, longitudinal section; **g**, male flower; **h**, male flower, longitudinal section; **j**, part of infructescence; **k**, fruit, cross section. (*a: Hort. bot. Bogor, m II NG 88 a; b: Hort. bot. Bogor VI D 11; c, d: Beguin 1002; e, f: C. H. B. 290; g, h: Hort. bot. Bogor VI D 11; j: Brass 3468; k: Hort. bot. Bogor.*)

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free, filaments filiform, 0.4-0.6 cm. long, anthers oblong, 0.25-0.3 cm. long, female coherent with the disk, filaments subulate, broadened at base, about 0.4-0.5 cm. long, anthers oblong, 0.1-0.2 cm. long; *disk* of male cushion-shaped, 0.1 cm. high, glabrous, of female adnate to receptacle, except for minutely pilose margin; *pistil,* male, very minute to none, female, glabrous, 0.5 cm. long, ovary subglobular, 0.1 cm. long, with a pseudogynophore 0.1 cm. long, style cylindrical, 0.15 cm. long, stigma capitate, 3-lobed, 0.15 cm. long. *Infructescences* large, with up to about 30 well-developed fruits (*f. Kajewski 122*); pedicels 0.4-0.5 cm. thick; fruiting calyces spreading, often the margin slit up, 1.7-2.5 cm. in diameter, densely, appressedly pubescent, especially on inner surface. *Fruits* ovoid, round or more or less triangular, 3.5-6 × (1.5-) 2-3 cm., glabrous, purple to black when ripe (according to Lam, Jard. bot. Buitenzorg, Bull. III, 12: 515, 1932); pericarp faintly coarsely wrinkled, 0.1-0.2 cm. thick, fleshy; putamen rounded triangular in cross section except for three more or less acute ribs at base and apex; mesocarp 0.3-0.4 cm. thick; 3-celled, usually 1 cell fertile, the others not strongly reduced.

Neotype: *Hort. bot. Bog. VI. B. 65* (L).

Range: Moluccas, New Guinea, Solomons, New Hebrides; often cultivated.

Solomon Islands. Bougainville: Siwai, female fl., *Waterhouse 69* (BISH, K); Siwai, Oct. 1932, female fl., *Waterhouse 106* (A, K); Kugi-Maru, Buin, alt. 150 m., June 7, 1930, fr., *Kajewski 1828* (A, BISH, BO, G, L), common, this is one of the finest trees in the islands and subject to a lot of variations throughout the different groups; without exact locality, Sept. 1932, female fl., *Waterhouse 70* (K). Shortland Island: Paperang, Sept. 1905, male fl., *Rechinger 4900* (W, type specimen of *C. shortlandicum* Rechinger). New Georgia: June 26, 1929, fr., *Waterhouse 110* (K); July 30, 1929, male fl., *Waterhouse 220* (K); 1927, *Waterhouse* (K); Surintambona [Suritambuna] Point, Oct. 14, 1945, male fl., *Walker BS-IP 3A* (K). Duke Island: Aug. 16, 1929, male fl., *Waterhouse 298 and 299* (K). Isabel Island: Jan. 13, 1933, fr., *Brass 3468* (A, BISH, BO, G, L), lowland and hill forests. Guadalcanal: North coast, male fl., *Walker BS-IP 3* (L), rain forest, river side. San Cristoval: Waimamura, Aug. 11, 1932, fr., *Brass 2631* (A, BISH, L), lowland rain forest, common; Balego-Nagonago, Aug. 19, 1932, male fl. and fr., *Brass 2701* (A, BISH, BO, L), plentiful in all the lowland and foothill rain forests.

New Hebrides. Eromanga: Dillons Bay, sea level, May 14, 1928, fr., *Kajewski 243* (A; K; syntype of *C. nungi* Guillaumin), common. Tanna: Lenakel, alt. 100 m., Mar. 7, 1928, fr., *Kajewski 122* (A, K, P, syntype of *C. nungi* Guillaumin), common.

Cultivated. Marianas: Guam, June 1888, *Marche 192* (P). Samoa: Upolu, alt. 50 m., Mar. 2, 1921, fr., *Eames 197* (BISH), said to be introduced from Solomons. Society Islands: Raiatea, alt. 1 m., May 18, 1927, *Moore 773* (BISH).

Habitat: lowland and hill rain forest.

Vernacular names: *tariapo, moi, okete, uagele, mi, tugtug-purua* (Bougainville); *okete-davala* and *okete* (New Georgia); *koke-malegore* and *koke*

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noana (Duke Island); ***nali*** (Isabel Island); ***ngali*** (Guadalcanal); *nari* (San Cristoval); ***nungi*** (Eromanga); and ***narngi*** (Tanna).

The seeds are popular food.

The synonymy of this and the next species is considerably confused (see Lam, Jard. bot Buitenzorg, Bull. III, **12**; 510, 1932; Merrill, Interpret. Herb. Amb., 301, 1917). For this reason I have given here all synonyms and the most important Rumphian, Linnean, and older post-Linnean literature, even that not directly related to the Pacific region.

The first Linnean binomial given in the genus *Canarium* is *C. indicum* L. This species was based upon all the plates of *Canarium* given by Rumphius (Herb. Amb. **2**: pls. 47-56, 1741). As usual, Rumphius' description and plate of the first of a group of related forms is the most complete. In this case, this is *C. vulgare* (pl. 47). Plate 47 would be the best typification of *C. indicum* L.

In Mantissa plantarum (**1**: 127, 1767) Linné describes *C. commune* L., based upon plate 47 of Rumphius. This being the only species mentioned, it seems plausible to me that Linné believed that all Rumphius' plates refer to one species only. The first plate being the most complete one, no other references were added. If this view is correct, it may be assumed that the name *C. indicum* L. was replaced by that of *C. commune* L. Plate 47 should then be a closer typification.

As is true with many Linnean names, the interpretation of *C. commune* L. became broader as time went on. Rumphius' *C. vulgare* already was a mixture: the forms I and II and the greater part of the plate fairly well represent *C. indicum* L. *sensu* Leenhouts, the forms III and IV represent *C. vulgare* Leenhouts. Konig (Ann. Bot. Konig and Sims **1**: 360, 1805), in closer typifying *C. commune* L. by Rumphius' plate 48, gave evidence of this right interpretation. Schultes [Roemer et Schultes, Syst. veg. **7** (2): 1622, 1830] was the first to give a detailed description of *C. vulgare* Leenhouts under the name *C. commune* L. The confusion was made complete by Blume (Mus. bot. Lugd.-Bat. **1**: 214, 1850), who correctly distinguished both species but wrongly reduced the species with entire stipules to *C. commune* L.; and the species with dentate stipules he named *C. moluccanum* Blume. As after that time the name *C. commune* L. was almost always used in the wrong sense, it seems justifiable to me to reject the name as a "long persistent source of error" (Int. Code of botanical Nomenclature, article 75, 1952). In doing so, in my opinion, it is possible and desirable to use Rumphius' plate 47, on which *C. commune* L. was based, as a closer typification of *C. indicum* L.

Should there be strong objections to this interpretation, the following changes would be necessary:

1. *C. indicum* L. *sensu* Leenhouts should be named *C. zephyrinum* Rumph. ex Blume or *C. moluccanum* Blume (the name *C. mehenbethene* Gaertner is an illegitimate one, as it mentions *C. commune* L. as a synonym).

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2. *C. vulgare* Leenhouts should be retained, as it has no synonym.

3. *C. asperum* Bentham should be named *C. indicum* L. (this is the interpretation of Rumphius' plate 53, the only syntype of *C. indicum* L., on which no species has been based).

This is a fine, large tree, with buttressed, straight trunk and a fissured and scaly, pale brown or gray bark; the wood is very resinous. Most of the variations mentioned by some collectors probably are only cultivated races.

FIGURE 13.—*Canarium vulgare,* stipules. (*Hort. bot. Bogor VI 66.*)

13. Canarium vulgare, nom. nov. (fig. 13).

Canarium vulgare III and IV, Rumphius, Herb. Amb. **2**: 145, pl. 47 (for the lesser part), 1741.

Canarium indicum L., Amoen. Acad. **4**: 143 (for the lesser part), 1759.

Canarium commune L., Mant. pl. **1**: 127 (for the lesser part), 1767.—Blume, Bijdr. Fl. Ned. Ind., 1161 (in part), 1826; Mus. bot. Lugd.-Bat. **1**: 214, 1850.—Bennett in Hooker f., Fl. Brit. Ind. **1**: 531, 1875.—Miquel, Fl. Ned. Ind. **1** (2): 643, 1859.—Engler in DC. Monogr. Phan. **4**: 112, 1883.—King, Asiatic Soc. Bengal, Jour. **62** (2): 246, 1893.—Koorders and Valeton, 's Lands Plantent. Buitenzorg, Med. **17**: 30, 1896.—Lauterbach, Engler Bot. Jahrb. **56**: 515, 1921.—Neal, B. P. Bishop Mus., Sp. Pub. **13**: 174, fig. 36, 1929.—Engler in Engler and Prantl, Nat. Pflanzenfam., ed. 2, **19a**: 447, fig. 211, 1931.—Kanehira, Bot. Mag. Tokyo **45**: 288, 1931.—Lam, Jard. bot. Buitenzorg, Bull. III, **12**: 509, 1932.—Kanehira, Fl. Micronesica, 434, 1933.—V. Malm, Fedde Repert. **34**: 277, 1934.—Christophersen, B. P. Bishop Mus., Bull. **128**: 113, 1935.—Kanehira, Dept. Agric. Kyushu Imp. Univ., Jour. **4**: 344, 1935.

Type: Bali, *Becking 142* (L).

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Range: Eastern Malay Archipelago, except New Guinea; cultivated in many tropical regions.

Cultivated only. Carolines: Ponape, Aug. 1929, fr., *Kanehira 848* (A). Cook Islands: Rarotonga, Avarua, May 20, 1929, female fl., *Wilder 860* (BISH). Fiji Islands: Viti Levu, Naitasiri, Nasinu Experiment Station, May 18, 1939, fl., *Parham 1540* (A). Without exact locality, Nov. 1878, fr., *Reichenbach* (K), fruits only, very probably belonging to this species. Hawaiian Islands: Oahu, Jan. 13, 1927, fl., *L. H. MacDaniels 413* (BISH); Queen's Hospital grounds, fl., *J. F. Rock* (BISH); June 1, 1931, female fl. and fr., *G. P. Wilder 462* (BISH). Kauai, Waiawa, Apr. 1919, female fl., *J. F. Rock 17140* (BISH). Maui, Wailuku, Mar. 31, 1932, fl., *T. C. Zschokke* (BISH).

Commonly known as the Java almond; the seeds are eaten, and wood from the tree is used for lumber.

A full account of the synonymy is to be found under *C. indicum* L.

