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SOME MALESIAN SPECIES OF POUTERIA (SAPOTACEAE)

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SUMMARY

Some Malesian species of *Pouteria* are described or redescribed in view of new or additional material. In some taxa a wide variability is found. It is proposed to accept Pennington's system of the Sapotaceae as final, because the century-long battle over the systematics of that family has seriously havocked its taxonomy.

Presented are: additions to the descriptions of *Pouteria garcinioides, P. lamii, P. obovata*, and *P. occidentalis*, redescriptions of *P. anteridifera, P. cyclopensis, P. densinervia, P. kaernbachiana, P. keyensis, P. lanatifolia, P. ledermannii, P. monticola, P. thyrsoidea*, and *P. vrieseana*, and descriptions of the new species *P. gillisonii, P. menait, P. orkor, P. pullenii, P. ridsdalei, P. wandae*, and *P. whitmorei*.

Planchonella dies-reginae P. Royen is transferred and becomes *Pouteria dies-reginae* (P. Royen) Vink.

Palaquium komakomar P. Royen becomes a synonym of *Pouteria anteridifera* (Lane-Poole) Baehni, *Planchonella clementis* H.J. Lam of *Pouteria ledermannii* (K. Krause) Baehni, and *Planchonella maculata* P. Royen of *Pouteria monticola* (K. Krause) H.J. Lam.

Pouteria rhopalocarpa P. Royen is transferred from sect. *Pierrisideroxylon* to sect. *Oligotheca*.

Key words: *Pouteria*, Sapotaceae, Malesia.

INTRODUCTION

> He had never been afraid of error since all his experience had shown him that knowledge was self-corrective and that a search honestly pursued must bring a man closer to the shores of revelation, even though their outline remained for ever hidden from his view.
>
> Morris West, 1965.

During the last few decades problematic material accumulated in my room to build up into a pile of problems. Some of these problems are caused by the substantial increase in number of collections, revealing a large variability in characters traditionally considered of diagnostic value at the specific level (see e.g. *Pouteria ledermannii* and *P. cyclopensis*). This loss of diagnostic value of floral and fruit characters complicates the characterisation of species against each other.

NB The editors allowed the author of this paper to use sections 'Material seen', such in difference to the statement in the editorial in Volume 46 (p. 1 and 2). The reason for this is an agreement made in the past.

In this paper are described, redescribed, or discussed a number of species of *Pouteria*, mostly formerly ascribed to *Planchonella*, of the sections *Oligotheca* and *Pierrisideroxylon* sensu Pennington.

I have based myself on Pennington's generic concept (Pennington, 1991) that incorporates the many earlier trials to set up a system of the Sapotaceae. Although it certainly has some weaknesses of its own, I strongly advocate to follow this system and to use the energy to focus on the many problems at the specific level.

NOTES

Measurements

In deviation from the measurements given in the present paper (length of leaf blade and petiole separately), Van Royen included the petiole length in the leaf length, although petiole length is recorded separately (Van Royen, 1957: 255).

The length of the sepals is measured at the inside along the median.

In this paper several times "inserted in corolla throat" is recorded where Van Royen reports "inserted in the middle of the tube". I have taken as point of insertion the sinus between the filament and the corolla. Seen from the inside of the flower this sinus is not visible; below this point of fusion the body of the filament is still distinct over some length of the tube and this situation has caused several authors to believe that the point of fusion is further down the tube.

Indument: cemented hairs

In several species young parts like terminal buds, innovations, branchlet tips, leaves, pedicels, and calices, have a scaly appearance. This is caused by an exudate that looks like latex; in *Pullen 5939 (P. monticola)* the terminal bud even shows white hardened droplets similar to drops sometimes seen on surfaces of branchlets cut upon collection. This exudate hardens in contact with the air and cements the outer part of the indumentum into a continuous layer. Depending on the type of indument this layer is rough (indument tomentose or villous) to smooth (indument sericeous). In *P. monticola* some specimens have small, young terminal buds that are sericeous without exudate, as well as larger, older buds with cemented indumentum.

Upon stretching of the growing parts the cemented layer breaks up into scale-like particles that later drop off, taking with them the top of the indument. The remaining hair cover can be quite different, again depending upon the type of indument. In some cases this remainder consists only of the shafts of the T-hairs, seemingly representing short grey simple hairs. In other cases the scales remove the top of a dense sericeous layer and the remainder is still thickly ferruginously sericeous.

In *P. orkor* the indument is more open and consists of hairs with different shaft lengths. Here the exudate hardens also partly in the middle layers and thus the scales remove also a part of this middle layer. In fully mature leaves the remaining hairs are thus more widely spaced.

There are also a few specimens of *P. monticola* in which the exudate was apparently insufficient to cause a cementing.

The upper side of very young leaves of *Blackwood 258 (P. monticola)* is seemingly glabrous, but it is covered by a colourless film containing colourless hairs. This film disappears when the leaf matures and thus this leaf side becomes completely glabrous.

Stipules

Absence of stipules is one of the characteristics of *Pouteria*. Pennington (1990: 472) reports a single deviation: *P. congestifolia* Pilz. To this a second species can now be added: *P. wandae*. In New Guinea there is a third, as yet undescribed, taxon in the *P. firma*-group with stipulate leaves.

Inflorescences

The flowers are arranged in axillary fascicles enclosed by two lateral inflorescence bracts. Each flower is subtended by 0–3 lateral flower bracts. The arrangement of the flowers has not (never?) been studied comprehensively, but apparently the fascicle is a contracted dichasium. Usually a central flower is distinct and mostly the number of flowers per fascicle is uneven. The bracts of inflorescence and flower take adaxial-lateral positions.

It is not uncommon in the Sapotaceae that the central flower is 'replaced' by a vegetative bud. If this bud develops into a shoot, the resulting lateral axis is basally surrounded by pedicel scars.

Mostly the axial part of the fascicle has no appreciable length, but in some species (e.g. *Pouteria anteridifera, P. orkor, P. vrieseana*) this part becomes burly, sometimes already in an early bud stage, in other cases after flowering. Such burls are also found in other genera, e.g. in *Palaquium galactoxylon* (F. Muell.) H.J. Lam.

Cataphylls

As is described under *P. monticola*, the flowering twigs may show an alternation of stretches of fully developed axis and leaves, with stretches consisting of considerably shortened axis in which the leaves do not develop fully but have a stipule-like appearance (cataphylls). The axillary inflorescences thus become crowded on a 'leafless' part of the twig.

In other genera (e.g. *Burckella*) cataphylls are formed at the end of a twig entering a resting stage. In that case cataphylls and stipules are almost identical; the assemblage of cataphylls and stipules is densely crowded around the terminal vegetative bud. The new elongated shoot will be based on an area with densely crowded small scars.

Galls

Galls are very uncommon in Sapotaceae. One case is described under *P. wandae*.

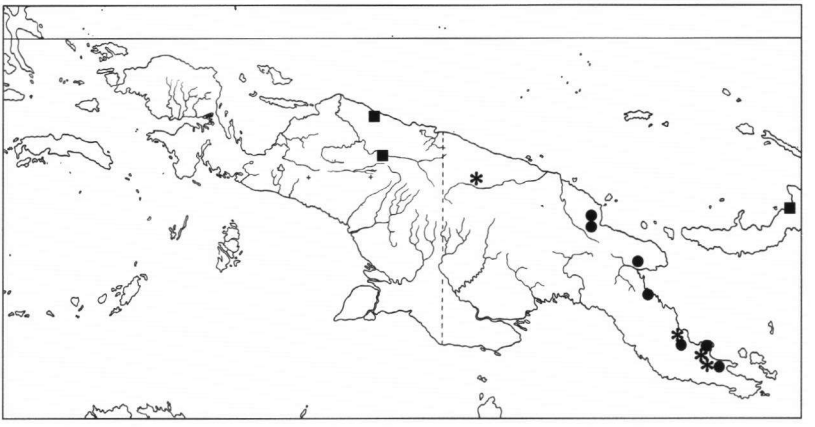
DESCRIPTIONS

1. **Pouteria** (sect. ?) **occidentalis** (H.J. Lam) Baehni — Map 1

Pouteria occidentalis (H.J. Lam) Baehni (1942) 344; Hermann-Erlee & P. Royen (1957) 469. — *Lucuma occidentalis* H.J. Lam (1925) 228, f. 62; (1927) 477; K. Heyne (1927) 1244; (1950) 1244. — *Pichonia occidentalis* (H.J. Lam) Aubrév. (1963) 330. — *Richardella occidentalis* (H.J. Lam) Baehni (1965a) 97. — Syntypes: *Beguin 2118 & 2264* (BO; iso L). Lectotype: (Hermann-Erlee, 1957): *Beguin 2264* (BO).

Corrections to the descriptions by Lam (1925) and Hermann-Erlee & Van Royen (1957):

Sepals 5 (or 6), free, inside sparsely appressedly hairy, basal third to basal half glabrous. *Corolla* glabrous; lobes rounded to almost eared at base. *Stamens* inserted in



Map 1. Distribution of *Pouteria occidentalis* (H.J. Lam) Baehni (■), *P. pullenii* Vink (●), and *P. densinervia* (K. Krause) Baehni (✱).

corolla throat. *Staminodes* ovate-oblong, apex rounded, base rounded to almost eared. *Pistil* without apparent disk, but locules appreciably high above base of pistil; style in very young bud distally apparently glabrous, in later bud stage short-villous up to the stigma; stigma with some wavy hairs (from calyx?). *Fruits* with remnant of indument, especially at base and at apex.

Notes — The flowering material (*Beguin 2118*) is badly damaged by insects; except for empty calyces only a few buds remain. In these buds the corolla- and androecium-parts are firmly sticking together: opening thus results in artefacts. Apart from that, Lam had apparently an abnormal bud at hand (with a half-sepaloid corolla lobe). The sterile specimen from New Britain has its very young leaves appressedly hairy on either side, its mature leaves are glabrous.

The leaves are very similar to those of *Notaphoebe elata* (Kosterm.) Kosterm. (Lauraceae).

Additional sterile material, probably belonging here, and only of interest because of the distribution:

NEW GUINEA. **Irian Jaya**. Subprov. Jayapura. Sarmi Distr., Foein R., low alt., *O. Moll BW 6670* (L); Idenburg R., Bernhard Camp, 80 m alt., *Brass & Versteegh 14107* (L). — **Papua New Guinea**. New Britain. Open Bay, *Shoji Sudo 14* (L).

2. **Pouteria** (sect. ?) **pullenii** Vink, *spec. nov.* — Fig. 1, Map 1

Arbor. Ramuli tenues, (adpresse) tomentosi, glabrescentes. Folia exstipulata, obovata vel elliptica, (9–)12–29 × 5–11 cm, chartacea, apice (retuso vel) acuto vel usque ad 1.5 cm acuminato, basi acuta ad obtusa ad (ultimo) rotundata, supra rare sericea mox glabrescentia, subtus argenteo-sericea pilis ferrugineis tarde evanescentibus rare velatis; nervi secundarii 10–20(–26) angulo 50–65° prope marginem sine conjunctionibus diminuentes; nervi tertiarii reticulati, nervi incrassati irregulariter transversi vel prope costam perpendiculares; petioli 0.5–1.2 cm longi (adpresse) tomentosi glabrescentes. Flores ignoti. Infructescentiae fructibus subsessilibus singulis. Pedicelli 0.5–2.5 mm longi. Sepala 5, intus glabra; exteriora triangularia, 1–1.5 × 1–2.5 mm, acuta (vel acuminata), adpresse tomentosa; interiora late ovata, 1–1.5 × 1.5–2 mm, rotundata, adpresse

tomentosa vel sericea prope marginem fimbriatum glabra. Fructus 1-seminalis oblique ellipsoideus, 30–43 × 15–24 × 12–21 mm, apice acuto ad rotundato, basi obliqua rotundata vel in cylindro usque ad 5 mm longo attenuata ventraliter excavata, glaber glaucus furfuraceus postremo laevis. Semen oblique ellipsoideum lateraliter compressum, 28–35 × 14–20 × 10–18 mm; testa opaca pallide ochracea ad pallide bruneola, lignea (1.5–)2–3 mm crassa, rimosa; hilum semine circiter equilongum, 3–6 mm latum; albumen copiosum; cotyledones foliaceae. — Typus: *Kanis 1243* (holo L; dupl. n.v.: A, BRI, CANB, CHR, K, LAE).

Tree 12–20 m high, bole 7–10 m, dbh 15–24 cm. Bark grey-green to dark brown, rather smooth, shallowly longitudinally fissured or longitudinally pusticular; inner bark straw; wood straw to creamy orange, hard. Branchlets slender, angular, soon becoming terete, (1–)2–3 mm in diam., as innovations dark ferruginously (appressed-)tomentose, soon glabrescent. Stipules absent. *Leaves* spirally arranged, scattered along ends of branchlets; blade obovate to elliptic, (9–)12–29 by 5–11 cm, chartaceous, apex (retuse to) acute to up to 1.5 cm acuminate, base acute to obtuse, or (ultimately narrowly) rounded; above thinly silvery sericeous with on top widely spaced dark hairs, soon glabrescent, below silvery sericeous with on top widely spaced dark hairs that disappear on age, midrib and secondary nerves ibidem but dark hairs dense, midrib and secondary nerves glabrescent; midrib flat to minutely impressed, minutely crested above, rounded below; secondary nerves 10–20(–26), at 50–65°, straight or slightly curved, near margin diminishing until inconspicuous, prominulous above, prominent below; tertiary nerves reticulate, stronger ones all irregularly transverse or in middle of blade becoming perpendicular to midrib, prominulous on either side; petiole 0.5–1.2 cm long, broadly grooved above, rounded below, (appressed-)tomentose, glabrescent, rough on age. *Flowers* unknown. *Infructescences* below the leaves, developing one subsessile fruit each; inflorescence axis slightly enlarged and covered with tiny hairy bracteoles. *Pedicel* 0.5–2.5 by 2–3 mm, with remnants of appressed-tomentose indumentum. *Sepals* 5, all glabrous inside; outer ones triangular, 1–1.5 by 1–2.5 mm, acute (or acuminate), appressed-tomentose; inner ones broadly ovate, 1–1.5 by 1.5–2 mm, rounded, appressed-tomentose or sericeous but with glabrous zones along the fimbriate margins. *Fruit* 1-seeded, obliquely ellipsoid, 30–43 by 15–24 by 12–21 mm, apex subacute to rounded or up to 3 mm acuminate by thickened style, base oblique, rounded to abruptly narrowed into an up to 5 by 7 mm cylinder forming a hood over the pedicel and the reflexed calyx; surface glabrous, glaucous, scurfy, ultimately becoming almost smooth, when ripe orange to pink or pale purple-red; dry pericarp 0.3–2 mm thick. *Seed* obliquely ellipsoid, laterally flattened, 28–35 by 14–20 by 10–18 mm, obtuse to rounded at either end; testa dull, very light (orange-)brown, woody, (1.5–)2–3 mm thick, outside with many cracks (ruptures); scar as long as seed, 3–6 mm wide, bordered by a 1–4 mm wide rim of testa; albumen copious; cotyledons foliaceous, radicle exsert, cylindrical, c. 3 by 2 mm.

Distribution — NE Papua New Guinea (7 collections seen).

Ecology — From coastal rain forest to *Araucaria–Anisoptera*-forest, at 0–930 m altitude. Understory tree. Fruiting from May to November.

Vernacular name — Bariji–Managalase: Iwawa.

Etymology — This species is named in honour of Royal Pullen (see Flora Malesiana I, 5, 1958: CCCXII; 8, 1974: LXXVII, photograph), a dear friend since our 1963 Kubor Ra. expedition.