14. Canarium salomonense B. L. Burtt, Kew Bull., 302, 1935. (See figure 14, *a-n.*)

ssp. **salomonense.**

Large tree (up to 30 m. high, *f. Kajewski 2056*). *Branchlets* terete, 0.5-0.7 cm. in diameter, youngest parts pulverulent, glabrescent; medulla with several small amphivasal vascular bundles—each with a resiniferous duct—peripheral ones more or less distinctly arranged into a cylinder. *Leaves* 1½-2½ (-3½)-jugate, not infrequently without a terminal leaflet, 18-30 (-38) cm. long; *stipules* subpersistent, attached on the petiole at 0.4-1.5 cm. from branchlet, shriveled, auriculate, 0.3 × 0.4-0.7 cm., connected with branchlet by a more or less conspicuous ridge; *petioles* terete, flattened at base, 2-7 cm. long, 0.15-0.3 cm. thick, scars of stipules prominent, crescent-shaped, transverse, 0.3 cm. long, medulla with 6-8 scattered large vascular bundles with resiniferous ducts; interjugal parts (1.5-) 2.5-3 (-4.5) cm.; *petiolules* semiterete, lateral ones 1.1-2.4 (-3), terminal ones 2.4-4.8 (-6) cm. long; leaflets (oblong-) elliptical to ovate, 6-14 (-19) × 2.5-6.5 (-10.5) cm., thin coriaceous, shining on both sides, glabrous, base usually somewhat unequal, broadly cuneate, rounded or truncate, margins entire, somewhat thickened, apex abruptly, bluntly acuminate, acumen 0.4-0.9 (-1.5) × 0.2-0.4 (-0.6) cm.; midrib prominulous above, prominent beneath, secondary nerves (8-) 10-12 (-14) pairs, angle decreasing from 80 degrees at base to 50 degrees at apex, basal ones S-shaped, somewhat decurrent with the midrib, the others slightly curved to straight, distinctly arched and joined at some distance from margin, prominulous at both sides, veinlets coarsely reticulate, prominulous at both sides. *Inflorescences* terminal, male ones much-branched and many-florous, 20-30 cm. long, female ones slender, less branched and fewer florous, 8-20 cm. long, in both sexes shortly ferruginously pubescent, glabrescent; peduncles somewhat angular; pedicels, male, 0-0.1 cm., female, 0-0.3 cm. long; bracts deciduous, broad, acute at apex, 0.2 × 0.15 cm. *Flowers,* male, 0.4-0.55 cm. long, female, 0.9-1 cm. long, with a shallow receptacle; *sepals,* male, 0.15 cm. long, connate for one-half to two-thirds of their length, densely appressedly tomentose outside, densely woolly inside, female, 0.55 cm. long, connate for three-fourths of their length, tomentose outside, shortly and appressedly pubescent inside, in both sexes lobes broadly triangular, acute; *petals,* male obovate, 0.3 × 0.15 cm., female, broadly obovate, 0.7 × 0.4 cm., in both sexes somewhat fleshy, tomentose outside, except at base and margin, glabrous inside, pale yellow (*f. Brass 2847*) or light green (*f. Kajewski 2365 and 2712*); *stamens* 6, coherent with disk, filaments subulate, more or less fleshy, glabrous,

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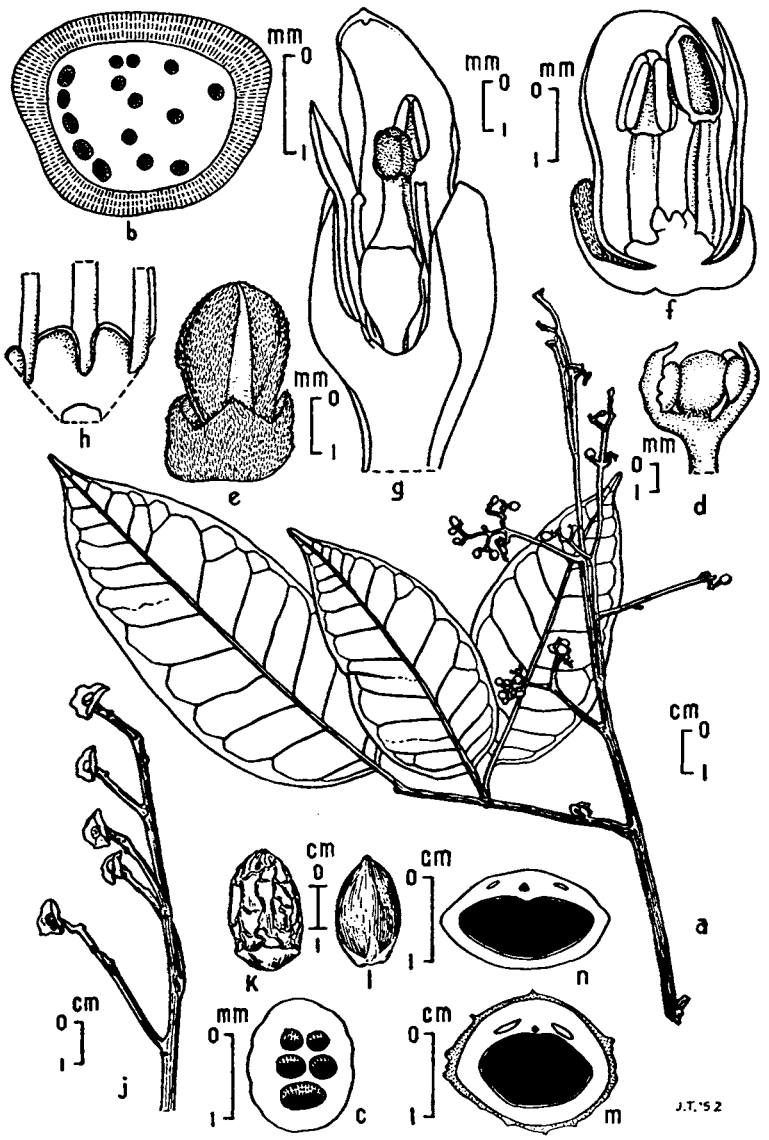

FIGURE 14.—*Canarium salomonense:* **a**, male specimen; **b**, medulla and wood of branchlet, cross section; **c**, petiole, cross section; **d**, ultimate part of young inflorescence with bracts; **e**, male flower; **f**, male flower, longitudinal section; **g**, female flower, longitudinal section; **h**, female flower, disk from inside; **j**, infructescence; **k**, fruit; **l**, putamen; **m**, **n**, putamen, cross section. (*a: Kajewski 2365; b, n: Kajewski 2056; c: Waterhouse B 425; d: Waterhouse B 545; e, f: Brass 2847; g, h: Waterhouse Y 73; j: Waterhouse 86; k-m: Kajewski 1924.*)

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female 0.35 cm. long (no open male flowers seen), anthers broadly sagittate, 0.15 cm. long, in female flowers fairly well-developed, probably not always sterile; *disk*, male ovariodisk, 0.1 cm. high, strongly lobed, glabrous, with a central canal, female adnate to receptacle, except for the 6-lobed margin, 0.15 cm. high fleshy glabrous; *pistil*, male none, female ovary obovoid, tapering at either end, 0.5 × 0.2 cm., glabrous, style terete, stigma 3-lobed. *Infructescences* 10-12 cm. long, with 1-4 fruits; pedicels 0.2 cm. thick; fruiting calyces faintly 3-lobed to circular, about 1 cm. in diameter, tomentose at both sides, glabrescent, with remainder of disk. *Fruits* ellipsoid, usually somewhat flattened on one side, sometimes more or less acute at both ends, 2.8-4.5 × 1.8-2.7 × 1.4-2.5 cm., glabrous; pericarp coarsely wrinkled, 0.1 cm. thick, fleshy, purple-black (*f. Brass 2847*); putamen smooth, pointed at base, with 3 strong, blunt, white ribs at apex (as found in *C. vulgare* Leenhouts); mesocarp 0.25 cm. thick; 3-celled, 2 cells strongly reduced.

A second subspecies is found in New Guinea.

Solomon Islands. Bougainville: Kugumaru, Buin, alt. 150 m., July 4, 1930, fr., *Kajewski 1924* (A, BISH, BO, G, L); Kuniguru, Buin, alt. 950 m., Aug. 10, 1930, fr., *Kajewski 2056* (A, BISH, BO, G, L, P), fruits more flattened and without the apical ribs, "leaves and appearance different from lowland specimens"; Siwai, Sept. 1932, female fl., *Waterhouse Y 73* (K, type specimen; A; BISH); fr., *Waterhouse B 725* (BISH; K; isotype); Maisua, Sept. 18, 1931, young fl., *Waterhouse B 545* (K, paratype). New Georgia: June 22, 1929, young fl., fr., *Waterhouse 86* (K), probably cultivated; Roviana, 1927, fr., *Waterhouse* (K), leaves large. Duke Island: Aug. 16, 1929, male fl., *Waterhouse 296* (K); fr., *Waterhouse 297* (K). Guadalcanal: Sorvorhio basin, alt. 200 m., Jan. 23, 1932, young fl., *Kajewski 2712* (A, BISH, BO, G, L, P), large tree with medium-sized buttresses, much smaller than common variety on seashore; found in foothills and mountains. Malaita: Quoimonapu, alt. 200 m., Dec. 12, 1930, male fl., *Kajewski 2365* (A, BISH, BO, G, L, P). San Cristoval: Waimamura, Sept. 9, 1932, male fl. and fr., *Brass 2847* (A, BISH, BO, L), common over whole island from coast to altitudes of 500 m. or more; Oct. 1890, male fl. and fr., *Comins 112* (K). Habitat: rain forest.

Vernacular names: *kegi-mai, keginon, ku-kugi, pii, kuhuri-ma* (Bougainville); *tovinia* (New Georgia); *haoro malegoro, haoro noana* (Duke Island); *baccero* (Guadalcanal); *ai-quassi* (Malaita); and *gatoga* (San Cristoval).

The seeds are eaten by the natives, and the resin is used for making torches.

This species is mentioned by almost all collectors as a fine, tall, buttressed tree, one of the largest in the islands; bark gray, fairly smooth, peeling in thin flakes; the wood and bark faintly fragrant with a pineapple-like odor; the seeds with a very pleasant almond-like flavor (*f. Brass 2847*). It seems to be common in all of the islands mentioned, and it is said to be cultivated generally. However, it is not improbable that some records refer to *C. indicum* L., though the vernacular names are different.

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15. Canarium harveyi Seemann, Fl. Vit., 35, 1865.—Engler in DC. Monogr. Phan. **4**: 133, 1883.—Hemsley, Linn. Soc. Bot., Jour. **30**: 171, 203, 210, 1895.—Engler in Engler and Prantl, Nat. Pflanzenfam. **3** (4): 241, 1897; ed. 2, **19a**: 449, 1931.—Burkill, Linn. Soc. Bot., Jour. **35**: 31, 1901.—Lam, Jard. bot. Buitenzorg, Ann. **42**: 216, 1932; Jard. bot. Buitenzorg, Bull. III, **12**: 427, 1932.—Yuncker, B. P. Bishop Mus., Bull. **178**: 71, 1943. (See figures 15, 16.)

Canarium sapidum Hemsley, Ann. Bot. **5**: 504, 1891.—Schumann and Lauterbach, Fl. deutsch. Schützgeb. Südsee, 378, 1901.—Lauterbach, Engler Bot. Jahrb. **56**: 324, 1920.—Lam, Jard. bot. Buitenzorg, Ann. **42**: 216, 1932; Jard. bot. Buitenzorg, Bull. III, **12**: 427, 1932.

Canarium mafoa Christophersen, B. P. Bishop Mus., Bull. **128**: 111, fig. 14, 1935.

Canarium sp. nov. Guillaumin, Jour. Arnold Arb. **12**: 237, fig. 2B, 1931.—Lam, Jard. bot. Buitenzorg, Bull. III, **12**: 427, 1932.—Guillaumin, Mus. colon. Marseille, Ann. VI, **55-56** (5-6): 28, 1948.

Canarium vitiense auct. non A. Gray, Degener, Naturalist's south Pacific Expedition: Fiji, 294, 1949.

Small to moderate-sized tree (100 ft., *f. Guppy*), rarely liane. *Branchlets* terete, (0.4-) 0.5-0.7 (-0.9) cm. thick, youngest parts shortly and thinly brown tomentose, glabrescent; medulla with some to many amphivasal vascular bundles—sometimes with a small resiniferous duct—all or part of them peripherally arranged, central part of medulla sometimes vanishing. *Leaves* 2½-3½ (-4½)-jugate, up to 40 cm. (or more?) long, short, appressed brown tomentose when young, glabrescent; *stipules* inserted on base of petiole at distance of 0.1-1 cm. from branchlet, deciduous, auricle-shaped, measuring 0.4 × 0.2 to 1.7 × 1.1 cm., shortly tomentose outside, glabrous inside, coarsely reticulate-nerved; *petioles* terete, glabrous, 2.5-8.5 cm. long, 0.15-0.25 cm. thick, base with slender drop-shaped, prominent stipule scars, measuring 0.2-0.5 × 0.05-0.1 cm., connected with branchlet by faint but conspicuous ridges, medulla with up to ± 8 small, peripherally arranged, and up to ± 3 large central, vascular bundles with resiniferous ducts; interjugal parts (1.5-) 2.5-5 (-7) cm. long; *petiolules* terete, more or less grooved above, the lateral ones 0.6-2.8, terminal ones 2-6 cm. long; *leaflets* orbicular-ovate (basal ones) to elliptic or oblong (terminal ones), 4-20 (-35) × 2-7.5 (-13) cm., herbaceous to coriaceous, dull, glabrous, base more or less unequal, broadly cuneate, rounded, truncate or faintly cordate, somewhat decurrent, margins entire, apex more or less gradually and bluntly acuminate, acumen 0.4-3.3 × 0.4-0.6 cm.; midrib mostly prominulous above, prominent beneath, secondary nerves (6-) 8-13 (-17) pairs, angle 90-50 degrees, decreasing from base to apex, straight to faintly curved, basal ones S-shaped, in most distinctly arched and joined near margin, prominulous above, prominent beneath, veinlets coarsely reticulate, sometimes some distinct transverse and intermediate tertiary nerves. *Inflorescences* (male known in var. *harveyi* only; female known in var. *sapidum* and var. *harveyi*) axillary to pseudoterminal, male thyrsoid and many-florous, 10-20 cm. long, female racemose, 6-7-florous, 3.5-9 cm. long, shortly brown tomentose, glabrescent; peduncles, male, 2.5-6.5 cm. long, female, 1-3 cm. long; pedicels, male none, female 0.3-1.2 cm. long; bracts deciduous, triangular, 0.15-0.2 cm. wide, brown tomentose. *Flowers,* male, 0.4-0.6 cm. long, female, 0.6 cm. long, female flowers with a shallow receptacle (0.05-0.1 cm.); *sepals,* male, 0.25 cm. long, female, 0.35-0.4 cm. long, both connate for the greater part, outer and inner surface densely, shortly, and appressedly tomentose to (male inner surface) subglabrous, lobes broadly triangular, blunt, male

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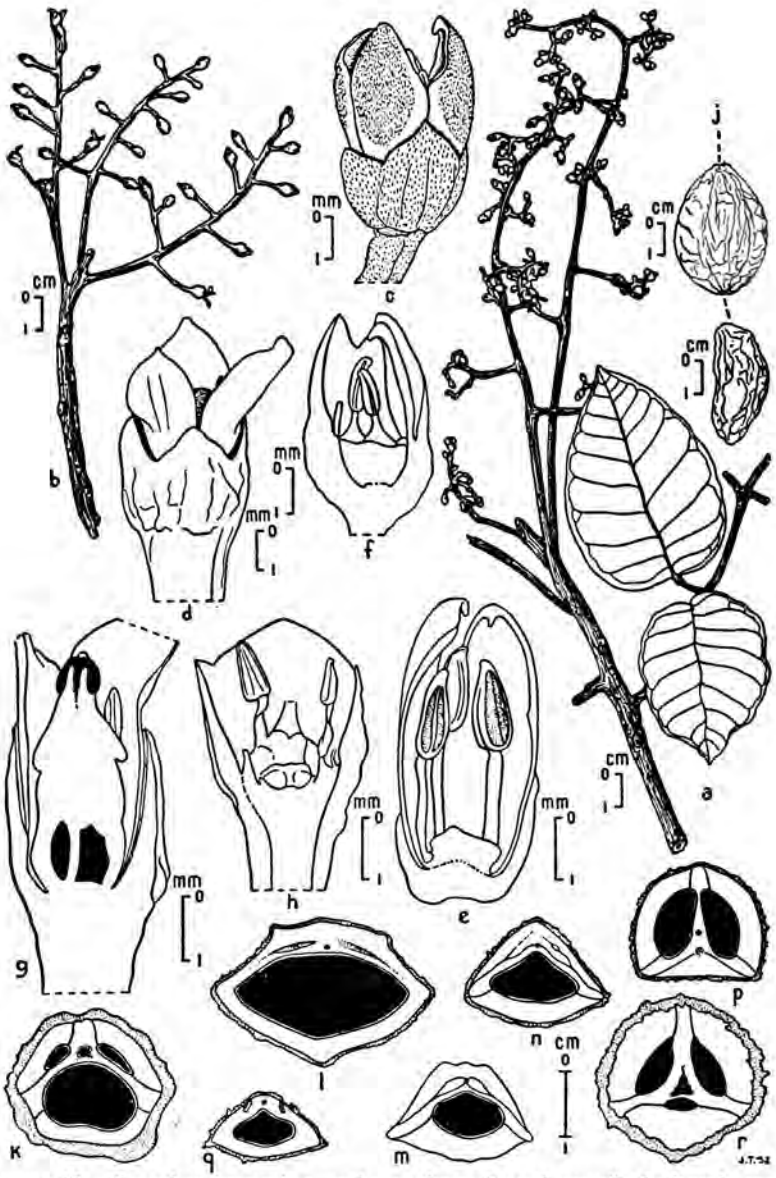

FIGURE 15.—*Canarium harveyi:* **a**, male specimen (var. *harveyi*) ; **b**, female specimen (var. *harveyi*) ; **c**, male flower (var. *harveyi*) ; **d**, female flower (var. *sapidum*) ; **e**, male flower, longitudinal section (var. *harveyi*) ; **f**, female flower, longitudinal section, pistil removed (var. *harveyi*) ; **g**, female flower, longitudinal section (var. *sapidum*) ; **h**, male flower, pistil removed (var. *harveyi*) ; **j**, fruit (var. *nova-hebridiense*) ; **k**, fruit, cross section (var. *sapidum*) ; **l**, fruit, cross section (var. *nova-hebridiense*) ; **m**, fruit, cross section (var. *scandens*) ; **n**, fruit, cross section (var. *harveyi*) ; **p, q, r**, fruit, cross section (var. *scandens*). (*a, h: Lister; b: Crosby 213; c, e: Yuncker 9849; d, g, k: Comins 224; f: Christophersen 3369; j, l: Kajewski 408; m: Degener 15159; n: Gillespie 3620; p, r: Gillespie 2320; q: Degener 15196.*)

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sometimes acute; *petals* ovate, 0.45-0.5 × 0.2-0.3 cm., inflexed, bluntly to acutely acuminate, greenish orange (*f. Yuncker 9849*), densely and appressedly tomentose at outer surface (var. *sapidum* at both sides) except at base and margins; *stamens* 6, free (female sometimes confluent with the disk) more or less didynamic, glabrous, filaments subulate, more or less broadened at base, 0.15-0.25 cm. long; anthers, male, oblong, 0.15-0.2 cm. long, female, sagittate, 0.1 cm. long; *disk,* male ovariodisk, rather variable in form, 0.07-0.1 cm. high, fleshy, glabrous to shortly brown tomentose, with a central canal, female adnate to the receptacle, except for the faintly 6-lobed rim, glabrous; *pistil,* male none (probably part of the ovariodisk; *Yuncker 9849*), female ovary obovoid, 0.4-0.45 × 0.13 cm., glabrous, style short, stigma 3-lobed. *Infructescences* 2-12 cm. long, glabrous (to faintly brown puberulous), with 1-4 fruits; peduncles 0.2-0.4 cm. thick, pedicels 0.5-1.5 cm. long, 0.15-0.3 cm. thick, hardly thickened at apex; fruiting calyces faintly 3-lobed, 0.6-0.8 cm. in diameter, glabrous outside, thinly pilose inside, glabrescent, with remnants of disk. *Fruits* 3-celled, (1-) 2 cells in most specimens, strongly reduced, extremely variable.

a. var. **sapidum** (Hemsley), comb. nov. (fig. 15, *d, g, k*).

Canarium sapidum Hemsley, Ann. Bot. **5**: 504, 1891.

Main characteristics: Part of *leaves* large, probably more than 40 cm. long; their *leaflets* very large, up to 23-35 × 7-13 cm., apex abruptly and long and bluntly acuminate, acumen 1.7-3.3 × 0.5-0.6 cm.; secondary nerves 10-17 pairs. *Petals* of female flowers tomentose at both sides. *Fruits* elliptic, 5 × 2.5 × 2.5 cm., olive brown when dry, glabrous; pericarp 0.1-0.2 cm. thick, coarsely wrinkled, fibrous; putamen faintly 6-angular, at base acutely 3-angular, smooth; mesocarp 0.2-0.35 cm. thick; 3-celled, 2 cells slightly reduced (0.6 × 0.2 cm.; the well-developed one 1.5 × 0.8 cm.).

Solomon Islands. Shortland Island: *Guppy 320* (K, paratype of *C. sapidum* Hemsley). Treasury Island: July 1884, *Guppy 305* (K, paratype of *C. sapidum* Hemsley), trunk with pronounced flange-like buttresses which rise 8 or 9 feet up the trunk, which is cylindrical above; Aug. 1884, *Guppy 319* (K, paratype of *C. sapidum* Hemsley). Oima Atoll: Aug. 1884, fr., *Guppy 318* (K, paratype of *C. sapidum* Hemsley). San Cristoval: Oct. 1890, female fl. and fr., *Comins 224* (K, lectotype of *C. sapidum* Hemsley).

Vernacular names: *nié* (Treasury Island), *rai* (Oima Atoll), *mali* (San Cristoval).

b. var. **nova-hebridiense,** var. nov. (figs. 15, *j, l;* 16, *c*).