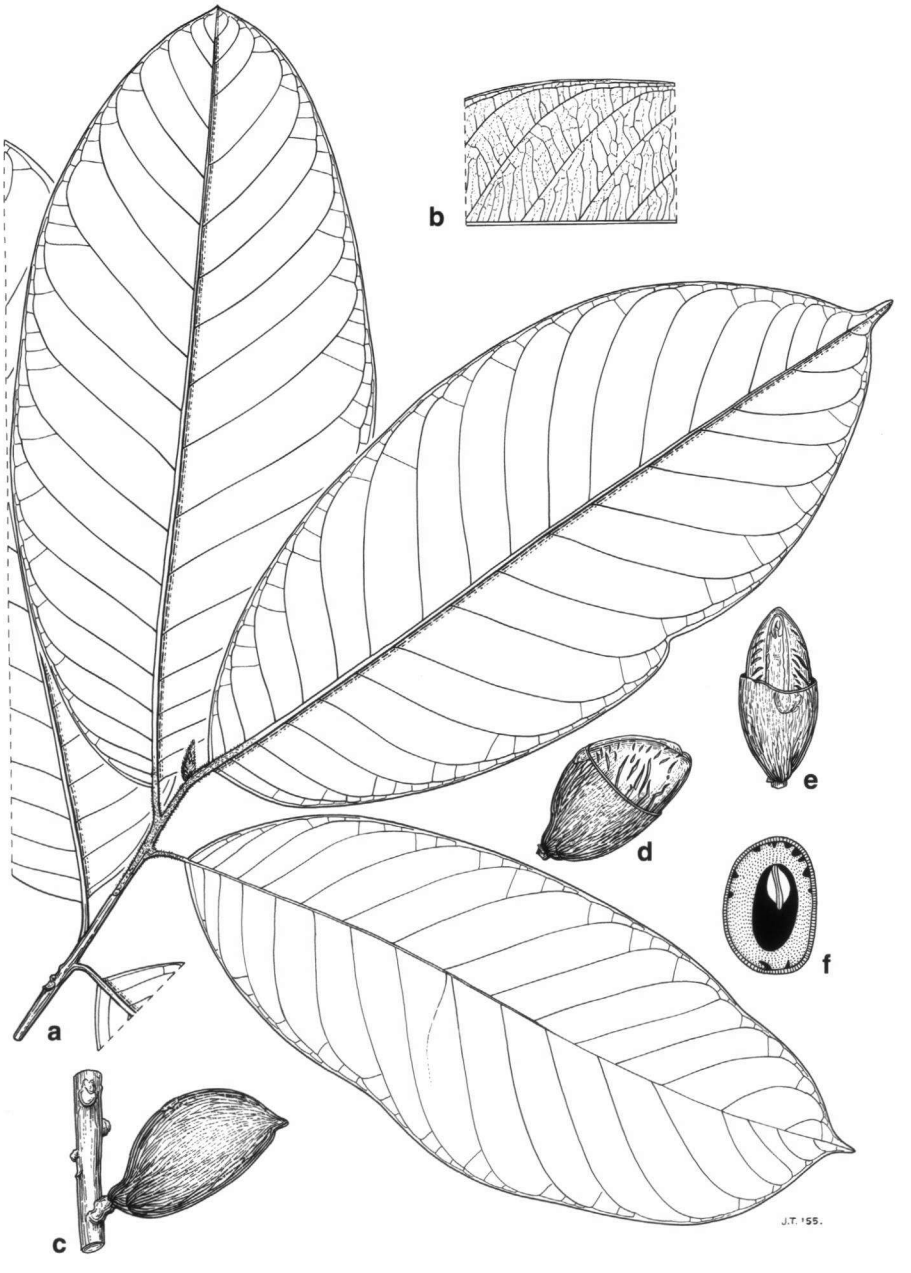


Fig. 1. *Pouteria pullenii* Vink. a. Habit. b. detail of venation on lower leaf side; c. fruit; d. fruit, apical half of fruit wall removed, showing seed, lateral side; e. ibidem, ventral side with seed scar; f. cross section of fruit, testa stippled, cavities black (a, b: × 0.5; c–f: × 0.75; *Hoogland 4619*).

Notes — This species is characterised by its aberrant seed coat: light, woody, and cracked, absolutely deviating from the usual Sapotaceous seed.

From the young fruit of *NGF 45895* I gained the impression that also in early stages a shiny testa layer, typical for the Sapotaceae, is absent.

Material seen:

NEW GUINEA. **Papua New Guinea**. Madang Prov. Madang Subprov., Gogol R., 54 m alt., *Katik NGF 46671* (L) fr.; Amiaba R., 210 m alt., *Foreman et al. NGF 45895* (L) y. fr. – Morobe Prov. Lae Subprov., Sankwep R., Mt Jasop nr Musom, 930 m alt., *Katik LAE 74755* (L) fr.; Morobe Subprov., Waiu Bay, sea level, *Gillison & Kairo NGF 25625* (L) fr. – N Prov. Bariji–Managalase area, S of Toma, 795 m alt., *Pullen 5889A* (CANB) fr.; Tufi Subprov., 1 km SE of Budi Barracks, 100 m alt., *Hoogland 4619* (L) fr. – Milne Bay Prov. Baniara Subprov., S of Opanabu village, 600–700 m alt., *Kanis 1243* (L, type) fr.

3. **Pouteria** (sect. *Oligotheca*) **densinervia** (K. Krause) Baehni — Map 1

Pouteria densinervia (K. Krause) Baehni (1942) 342. — *Sideroxylon densinervium* K. Krause (1923) 476. — *Planchonella densinervia* (K. Krause) H.J. Lam (1932) 562, t. 114; P. Royen (1957) 357. — Type: *Ledermann 12689* (holotype B†; lecto- (iso-)type (Van Royen, 1957; errore *Schlechter 12689*) L; iso K).

Tree 8–18 m high, bole 3–8 m, dbh 18–30 cm. Bark smooth or shallowly longitudinally fissured, (greyish, purplish) brown, underbark red or green (!), inner bark pink to (purplish) brown; sapwood cream to straw, heartwood pink to red-brown. Indument light brown. Innovations obliquely erect hispid. Branchlets slender to rather stout, ribbed, ultimately becoming terete, solid, 5–8 mm in diam., laxly coarsely tomentose over a dense subappressed layer of shorter hairs, glabrescent and bark peeling off. Stipules absent. *Leaves* spirally arranged but mostly more or less distinctly aggregated into pseudowhorls, scattered along branchlets to tufted at their ends; or between the pseudowhorls stretches with scars of reduced well-spaced leaves (often with an axillary inflorescence); blade oblong or obovate to obovate-lanceolate, 14–34 by (3–)5.5–10.5 cm, chartaceous to subcoriaceous; apex (sub)obtuse and 3–15 mm acuminate, base obtuse broadly to narrowly cuneate to attenuate; above glabrous or with indument remnants on midrib, below laxly beset with hairs with rather short shaft and about equal arms, on nerves and midrib denser so and underlain by dense (sub)appressed hairs; midrib (slightly) impressed and crested above, rounded and (usually) strongly prominent below; secondary nerves (14–)20–29, at 55–80°, straight or slightly curved near midrib, near margin diminishing until inconspicuous, flat but distinct to prominulous above, prominent below; tertiary nerves transverse, more or less sinuous and often forked, close together, faint to inconspicuous above, prominulous below; petiole (10–)20–40 by 1.5–3 mm, above narrowly to closed-canaliculate and with median crest, below triangular (to rounded), base thickened, tomentose, ultimately glabrescent. *Inflorescences* between and below the leaves, 2–8-florous, leaving slightly bulgy scars. *Pedicel* angular, 1–3 by 1–2 mm, tomentose. *Calyx* 5-lobed, sepals free; outer sepals broadly ovate, 3–5.5 by 4–6.5 mm, apex obtuse to rounded, outside appressed tomentose, inside dark ferruginously sericeous-tomentose but glabrous at (ultimate) base; inner sepals broadly elliptic to broadly ovate, 3.5–5.5 by 3–5 mm, apex obtuse to rounded, base rounded, indumentum as outer sepals but on either side glabrous along ciliate margins. *Corolla* exsert, 5-lobed, 5.5–6.5 mm long, cream, entirely glabrous;

tube 3–3.5 mm; lobes broadly elliptic to broadly (ob)ovate, 2–2.5 by 2–2.5 mm, apex rounded to truncate. *Stamens* 5, inserted 0.5–1 mm above base of corolla tube, glabrous; filaments subulate, straight, 1–2.5 mm; anthers ellipsoid to ovoid, 1.4–1.8 by 0.8–1 mm, apex obtuse and mucron(ul)ate, base cordate. *Staminodia* 5, inserted in sinuses of corolla lobes, lanceolate to (obovate-)oblong, 1.5–2 by 0.3–0.5 mm, flat, glabrous, apex obtuse to truncate, base straight. *Disk* a free, slanting ring, 0.5 by 0.2 mm, densely villous on all sides. *Ovary* 5-celled, conical to ellipsoid, 1 by 1–1.5 mm, densely villous; style somewhat angular, 3.5–6 mm long, lower half widened towards ovary and short-villous, cream, after flowering red; stigma minutely 5-lobed. *Infructescences* not seen; fruit said to be sessile. *Pedicels* of fruits c. 4 by 4 mm (included in indention of base of fruit), weathered sericeous. Calyx not incrassate, adpressed into indented part of fruit base. *Fruit* 2–5-seeded, ellipsoid to (ob)ovoid, in sicco more or less distinctly star-shaped on cross section, 64–93 by 23–47 mm; apex attenuate to rounded, base shallowly cordate (3–4 mm) or lower part of fruit tending to become constricted above narrowly cordate base; said to be hairy when young; with indument remnants especially at places covered by the calyx, above the calyx, and around the style remnant, subglabrous, slightly glaucous, dark red or black when ripe; pericarp 0.3–1.5 (in spirit 6) mm thick. *Seeds* (semi-)ellipsoid to oblong-obovoid, 53–59 by 20–23 by 12–18 mm, apex obtusely to narrowly rounded, base acute to truncate, scar 3–7 mm shorter than seed, 1.5–7 mm wide; testa dark brown nitidous, buff around scar, 0.4–1 mm thick; cotyledons foliaceous, obliquely obovate-oblong, c. 38 by 15 mm, apex narrowly rounded, base cordate; radicle exsert, subcylindrical, narrowed near tip, 8 by 3 mm; albumen completely surrounding cotyledons, thinner near edges of cotyledons, 0.5–1.5 mm thick.

Distribution — Endemic to Papua New Guinea (8 collections seen).

Ecology — Rain forest at 75–1500 m altitude. Flowering in August; fruiting from June to August.

Vernacular name — Hanaa (Sila: Managalase).

Notes — The specimens brought together in this species are characterised by: flowers and leaves as in the *P. firma* alliance; leaves relatively large; stipules absent; flowers and fruits subsessile; inside of sepals glabrous at base; fruits large and ultimately glabrous; seeds large. However, the vegetative parts show different aspects in the three localities known up till now.

The Sepik material *(Ledermann 12689)* has smaller leaves with their secondary nerves rather close (4–6 mm apart). Fruits unknown. Altitude 1500 m.

The material from the Managalase area *(Pullen 5561, 6275, 6422)* has longer leaves with a longer acumen, the secondary nerves are 5–12 mm apart and often curve just after leaving the midrib; the indument is more yellowish and more appressed. Flowers unknown. Altitude 1100 m.

The other collections from localities slightly more to the SE but from lower altitudes (75–360 m) have somewhat thicker and larger leaves with a broader base and with the secondary nerves at a wider angle to the midrib. Both flowers and fruits are available.

From the above it follows that the circumscription of this species might be artificial, or that a subspecific differentiation is at hand. The presently available data do not allow further conclusions.

Material seen:

NEW GUINEA. **Papua New Guinea**. E Sepik Prov. Felsspitze, 1400–1500 m alt., *Ledermann 12689* (L) fl. – N Prov. Hydrographers Ra., Managalase area, nr Siurane, 1100 m alt., *Pullen 5561* (CANB) fr., *Pullen 6275* (CANB; LAE, n.v.) ster., *Pullen 6422* (CANB, L) ster.; Tufi Distr., nr Budi Barracks, 75 m alt., *Hoogland 4626* (CANB, n.v.; L) fl. – Milne Bay Prov. Raba Raba Distr., Mt Suckling, junction of Mayu and Ugat Rivers, 360 m alt., *Leach NGF 33298* (L) fr., *Leach & Katik LAE 56111* (L) fr.; rd to Mt Suckling, 360 m alt. (errore 3600 m), *Katik NGF 46904* (L) fr.

4. Pouteria (sect. *?Oligotheca)* dies-reginae (P. Royen) Vink, *comb. nov.*

Planchonella dies-reginae P. Royen (1957) 431, 352, f. 36. — Type: *Brass & Versteegh 13150* (holo L).

Van Royen depicted a female flowerbud. A flowerbud of the second collection *Brass & Versteegh 12585* was also female, with 4 abortive stamens without anthers. The drawing of the habit accompanying the original description (f. 36a) was not made after the type but from the second collection.

This species shows resemblances to *P. monticola* in the tendency to cemented appressed indumentum and in the aggregate inflorescences with cataphylls. However, not only the hairy patch on the inside of the sepals, but especially the tertiary nervation distinguish these two species clearly.

No further materials turned up until now.

5. Pouteria (sect. *Oligotheca)* garcinioides (K. Krause) Baehni

Pouteria garcinoides (K. Krause) Baehni (1942) 338; Hermann-Erlee & P. Royen (1957) 496. — *Sideroxylon garcinioides* K. Krause (1923) 477. — *Lucuma garcinioides* (K. Krause) H.J. Lam (1932) 568, t. 129. — Type: *Ledermann 10728* (holo B†; lecto-(iso-), here chosen: alcohol material in L).

The type material has in all probability been lost in the WWII Berlin disaster, and Hermann-Erlee & Van Royen (1957) could not trace any other material. However, in the Leiden alcohol collection I found a bottle with the same collection number. This is a fruiting specimen. Krause saw old flowers (depicted by Lam, 1932) as well as fruits. The following is an amplification of Krause's description, made after the alcohol material.

Leaves spirally arranged, scattered along ends of branchlets; blade broadly elliptic to elliptic-obovate, 7–20 by 4.5–10 cm, thinly coriaceous, apex obtuse to almost rounded and 0.5–2 cm acuminate, base acute or attenuate, ultimate base narrowed and decurrent along upper part of petiole; glabrous on either side; midrib almost equally prominent on either side; secondary nerves 12–20, at 60–70°, straight or slightly curved, very close to the margin archingly joined (or diminishing until inconspicuous), prominulous on either side; tertiary nerves reticulate-parallel, often the central one as strong as the secondary nerves, distinct on either side; petiole 5–15 by 1.5–3 mm, apex not clearly defined because of decurrent blade base, above convex, below triangular to rounded, base not thickened, glabrous. *Infructescences* between the leaves, each containing one fruit, scars not raised. *Pedicel* terete, 5–6 by 1.3–1.5 mm, withered sericeous to subglabrous. *Calyx* (4- or) 5-lobed, in alcohol firmly appressed to fruit, when drying up strongly recurved (artefact?!), (thinly) withered sericeous on either side but at inside

base glabrous; tube 0.25–0.5 mm, often ruptured; lobes broadly ovate, apex rounded or eroded, base rounded to almost eared; outer lobes 3–4 by 3–4 mm, inner lobes 2.5–3 by 3–3.5 mm. *Fruits* 5-seeded, globose (or slightly ovoid), 18–23 by 19–23 mm, glabrous; apex broadly rounded but with a dark coloured, cupshaped depression 2–2.5 mm wide, 1 mm deep, with indument remnants, containing a 1 mm long glabrous terete style with a minutely 5-lobed stigma; base broadly rounded, dark coloured and puberulous on area covered by calyx; pericarp beyond locules 2–3 mm thick, between locules 6–7 mm thick. *Seeds* laterally flattened semi-ellipsoid, 13–14 by 7–9 by 5–6 mm; apex (rounded-)acute, slightly notched, base obtuse, distinctly notched; scar reaching neither apex nor base, 9–10 by 1–1.5 mm; testa nitidous, dark brown but fawn in a broad zone along scar, 0.3–0.4 mm thick; cotyledons foliaceous, radicle exsert, cylindrical, 2 by 0.8 mm; albumen copious.

Distribution — See notes. The type is from Papua New Guinea, Sepik R., Malu camp, 20–40 m alt., *Ledermann 10728*, old fl., fr., January 1913 (L, alcohol; dissected fruits with seeds now on a herbarium sheet). Old flowers not seen, but depicted by Lam (1932).

Notes — Krause described the pedicels of the old flowers as 6–8 mm long; the pedicels of the fruits I have seen are 5–6 mm long. According to Krause the sepals are glabrous within, but in fact there is an indumentum.

The alcohol-preserved fruits do indeed look like fruits of some species of *Garcinia*.

The position of this species is not clear. I have seen specimens that I suspect of being conspecific (e.g. *LAE 52849*, W Sepik Prov., PNG; *BSIP 9671, 17818, 18004*, Solomon Is.), but these are supposed to belong to the complex of *Pouteria chartacea* (F. Muell.) Baehni (of which the epithet is dating from 1869), that has not been unravelled yet. Therefore, I refrain from ascribing further material to *P. garcinioides*.

6. Pouteria (sect. *?Oligotheca*) **gillisonii** Vink, *spec. nov.*

Arbor humilis. Ramuli tenues, patentiter pilosi. Folia exstipulata, elliptica vel (ob)ovata, 5–11 × 3–6 cm, papyracea, apice obtuso vel 1.5 cm acuminato, basi acuta vel obtusa, supra pilis adpressis sparsis, glabrescentia, costa autem pilis densis, subtus pilis adpressis raris nervi secundarii autem pilis paulo densis et costa pilis patentibus densis; nervi secundarii 5–10 angulo 55–80° prope marginem sine conjunctionibus diminuentes; nervi tertiarii plus minusve sinuati transversi; petioli 0.5–1.3 cm longi, pilis patentibus densis. Inflorescentiae 5–10-floribus. Pedicelli 1–1.5 mm longi, pilis patentibus densis. Sepala 5, 0.1–0.4 mm connata, elliptica vel obovata, acuta vel rotundata, extus pilis patentibus densis, intus pilis curvatis densis tubus autem glaber; lobi exteriores 2 × 1.1–1.5 mm, interiores 2 × 1–1.3 mm. Corolla et androecium submatura tantum cognita. Corolla 5-lobata, glabra; tubus 1.1 mm longus, lobi oblongi, 1.2 × 1 mm, apice late rotundati. Stamina 5, tubo medio inserta, glabra; filamenta 0.6 mm longa, recta; antherae ellipsoideo-ovoideae, 0.6–0.7 × 0.4–0.5 mm, apice mucronato, basi cordata. Staminodia 5, oblonga vel obovato-oblonga, 0.8 × 0.2–0.3 mm, apice late rotundata. Discus minutus et adnatus vel apparentiter nullus, hirsutus; ovarium ovoideum 5-loculatum, 1 × 1 mm, hirsutum; stylus angustatus, 1.5 mm longus, basi pilosus, distaliter glaber; stigma minute 5-lobatum. Fructus ignotus. — Typus: *Gillison & Kairo NGF 25627* (L).

Erect treelet 3 m high. Bark brown, slightly pustular. Indument ferruginous. Branchlets slender, (sub)terete, solid, 1.5–3 mm in diam., densely patent-hairy, ultimately glabrescent. Innovations with indumentum as branchlets. Stipules absent. *Leaves* spirally arranged, scattered along ends of branchlets; blade elliptic to (ob)ovate, 5–11 by 3–6

cm, papyraceous, apex obtuse to broadly rounded, up to 1.5 cm acuminate, base acute to obtuse, often ultimately shortly attenuate and often slightly oblique, not decurrent; above with scattered appressed hairs, glabrescent, but midrib densely hairy, below intercostals very thinly appressed hairy, secondary nerves rather densely hairy, midrib densely patently hairy; midrib not or slightly impressed and distinctly narrowly crested above, prominent and angular below; secondary nerves 5–10, at 55–80°, straight but in smaller leaves curved, near margin diminishing until inconspicuous, flat but distinct by light colouring above, rather prominent below; tertiary nerves transverse, more or less sinuous and often branched, well-spaced, faint above, prominulous below; petiole 5–13 by 1–2 mm, narrowly canaliculate above, rounded below, base not thickened, densely patently hairy. *Inflorescences* in the axils of the upper leaves, 5–10-florous, leaving flat scars. *Pedicel* 1–1.5 by 0.5–1 mm, densely patently hairy. *Calyx* 5-lobed, outside densely patently hairy, also the parts covered in bud; inside tube (almost) glabrous, lobes densely wavy-hairy; tube 0.1–0.4 mm; lobes elliptic to ovate, apex acute to rounded, base straight; outer lobes 2 by 1.1–1.5 mm, inner lobes 2 by 1–1.3 mm. *Corolla* only known from not yet fully opened flowers, then slightly exsert, 5-lobed, entirely glabrous; tube 1.1 mm long; lobes oblong, 1.2 by 1 mm, apex broadly rounded. *Stamens* 5, inserted just below the middle of the tube, glabrous; filaments subulate, straight, 0.6 mm long; anthers have already shed pollen in flower with still closed corolla, ellipsoid-ovoid, latrorse, 0.6–0.7 by 0.4–0.5 mm, apex mucronate, base cordate. *Staminodes* 5, inserted in sinuses of corolla lobes, oblong to obovate-oblong, 0.8 by 0.2–0.3 mm, glabrous, apex broadly rounded, base straight. *Disk* very low and adnate, to apparently absent, hirsute. *Ovary* 5-celled, ovoid, 1 by 1 mm, hirsute; style tapering, 1.5 mm long, basal half (short) hirsute, upper half glabrous; stigma minutely 5-lobed, reaching opening between apices of corolla lobes when corolla not yet opened. *Fruits* unknown.

Distribution — Only known from the type: Papua New Guinea, Morobe Province, Morobe Subprov., Waiu Bay (7° 30' S, 147° 15' E), 300 m altitude, on rocky outcrop, *Gillison & Kairo NGF 25627* (holo L; dupl. n.v.: A, BRI, CANB, K, LAE), old fl. & buds; August.

Etymology — This species is named after one of the collectors of the only specimen known, Dr. Andrew N. Gillison (see Flora Malesiana I, 8, 1974: XXXVIII).

Note — This species is characterised by its patent indumentum, low number of secondary nerves, and very short pedicels. *Pouteria gillisonii* resembles *Chrysophyllum papuanicum* (Dubard) P. Royen (see Vink, 1958: 35). Of the latter only female flowers are known, these lacking stamens and staminodes. It is very unlikely that there the staminodes are lacking because of reduction from the hermaphroditic to the female state, as in other species staminodes of female flowers tend to be larger than those in bisexual flowers.

7. **Pouteria** (sect. *?Oligotheca*) **lamii** Baehni

Pouteria lamii Baehni (1942) 313. — *Chrysophyllum ledermannii* K. Krause (1923) 485, non *Pouteria ledermannii* (K. Krause) Baehni (1942) 341. — *Planchonella chrysophylloides* H.J. Lam (1932) 566, t. 126, non *Planchonella ledermannii* (K. Krause) H.J. Lam (1932: 561), non *Pouteria chrysophylloides* (Mart.) Radlk. (1882) 333; P. Royen (1957) 406. — Syntypes: *Ledermann 11239†, 11317†, 11343*; neotype, here chosen: *Takeuchi 6442* (L).

Addition to description (see Van Royen, 1957):

Infructescences between and below the leaves, each developing 1 or 2 fruits, leaving indistinct scars. *Pedicel* 2–3.5 by 1 mm, glabrous. *Sepals* (4 or) 5, free, patent to recurved, (broadly) elliptic to (broadly) ovate, apex rounded, base straight in outer lobes, rounded in inner lobes, outside glabrous, inside with a short-sericeous patch; outer lobes 1 by 0.7–1 mm, margin glabrous, inner lobes 1 by 1–1.3 mm, margins ciliate. *Fruit* 1-seeded, obovoid, 10–13 by 5–7 mm, apex obtuse and *rugose*, base acute; glabrous but at base with a ring of hairs; style not apparent, stigma distinct; pericarp 0.3–0.5 mm thick. *Seed* laterally slightly compressed, obovoid to ellipsoid, 9–10 by 5–7 by 3–5 mm, apex obtuse, base acute; testa yellowish brown, 0.5–0.7 mm thick; scar as long as seed, 0.8–1.5 mm wide; cotelydons foliaceous, radicle minute, exsert; albumen not apparent.

New material:

NEW GUINEA. **Papua New Guinea**. E Sepik Prov. Hunstein Ra., nr site 'Camp 4', crest of main ridge to summit, 1000 m alt., *Takeuchi 6442* (L), fr. July.

8. Pouteria (sect. *Oligotheca*) **lanatifolia** (P. Royen) Vink, *comb. nov.*

Planchonella lanatifolia P. Royen (1957) 428, 306, f. 22. — Type: *Kanehira & Hatusima 13891* (A).

Shrub 2–6 m high. In all parts strongly lactiferous. Indument dark ferruginous. Branchlets slender to rather sturdy, terete, 1–4 mm in diam., solid, patently hairy, ultimately glabrescent. Stipules absent. *Leaves* spirally arranged, close together, usually of a flush the first formed leaves much smaller than the upper, younger ones; blade elliptic, obovate to suborbicular, 1–5.5 by 0.7–4 cm, coriaceous; apex acute to rounded, sometimes mucronate, base obtuse to rounded; woolly on either side, quickly glabrescent above, only ultimately so below; midrib grooved above, prominent below; secondary nerves 5–8, at 60–80(–90)°, curved, near margin diminishing until inconspicuous, usually minutely grooved above, prominulous below; tertiary nerves transverse, inconspicuous on either side; petiole 3–10 by 0.8–1.5 mm, shallowly grooved above, patently hairy. *Inflorescences* between the leaves; flowers hermaphroditic, but very often female only; solitary, sometimes in pairs. *Pedicel* 2–6 by 1 mm, patently hairy. *Sepals* in 1 spiral of 5, or in 2 whorls of 2, broadly ovate but inner ones triangular, 2.2–4 by 1.5–3 mm, apex obtuse to retuse, indistinctly crested, tomentose without, sericeous within. *Corolla* slightly exsert, 4- or 5-lobed, 4–5 mm long; waxy, greenish white to pale yellow; indument variable: outside with lines of appressed hairs over midrib of some to all corolla parts, to a tuft of hairs on some apices, to glabrous; inside with a few hairs on apical margin or below that margin of a single or a few lobes, to glabrous; tube 2–2.5 mm long; lobes orbicular to obovate, 1.5–4 by 1.6–2.3 mm, apex narrowly rounded to truncate. *Stamens* in hermaphroditic flowers 4 or 5, included, inserted in the middle of the tube, glabrous; filaments subulate, 0.5–1.3 mm, straight; anthers broadly ovoid, 0.7–1.2 by 0.5–0.7 mm, apex obtuse to rounded, base cordate; in female flowers stamens represented by filament rudiments (rarely also below semi-petalous staminodes!). *Staminodes* oblong, 1–1.3 by 0.3–0.5 mm, glabrous, apex rounded to emarginate; in female flowers staminodes very variable, also within one flower, not

always as many as petals, from tiny undivided to triplicate fingerlike bodies up to petaloid organs almost reaching the size and form of the petals. *Disk* absent. *Ovary* (2–)4- or 5-celled, ovoid to conoid, 1–2 by 1.5–2.5 mm, densely hirsute; style terete or slightly 2–5-ribbed, 1.5–4 mm long, lower half sericeous, upper half glabrous; stigma minutely lobed. *Infructescences* between and below the leaves, leaving not thickened scars. *Pedicel* and *sepals* not or only slightly incrassate. *Fruit* 1- (or 2-) seeded, ellipsoid, 12–17 by 6–8 mm, apex obtuse and with style remnant, base also obtuse, glabrous except for a ring of hairs on apex as well on base; pericarp thinly coriaceous. *Seeds* laterally flattened obovoid-ellipsoid, 12–17 by 7–8 by 7 mm, apex rounded, base acute; testa thin, light yellowish brown; scar linear, c. 3/4 as long as seed, c. 1 mm wide; cotyledons foliaceous, radicle exsert, c. 2 by 0.5 mm. *Seedlings*: hypocotyl light brown, just below the cotyledons light green, 1.5 mm in diam., 1.5 cm long, glabrous; cotyledons chartaceous, leaflike, elliptic, slightly oblique, 16–18 by 12–14 mm, apex and base broadly rounded; midrib crested above, distinct below, nerves 3 or 4 pairs, one pair ascending from leaf base at c. 30°, the others at c. 45°; epicotyl laxly ferruginous-tomentose.

Distribution — Endemic to the Anggi Lakes area, Vogelkop Peninsula, Irian Jaya, Indonesia (7 collections known).

Ecology — Locally common in secondary myrtaceous-ericaceous shrubbery, or in forest edges; on (stony) clays, or on coarse sand with strongly humified top layer; at 2140–2600 m altitude; flowers seen in January and April, fruits in January (dates do not give a real picture).

In the field it was observed that nearly all plants were infested by a fungus which blackens the indument of branches, petioles, leaves, and pedicels (cf. Van Royen, 1957: "Branchlets ... blackish tomentose"). Many plants also had gall-like structures which sometimes deformed almost all leaves of a shrub.

Vernacular name — Irian Jaya, Manikion language: Hongmooi.

Notes — In the field dozens of shrubs were searched for hermaphroditic flowers, but only very few were found; most flowers were female. However, this species is surely not dioecious and fruits were not really rare. On some plants both 4- and 5-merous flowers were found.

The staminodes of the female flowers are very variable in form and size; although their numbers are sometimes lower than that of the petals, no flowers completely lacking staminodes were found. The presence in *BW 14067* of filament rudiments not only epipetalous but also alternipetalous (that is, below the staminodes) is curious.

The description of the seedlings is after plantlets grown in the Hortus Botanicus in Leiden from seed sent directly from the Arfak Mountains in 1962. These plantlets did not develop further.

Material seen:

NEW GUINEA. **Irian Jaya**. Vogelkop Pen., Manokwari Subprov. Anggi Lakes, Anggi Gigi, Mt Sensenemes, 2600 m alt., *Sleumer & Vink BW 14218* (L), fl., y. fr.; Mt Tidjei, 2140 m alt., *Sleumer & Vink BW 14299* (L) fr.; Mt Kobreimot between Mt Tidjei and Mt Disrebei, 2430 m alt., *Sleumer & Vink BW 14349* (L) fl., fr.; between Anggi Gigi and Anggi Gita, Mt Kobreimot, above Testega, 2300 m alt., *Sleumer & Vink BW 14156* (L) fl. buds, *Stefels BW 2055* (L) ster.; Anggi Gita, Mt Misjnuk, 2150 m alt., *Sleumer & Vink BW 14067* (L; BO, BRI, CANB, LAE, n.v.) fl.

9. Pouteria (sect. *Oligotheca*) **ledermannii** (K. Krause) Baehni — Fig. 2, Map 2

Pouteria ledermannii (K. Krause) Baehni (1942) 341. — *Sideroxylon ledermannii* K. Krause (1923) 475. — *Planchonella ledermannii* (K. Krause) H.J. Lam (1932) 561, t. 111; P. Royen (1957) 358. — Type: *Ledermann 12248* (B†); neotype: *Ledermann 6956* (K) (Van Royen, 1957: 359).
Planchonella clementis H.J. Lam (1943a) 97, f. 6; P. Royen (1957) 356. — *Pouteria clementis* (H.J. Lam) H.J. Lam (1943b) 337. — Type: *Clemens 1155* (holo L; iso B n.v.).