Canarium sp. nov. Guillaumin, Jour. Arnold Arb. **12**: 237, fig. 2B, 1931; Mus. colon. Marseille., Ann. VI, **55-56** (5-6): 28, 1948.

Ab varietate typica fructu magno acute 5-costato differt.

This variety is mainly characterized by its fruits, being obovoid, flattened at one side, with 2 lateral acute ribs, 2 ribs at the flattened side and a median one at the convex side, 5 × 3.2 × 2.3 cm., purple (*f. Kajewski 548*), glabrous; pericarp faintly wrinkled, 0.05 cm. thick; putamen smooth, but for the 5 ribs; mesocarp 0.25-0.3 cm. thick; 3-celled, 2 cells strongly to almost entirely reduced.

New Hebrides. Banks Islands: Vanua Lava, sea level, July 5, 1928, fr., Kajewski 408 (BISH, type specimen; A, K, P), large and common tree.

Solomon Islands. Santa Cruz: Vanikoro, sea level, fr., Nov. 1, 1928, *Kajewski 548* (A, paratype), a common, large, and handsome tree.

Vernacular name: *nungi* (Vanikoro).

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c. var. **harveyi** (fig. 15, *a-c, e, f, h, n*).

Canarium harveyi Seemann, Fl. Vit., 35, 1865.

Canarium mafoa Christophersen, B. P. Bishop Mus., Bull. 128: 111, fig. 14, 1935.

The main differences between this variety and the others are found in the *fruits*, which are relatively small, 3-4 × 2.4-2.8 × 1.7-1.9 cm., obovoid, black (*f. A. C. Smith 1506*), 3-celled, 2 cells entirely or almost entirely reduced; putamen smooth, but for 3 acute ribs. In nearly all other characteristics this variety is almost as variable as the species as a whole.

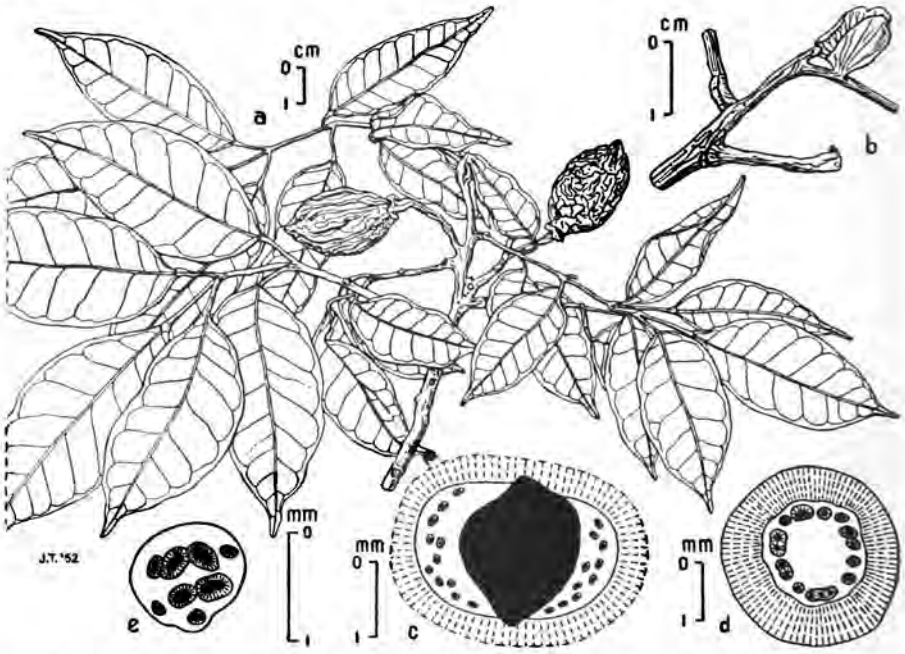

FIGURE 16.—*Canarium harveyi:* **a**, fruiting specimen (var. *scandens*); **b**, stipules (var. *scandens*); **c**, medulla and wood of branchlet, cross section (var. *nova-hebridiense*); **d**, medulla and wood of branchlet, cross section (var. *scandens*); **e**, medulla of branchlet, cross section (var. *harveyi*). (*a: Degener 15196; b: Gillespie 2320; c: Kajewski 408; d: Degener 15159; e: Smith 1151.*)

Tonga Islands. Vavau: 1892, male fl., *Crosby 213* (K); female fl., *Crosby 213* (K). Vavau and Lifuka: Aug. to Oct. 1855, fr., *Harvey* (K, type specimens of *C. harveyi* Seemann). Eua: Dec. 1889, male fl., *Lister* (K); plateau region, June to July 1926, fr., *Parks 16171* (BISH, G), *Parks 16349* (K), both specimens much stouter and more coriaceous than any of the others.

Fiji Islands. Viti Levu: vicinity of Masinu, alt. 150 m., Oct. 29, 1927, fr., *Gillespie 3620* (B, BISH, K); same locality, Nov. 1, 1927, fr., *Gillespie 3658* (P). Vanua Mbalavu: alt. 0-200 m., Apr. 2, 3, 1934, fr., *A. C. Smith 1506*

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(BISH, K, L). Fulanga: alt. 0-80 m., Feb. 22 to 26, 1934, male fl., *A. C. Smith 1151* (L), inflorescence much more branched than in any other specimens.

Samoa Islands. Savaii: Salailua, alt. 2 m., Sept. 11, 1931, male fl., *Christophersen 2582* (BISH); Siuvao-Auala, alt. 400 m., Nov. 20, 1931, female fl., *Christophersen 3369* (BISH, K, paratype of *C. mafoa* Christophersen); Siuvao-Auala, alt. 600 m., Nov. 20, 1931, fr., *Christophersen 3373* (BISH, type specimen of *C. mafoa* Christophersen; L). Tutuila: Pago Pago, alt. 30 m., Sept. 25, 1923, female fl., *Swezey and Wilder 256* (BISH).

Niue: in forest near Lakepa village, alt. 60 m., Jan. 24, 1930, male fl., *Yuncker 9849* (BISH).

Vernacular names: *yanga* (Fulanga), *laga'ali toga* (Savaii), *ai* (Niue).

d. var. **scandens**, var. nov.

Canarium harveyi d. var., Husson and H. J. Lam, Blumea **7** (1): 164, 1952 (*nomen*).

Canarium vitiense auct. non A. Gray, Degener, Naturalist's south Pacific Expedition: Fiji, 294, 1949.

Ab varietate typica habitu scandente, dimensionis partium vegetatibus minoribus differt.

The main differences between this and all other varieties are the following: Liane. *Branchlets* more slender (0.45 cm. thick). *Leaves* relatively small in all parts; total length 12-28 cm.; *petioles* 2.5-5 cm. long, interjugal parts 1.5-3.5 cm. long, lateral *petiolules* 0.9-1.5 cm. long, terminal ones 2.5-4 cm. long; *leaflets* 4-11 × 2-6 cm., coriaceous, gray-green when dry. *Fruits* extremely variable, more or less broadly ovoid, usually flattened on one side, 3.2-4 × 2-2.5 × 1.4-2.5 cm., glabrous, faintly wrinkled; pericarp 0.05-0.15 cm. thick; putamen smooth, with or without three acute ribs, or strongly rugose; mesocarp 0.3-0.6 cm. thick; 3-celled, (1-) 2 cells very strongly or entirely reduced, sometimes (in sterile fruits, *Degener 15196*) situated close to pericarp, as is found in *C. quadrangulare* H. J. Lam from New Guinea.

Fiji Islands. Viti Levu: Vatuvilakia, alt. 100 m., May 22, 1941, fr., *Degener 15159* (A, K, paratype); Vatutavathe, alt. 150 m., May 5, 1941, fr., *Degener 15196* (A, type specimen; BISH; K); southeast slope of Korombamaba Mountain, alt. 400 m., Aug. 23, 1927, fr., *Gillespie 2320* (B, BISH, K, paratypes).

Habitat: rain forest.

The nuts are eaten by both natives and Europeans in the Solomons and New Hebrides, and the resin is used for perfume in Samoa.

As this species is large and widely distributed, I feel sure that the subdivision given can be a provisional one only. When more material is available, var. *harveyi*—which is almost as variable as the species as a whole—will probably be shown to comprise some distinct types. The other varieties seem to be less variable, but they are based on only a few specimens, and differ

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mainly in the characteristics of the fruits, which are more or less variable in most species. The relative geographical isolation of the varieties is striking.

16. Canarium maluense Lauterbach, Engler Bot. Jahrb. **56**: 323, fig. 1, 1920.

Range: Borneo, Celebes, Moluccas, New Guinea. Rarely cultivated.

Cultivated only. Hawaiian Islands: Oahu, Honolulu, Queen's Hospital grounds, male fl., *J. F. Rock "A"* (BISH). Hawaii: Hilo, park near police station, male fl., Sept. 24, 1932, *T. C. Zschokke* (BISH).

GROUP C

Section **Canariellum** (Engler), comb. nov.

Genus *Canariellum* Engler in Engler and Prantl, Nat. Pflanzenfam. 3 (4): 242, 1896.

Though probably not monophyletic, this peculiar section is distinctly different from all other canariums in some essential characters. The only character which all species have in common is the absence of stipules, a character which is known to occur in several non-Pacific species. The only two characters exclusive to part of this section are: (1) the absence of medullar vascular bundles in the branchlets and (2) the two-celled ovaries. The first of these characters is very rare in non-Pacific species, though a tendency in this direction is probably found in *C. acutifolium* (DC.) Merrill and *C. australianum* F. Mueller, both from New Guinea, though the latter is also from the northern part of Australia (see Lam, Jard. bot Buitenzorg, Ann. **42**: 174, 1932). The second character occurs only in specimens in which the normal type is three-celled (see Van Heurn and Lam, Blumea, Suppl. 1: 97-106, 1937).

Obviously, this section can be subdivided into two minor groups, the first of which—comprising *C. baileyanum* Leenhouts, *C. muelleri* F. M. Bailey, and *C. oleiferum* Baillon—is probably the older one and probably reached New Caledonia through Australia. The second group—comprised of all other species of the section—probably reached New Caledonia later, and from New Guinea.