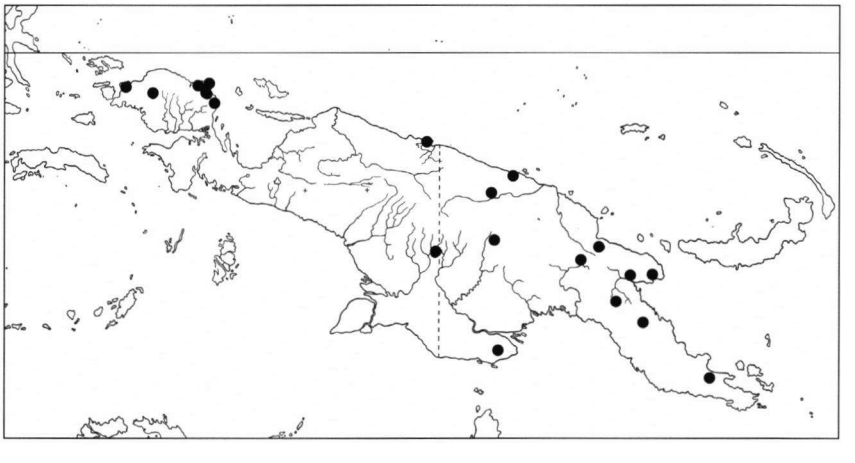
Tree 12–36 m high, bole 10–24 m, diam. above buttresses (15–)30–55(–82) cm; buttresses 0.5–2 m high, spreading 0.5–2 m, 4–10(–15) cm thick. Bark (grey-, dark-, red-)brown, rarely grey or purplish green, smooth, 0.1–0.5 mm thick; inner bark 5–18 mm thick, slash light brown to orange to red, inside white to pink. Wood not differentiated into sapwood and heartwood, light brown to pink, or: sapwood 1–5 cm, white to light brown to pink and heartwood pink to orange to brown. Branchlets slender to stout, angular or subterete, becoming terete, solid, 2–9 mm in diam., densely light brown villous-tomentose, (ultimately) glabrescent. Innovations light brown villous- or woolly-tomentose. Stipules absent. *Leaves* spirally arranged, scattered along ends of branchlets or crowded on ends of branchlets; blade elliptic to oblong, more often obovate to obovate-spathulate (to oblanceolate-spathulate), 11–37.5 by (4–)5–13.5 cm, papyraceous to subcoriaceous, apex acute (to obtuse to rounded), 0–12 mm acuminate, base attenuate-acute to narrowed and abruptly rounded; above with light brown appressed soft hairs, soon becoming glabrous, below with widely spaced erect, branched, light brown hairs, these dense on midrib and nerves; intercostals sometimes becoming almost glabrous; midrib slightly raised to slightly impressed above, rounded and very prominent below; secondary nerves (12–)15–33, at 55–80°, straight to somewhat curved, near margin diminishing until inconspicuous, sometimes (partly) joined by thickened tertiary nerves, prominulous to slightly impressed above, prominent below; tertiary nerves transverse, more or less sinuous, well-spaced, faint (to slightly impressed) above, prominulous below; petiole 2–8(–10) by 2–4(–6) mm, broadly grooved (to flat) above, rounded below, base not thickened, light brown villous or woolly-tomentose. *Inflorescences* between and/or below the leaves, 1– multi-florous, apparently containing flowers of the same age, not leaving bulgy scars; flowers bisexual, rarely female. *Pedicel* slender to rather stout, 2–15 by 0.5–2 mm, (light) yellowish brown (woolly-)tomentose (to patently velutinous). *Calyx* 5- or 6-lobed, lobes imbricate, (almost) free, tube 0–0.25 mm; outside light to dark yellowish brown tomentose (to patently velutinous), also parts covered in bud; inside (thick) yellowish brown sericeous, almost always glabrous near base, sometimes also along margins; outer lobes (broadly) ovate, 2–6 by 2–5.5 mm, apex subacute to broadly rounded, base straight to rounded; inner lobes elliptic to ovate, 2–5 by 1.5–3 mm, subacute to truncate, base straight to somewhat rounded. *Corolla* exsert, 5- or 6-lobed, 4.5–6 mm long, glabrous, rarely apices ciliate; tube 1.5–4 mm long; lobes elliptic to oblong or ovate, 1.3–5.5 by 1–3 mm, apex rounded to truncate. *Stamens* included, 5 or 6, inserted at or slightly below middle of corolla tube, rarely in or slightly below corolla throat, glabrous; filaments subulate, not recurved, 2–3 mm long; anthers in open flowers turned upside down and inwardly, ellipsoid to ovoid, 1–2.7 mm long, apex mucronate to apiculate, base cordate. *Staminodes* included, 5 or 6, inserted in sinuses of corolla lobes, (ob)lanceolate to linear, or lingulate, 1.5–4.5 by 0.3–1.5 mm, glabrous, apex acute to truncate, base not widened. *Disk* varying from a suberect ring basally adnate

to ovary 0.5 mm high and 0.3 mm thick, to a patent adnate ring 0.3 mm wide, to apparently absent; densely long-villous on all sides. *Ovary* 5- or 6-celled, lower part of cells surrounded by adnate part of disk, or, if disk apparently absent, bottom of cells 0.7–1 mm above base of ovary; free part conical to cylindrical, 1–1.7 by 0.7–1.5 mm, villous; style included, cylindrical or very narrowly conical, 2.5–5 mm long, for 0.6–0.9 short-villous; stigma flat but minutely to indistinctly lobed. *Infructescences* between and/or below the leaves, not burly, developing only a single fruit each. *Pedicel* terete, rather slender to very stout, 1–15 by 1.5–7 mm, longer ones not thickened at apex or base, light yellowish brown tomentose, glabrescent. *Calyx* not accrescent and recurved, to accrescent and patent to appressed to fruit; outside light yellowish brown tomentose to subglabrous, inside (weathered) sericeous, tube – if present – and often base of lobes glabrous; tube 0–1 mm; outer lobes 2.5–9 by 2.5–10 mm, inner lobes 2.3–8 by 3–6 mm. *Fruit* ellipsoid or globose to obpyriform, sometimes star-shaped in cross section, 26–60 by 20–40 mm, purple to black, apex rounded to depressed, with style (-remnant), base attenuate to rounded, patent short-hairy to tomentose, becoming glabrous with some indument remnants, at base with a disappearing ring of hairs (from disk); pericarp in vivo 1–3 mm thick, in sicco 0.2–0.9 mm thick. *Seeds* spindle-shaped, 22–38 by 10–18 by 7–13 mm, apex obtuse to rounded, base acute to rounded, testa (dark) brown, nitidous, 0.3–1.2 mm thick; scar almost as long as seed, 2–4 mm wide; cotyledons foliaceous, radicle exsert, cylindrical, 3 by 0.7 mm; albumen copious. Dry *wood* light pinkish brown, rather hard, s.g. 0.56 (0.47–0.65, n = 16).

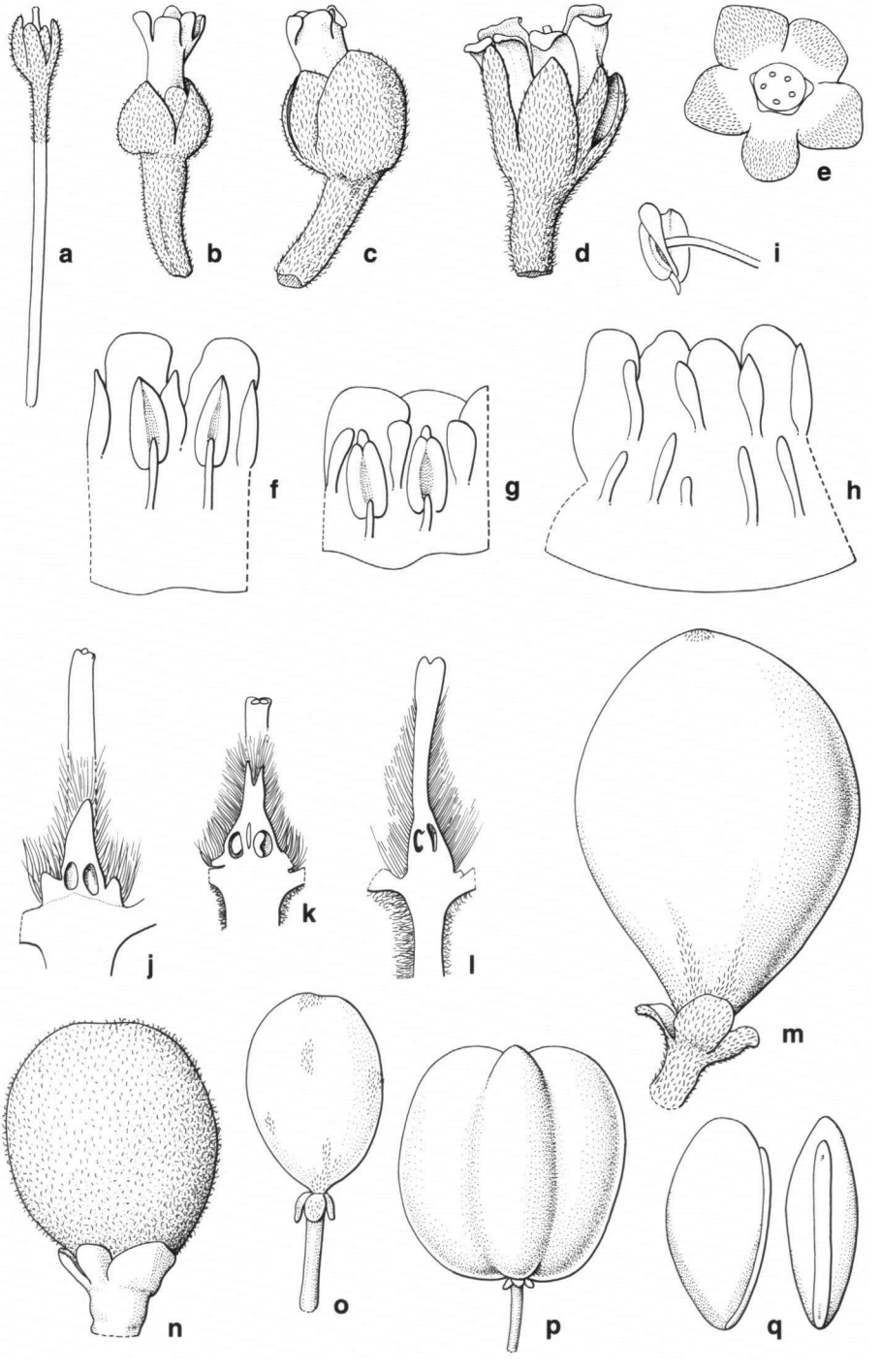
Distribution — New Guinea (34 collections seen).

Ecology — Very variable: rather common in lowland forest on alluvial clays or sandy clays, to scattered in *Melaleuca*-forest, in *Lithocarpus–Castanopsis*-forest, or in lower montane forest on ultrabasic soil, at 5–1500 m altitude. Flowering and fruiting from July to March. Chris Versteegh (*BW 3899*) reports the tree to be completely defoliated (July; the specimen has unfolding young leaves).

Vernacular names — Irian Jaya: Amberbaken language: Ditot, Nifa; Biak language: Morfor; Hatam language: Ndauw; Kebar language: Perrar; Manikion language: Bokkoi,



Map 2. Distribution of *Pouteria ledermannii* (K. Krause) Baehni.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Sowkwa, Serbahuni, Serebahoerid, Woökoi (5×); Meax language: Morida; Moi language: Tjemie; North Muyu: Taram; Middle Muyu: Mongkot; Sidei: Memekeni. — Papua New Guinea: Kiwai dialect: Idi; Oriomo: Porgeribrub.

Notes — The above descriptions show that there is something absolutely wrong. Flower sizes differing with a factor 3. Fruits like small 'carambolas' change into small hairy inverted eggs, sustained by slender stalks with small backward curved sepals that vary into short sturdy woody stalks with large hairy cupshaped calices. The description of the ecology proves also that the taxonomy cannot be right. The best Papuan tree expert, Jacob Ainjoessi (Manikion language) also disagrees.

Initially I thought to have at least two new species at hand. Awaiting publication some material has been identified with the preliminary names *Planchonella kosteri* and *P. schramii* (in honour of the BW collectors Chris Koster and Wim Schram), both based on material from 'Sidei', an 8,200 ha forest complex between the Wariki R. and the Mangopi R., NE Vogelkop, Irian Jaya, subjected by Forestry to a 2% inventory. There are 6 collections from this area, from which one with flowers, one with flowers and fruits, one with old flowers and fruits, two with fruits only, and one sterile. Such a 'dense' sampling of a taxon of Irian Jaya forest trees is quite uncommon.

Vegetatively these collections are absolutely indistinguishable and the field labels are almost identical. That seems to be a firm ground to compare e.g. materials with buds and with young fruits. However, there are some problems.

Considering the collection methods, *BW 6186* (bisexual) and *BW 6190* (female) must have grown at a short distance (at most a few hundred meters) from each other. Within the available material these specimens take a more or less central position: rather long and thick flower pedicels, rather large flower sepals, fruit pedicel incrassate, fruit sepals not incrassate.

BW 6757 and *BW 6762* were collected on the same day; both have ovoid fruits with shorter and thick fruit pedicels and a larger, appressed, fruit calyx. They form a bridge to *BW 12301* from the Warsamson area (250 km W of Sidei) with large fruits and seeds.

On the other side of *BW 6186/6190* is *BW 7687*: with a long slender pedicel, small calyx in old flowers, and smaller fruits on a less incrassate pedicel and with an apparently not incrassate but reflexed calyx.

Similar differences are found in the forest complexes at 10 to 90 km E and SE of Sidei.

Except for a sterile collection (*BW 7180*, Kebar Valley, 450 m alt.) these Vogelkop collections are all from the lowlands. Also from the lowlands are *BW 11139* (Yapen

Fig. 2. *Pouteria ledermannii* (K. Krause) Baehni. a–d. Differences in form and size of pedicel and calyx: a. old flower, b–d. open flowers, all × 3; e. inside of calyx from young fruit, with short tube, × 3; f. inside of corolla, open flower, × 6; g. ibidem, from bud, × 12; h. ibidem, from open female flower, with sterile stamens, × 6; i. old anther, × 6; j–l. longisections of gynoecia, off-centre: j. disk an erect ring, k. disk a patent ring, l. disk apparently absent, locules high in ovary; m–p. fruits, × 1: n. densely hairy, the others with indumentum remnants: m, n. pedicel short, thick, calyx large and adpressed, o, p. pedicel slender, calyx smaller and recurved; q. seed, × 1 (a, o: *BW 10970*; b, h, k: *BW 6190*; c: *BW 11796*; d, i, l: *Hartley 13125*; e: *BW 929*; f, j: *BW 6186*; g: *Lederman 6956*; m: *BW 12301*; n: *BW 6757*; p, q: *NGF 46958*).

Is., ster.) and *BW 6427* (Jibi, SE Irian Jaya); the latter is comparable to *BW 7687* by its slender pedicels and recurved fruit-calices.

In Papua New Guinea, lowland collections are available from the Sepik area (the neotype) and from the Oriomo Creek; the latter are comparable to the 'central' Sidei type (*BW 6186/6190*).

There are collections from widely scattered localities from the Cyclops Mts to Mt Suckling, with an altitudinal range from 366 to 1500 m! Here the variability is also large. *NGF 46958* (Mt Suckling, 366 m alt.) has star-shaped fruits with a small, reflexed calyx and a slender pedicel. In the other collections the pedicel is (very) short, thin to thick, the sepals are comparatively medium-sized to large, in fruit patent to reflexed, and the fruits are large.

In *Hartley 13125* (Okapa, 1200 m alt.) the flowers deviate from all other ones seen by the sepals being longer than wide, and by the stamens inserted in or very slightly below the corolla throat (variation within flowers). This specimen deviates also by a deeply fissured bark (against smooth).

The neotype bears buds only. The apices of the corolla lobes are ciliate, a condition not seen in the (few) other flowering specimens.

Pullen 1373 deviates by its anthers being laterally thinly hairy.

The variation in the disk is large but continuous: from ring-shaped and up to halfway adnate, to very low, or apparently absent. However, as far as could be ascertained, a ring of hairs is always present at the base of the fruit.

The sterile specimen *BW 11737* (Warsamson) has leaves very much like those of *BW 929* (Cyclops Mts), but it deviates by its appressed indumentum. A similar deviation is reported for *P. kaernbachiana.*

Pouteria ledermannii is very close to *P. kaernbachiana.* The latter has a distinct calyx tube, recurved filament tips, usually basally broad, toothed staminodes, a glabrous disk base (also visible in fruit), and a more reddish indument.

The material from the Huon Peninsula, described as *Planchonella clementis*, falls within the variability described above.

The series of BW-wood samples of *P. ledermannii* is just as homogeneous in colour and specific gravity as are the series of *P. menait* and *P. keyensis*; this supports the choice for a wide species concept. The wood sample of *BW 11737* differs somewhat in colour and finish and that number was, based upon herbarium material, listed as 'doubtful'.

Material seen (* = also wood sample):

NEW GUINEA. **Irian Jaya**. Subprov. Sorong. Warsamson Valley, 50 m alt., *Schram BW 12301* (BO, CANB, L*; LAE, n.v.) fr.; S of Ayawasi, Irafe, 480 m alt., *Polak 1358, 1359* (L) ster. – Subprov. Manokwari. Kebar Valley, 450 m alt., *Koster BW 7180* (L*; LAE, n.v.) ster.; Wariki, 5–10 m alt., *Koster BW 6993* (L*) ster., *Schram BW 7621* (L*) ster.; Sidei, 5–20 m alt., *Schram BW 1735* (L*) ster., *BW 6186* (CANB, n.v.; L*) fr., *BW 6190* (KEP, n.v.; L*) fl., *Koster BW 6757* (L*) fr., *BW 6762* (L*) fr., *BW 6952* (L*) ster., *Schram BW 7687* (A, CANB, KEP, LAE, PNH, SING, n.v.; L*) fr.; Masni, 5 m alt., *Koster BW 10970* (L*; LAE, n.v.) fl., fr.; Oemboei, 30–40 m alt., *Koster BW 11796* (L*) fl., *BW 11832* (BO, CANB, n.v.; L*) ster.; Beri Creek, 70 m alt., *Koster BW 13505* (BO, CANB, n.v.; L*) ster.; Maroeni Creek, 77 m alt. *Koster BW 11999* (CANB, L) ster.; Warmare, 120 m alt., *O. Moll BW 15729* (A, BO, CANB, n.v.; L), old fl.; Oransbari, 50 m alt., *Chr. Versteegh BW 3899* (L*) fl. buds. – Subprov. Yapen–Waropen. Yapen Is., Sumberbaba, 10 m alt., *Koster BW 11139* (BO, CANB, L*) ster. – Subprov. Jayapura. Cyclops Mts, trail Ifar–

Ormu, 680 m alt., *Chr. Versteegh BW 929* (L; A, CANB, K, LAE, SING, n.v.) y. fr. – Subprov. Merauke. Jibi, 5 km N of Ninati, 50 m alt., *Kalkman BW 6427* (L*; LAE, n.v.) old fl., y. fr. — **Papua New Guinea**. E Sepik Prov. Sepik area, *Ledermann 6956* (K, neotype) fl. buds; Prince Alexander Mts, pass E of Mt Ulbanep, Lawon–Yamil track, S of But, 1000 m alt., *Pullen 1373* (L) fl. – W Highl. Prov. Lake Kopiago, 1500 m alt., *Galore & Vandenberg NGF 41091* (L) fr. – W Prov. Oriomo Creek, mouth of Yakup Creek, 15 m alt., *Womersley NGF 17711, NGF 17749* (L) fr. – Madang Prov. S foothills of Finisterre Ra., Damanti village, 1080 m alt., *Pullen 5967* (L) fl. – E Highl. Prov. Okapa, 1200 m alt., *Hartley 13125* (L) fl. – Morobe Prov. Saruwaged Ra., Boana, 1200–1500 m alt., *Clemens 8588* (L) fr.; Rawlinson Ra., Quembung, 600–900 m alt., *Clemens 1155* (L) y. fl.; Upper Watut R., Nauti logging area, 1500 m alt., *Streimann 8307* (L) fr.; Saru R., 10 km SE of Garaina, 690 m alt., *Streimann & Kairo NGF 47978* (L) fr. – Milne Bay Prov. Mt Suckling, Rabaraba, 366 m alt., *Katik NGF 46958* (L) fr.; Mt Suckling, junction Mayu R. and Ugat R., 360 m alt., *Leach LAE 56062* (L) fr.