Key to Species of Group C

1a. Leaves ½-3½-jugate 2
b. Leaves 5½-8½-jugate (New Caledonia) ..... **17. C. whitei.**
2a. Branchlets and leaves, at least below, ferruginously pilose. Almost all leaves unifoliolate. Inflorescences terminal, with scattered small unifoliolate leaves; petals pilose. Pericarp thick and hard (0.6 cm.) (New Caledonia) ..... **18. C. oleiferum.**
b. Glabrescent at an early stage. Rarely, some leaves unifoliolate. Inflorescences axillary to pseudoterminal, seldom distinctly terminal; bracts small and triangular, never leaflike; petals (nearly) glabrous. Fruits (unknown in *C. trifoliolatum* Engler and *C. muelleri* F. M. Bailey) with thin pericarp (up to 0.2 cm.) 3

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3a. Base of leaflets cuneate, apex broadly rounded to shortly and bluntly acuminate; midrib in most specimens sub-bifurcate at some distance from the apex. Petals 0.35 cm. long (Queensland, N. S. W.).....**19. C. baileyanum.**[2]

b. Base of leaflets rounded to cordate, apex shortly acuminate; midrib entire up to apex. Petals up to 0.2 cm. long..... 4

4a. Leaves verticillate, ternately whorled, 2½-3½-jugate, those near inflorescences unifoliolate; acumen of leaflets 0.4-0.5 × 0.4-0.5 cm.; angle between midrib and secondary nerves 50-60 degrees (Loyalty Islands).....**20. C. balansae.**

b. Leaves scattered, 1½-2½-jugate; acumen of the leaflets 1-1.1 × 0.7-0.75 cm.; angle between midrib and secondary nerves 70-80 degrees (New Caledonia).....**21. C. trifoliolatum.**

17. Canarium whitei Guillaumin, Jour. Arnold Arb. **7**: 91, 1926; Soc. bot. France, Bull. **85**: 21, 1938; Fl. Nouv. Caléd., 171, 1948. (See figure 17, *a-f.*)

Medium-sized tree. *Branchlets* angular, ± 1 cm. thick, brown tomentose, glabrescent; medulla with scattered small sclerenchymatic strands without resiniferous ducts. *Leaves* 5½-8½-jugate (leaflets of basal jugae not strictly opposite), ± 50 cm. long, brown tomentose when young, glabrescent; *petioles* terete, 17-19 cm. long, 0.3 cm. thick, broadened and flattened at base, medulla with about 8 small, scattered vascular bundles; interjugal parts 3.5-4.5 cm. long; *petiolules* terete or flattened, lateral ones 1.5 cm. long, terminal ones 2.2-2.5 cm. long; *leaflets* oblong to (basal and terminal ones) elliptic, 6-14 × 2.5-4 cm., coriaceous, grayish green above, nitidulous at both sides, glabrous, base cuneate, decurrent, margins entire, apex abruptly long, narrow and bluntly acuminate, acumen 0.6-0.9 × 0.2-0.4 cm.; midrib prominulous above, prominent beneath, secondary nerves from 8-9 in basal, to 11-13 in terminal, leaflets, angle from base to tip 50-90 degrees, gradually curved, at some distance from margin arched and joined, prominulous at both surfaces, veinlets nearly inconspicuous. *Inflorescences and flowers* unknown. *Infructescences* racemose, axillary, probably short and with only a few fruits; peduncle about 5 cm. long and 0.6 cm. thick; pedicels 1.5 cm. long and ± 0.4 cm. thick, somewhat thickened toward calyx; fruiting calyces 3-lobed, 1.5 cm. in diameter, glabrous without, shortly and fulvously tomentose within, remainder of disk annular, reddish brown pilose. *Fruits* obovoid, somewhat compressed, 4.7 × 3.4 × 2.5 cm., keeled at base and apex, faintly acuminate at apex, glabrous, black when dry; pericarp wrinkled, 0.2-0.3 cm. thick; putamen smooth; mesocarp 0.4 cm. thick; 2 cells, one slightly reduced. *Cotyledons* 3-partite, contortuplicate, membranous.

New Caledonia: Rio des Pirogues, Oct. 27, 1923, fr., *White 2255* (A, type specimen). Habitat: rain forest.

As Guillaumin has remarked, this species is related to *C. balansae* Engler. There is an especially striking resemblance in the form of the fruit, which has been found in no other species. The specimen cited is the only one known.

18. Canarium oleiferum Baillon, Adansonia **10**: 341, 1871-1872.—Engler in DC. Monogr. Phan. **4**: 135, pl. 3, fig. 23, 1883.—Lam, Jard. bot. Buitenzorg, Ann. **42**: 216, 1932; Jard. bot. Buitenzorg, Bull. III, **12**: 427, 1932. (See figure 18, *a-q.*)

[2] *Canarium muelleri* F. M. Bailey (Cat. Indig. and Nat. Pl. Queensland, 106, 1890) which is most closely related to this species, differs from it by its nearly always 3½-jugate leaves (instead of 1½-jugate), its flattened to canaliculate petioles and petiolules, and its leaflets being grayish green when dry (instead of olive brown), with 10-12 pairs of secondary nerves (instead of about eight pairs). (Queensland.)

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Canariellum oleiferum (Baillon) Engler in Engler and Prantl, Nat. Pflanzenfam. **3** (4) : 242, fig. 137, 1896; ed. 2, 19a : 450, fig. 214, 1931.—Guillaumin, Sci. Nat. Bot., Ann. LX, 10 : 250, fig. 31, 1909; Mus. colon. Marseille, Ann. II, **9** : 114, 1911.—Mezger, Mus. colon. Marseille, Ann. IV, **4** (2) : 8, pl. 8, 1926,—Däniker, Bot. Mus. Univ. Zürich,

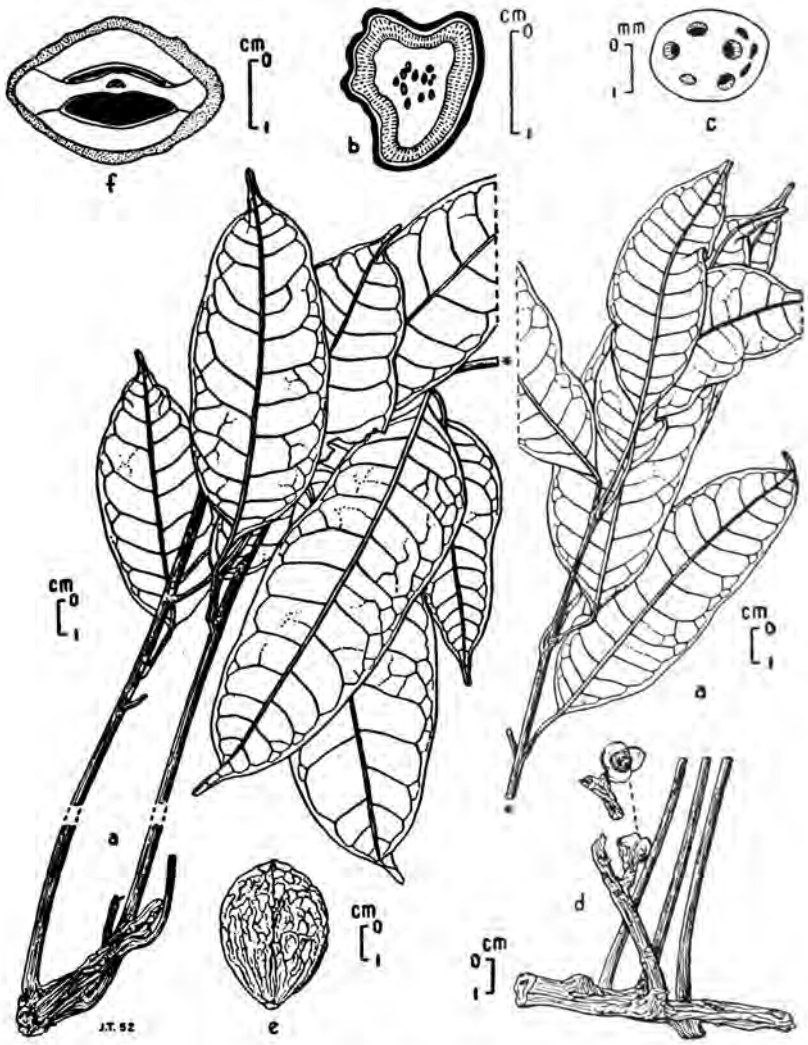

Figure 17.—*Canarium whitei;* **a,** vegetative specimen; b, branchlet, cross section; c, medulla of petiole, cross section; **d,** infructescence; e, fruit; f, fruit, cross section. (*a-f: White 2255.*)

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Mitt. **142**: 205, 1932.—Guillaumin, Soc. bot. France, Bull. **85**: 21, 1938; Mus. nat. Hist. nat., Paris, Bull. II, **13**: 323, 1941; Mus. nat. Hist. nat., Paris, Bull. II, **20**: 358, 1948; Fl. Nouv. Calèd., 170, 1948; Mus. nat. Hist. nat., Paris, Bull. II, **22**: 518, 1950.

Medium-sized tree (20 m. high, *f. Balansa 3458*). *Branchlets* terete, 0.4-0.7 cm. thick, young parts ferruginously tomentose, older ones covered by the reticular remainder of the tomentose epiderm; medulla without vascular bundles. *Leaves* ½ (-2½)-jugate, 11-42 cm. long; *petioles* semiterete, 3-13 cm. long, 0.1-0.15 (if leaves pinnate, 0.3-0.4) cm. thick, densely ferruginously (later grayish brown), tomentose, medulla with 1 to many scattered, relatively large, amphivasal vascular bundles with resiniferous ducts; interjugal parts 4-4.5 (-6) cm. long; *petiolules* terete, lateral ones 1.5-2 cm., terminal ones 3-4 (-5.5) cm. long, 0.2 cm. thick; leaflets elliptic (to oblong-ovate), 5-13.5 (-17) × 3.5-7.5(-9.5) cm., coriaceous, olive brown when dry, nitidulous above, dull beneath, shortly and ferruginously tomentose, especially on the nerves, to grayishly papillose, base broadly cuneate (to rounded), decurrent, margins entire, apex broadly rounded to cordate or shortly and bluntly acuminate; midrib prominulous above, prominent beneath, near apex, if the latter is not acuminate, more or less bifurcate, secondary nerves 4-8 pairs, angle 55-65 degrees, faintly S-shaped to straight, more or less distinctly arched and joined near the margin, prominulous above, prominent beneath, veinlets coarsely reticulate, nearly inconspicuous above. *Inflorescences* terminal, 15-20 (female ones -25) cm. long, branches up to 8 cm. long, ferruginously tomentose, male flowers clustered, pedicels 0-0.1 cm. long, female pedicels 0.05-0.3 cm. long. Lower part of inflorescences with some scattered, unifoliolate, small leaves (apical ones 1 × 0.5 cm., petioles 1 cm. long); bracts deciduous, rounded to acute, up to 0.1 × 0.075 cm. *Flowers* white (*f. Balansa 3458*), male 0.5-0.6 cm. long, female 0.6-0.7 cm. long; *sepals* 0.2-0.3 cm. long, one-third to two-thirds of their length connate, lobes triangular, more or less rounded at apex; *petals* oblong, 0.4-0.5 × 0.15 cm., thick, rigid, densely and shortly tomentose without, with a small inflexed acumen; *stamens* 6, free, didynamic, in male flowers epipetalous stamens 0.25 cm. long, episepalous stamens 0.45 cm. long; in female flowers respectively 0.3-0.4 and 0.45-0.5 cm. long, filaments subulate, glabrous, anthers sagittate, male 0.075 cm. long, female 0.05 cm. long; *disk* cupular, margin undulate to truncate, 0.05-0.1 cm. high, fleshy, glabrous, especially in male flower rather variable; *pistil* in male slightly to entirely reduced, when slightly reduced densely golden pilose, the cells enclosing small and probably sterile ovules, when strongly reduced conical and 0.02 cm. high, solid, female ovary ovoid, narrowed toward base, 0.3 cm. high, tapering into a short style with 3-lobed stigma, densely and shortly ferruginously tomentose, sometimes more or less 3-lobed in the upper half, 2 (-3) celled. *Infructescences* unknown. *Fruits* subovoid, 5 × 3.5 cm. (*f. Baillon 3458*), faintly ribbed, glabrous; pericarp smooth, hard, lacunar, 0.6 cm. thick; putamen smooth, faintly 2-ribbed; mesocarp 0.4 cm. thick; 2 cells, one of which is sterile and more or less reduced; axial intrusion not clearly distinguishable.

New Caledonia: Baie du Prony, Sept. 1868, *Balansa 481* (P, paratype); Prony, *bords de la mer,* Jan. 1906, male fl., *Franc ex Herb. Bonati 241* (L): Prony, Jan. 1914, *Franc 1595A* (P); Prony, Dec. 12, 1914, female fl., *Franc 1918* (K, P); Prony, young fl., *Le Rat 442* (P); Baie du Sud, 1905, female fl., *Le Rat 2985* (P); Rouvy, 1918, female fl., *Franc* (K); St. Louis, male fl., *Le Rat 1082* (P); Drobio, Feb. 1872, male fl. and fr., *Balansa 3458* (P, lectotype), *bosquets des terrains éruptifs, près de l'embouchure du Drobio;* Ballade Mountains, 1855-1860, male fl., *Vieillard 4* (P, paratype); without

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exact locality, male fl., *Vieillard 692* (P). Habitat: forests of lowlands and hills.

Vernacular names: *carottier, arbre absinthe.*

The edible fruits contain considerable oil (*f. Balansa 3458*).

Engler [Engler and Prantl, Nat. Pflanzenfam. **3** (4): 242, 1896] based his genus *Canariellum* mainly on the two-celled fruits, the unifoliolate leaves, and the absence of vascular bundles in the medulla of the branchlets. None of

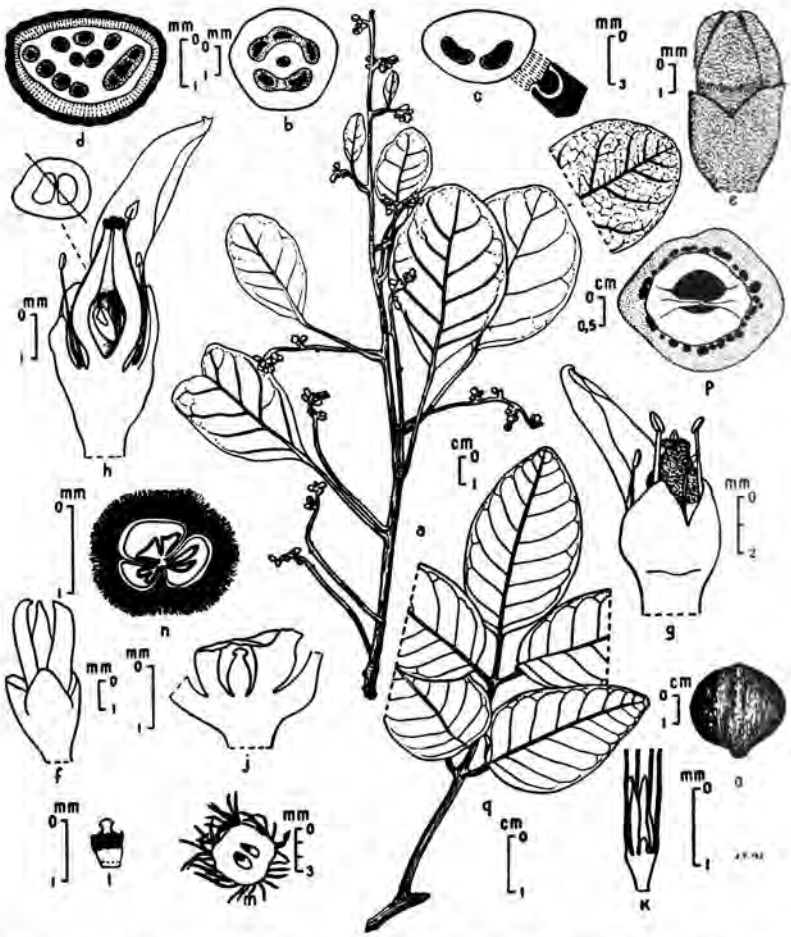

FIGURE 18.—*Canarium oleiferum:* **a**, female specimen; **b**, medulla of branchlet, cross section; **c**, **d**, petiole, cross section; **e**, **f**, male flower; **g**, female flower, two petals removed; **h**, female flower, longitudinal section; **j**, **k**, male flower, disk, longitudinal sections; **l**, male flower, well-developed pistil; **m**, male flower, pistil, cross section; **n**, female ovary, cross section; **o**, fruit; **p**, fruit, cross section; **q**, pinnate leaf. [*a, l, m: Le Rat 2985; b, g, h, n: Franc 1918; c, e, k: Le Rat 1082; d: Franc 1595; f, j: Bonati 241; o, p: Balansa 3458* (partly after Engler); *q: Franc 1918.*]

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these three characteristics is completely differential, as each is found occasionally in other *Canarium* species, especially New Caledonian ones, whose insertion in the genus seems beyond doubt. Among these, *C. baileyanum* Leenhouts is most closely related to *C. oleiferum* Baillon.

19. Canarium baileyanum, nom. nov. (See figure 19, *a-p.*)

Bursera australasica F. M. Bailey, Queensland Dept. Agric., Bull. **18**: 8, 1892; Roy. Soc. Queensland, Proc. **11**: 14, 1895; Queensland Flora **1**: 223, 1899; Compr. Cat. Queensland Plants, 85, fig. 71, 1909.—W. D. Francis, Roy. Soc. Queensland, Proc. **34**: 218, 1922.

Protium australasicum (F. M. Bailey) Sprague, Kew Bull., 370, 1912.—W. D. Francis, Australian rain-forest trees, 175, figs. 112-113, 1929; ed. 2, 200, figs. 114-115, 1951.—Engler in Engler and Prantl, Nat. Pflanzenfam., ed. 2, **19a**: 414, 1931.—H. J. Lam, Jard. bot. Buitenzorg, Bull. III, **12**: 321, 1932.

Bursera australiana F. M. Bailey, *in errore,* Lam, Jard. bot. Buitenzorg, Ann. **42**: 139, 1932.

Protium australianum (F. M. Bailey) Sprague, *in errore,* Lam, Jard. bot. Buitenzorg, Ann. **42**: 139, 1932.

Santiria ? spec. J. J. Swart, Rec. Trav. bot. néerl. **39**: 393, 1942.

Canarium australasicum (F. M. Bailey) Leenhouts, Blumea **7** (1): 159, 1952.

non Canarium australasicum auct., G. Bentham and F. v. Mueller, Fl. Australiensis **1**: 377, 1863 (=*Canarium australianum* F. Muell.).

Large tree (40 m. high, *f. De Beuzeville*). *Branchlets* terete, 0.3-0.45 cm. thick, youngest parts ferruginously tomentose, glabrescent; medulla without vascular strands. *Leaves* (½-) 1½ (-3½)-jugate, (8-) 15-25 (-40) cm. long, ferruginously pubescent when young, glabrescent; *petioles* terete, somewhat broadened at base, 1.4-9.5 cm. long, 0.1-0.2 cm. thick, medulla with many small to one large vascular strand, each with one, or in the latter case, sometimes a few, resiniferous ducts; interjugal parts (1.8-) 2.2-3.0 (-5.0) cm. long; *petiolules* somewhat flattened above, lateral ones 0.3-4.8, terminal ones 1.5-8 cm. long, fulvously tomentose; *leaflets* obovate to oblong or lanceolate, (4-) 7-9 (-14) × (1.5-) 3-4 (-6.5) cm., coriaceous, shining above, nitidulous beneath, base more or less broadly cuneate, not infrequently somewhat unequal, decurrent, margins entire, apex shortly, broadly, and bluntly acuminate to blunt or rounded; midrib prominulous above, prominent beneath, not infrequently splitting up into 2 or 3 nervelets near the apex, secondary nerves (6-) 8 (-12) pairs, angle 50-65 degrees, prominulous to nearly inconspicuous above, prominent beneath, arched and joined near margin, veinlets in most nearly inconspicuous. *Inflorescences* (female unknown) terminal or pseudoterminal, narrowly and laxly thyrsoid, 4-11 cm. long, with additional axillary ones, few-florous, more or less tomentose, greater part of partial inflorescences subsessile, bracts deciduous. *Flowers* (female unknown) glabrous, about 0.4 cm. long, with a scantily developed receptacle; *sepals* 0.1 cm. long, connate for one-third to one-half of their length, bluntly triangular; *petals* 0.35 cm. long, elliptic, somewhat fleshy, wine purple when dry, margins and acumen (the latter very small) inflexed; *stamens* 6, free, inserted on disk, 0.2-0.25 cm. long, filaments flattened, 0.05-0.1 cm. long, anthers somewhat hastate, 0.17 cm. long; *disk* shallow, partly adnate with the receptacle, fleshy, glabrous, free part 0.05 cm. high, margin undulate; *pistil* in male flower

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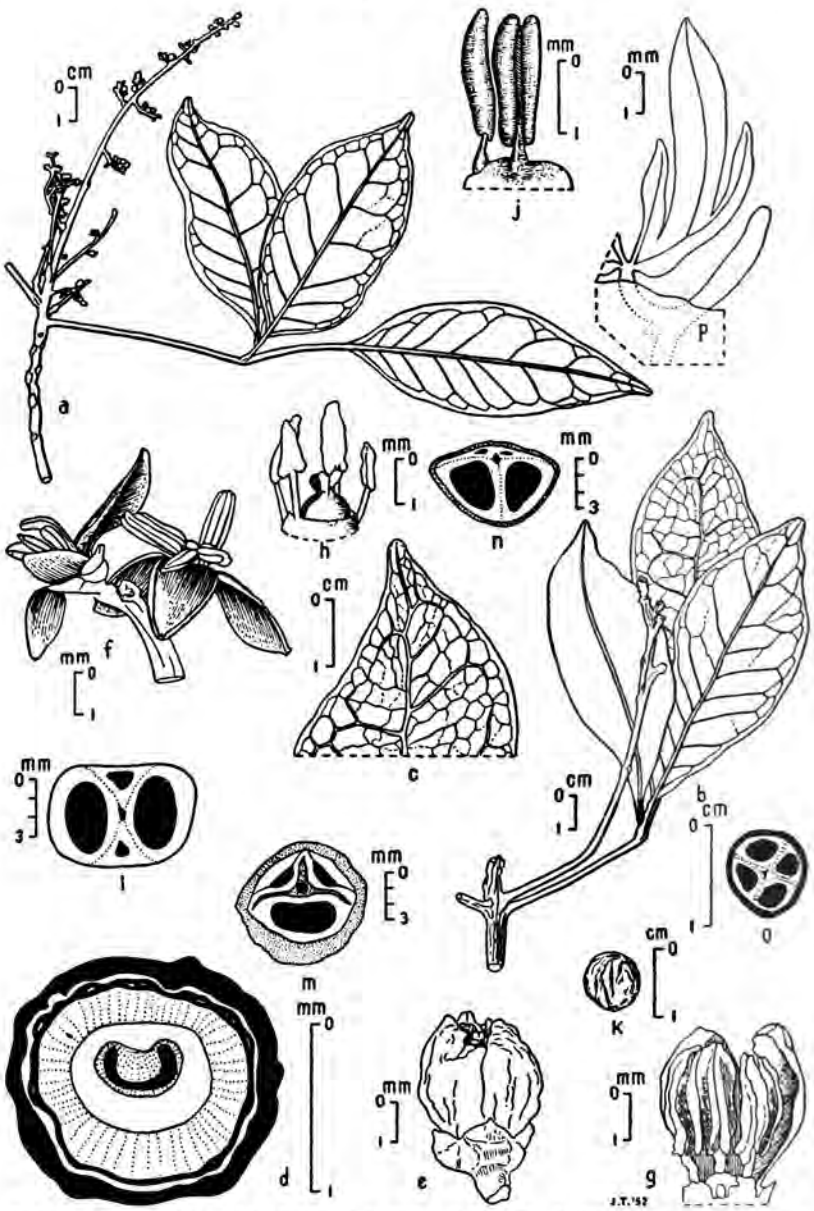