Doubtful: Irian Jaya. Warsamson Valley, 30 m alt., *V.W. Moll BW 11737* (CANB, L*) ster.

10. Pouteria (sect. *Oligotheca*) monticola (K. Krause) H.J. Lam — Fig. 3, Map 3

Pouteria monticola (K. Krause) H.J. Lam (1943) 337. — *Sideroxylon monticolum* K. Krause (1923) 481. — *Planchonella monticola* (K. Krause) H.J. Lam (1932) 561, t. 112; P. Royen (1957) 328; Sillitoe (1988) 26. — Type: *Ledermann 10246* (B†); neotype (Van Royen, 1957): *Carr 15189* (L).

Planchonella maculata P. Royen (1957) 430, 323, f. 28. — Type: *Brass & Versteegh 11904* (holo L; iso A n.v.).

Small to tall tree (2.5–)9–30 m high, bole 6–22.5 m, dbh 10–40(–80) cm; buttresses negligible to absent. Outer bark (grey- to dark-)brown, rarely patchy grey and fawn, smooth, rarely shallowly longitudinally fissured; inner bark outside (red-)brown or green (!), slash straw to chestnut, sometimes striated brown to maroon. Wood pale straw to pinkish brown, heartwood not defined but slightly darker. Terminal bud sharply acute, sharply ribbed, indument mostly cemented. Branchlets slender to rather slender, rarely sturdy, angular becoming ribbed (to terete), with zones of compacted smaller leaf scars, solid, 2–4(–7) mm in diam., like terminal buds indument with a smooth outer layer of aligned hairs cemented together, glabrescent. Stipules absent, rarely some leaves with stipule-like structures on the proximal part of the pedicel. *Leaves* spirally arranged, scattered along (ends of) branchlets; blade (elliptic to) oblong or obovate-oblong (to lanceolate), 2.5–16.5(–25.5) by 1–5.5(–8.5) cm, (sub)coriaceous, apex acute to obtuse (to retuse), 0–7(–12) mm acuminate, base acute and often shortly attenuate and shortly decurrent, rather often slightly oblique; upper layer of indumentum often cemented, falling away into scale-like particles; above from densely closely appressed silvery to ferruginously hairy and glabrescent, to apparently glabrous when young; below thin to thick (closely appressed) light brown (with scattered ferruginous hairs) to dark ferruginously sericeous, often withering (patchily) to light grey or colourless, rarely ultimately subglabrous; midrib above (slightly) impressed an usually distinctly crested, below prominent and angular or ribbed to almost rounded; secondary nerves (7–)10–18, at 60–80(–90)°, almost straight to curved, near margin diminishing until inconspicuous, faint to prominent on either side; tertiary nerves transverse, slender, closely together, near midrib perpendicular to the latter, on either side usually very faint to inconspicuous, less often faint to prominulous; petiole 5–35 by 1–1.5 mm, above widely open to closed canaliculate, often crest of midrib descending into groove of petiole, ribbed to almost rounded below, base usually thickened and flat to canalicu-

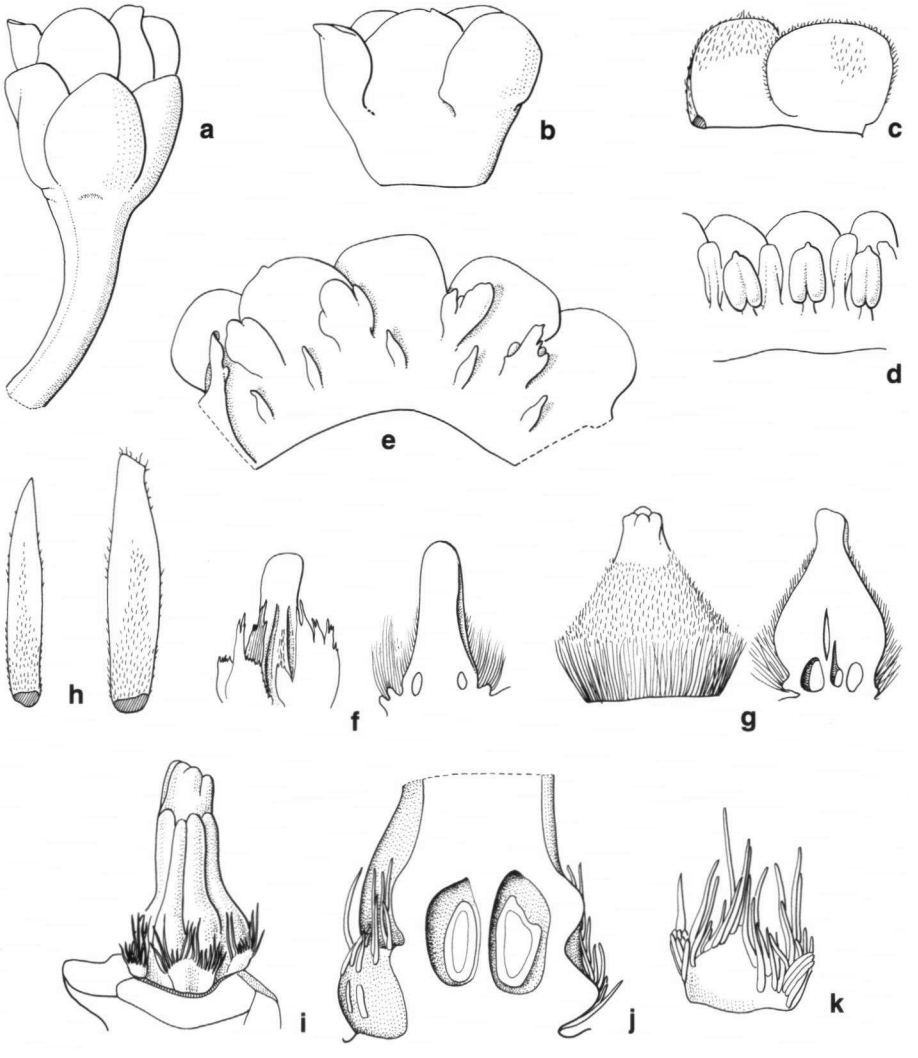
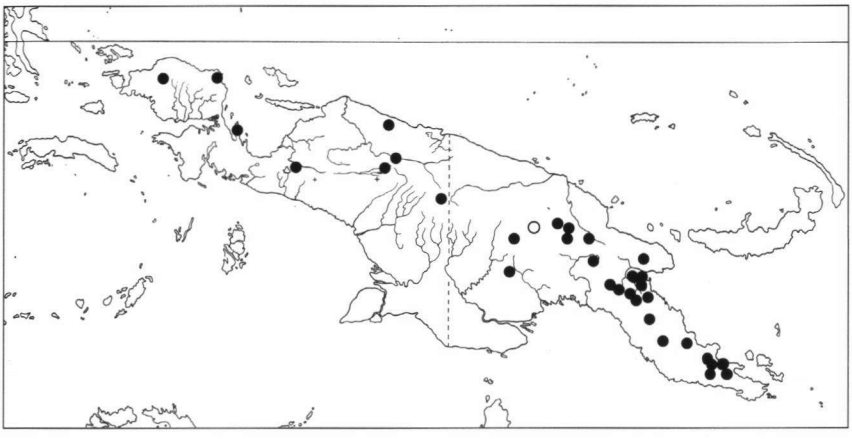


Fig. 3. *Pouteria monticola* (K. Krause) H.J. Lam. a. Flower, indumentum of pedicel and calyx omitted, × 6; b. corolla, × 6; c. inside of outer and inner sepal, × 6; d. stamens and staminodes from bud, × 6; e. inside of corolla of female flower: staminodes with (indications of) abortive thecae, × 6; f. gynoecium from hermaphrodite flowerbud: stamens have caused grouping of disk hairs and impressions on ovary, the grooves are glabrous, × 12.5; g. gynoecium from female flower, × 9; h. largest bracteoles of inflorescences, inside, × 6. — *Pouteria ?monticola*. i–k. Gynoecium from just opening hermaphrodite flower, only the margins of the disk lobes with hairs: i. ovary and lower style with impressions of anther locules, disk hairs fitting cordate bases of anthers, × 12.5; j. longisection, off-centre, × 25; k. one disk lobe, outside, × 25 (a–c, e, g, h: *Takeuchi 4053*; d: *Raynal 17145*; f: *Lae 54846*; i–k: *NGF 32051*).

late above, indument as lower leaf side but more often glabrescent. *Inflorescences* between the leaves, but also in zones with compacted smaller leaf scars, 1–3(–5)-flowered, largest bract of an inflorescence ovate to (ob)lanceolate to linear, 3–6 by 0.7–2 mm, apex acute to truncate, basal half sometimes canaliculate, outside short sericeous, inside from glabrous to partly sericeous, margins and apex sometimes ciliate; inflorescence scars not enlarged; flowers bisexual or female (often in the same specimen). *Pedicel* rather slender, 9–20 by 0.8–1.3 mm, (subterete to) ribbed, apex not or slightly thickened, short sericeous. *Calyx* 4–6-lobed, lobes imbricate, tube (0–)0.2–0.5 mm, indument light brown to ferruginous; outer lobes (ovate to) broadly elliptic (to orbicular), 2.2–4 by 2.8–4.3 mm, apex (obtuse to) broadly rounded (to truncate), base straight to somewhat rounded, outside short sericeous, sometimes apex with tuft of darker hairs, inside in upper part with scattered appressed hairs to short sericeous, only once so along all margins; inner lobes (ovate to) broadly elliptic to orbicular, 1.7–3.3 by 2.3–4 mm, sometimes outside carinate, apex (obtuse to) broadly rounded to truncate (to retuse), base (slightly) rounded, outside short sericeous but (laxly so to) glabrous along the usually ciliate lateral margins, inside rarely only with a few scattered hairs, usually short sericeous but glabrous at base and along lateral margins, or also glabrous along apex, sometimes the resulting hairy patch split into two small patches. *Corolla* exsert, 4–6-lobed, 3.5–4.7 mm long, glabrous or outside with a few scattered short, dark ferruginous hairs; tube 1.8–3 mm long; lobes broadly elliptic (to elliptic-obovate, or squarish, or orbicular), 1.3–2.3 by 1.5–2.8 mm, apex broadly rounded to truncate, base straight to almost eared. *Stamens* included, 4–6, inserted from close to the base to close to the top of the corolla tube, glabrous; filaments straight, cylindrical (to strap-shaped), 0.3–1 mm long; anthers ovoid, 1.2–1.4 by 0.4–1 mm, basifix, latero-introrse to latrorse, apex acute, apiculate to mucronate, base slightly to deeply cordate; in female flowers stamens reduced to filament remnants, or completely absent. *Staminodes* included, 4–6, inserted in sinuses of corolla lobes, glabrous; in hermaphrodite flowers ovate to oblong, 1.3–1.6 by 0.6–1 mm, apex rounded to truncate, base straight (to rounded), adaxially carinate or longitudinally ribbed (impressions made by anthers); in female flowers more or less petaloid, ovate to obovate or very irregular, 0.7–1.8 by 0.5–1.3 mm, apex rounded to dentate, crenulate, retuse, or bifid, base slightly to strongly narrowed, sometimes with tiny abortive anther-locules. *Disk* varying from a minute free ring, to a basally adnate lobed ring up to 0.5 mm high and 0.2 mm thick with its lobes episepalous, to completely adnate and smooth to lobed; long-villous on all free parts, sometimes locally near base on outside (sub)glabrous. *Ovary* 4–6-celled, with compitum, cells basal in ovary; free part ovoid, conical, or cylindrical, 0.4–1.5 by 1–2 mm, in hermaphrodite flowers usually ribbed, ribs alternating with disk lobes; short-villous but sometimes long-villous as disk; style stout, 1.5–3 mm long, basal half conical or flask-shaped, ribs and indumentum as ovary or glabrous between ribs, upper half (sub)terete, glabrous; stigma (sub)capitate, with tiny lobes or lateral knobs. *Infructescences* between the leaves, not burly, developing 1 (or 2) fruits each. *Pedicel* terete (to angular), rather slender, 7–19 by 0.8–1.5 mm, distally slightly thickened, brown sericeous withering grey, subglabrescent. *Calyx* not accrescent, (sub)patent, outer lobes 2.5–3 by 3–3.5 mm, inner lobes 2–3.3 by 2–4 mm, indument outside withering grey and sometimes glabrescent, inside of inner lobes also sometimes glabrous. *Fruit* obovoid, 1- or 2-seeded, 13–20 by 7–11.5 mm, apex (obtuse to) flattened to indented, with persistent non-accrescent style, base acute, ferruginously to light



Map 3. Distribution of *Pouteria monticola* (K. Krause) H.J. Lam (○ = doubtful).

brown (thinly) sericeous-tomentose; around style hairs lighter, denser, and more appressed; at base with a ring of longer hairs (disk); pericarp 0.3–0.5 mm thick, inside with dark stripes. *Seed* obovoid, 16 by 5 by 6 mm, apex rounded, base acute, testa straw, nitidous, 0.2 mm thick; scar 12 by 3 mm, reaching base of seed; cotyledons foliaceous; albumen present.

Distribution — New Guinea (44 collections seen).

Ecology — Subcanopy to canopy tree(let) in (lower) montane forests, often associated with *Lithocarpus, Castanopsis*, or *Nothofagus*, also on ridges, locally frequent to very common, probably on different types of soil, at 450–2200 m altitude. Flowering: (May) August to February; fruiting: May to September.

Vernacular names (mostly one record only) — Irian Jaya. Kebar language: Urupop; Kwerba language: Krahidja; Maybrat language: Asi. — Papua New Guinea. Fiyugi (Woitape): Ko; Maring language: Kina; Wola language: Aerel; Ekna village, Morobe: Paba.

Uses — Seeds used to decorate skirts and cowry necklaces (Wola area, Southern Highlands Province).

Notes — The vegetative terminal bud is sharply acute and has sharp longitudinal ribs. In *P. macropoda* (H.J. Lam) Baehni the terminal bud has a likewise strongly cemented indumentum, but the bud has a rounded apex and rounded longitudinal ribs.

Most specimens have parts of the twigs with more compacted, smaller leaf scars. In such areas the leaf scar axil can contain inflorescences or infructescences not different from those in axils of leaves or of large leaf scars. Probably *Pullen 5939* illustrates how these areas arise. In this specimen the lower 'leaves' of the terminal bud are spreading from the base of the real bud, but they do not develop normally: although they are apparently rather old as the indumentum is already withered, they remain subulate (6 mm long). These abortive leaves must leave small scars on an apparently less strongly elongating section of the branchlet. If all leaves of a bud are abortive, a leafless flowering twig may arise, as is reported for e.g. *P. duclitan* (Blanco) Baehni and *P. thyrsoidea* (C.T. White) T.D. Penn.

The larger leaf sizes were found in the sterile material from the Ayawasi area (Vogelkop, Irian Jaya).

Brass 29691 has stipule-like organs on the proximal end of the petiole: lingulate, c. 2 by 0.7 mm, narrowly rounded, outside sericeous, inside glabrous. These could represent bracts displaced from the axillary inflorescence to the basal part of the petiole.

In female flowers the stamens are reduced to filament remnants, or they can even be completely absent (*Manner & Street 429*). In these flowers the staminodes are often more petaloid but very irregular and in *Takeuchi 4053* some staminodes do even have abortive locules.

In hermaphrodite flowers the ovaries are often ribbed, with the indumentum more distinctly expressed on the ribs; in female flowers the ovary is smooth and the indumentum is equally spread over its surface. No difference in development of ovules could be detected. In *Manner & Street 429* hermaphrodite and female flowers were found in the same inflorescence.

The ovary of *NGF 32051* (sub.: 'Doubtful') is glabrous. One would expect such an ovary to develop into a glabrous fruit, but no such material came to my knowledge. *ANU 2683* has its older leaves glabrous and therefore has also been listed as 'Doubtful'.

Material seen:

NEW GUINEA. **Irian Jaya**. Subprov. Sorong. Surroundings of Ayawasi, 450 m alt., *Avé 4276* (L) ster., 600 m alt., *Polak 1361, 1362* (L) ster. – Subprov. Manokwari. Mt Krabo, 780 m alt., *Koster BW 10757* (L) ster.; Wandammen Penins., Wondiwoi Mts, 1800 m alt., *Schram BW 13368* (L) ster. – Subprov. Paniai. Enarotali, *Eyma s.n.* (BO) fr. – Subprov. Jayapura. Mt Moasets, 560 m alt., *Karstel BW 5318* (L) ster. – Subprov. Jayawijaya. Idenburgh R., Bernhard Camp, 1750 m alt., *Brass & Versteegh 11904* (L, type of *Planchonella maculata* P. Royen) fl.; Baliem Valley, Napua, *Raynal 17145* (L) fl.; Star Mts, Mt Antares, junction of Bon R. and Minam R., 1500 m alt., *Kalkman 4417* (L) fr. — **Papua New Guinea**. S Highl. Prov. Tari Subprov., Habono, W foot of Mt Ambua, 1900 m alt., *Frodin NGF 32089* (L) ster.; Mt Bosavi, 1250–1350 m alt., *Jacobs 8737* (L) ster.; idem, 1500 m alt., *Gideon LAE 57374* (L) fl. – W Highl. Prov. Bismarck Ra., Mt Obio, 2075 m alt., *Takeuchi 10598* (L) fl. buds; Nondugl, Al R., 2100 m alt., *Womersley NGF 5339* (L) ster.; Jimi R.(?), 1860 m alt., *Manner & Street 429* (L) fl. buds. – E Highl. Prov. Goroka Subprov., Barapa Timber Lease nr Goroka, *Apare LAE 55259* (L) fl. buds; Purosa, Okapa area, 1950 m alt., *Brass 31722* (L) fr. – Morobe Prov. Wagau, 1200 m alt., *Sayers NGF 21526* (L) old fl.; Mt Mission, 2050 m alt., *Van Valkenburg 443* (L) ster., *451* (L) fl.; Kuper Ra., track to Biaru, 2100 m alt., *Takeuchi 4053* (L) fl.; Kuper Ra., Mt Kolorong Wildlife Cons. Area, 2050 m alt., *Höft 3521* (L) fl. buds; Wau–Salamaua Rd, pad 27, 1920 m alt., *Millar NGF 22806* (L) y. fr.; ibidem, pad 28, 2100 m alt., *Millar NGF 22819* (L) old fl.; Wau, Eraulu logging area, 1829 m alt., *Katik & Eddowes LAE 62095* (L) y. fr.; Kaisenik, alt. 2200 m, *Kapi Rau 262* (L) y. fr.; Ekna village, 1350–1500 m alt., *Blackwood 258* (L) ster.; Kaindi, 2150 m alt., *Brass 29691* (L) y. fr.; Lake Trist, 1620 m alt., *Henty NGF 29114* (L) old fl.; Menyamya Subprov., Angabena ridge, 1750 m alt., *Stevens & Streimann LAE 54846* (L) fl.; Aseki Patrol area, Haunga, 1560 m alt., *Craven & Schodde 1071* (L) fl. buds; E slope Spreader Divide, 2010 m alt, *Schodde & Craven 4901* (L) fl. buds. – Central Prov. Mt Kumme, E of Woitape, 1830 m alt., *Van Royen NGF 20415* (L) fl. buds; Woitape, 1500 m alt., *Corner & Gray s.n.* (L) y. fr. – N Prov. Alola, 1800 m alt., *Carr 13624* (L) fl. buds, *14158* (L) old fl.; Uniri R., 1950 m alt., *Carr 15189* (L, neotype) fl. buds; Hydrographers Ra., 1825 m alt., *Pullen 5939* (L) y. fr. – Milne Bay Prov. E of Mt Suckling between Mt Gouru and Rui's Camp, 1676 m alt., *Pullen 8379* (L) ster.; N slopes Mt Dayman, 1650 m alt., *Brass 23349* (L) fr.; Agaun, 1340 m alt., *Schodde 5533* (L) fr.; Aparamu ridge, E Mt Simpson Ra., 1780 m alt., *Schodde 5457* (L) fr.; Rabaraba Subprov., Mt Metata–Nepesip Rd, 1800 m alt., *Wood et al. NGF 17593* (L) fr.

Doubtful: Papua New Guinea. S Highl. Prov. Tari Subprov., W foot Mt Ambua, *Frodin NGF 32051* (L) fl. – W Highl. Prov. Wabag–Kompiam Rd, 2300 m alt., *Flenley ANU 2683* (L) ster.

11. **Pouteria** (sect. *Oligotheca*) **obovata** (R.Br.) Baehni

Pouteria obovata (R.Br.) Baehni (1942) 324; Ng (1992) 510, f. 870 (seedling), f. 871 (twig).
For synonymy see H.J. Lam (1925: 209), Van Royen (1957: 368), excl. *Sideroxylon glabrum* Ridl. (acc. to Ng, 1972: 435).

During a taxonomy course in 1980, Miss José Steenvoorden (now Mrs J.A.A.G. Ambrosius-née Steenvoorden) studied the variability of this species. She found that from East to West there is a change in the indument of the lower leaf side from (almost) glabrous to dark ferruginously puberulous or sericeous. In the latter case the flowers are usually smaller. Within a specimen the indument can also differ from glabrous to hairy. There is no relation between form and size of the leaf and the distribution of the species.

Her most obvious result is concerned with the indumentum of the fruit. Usually the fruit is glabrous, but in the material from Borneo (and also in some specimens from Java and Palawan) the fruits are ferruginously hairy. She found no glabrous fruits in the Bornean material available! Reminding that this species occurs from the Seychelles, India, and Ryukyu Is., throughout Malesia, into the Solomon Is. and Australia, this 'insular' variation is quite remarkable!

Baehni (1942) suspects the occurrence of cleistogamic flowers.

Ng (1992) records a germination period of 6–23 days.

12. **Pouteria** (sect. *Oligotheca)* **rhopalocarpa** P. Royen

Pouteria rhopalocarpa P. Royen (1959) 134; T.D. Penn. (1991) 202. — *Wokoia rhopalocarpa* (P. Royen) Baehni (1964) 78; (1965b) 33 '*Woikoia*'; (1965a) 105 '*Woikoia*'. — Type: *Mangold 51 = BW 2107* (L).

Pennington (1991) inserted this species into section *Pierrisideroxylon*. The species of sect. *Pierrisideroxylon* described below have:

a) sepals basally united into a short tube (except *P. keyensis*);
b) exsert stamens (except *P. hochreuterini*, not included in this paper);
c) a disk basally adnate to the ovary but apically free (except *P. keyensis)*, hairy but abaxially entirely or in the lower part glabrous. In fruit this arrangement is still visible by a ring of hairs above a glabrous very narrow zone at the ultimate base;
d) a narrow seed scar;
e) cotyledons foliaceous.

Pouteria rhopalocarpa has free sepals, included stamens, no disk, a scar covering almost the entire surface of the seed, and thick cotyledons. Although other characters – like stamen insertion in the corolla throat, and basally toothed staminodes – are shared with a number of species of sect. *Pierrisideroxylon*, it seems that this species is more in line with sect. *Oligotheca* (A.DC.) Baehni.

13. **Pouteria** (sect. *Oligotheca*) **wandae** Vink, *spec. nov.* — Fig. 4

Arbor. Ramuli paulo crassi, conglutinate adpresse tomentosi, mox glabrescentes. Stipulae (late) ellipticae vel ovatae ad lanceolatae, 5–17 × 2.5–5 mm. Folia (anguste) elliptica ad (anguste) oblonga, raro (anguste) (ob)ovata, (9–)12–34 × 4–12.5 cm, subcoriacea, apice

acuto ad obtuso 2–20 mm acuminato, basi acuta ad obtusa necnon extremum attenuata, supra glabra, subtus costa et nervi secundarii sparse pilosi; nervi secundarii (13–)19–35 angulo 55–90°, prope marginem sine conjunctionibus diminuentes; nervi tertiarii plus minusve sinuati transversi; petioli 1.5–3 cm longi, mox glabrescentes. Inflorescentiae 2–10-floribus. Pedicelli 3–5 mm longi, adpresse tomentosi. Sepala 5, (fere) discreta, ovata vel orbiculata, apice rotundato interdum obtuso, interiora basi rotundata vel auriculata, 2.5–5.3 × 3–5.5 mm, extus adpresse tomentosa, interiora prope marginem ciliarem glabra, intus sericea vel adpresse tomentosa basi glabris. Corolla exserta 5-lobata, 6–7.5 mm longa, glabra; tubus 3–3.5 mm longus, lobi 3–4 × 3–3.5 mm. Stamina 5, 1.5(–2) mm infra fauce inserta, glabra; filamenta recta 1.5–2.5 mm longa; antherae ellipsoideae vel anguste ovoideae, 1.4–1.6 × 0.8–1 mm, apice mucronato basi cordata. Staminodia 5, ovata, 2–2.5 × 1–1.5 mm, carinata, glabra. Discus annularis complanatus villosus. Ovarium 5-locularum, ovoideum vel globosum, 1–1.5 × 2–2.5 mm, breve villosum; stylus glaber 2–4.5 mm longus; stigma minute lobatum. Fructus 4- vel 5-seminalis, globosus, usque ad 30 × 30 mm, dense breve patentiter hirsutus; semen semi-ovoideum, 18–20 × 7–10 × (4–)6–7 mm, cicatrice subaequilonga angusta; albumen copiosum; cotyledones foliaceae. — Typus: *Avé 4163* (holo L; iso CANB, K; BO, MAN, n.v.).

Tree 8–18 m high, dbh up to 25 cm. Bark smooth, reddish brown; inner bark pinkish, latex white. Indument ferruginous. Branchlets rather stout, ribbed, becoming terete, solid, (3–)4–5 mm in diam., cemented appressed-tomentose, quickly glabrescent. Innovations appressed-tomentose, cemented where exposed. Stipules caducous, (broadly) elliptic or ovate to lanceolate, 5–17 by 2.5–5 mm, apex obtuse to rostrate, outside cemented appressed-tomentose, glabrescent, inside (thinly) appressed-tomentose. *Leaves* spirally arranged, scattered along ends of branchlets; blade (narrowly) elliptic to (narrowly) oblong, sometimes (narrowly) (ob)ovate, (9–)12–34 by 4–12.5 cm, often strongly varying in size within a specimen, subcoriaceous; apex acute to obtuse, 2–20 mm acuminate, base acute to obtuse and (ultimately) slightly to strongly attenuate; above glabrous, below with indument remnants on midrib and usually also on secondary nerves; midrib slightly impressed or flat, with a distinct narrow crest above, rounded and smooth or finely ribbed below; secondary nerves (13–)19–35, at 55–90°, curved or straight but curved towards margin, near margin diminishing until inconspicuous, prominulous (rarely slightly impressed, also in vivo) above, prominent below; tertiary nerves transverse, more or less sinuous, close together, faint to inconspicuous above, prominulous or faint but distinct by lighter colour below; petiole 15–30 by 1.5–2 mm, above narrowly canaliculate and with crest, rarely flat and with lateral and central crests, below rounded, base thickened, thinly appressed-tomentose, quickly glabrescent. *Inflorescences* axillary to leaves, leafscars, or (scars of) reduced leaves, 2–10-florous, leaving somewhat bulgy scars. *Pedicel* 3–5 by 1–2 mm, angular to ribbed, brown short appressed-tomentose. *Calyx* 5-lobed, sepals free or ultimate base connate; outer sepals (broadly) ovate, 3–5.3 by 4–5 mm, apex rounded (or obtuse), base somewhat rounded, outside short appressed-tomentose with scattered darker hairs, inside (thinly) light brown to whitish sericeous to appressed-tomentose but basal 0.5–1 mm glabrous; inner sepals ovate to orbicular, often carinate, 2.5–5.3 by 3–5.5 mm, apex rounded, base rounded to eared, indumentum as outer sepals but outside especially in basal half glabrous along ciliate margins. *Corolla* exsert, 5-lobed, 6–7.5 mm long, entirely glabrous; tube 3–3.5 mm; lobes ovate, 3–4 by 3–3.5 mm, apex rounded, base eared. *Stamens* 5, inserted 1.5(–2) mm below corolla throat, glabrous; filaments thick-

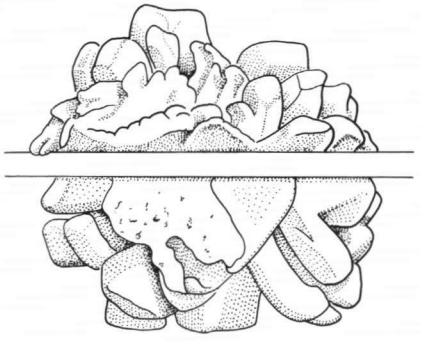


Fig. 4. *Pouteria wandae* Vink. Gall, projecting on either side of leaf blade, × 12.5 (*Polak 1371B*).

subulate, straight, 1.5–2.5 mm; anthers ellipsoid to narrowly ovoid, 1.4–1.6 by 0.8–1 mm, apex rounded and 0.2 mm mucronate, base cordate. *Staminodes* 5, inserted in sinuses of corolla lobes, ovate, 2–2.5 by 1–1.5 mm, lengthwise folded and carinate, glabrous, apex rounded, base straight. *Disk* a flat ring perpendicular to floral axis, 0.2–0.3 mm high, 0.3–1 mm wide, adnate to base of ovary, densely villous. *Ovary* 5-celled, with compitum, ovoid to globose, 1–1.5 by 2–2.5 mm, short villous; style terete to 5-ribbed, 2–4.5 mm, glabrous; stigma minutely 5-lobed. *Infructescences* between and below the leaves, slightly burly. *Pedicel* terete, 2–5 by 2–2.5 mm, withered tomentose. *Calyx* appressed to fruit, not or slightly incrassate. *Fruit* 4- or 5-seeded, globose, up to 30 by 30 mm; apex rounded and indented, indented field 4 mm in diam. with appressed straight hairs and with a 2.5–4 mm long glabrous style, base rounded; densely shortly patently ferruginously hirsute, base surrounded by a ring of longer straight hairs (disk); pericarp 2–3 mm thick. *Seeds* semi-ovoid, 18–20 by 7–10 by (4–)6–7 mm, apex narrowly rounded, base broadly rounded; testa nitidous, dark brown, 0.5 mm thick; scar c. 16 by 3 mm; albumen copious; cotyledons foliaceous, oblong, c. 14 by 7 mm, both ends rounded, radicle exsert, cylindrical, c. 5 by 1.7 mm.

Distribution — Endemic to the Vogelkop Peninsula, Irian Jaya, Indonesia (3 collections seen).

Ecology — Primary forest, on clay (or sandy clay or sand), in secondary growth 45–50 years old, left-over in garden, at 450 m altitude. Flowering: January; young fruits: March; fruits: May.

Vernacular names — Maybrat language: Asi, Asi pomao(n), Asi sme.

Etymology — This species is named after Ms Wanda Avé, born 10 March 1955 at Malang, Indonesia, ethnobotanist who worked earlier in West Malaysia (rattans) and Siberut, Indonesia (medicinal plants).

Note — The leaves are, except for their larger size, very similar to those of *P. firma*, but the hairy fruits and the stipules differentiate *P. wandae* easily from that species.

Galls — Leaf galls are found in *Polak 1371 A & B*. These galls form equal, dark brown, glabrous structures on either side of the leaf, connected by a narrow canal through the latter. Six to twelve excrescences radiate from a central area. They are angular and obtuse, once to twice as long as wide. Close to the leaf they are surrounded by smaller irregular excrescences. All together these form a hemispherical structure 1.5–2.5 mm in diameter and 1–1.5 mm high.