FIGURE 19.—*Canarium baileyanum:* **a**, male specimen; **b**, fruiting specimen; **c**, nervature in apical part of leaflet; **d**, petiole, cross section; **e**, male flower bud; **f**, male flowers; **g**, male flower, longitudinal section; **h**, hermaphroditic flower, sepals and petals removed; **j**, male flower, disk with stamens; **k**, fruit; **l-o**, fruit, cross sections; **p**, unfolded embryo, partly covered by the testa. (*a, d, e, g, j: Bailey, Sept. 1895; b, c, l, n-p: Bailey and Simmonds, May 1892; f: Jones; h: Clemens, 1947; k: De Beuzeville, May 9, 1936; m: De Beuzeville 390-36-11.*)

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much reduced, glabrous, in a probably hermaphroditic one (*Clemens*) ovary ovoid, 0.15 cm. high, glabrous, 3-celled, style short, stigma 3-partite. *Infructescences* rarely more than 8 cm. long, rarely with more than 3-4 fruits; pedicels 0.3 cm. long; calyces not enlarged. *Fruits* globose, faintly 3-angular at base, diameter 0.8-0.9 cm., black and nitidous when dry, glabrous; pericarp thin, faintly wrinkled; putamen smooth with the exception of 3 distinct keels, corresponding with the septa; 3 cells, 1 well-developed, the others somewhat reduced. *Cotyledons* 3-lobed, contortuplicate.

Queensland. Cook District: Atherton Tableland, Ravenshoe, *For. subdep.* (BRI). North Kennedy District: Murray, Upper, north of Cardwell, *S. Menadue* (BRI). Townsville District: Jan. 1920, *Arnold* (BRI). South Kennedy District: Dalrymple Heights and vicinity, July to Nov. 1947, hermaphroditic, *M. S. Clemens* (BRI). Fraser Island: *F. B. Epps,* male (BRI); Mar. 1916, fr., *W. Petrie 18* (BRI); Apr. 1916, young fl., *W. Petrie 18* (BRI); Oct. 1921, *C. T. White 1218* (BRI). Darling Downs District: Eungella Range via Mackay, Oct. 3 to 12, 1922, *W. D. Francis* (BRI). Moreton District: Eumundi, Mar. 1894, young fl., *unknown collector* (BRI); Sept. 1895 (?), male, *F. M. Bailey* (BRI, K); May 1892, fr., *J. F. Bailey and J. H. Simmonds* (BRI, type specimen of *Bursera australasica* F. M. Bailey; K); Nov., 1894, *J. F. Bailey and J. H. Simmonds* (BRI); Mar. 1894, *Field Naturalists* (BRI).

New South Wales. Clarence District: Nullimstate Forest via Murwillumbah, male, *H. Hayes* (BRI); Mullumbimby locality, Nov. 29, 1943, male, *W. F. Jones* (NSW); Palm Vale, Cudgera Creek, Moobal New, May 7, 1936, fr., *De Beuzeville 390-36-11* (NSW), common; Palm Vale, Cudgera Creek, about midway between Tweed River and Brunswick River, May 9, 1936, fr., *De Beuzeville* (BRI), plentiful; Hollowwood Minyon, Lismore, July 16, 1936, *De Beuzeville 36-66* (BRI, NSW), most southerly locality in which it has been seen, fairly plentiful from here north to Palm Vale.

Vernacular names: Carrotwood (Eumundi); mango bark (Fraser Island); parshipwood, hallowbox (Clarence District).

The identity of this species has long been mysterious, as the only specimens published—*J. F. Bailey and J. H. Simmonds* and *F. M. Bailey*—are more or less anomalous, the fruits and part of the flowers being 4-merous. In particular, the fruits of *De Beuzeville 390-36-11* clearly show the *Canarium* type. The nearest relationship of this species seems to be with *C. oleiferum* Baillon from New Caledonia and *C. muelleri* F. M. Bailey from Queensland.

As the name "*Canarium australasicum* F. Mueller" is an older homonym, though not a valid one—being an error for *C. australianum* F. Mueller (Fragm. phytogr. Australiae **3**: 15, 1862-1863)—*C. australasicum* (F. M. Bailey) Leenhouts had to be renamed. As far as I know, this mistake was made for the first time by Bentham and Mueller (Fl. Australiensis **1**: 377, 1863), and this incorrect name has been almost generally used ever since.

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20. Canarium balansae Engler in DC. Monogr. Phan. **4**: 117, 1883; in Engler and Prantl, Nat. Pflanzenfam. **3** (4): 240, 1897; ed. 2, **19a**: 447, 1931.—Guillaumin, Ann. Sci. Nat. Bot. IX, **10**: 222-224, figs. 10, 22 (18), 23 (8 and 9), 1909; Mus. colon. Marseille, Ann. II, **9**: 114, 1911.—Lam. Jard. bot. Buitenzorg, Ann. **42**: 216, 1932; Jard. bot. Buitenzorg, Bull. III, **12**: 427, 1932.—Guillaumin, Soc. bot. France, Bull. **85**: 21, 1938; Mus. nat. Hist. nat., Paris, Bull. II, **15**: 218, 1943; Fl. Nouv. Caléd., 171, 1948. (See figure 20, *a-j*.)

Medium-sized tree (15-20 m., *f. Balansa 2324*). *Branchlets* terete, 0.5 cm. thick, shortly, thinly, and fulvously puberulent; medulla with peripherally arranged amphivasal vascular bundles with large resiniferous ducts, in the central part some scattered conspicuous large parenchymatic cells. *Leaves* whorled in threes, 2½-3½-jugate (near inflorescences, some unifoliolate ones), up to about 35 cm. long, fulvously tomentose when young, glabrescent; *petioles* semiterete, flattened above, broadened at base, 5-9 cm. long, 0.15-0.35 cm. thick, in the unifoliolate leaves 1.7 cm. long and 0.15 cm. wide, narrowly winged, medulla with one large crescent-shaped, and some small, scattered, vascular bundles; interjugal parts 2.2-6 cm. long; *petiolules* terete, grooved (terminal ones near apex only), lateral ones 0.6-2 cm., terminal ones 1.5-3.5 cm. long, ± 0.1 cm. thick; *leaflets* elliptical (basal ones ovate), usually somewhat unequal, 7-14 × 4.5-7 cm. (basal ones 5.5 × 3.5-4 cm., unifoliolate ones 4 × 2 cm.), coriaceous, grayish green, nitidous above, nitidulous beneath, base unequal, (rounded to) semicordate, margins entire, thickened, apex gradually, shortly, broadly, and bluntly acuminate, acumen 0.4-0.5 × 0.4-0.5 cm.; midrib somewhat sunken above, prominent beneath, secondary nerves 7-9 (-12) pairs, angle from base to apex 60-50 degrees, straight to slightly (near margin strongly) curved, not distinctly archingly joined, prominulous above, prominent beneath, veinlets little conspicuous. *Inflorescences* (female unknown) axillary, much-branched, length unknown (probably not very large), glabrous in all parts; pedicels 0.1-0.2 cm. long; bracts oblong-triangular, 0.1-0.2 × 0.025-0.05 cm., somewhat scabrous. *Flowers* (female unknown) glabrous, with a scantily developed receptacle, flower buds globose, 0.15 cm. in diameter; *sepals* about 0.1 cm. long, for one-tenth to two-fifths of length connate, broadly triangular, acute; *petals* ovate with thickened and inflexed apex, 0.15 × 0.1 cm.; *stamens* 6, 2-whorled, with short and broad (probably not yet fully developed) filaments and oblong, 0.075 cm. long anthers; *disk* (not yet well-developed) adult probably cupular and partly adnate to the receptacle; *pistil* strongly reduced, 0.05-0.075 cm. high, glabrous. *Infructescences* axillary, up to 9 cm. long, with 1-3 fruits; peduncle about 4.5 cm. long and 0.4 cm. thick; pedicels 0.9 cm. long and 0.15-0.2 cm. thick, gradually thickening to calyx; fruiting calyces faintly 3-lobed, 0.3 cm. in diameter. *Fruits* compressed elliptical, acute at apex, acuminate at base, 2.5-3.5 × 1.8-2 × 1.2-1.6 cm., blackish brown (*f. Balansa 2324*); pericarp wrinkled, glabrous, 0.07-0.2 cm. thick; putamen somewhat gibbous; mesocarp 0.1 cm. thick; 1 or 2 cells well-developed and fertile, the third one strongly to entirely reduced (note: mistaking the axial intrusion for it). *Cotyledons* dark green, herbaceous.

Loyalty Islands: Lifu, Chépénéhé, July 1869, young fl., fr., *Balansa 2324* (P, lectotype; K); fr., *Deplanche 55* (P, paratype). Vernacular name: *meingueul*.

The inflorescences in Balansa's specimen 2324 are too young for one to decide with certainty whether they are male or female, but probably they are male. If this is so, the type specimen is probably monoecious, as there are fruits too.