Material seen:

NEW GUINEA. **Irian Jaya**. Subprov. Sorong. Surroundings of Ayawasi, 450 m alt., *Avé 4163* (type, CANB, K, L; BO, MAN, n.v.) fl.; ibidem, *Ridsdale 2363* (L, LAE; BO, MAN, n.v.) y. fr.; ibidem, *Polak 1369A* (L, LAE) ster., *1369B* (BO, L) ster.; NE of Ayawasi, Skof fnes, 475 m alt., *Polak 1372* (CANB, L) ster.; SE of Ayawasi, Smuoh Air, 450 m alt., *Polak 1280* (A, CANB, L; BO, MAN, n.v.) fr.; S of Ayawasi, Ayamtot, 450 m alt., *Polak 1370* (BO, L) ster., Irafe, 485 m alt., *Polak 1371A* (L, LAE), *1371B* (L).

14. **Pouteria** (sect. *Pierrisideroxylon*) **anteridifera** (Lane-Poole) Baehni — Map 4

Pouteria anteridifera (Lane-Poole) Baehni (1942) 381; T.D. Penn. (1991) 201; Lemmens (1993) 367. — *Sideroxylon anteridiferum* White & Francis ex Lane-Poole (1925) 132; (1927) 252, f. 15. — *Planchonella anteridifera* (Lane-Poole) H.J. Lam (1927) 471; (1932) 562, t. 116; P. Royen (1957) 336. — Type: *Lane-Poole 161* (holo BRI).

Palaquium komakomar P. Royen (1960) 486. — Type: *Hoogland 4521* (holo L).

Tree 22–42 m high, bole 12–30 m, dbh 27–100 cm; buttresses up to 2.5 m high and spreading 1.5 m. Outer bark light brown to dark grey brown, or reddish brown, to dark purple-brown, smooth, often with shallow vertical cracks and also often with vertical rows of pusticular lenticels, sometimes with leaf-scars still distinct; inner bark (pinkish) cream to light red, often mottled. Wood white to straw, not defined into sapwood and heartwood. Branchlets (rather) stout, subterete or rounded-angular, becoming terete, with (slightly) raised inflorescence scars, solid or hollow, 7–11 mm in diam., densely puberulous, (dark) ferruginous, withering grey, sometimes with widely spaced long hairs, ultimately glabrous. Innovations villous. Stipules absent. *Leaves* spirally arranged, scattered along ends of branchlets; blade elliptic to obovate, (15–)20–40 by (8–)9–16 cm, chartaceous to subcoriaceous, apex (acute to) obtuse to rounded and 0–5 mm acuminate, base acute, or acute to rounded but ultimately attenuate, somewhat decurrent along upper side of petiole; above (yellowish) brown thin-sericeous, often interspersed with long simple hairs, ultimately intercostals glabrous, midrib and nerves withered puberulous; below densely (rich-) red-ferruginously subsericeous, withering to light brown or grey; midrib shallowly grooved to flat and sometimes crested above, very prominent and rounded below; secondary nerves 11–20, at 55–70°, straight or slightly curved, near margin diminishing until inconspicuous or (partly) joined by thickened tertiary nerves, flat or slightly raised above, prominent below; tertiary nerves transverse, more or less sinuous, widely spaced, faint to prominulous above, prominulous below; petiole 20–55 by (2–)3–4 mm, flat above, rarely proximally canaliculate, base not or slightly thickened, indument as lower side of leaf blade. *Inflorescences* between (and below) the leaves, multi-florous, often containing flower(bud)s of different ages, leaving rather bulgy scars. In *Hoogland 4258* cleistogamic flowers. *Pedicel* slender, 10–22 by 0.6–1 mm, ferruginously or light brown puberulous. *Calyx* 5- or 6-lobed; outside ferruginously or light brown puberulous, also the parts covered in bud, these ciliate; tube 1–2 mm long, inside glabrous; outer lobes (broadly) elliptic to (broadly) ovate, 2.3–3.3 by 1.7–3.3 mm, apex acute to rounded, base straight to rounded, inside thinly sericeous, base almost always glabrous; inner lobes (broadly) elliptic to ovate, 2–3.2 by 1.7–3.5 mm, otherwise similar to outer lobes. *Corolla* exsert, greenish cream, pinkish red, or crimson, 5- or 6- (or 7-)lobed, 5.5–7 mm long, glabrous, lobes not ciliate; tube 2–3.5 mm long; lobes elliptic to ovate, 2.5–4.5 by 2–3 mm,

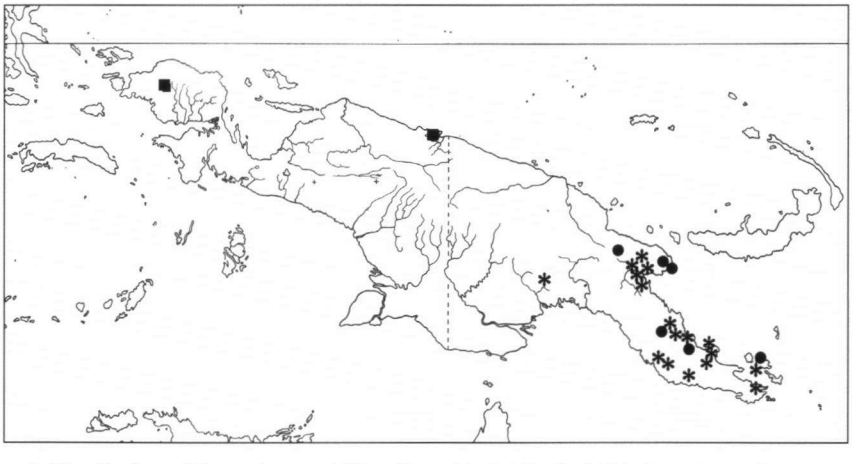
apex rounded. *Stamens* exsert, 5 or 6, inserted in corolla throat, glabrous; filaments cylindrical, 4–7 mm long, apical 0.5–1 mm curved outwards both in bud and in open flowers; anthers ellipsoid to ovoid, 1.5–2 by 0.5–1 mm, apex obtuse with an acute or 3-toothed mucro, base cordate. *Staminodes* 5 or 6, inserted in sinuses of corolla lobes, subulate to narrow lanceolate, sometimes crested on the back, 1.5–3 mm long, glabrous, apex acute, base not or slightly widened, sometimes with 1 or 2 teeth. *Disk* for 1/4–3/4 adnate, 5- or 6- or irregularly lobed, lower outside glabrous, otherwise free part on all sides densely light ferruginously short-villous. *Ovary* 5- or 6-celled, cellular part surrounded by adnate part of disk, free part conical to cylindrical, 0.4–0.7 by 1 mm, light-ferruginously villous; style subulate, sometimes 5-sided, 5–6 mm long, glabrous but usually basal 0.7–1 mm villous as ovary; stigma indistinct. *Infructescences* below the leaves, slightly burly. *Pedicel* terete, 15–37 by (2–)3–6 mm, thickened below calyx, (sub)glabrous. *Calyx* 9–10 mm in diam., lobes spreading, eroded. *Fruit* 1–4-seeded, spindle-shaped to ellipsoid, 4–7.5 by 2–3.5 cm, apex acute (or attenuate) to truncate, with tiny style remnant, base (acute) to attenuate; glabrous, black, ultimate base with a disappearing ring of villous hairs above a glabrous ring (disk); pericarp in sicco 2–4 mm thick. *Seed* spindle-shaped to ellipsoid, laterally flattened, 24–47 by 9–19 by 6–10 mm, apex acute to apiculate, base acute, testa (sub)nitidous, light to dark brown, 1–2 mm thick; scar as long as seed, 2–5 mm wide; embryo unknown.

Distribution — South and East Papua New Guinea (21 collections seen).

Ecology — Canopy tree in riverine, floodplain, dryland, and hill forests at 8–400 m altitude. Van Royen (his collection *4172)* reports a forest dominated by *P. anteridifera.* Another precision is *Lithocarpus–Calophyllum*-forest *(NGF 20132).* There is no distinct pattern in reported flowering and fruiting times.

Vernacular names — Papua New Guinea: Daga language: Inamat; Kiwai: Koio; Wanigela: Komakomar; Onjob, Koreaf: Mo'a, Mowa; Orokaiva language, Mumuni: Soriho.

Uses — Exudate used as a bird lime, wood not used *(Pullen 8327).*



Map 4. Distribution of *Pouteria anteridifera* (Lane-Poole) Baehni (✱), *P. cyclopensis* (P. Royen) T.D. Penn. (■), and *P. kaernbachiana* (Engl.) Baehni (●).

Notes — *Kajewski 1903*, the only report for *P. anteridifera* from the Solomon Islands (Van Royen, 1957), was later accepted as *Palaquium erythrospermum* H.J. Lam (Van Royen, 1960: 474).

Palaquium komakomar was described as with its very young fruits being brownish tomentose. In fact, at this very young stage the fruit body (above the villous disk) has the lower half with subappressed soft rather long light ferruginous hairs whereas the apical half is subglabrous. In the other material no fruits in this very young stage are available, but later stages show some scattered hairs near the fruit base. Probably this indument forms the remains of the hairs at the apex of the ovary and of the adjoining base of the style, and disappears very soon.

There is a manuscript note of Lam that in his key (Lam 1932: 559) *Planchonella anteridifera* was mistakenly arranged under the lead "6.c. leaves glabrous".

Material seen:

NEW GUINEA. **Papua New Guinea**. Gulf Prov. Seribi nr Middletown, A.P.C. logging area, *Floyd c.s. NGF 8061* (L) fr. – Morobe Prov. Lae Subprov., Gwabadik, towards Gawam, 365 m alt., *Takeuchi 8788* (L) y. fr.; Butibum R., 11 km N of Lae, 30 m alt., *Hartley 9851* (L) y. fr.; Gnalan Bumbum, 60 m alt., *Havel NGF 17220* (L) fl.; Bumbu area, 50 m alt., *Vickery NGF 1398* (L) y. infl.; Trans Busu Timber Lease, E of Lae, 180 m alt., *Van Royen 4172* (L) fr.; Lae, 8 m alt., *White c.s. NGF 1535* (BRI) fl., fr.; Oomsis, 30 m alt., *White NGF 10345* (L) fl., y. fr.; Markham Point, 270 m alt., *Van Royen NGF 20132* (L) old fl., y. fr.; Salamaua, *Williams 154* (BRI), y. infl. – N Prov. Divinakoiari village nr Saiho, 150 m alt., *Womersley & Coode NGF 24840* (L) fr.; Pitoki village, 3 km S of Kokoda, 400 m alt., *Hoogland 3980* (L) y. fr.; Buna Hinterland, 15 km N of Embi Lakes, 15 m alt., *Smith NGF 1259* (BRI, L) y. fl., fr.; Buna, *Lane-Poole 161* (BRI, holotype) fl.; Tufi Subprov., 5 km N of Wanigela airstrip, 100 m alt., *Hoogland 4258* (L) cleistogamic fl.; Budi Barracks, 75 m alt., *Hoogland 4521* (L, holotype of *Palaquium komakomar)* y. fr. — Milne Bay Prov. Mt Suckling, Mayu Camp I, 360 m alt., *Leach NGF 33293* (L) fl.; Mayu R., E of Mt Suckling, 365 m alt., *Pullen 8327* (L) fl.; Sagarai R., 60 m alt., *Henty & Katik NGF 42931* (L) fr.; Fergusson Is., between Gamwabila and Tutubea, 200 m alt., *Croft c.s. LAE 68753* (L) fr. – Central Prov. Sogeri, *Heather NGF 2838* (L); Koitaki, 350 m alt., *Carr 12607* (L) fl., *12608* (L) fr.; Yamu village, Mori R., 15 km NE of Cape Rodney, 30 m alt., *Pullen 8203* (L) fl.

15. **Pouteria** (sect. *Pierrisideroxylon*) **cyclopensis** (P. Royen) T.D. Penn. — Map 4

Pouteria cyclopensis (P. Royen) T.D. Penn. (1991) 201. — *Planchonella cyclopensis* P. Royen (1957) 430, 333, f. 29. — Type: *Van Royen 3770* (holo L).

Tree 20–25 m high, bole c. 17 m, diam. above buttresses 25–70 cm; buttresses 1–1.5 m high, spreading 0.7 m, 10 cm thick. Bark smooth but horizontally cracked; slash pink to red. Branchlets stout, with flattened sides and with more or less distinct ribs, solid, densely ferruginously puberulous over silvery appressed hairs, withering brown to blackish. Innovations villous. Stipules absent. *Leaves* spirally arranged, scattered; blade elliptic to subobovate, 10–28 by 7–15 cm, subcoriaceous, apex obtuse to rounded and 0–1.2 cm acuminate, base obtuse to acute, usually tapering (obliquely) towards petiole; above glabrous with indument remnants on midrib and secondary nerves; below with 2 layers of hairs: dense, short, appressed, light ferruginous hairs, overtopped by well-spaced, rather long, erect, branched, dark ferruginous hairs, the latter denser on midrib and nerves; midrib above (impressed and) narrowly crested, or broad and flat to raised in basal half of blade, below very prominent and rounded to triangular; secondary nerves 12–18, at 60–70°, straight to slightly curved, near margins diminishing

until inconspicuous to archingly joined, prominulous above, prominent below; tertiary nerves transverse, more or less sinuous, widely spaced, flat to slightly impressed above, prominulous below; petiole 30–50 by 2–3 mm, above flat to slightly convex or narrowly (closed) canaliculate and proximally flat, base often somewhat thickened, indument as branchlets. *Inflorescences* between and below the leaves, 8–multi-florous, leaving slightly bulgy scars. Pedicels (4–)8–16 by 0.6–0.9 mm, elliptic to triangular in cross section, in very young fruits 2 mm thick; with dense appressed silvery hairs overtopped by rather dense patent light brown hairs. *Calyx* 5–7-lobed, somewhat constricted at base of lobes; indumentum outside as pedicels but more dense, parts covered in bud more silvery as patent hairs are lacking there; tube 0.5–1.5 mm, glabrous inside; lobes triangular-ovate, (sub)acute; outer lobes 1.5–3 by 1.3–3 mm, base rounded to straight, inside (apically) shortly silvery puberulous; inner lobes 1.5–3 by 1.5–3 mm, base eared, marginal zone membranous, margins ciliate, inside (apical-)centrally minutely silvery sericeous. *Corolla* exsert, 5- or 6- (or 7-)lobed, 5–6.5(–7.5) mm long, glabrous but apices (minutely) ciliate; tube 2–3 mm long; lobes ovate to oblong, 2–2.5(–3.5) by 1.5–2.7 mm, subtruncate to rounded, base straight. *Stamens* exsert, 5–7, inserted in corolla throat, glabrous; filaments subulate to cylindrical, in closed corolla recurved outwards, thin apical part curved upwards, 2.5–4 mm long; anthers basi-dorsifix, ovoid, 0.8–1.5 by 0.3–0.8 mm, apex acute and 0.2 mm mucronulate, base cordate. *Staminodes* 5 or 6, inserted in sinuses of corolla lobes, subulate or lanceolate, 1–2 mm long, glabrous, apex sharply acute, base narrow or widened up to 0.3–0.5 mm and than sometimes shouldered or toothed. *Disk* ringshaped, for 0.3–0.5 adnate, 0.8–1 mm high, 0.2–0.3 mm thick, adnate part thicker and glabrous, free part light yellow brown villous. *Ovary* ovoid, 0.8–1 by 0.8–1 mm, lower half containing the locules and adnate to disk, free part villous as disk; style exsert, cylindrical, 3.5–4.5 mm long, glabrous or at base slightly villous. *Infructescences* between and below the leaves, not burly. *Pedicel* terete, 12–20 by 3–6 mm, apically thickened, lenticellate and glabrous or smooth and glabrescent. *Calyx* lobes appressed to fruit to recurved, somewhat incrassate, apices often eroded. *Fruits* 1- or 2-seeded, ellipsoid to obovoid, up to 40 by 24 mm, apex rounded to indented, with or without slightly thickened style base which only in hairy fruits is surrounded by a trace of a ring of appressed hairs, base cuneate; glabrous or densely light ferruginously patent hairy and glabrescent, ultimate base with a ring of villous hairs above a glabrous ring (disk); pericarp in sicco 3.5–6 mm thick. *Seed* spindle-shaped, 18–22 by 7–10 by 6–7 mm, apex acute to rounded, base obtuse; testa nitidous, dark brown, yellowish brown along scar, 0.4–0.6 mm thick; scar almost as long as seed, 2.5–3 mm wide; embryo (fide Van Royen): cotyledons foliaceous, albumen copious, radicle unknown.

Distribution — West New Guinea (4 collections seen).