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21. Canarium trifoliolatum Engler in DC. Monogr. Phan. **4**: 124, 1883; in Engler and Prantl, Nat. Pflanzenfam. **3** (4): 241, 1897; ed. 2, **19a**: 449, 1931.—Guillaumin, Mus. colon. Marseille, Ann. II, **9**: 114, 1911.—Lam,

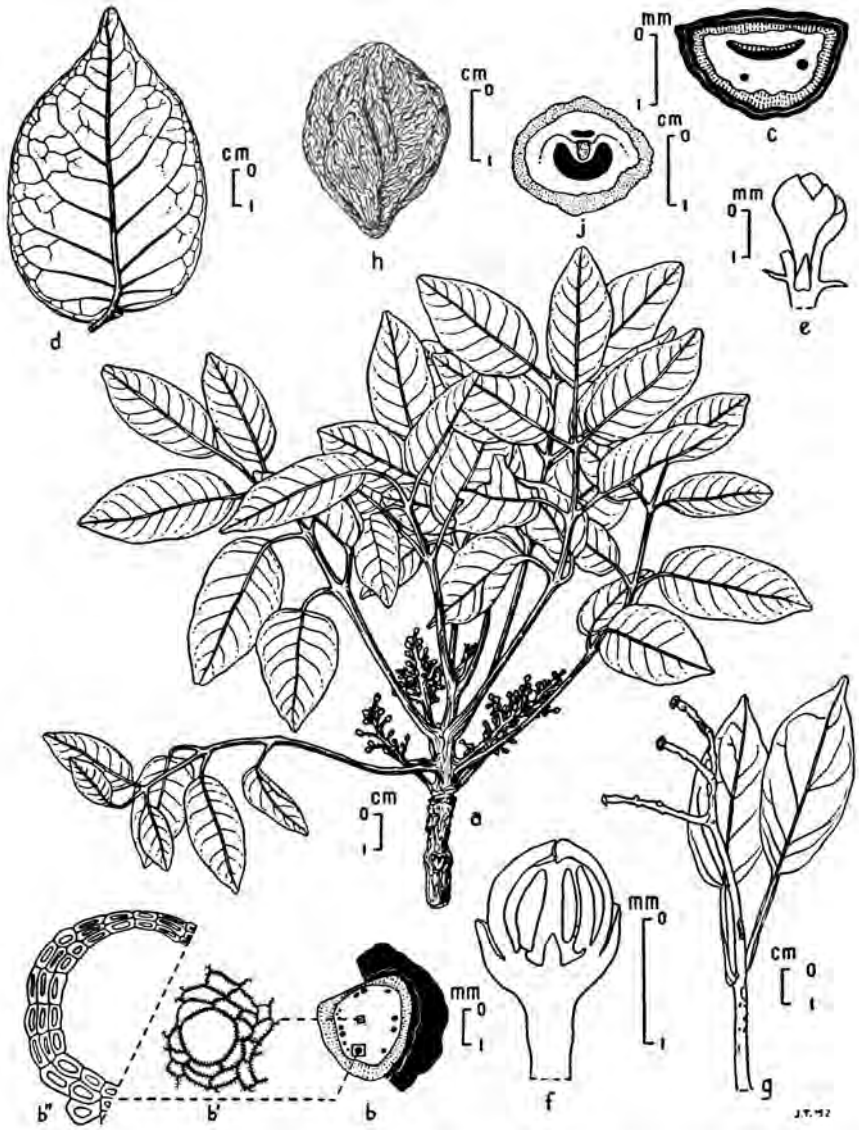

FIGURE 20.—*Canarium balansae:* **a**, specimen with young leaves and young flowers; **b**, branchlet, cross section; **c**, petiole, cross section; **d**, adult leaflet; **e**, male (?) flower buds; **f**, flower bud, longitudinal section; **g**, infructescence; **h**, fruit; **j**, fruit, cross section. (*a-h, j: Balansa 2324.*)

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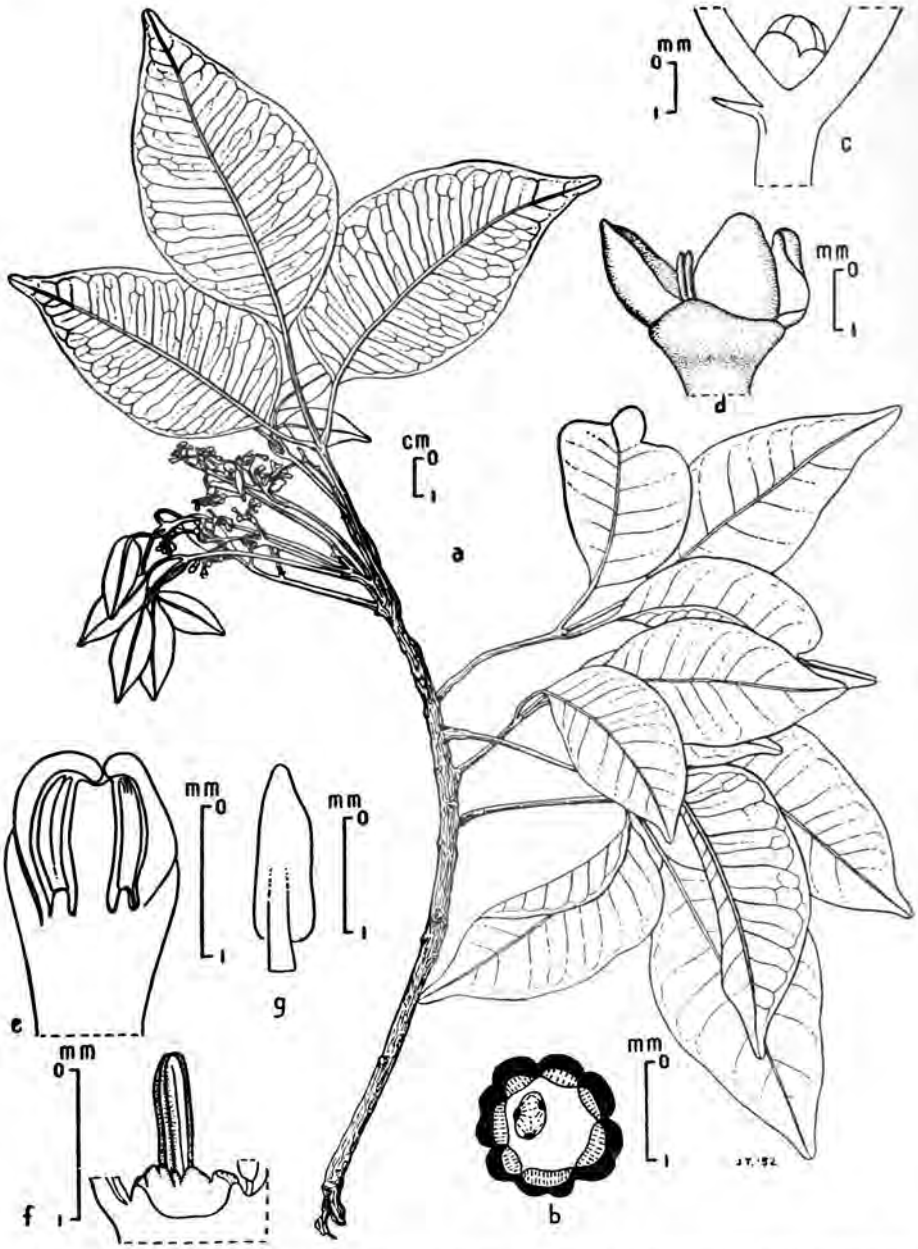

FIGURE 21.—*Canarium trifoliolatum:* **a**, male specimen; **b**, branchlet, cross section; **c**, male flower, bud and bract; **d**, male flower; **e**, male flower, longitudinal section; **f**, male flower, disk; **g**, male flower, stamen. *(a-g: Balansa 3550.)*

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Jard. bot. Buitenzorg, Ann. **42**: 154, 1932; Jard. bot. Buitenzorg, Bull. III, **12**: 427, 1932.—Guillaumin, Soc. bot. France, Bull. **85**: 21, 1938; Fl. Nouv. Caléd., 171, 1948. (See figure 21, *a-g.*)

Small tree (6-8 m., *f. Balansa 3550*). *Branchlets* terete, 0.7 cm. thick, youngest parts shortly and densely grayish brown tomentose, glabrescent; medulla without vascular bundles. *Leaves* 1½ (-2½)-jugate, 15-25 cm. long, fulvously tomentose when young, glabrescent; *petioles* terete, somewhat broadened and flattened at base, 7.5-8.5 cm. long, 0.15-0.3 cm. thick, medulla with one large crescent-shaped amphivasal vascular bundle with a few small resiniferous ducts; interjugal parts 3 cm. long; *petiolules* like the petioles, lateral ones 1.1-2 cm., terminal ones (1.3-) 5 cm. long; *leaflets* ovate, 8-10.5 × 5-6 cm., coriaceous, nitidulous above, dull beneath, base, especially in older leaves, very unequal, rounded, margins entire, somewhat involute and thickened, apex gradually narrowed, shortly and bluntly acuminate, acumen 1-1.1 × 0.7-0.75 cm.; midrib prominulous above, prominent beneath, secondary nerves 8-9 pairs (not infrequently one nerve more at one side of leaflet than at the other), angle 70-80 degrees, near margin splitting up into two strong veins, archingly joined with intermediate tertiary nerves, prominulous to sunken above, prominulous beneath, veinlets inconspicuous, except for intermediate tertiary nerves. *Inflorescences* (female unknown) axillary, branched, 7 cm. long, shortly and thinly grayish tomentose; peduncle 3.5 cm. long, 0.1-0.15 cm. thick; primary branches up to 1 cm. long; pedicels 0.2-0.35 cm. long; bracts deciduous, bluntly and narrowly triangular, 0.05 × 0.03 cm. *Flowers* (female unknown) about 0.2 cm. long, with a scantily developed receptacle; *sepals* 0.15 cm. long, connate at base, thinly and minutely grayish puberulous without, triangular, rounded at apex; *petals* ovate, 0.2 × 0.125 cm., herbaceous, white (*f. Balansa 3550*), glabrous; *stamens* 6, 2-whorled, free, filaments very short, filiform, anthers oblong, ± 0.07 cm. long; *disk* cupular with irregularly undulate margin, 0.02-0.025 cm. high, fleshy, glabrous; *pistil* not strongly reduced, ovoid, about 0.1 cm. long and 0.03 cm. wide, glabrous, stigma sessile. *Infructescences and fruits* unknown.

New Caledonia: Mont Pénari, Bord des Torrenti, alt. 200 m., Feb. 1872, male fl., *Balansa 3550* (P, type specimen).

The type specimen and two other sheets are 3-foliolate throughout; a fourth is partly 2½-jugate.

EXCLUDED SPECIES

Canarium aneityense Guillaumin, Jour. Arnold Arb. **14**: 54, 1933=*Haplolobus aneityensis* (Guillaumin) Husson, Blumea **7** (2): 449, 1953.

Canarium sp., Christophersen, B. P. Bishop Mus., Bull. **128**: 113, 1935=*Haplolobus aneityensis* (Guillaumin) Husson.

Canarium sp., Yuncker, B. P. Bishop Mus., Bull. **184**: 44, 1945 [vernacular name *a'amatie*, hence probably also *Haplolobus aneityensis* (Guillaumin) Husson].

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COLLECTION DATA

Collection numbers are italicized. The species numbers used in the text are enclosed in parentheses.

Arnold, 1920 (19)

Bailey, F. M., 1895 (19)
Bailey, J. F., and Simmonds, 1892 (19), 1894 (19)
Balansa *481* (18), *2324* (20), *3458* (18), *3550* (21)
Beuzeville, de *390-36-11* (19), *36-66* (19), 1936 (19)
Brass *2631* (12), *2701* (12), *2824* (4), *2847* (14), *3468* (12)

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