Ecology — In the Cyclops Mts: Rather common in Sapotaceae–*Nothofagus*-forest on clayey soil with serpentine rocks at 920–1040 m altitude. Flowering and fruiting: October. In the Vogelkop Peninsula: Primary and old secondary forest with *Sloanea aberrans* (and also *Chionanthus, Ceratopetalum* and *Lithocarpus*) on clayey soil at c. 450 m altitude. Flowering: March and November; fruiting: November.

Vernacular name — Maibrat language: Asi tefetiah.

Notes — This species takes – both geographically and morphologically – a position between *P. vrieseana* and *P. anteridifera.*

On the lower leaf side the indument consists of two layers of hairs: closely appressed hairs as in *P. anteridifera* combined with erect hairs as in *P. vrieseana*. In the material from the Ayawasi area there is, however, an unexpected variability: *Ridsdale 2174* has an indument similar to that of the type from the Cyclops Mts; in *Ridsdale 2421* the layer of appressed hairs is very thin to discontinuous; and in *Polak 1365* appressed hairs are only found on nerves and stronger veins. This variation is not accounted for by differences in age or habitat.

In the type specimen the fruit is densely patently hairy as in *P. vrieseana*.

Except for the indument of leaves and fruits, the type of *P. cyclopensis* does not really differ from *P. anteridifera* which occurs far more easterly in Papua New Guinea (see Map 4):

	P. vrieseana	*P. cyclopensis*	*P. anteridifera*
petiole (mm)	7–25	30–50	20–55
secondary nerves	(14–)18–30	12–18	11–20
pedicel (mm)	20–45	(4–)8–16	10–22
sepal length (mm)	3–4.5	1.5–3	2–3.3
margin inner sepal glabrous	+	– (or ±)	–
corolla length (mm)	6–10	5–7.5	5.5–7

However, the specimen *Ridsdale 2174* (fl., fr.) from Ayawasi has – except for the basal ring of disk hairs – completely glabrous fruits as in *P. anteridifera*.

I do not see how to reach a satisfactory taxonomic solution for these Irian Jaya specimens and therefore I unite them into this 'dustbin species'.

Material seen:

NEW GUINEA. **Irian Jaya**. Subprov. Sorong. Surroundings of Ayawasi, c. 450 m alt., *Polak 1365* (K, L; BO, MAN, n.v.) ster., *Ridsdale 2174* (A, L, LAE) fl., fr., *Ridsdale 2421* (CANB, L) fl. – Subprov. Jayapura. Cyclops Mts, 920 m alt., *Van Royen 3770* (type, L) old fl., fr.

16. Pouteria (sect. *Pierrisideroxylon*) kaernbachiana (Engl.) Baehni — Map 4

Pouteria kaernbachiana (Engl.) Baehni (1942) 338; T.D. Penn. (1991) 201; Lemmens (1993) 369. — *Sideroxylon kaernbachianum* Engl. (1895) 102; K. Schum. & Lauterb. (1900) 493; K. Krause (1923) 476. — *Planchonella kaernbachiana* (Engl.) H.J. Lam (1925) 200; (1927) 467; (1932) 561, t. 110; P. Royen (1957) 332. — Type: *Kaernbach 19* (B†); neotype (P. Royen, 1957): *Carr 15562* (L).

Tree 24–30 m high. Branchlets rather slender to stout, with flattened sides or with rounded ribs, often becoming terete, solid, rarely hollow, 5–9 mm in diam., dark ferruginously tomentose withering grey. Innovations dark ferruginously tomentose. Stipules absent. *Leaves* spirally arranged, scattered along ends of branchlets; blade (elliptic-)obovate(-spathulate), 14–35 by 7–15 cm, papyraceous to subcoriaceous, apex mostly rounded or obtuse and up to 5 mm acuminate, base cuneate to acute, often ultimately abruptly narrowed to subtruncate; above with whitish soft appressed hairs, on midrib and secondary nerves usually becoming grey and intercostals soon becoming glabrous, below with widely spaced erect branched dark reddish ferruginous hairs, these dense on midrib and nerves, rarely (Fergusson Is.) underlain by dense whitish appressed hairs; midrib flat, sometimes slightly raised or impressed above, very prominent and rounded below; secondary nerves 11–23, at 50–80°, straight to

slightly curved, near margins diminishing until inconspicuous or joined by thickened tertiary nerves, prominulous or rarely slightly impressed above, (very) prominent below; tertiary nerves transverse, more or less sinuous, well-spaced, faint but distinct or sometimes prominulous above, prominulous to prominent below; petiole 5–20 by (2.5–)3–4(–5) mm, flat and rarely slightly crested above, rounded or sometimes slightly angular below, base not thickened, reddish ferruginously tomentose, withering grey. *Inflorescences* between the leaves, multi-florous, leaving slightly bulgy to flat scars. Flowers bisexual, sometimes male (fide Lam). *Pedicel* rather slender, 4–11 by 1–1.5 mm, ferruginously (appressed-)tomentose. *Calyx* 5-lobed; outside ferruginously tomentose, also parts covered in bud, apices often with tufts of dense ferruginous to blackish brown hairs; tube 1–1.5 mm, inside glabrous; lobes inside puberulous to appressed-tomentose but glabrous towards base and along basal parts of margins; outer lobes elliptic to ovate, 2.5–3.4 by 3–3.5 mm, apex acute to rounded, sometimes shortly acuminate, base straight to rounded; inner lobes ovate to orbicular, 2.5–3 by 2–3 mm, apex as outer lobes, base rounded or sometimes eared. *Corolla* exsert, greenish, 5-lobed, 5–6.5 mm long, glabrous but apices sometimes ciliate; tube 2.5–3.5 mm; lobes elliptic to ovate, 2.5–4 by 2–2.5 mm, apex broadly rounded to truncate. *Stamens* exsert, 5, inserted in corolla throat, glabrous; filaments subulate, apical 1 mm curved outwards both in bud and in open flowers; anthers ovoid, 1.5–1.7 by 0.7–1 mm, apex apiculate or mucronulate, base cordate. *Staminodes* 5, inserted in sinuses of corolla lobes, lanceolate, 1.5–2.2 mm long, glabrous, apex acute, base widened and with shoulders or teeth. *Disk* for 1/4–3/4 adnate, ring-shaped, erect to slanting, 0.5–1 mm high, 0.2–0.3 mm thick, outside more or less distinctly 5-lobed, densely short-villous, basal half to two-thirds glabrous. *Ovary* 5-celled, cells surrounded by adnate part of disk, distal free part conical, c. 0.5 by 0.5 mm, short-villous; style cylindrical, 4–5 mm long, slightly exsert, glabrous; stigma indistinct. *Infructescences* between and below the leaves, slightly to not burly. *Pedicel* terete, 8–14 by 3–7 mm, thickened at apex and sometimes at base, with remnants of indument. *Calyx* appressed to fruit, tube ruptured, 1 mm long, lobes not enlarged, indument withered. *Fruit* ellipsoid to obpyriform, 62–80 by 26–40 mm, apex acute to attenuate, ultimately often depressed, style complete and then 4 mm but mostly broken off, base cuneate to attenuate; tomentose when young, with indument remnants when mature, base with disappearing ring of hairs on top of a glabrous ring (disk); pericarp in vivo 4–7 mm thick. *Seeds* spindle-shaped, 41(–50, fide Van Royen) by 15–16 by 12–14 mm, apex narrowly rounded, base acute; testa dark brown, nitidous, 2–2.5 mm thick; scar as long as seed, 7–9 mm wide; cotyledons foliaceous, radicle cylindrical, 5–7 by 1.5 mm; albumen copious.

Distribution — East Papua New Guinea (8 collections known).

Ecology — Canopy or subcanopy tree in primary or secondary forest (once reported as *Castanopsis–Lithocarpus*-forest) at 800–1500 m altitude. Presently there is too little material to establish flowering (Jan., ex litt.; Febr., Nov.) and fruiting (Febr.) times.

Uses — In Isuarava the very sticky latex used as bird lime.

Vernacular names — Biagi language: Nigu; Sattelberg: Natŭ.

Notes — The specimen from Fergusson Is. deviates in its indumentum of the lower leaf side. As in all other specimens this indument consists on the intercostals of a single layer of well-spaced erect branched hairs leaving view on the epidermis, in the

Fergusson specimen the epidermis is obscured by an additional layer of light-coloured appressed hairs. The latter case is completely comparable to the indument of *P. cyclopensis*.

Lam (1932: 553) has seen and depicted (t. 96) the sterile specimen *Schlechter 16200*, one of the two syntypes of *Palaquium densivenium* K. Krause (1923: 469). He was unable to distinguish it from material of *Planchonella kaernbachiana*. The other syntype, *Schultze 43*, a flowering specimen, was not seen by him. Van Royen (1960: 597) could not trace any of these specimens any more.

However, Krause's analysis of the flowers of *Palaquium densivenium* differs from the above description: pedicels 1–2 cm long, calyx lobes (their number not mentioned) sericeous outside (and apparently glabrous inside) and 5–6 mm long, style 2 cm long. Therefore, it is highly unlikely that these two species are synonymous.

Material seen:

NEW GUINEA. **Papua New Guinea**. E Highl. Prov. Kassam, 1370 m alt., *Brass 32395* (L) fl. – Morobe Prov. Sattelberg, 1050 m alt., *Clemens 2030* (L) ster.; Sattelberg, 900 m alt., *Kaernbach 19* (ex litt.). – N Prov. Isuarava, 1380–1500 m alt., *Carr 15372* (L) fl., *15373* (L) y. fr., *15420* (L) fl., *15562* (L, neotype) fr.; Managalase area, Siurane, S side of Hydrographers Ra., 1100 m alt., *Pullen 5467* (CANB) fr. – Milne Bay Prov. D'Entrecasteaux Is., Fergusson Is., between Agamoia and Ailuluai, 900 m alt., *Brass 27014* (L) y. fr.

17. Pouteria (sect. *?Pierrisideroxylon*) keyensis (H.J. Lam) Baehni — Fig. 5, Map 5

Pouteria keyensis (H.J. Lam) Baehni (1942) 210; M. Harley (1991) 32, f. 10F (photo pollen grain). — *Planchonella keyensis* H.J. Lam (1925) 197, f. 54; (1927) 467 '*kaiensis*'; P. Royen (1957) 354; Chr. Versteegh (1958) 2, 4". — Type: *Jaheri 138* (holo BO; iso L).

Ramiflorous tree (10–)15–30(–35) m high; crown usually small and compact; bole straight, rarely crooked, 9–24 m, 25–45(–75) cm in diam., often fluted, sometimes throughout its length; buttresses 0–2.5 m high, sometimes steep, spreading up to 2 m, 2–7 cm thick. Bark smooth and (greenish) grey to brown, but often peeling scaly or flaky and thereby becoming dippled green and/or rusty in a variety of shades (several times described as "like *Eucalyptus deglupta*"), under bark green, inner bark from white to light red or light orange, sometimes banded or mottled, sometimes green, inside of inner bark light yellow to pink, but usually white. Wood hard; sapwood 1.5–9 cm, white to pink or light brown; heartwood pink to (reddish) brown. Branchlets slender to rather slender, angular and smooth or ribbed, becoming terete, solid, 1–4 mm in diam., from ferruginously tomentose or grey sericeous and ultimately glabrescent to glabrous, but then often tips sericeous or with scattered hairs, glabrous parts grey to brown to black; terminal bud ferruginously sericeous to tomentose, becoming grey; innovations ferruginously (short) tomentose on either side, (rather) soon glabrescent. Stipules absent. *Leaves* spirally arranged, scattered along old and/or young branchlets; blade elliptic to oblong to (narrowly) oblanceolate, 4–25 by 1.7–8 cm, (chartaceous to) subcoriaceous (to coriaceous), apex acute to obtuse (to rounded), 0–1.5 cm acuminate, base acute to cuneate and attenuate, decurrent along upper part of petiole; glabrous on either side but often with some indument remnants on midrib and base; midrib above flat to concave (to prominent) and crest if present minute, below rounded (to triangular), (somewhat) prominent; secondary nerves c. 15–40 not (all) defined against tertiary nervation, at 60–75(–80)°, straight, near margin connected

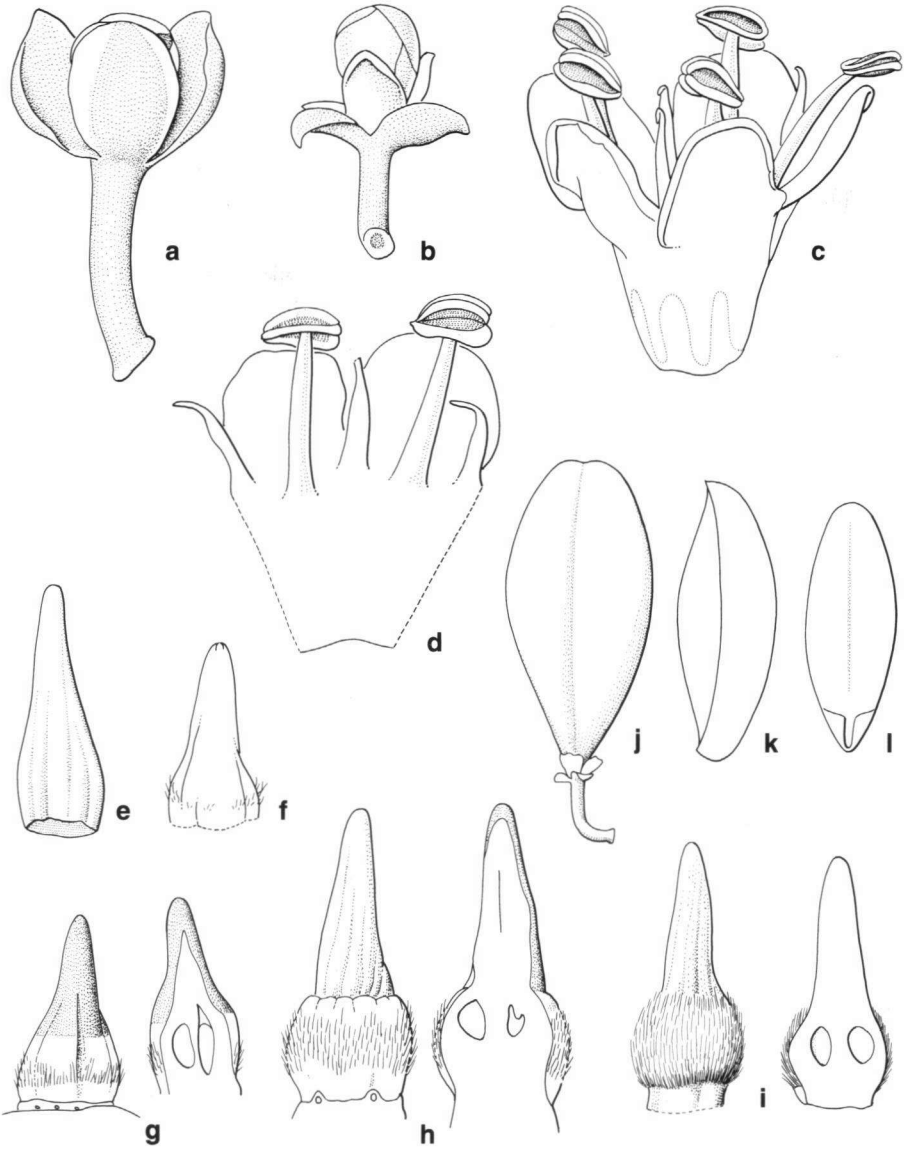
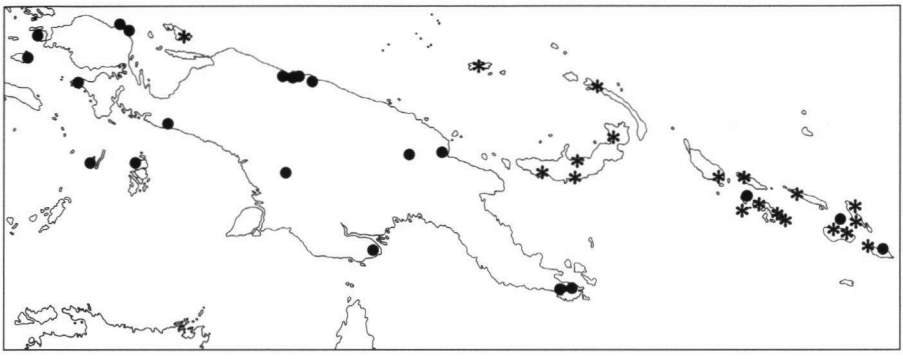


Fig. 5. *Pouteria keyensis* (H.J. Lam) Baehni. a, b. Differences in bud size, × 6: a. corolla still enclosed, b. closed corolla exsert; c. corolla with androecium, × 6; d. inside of part of corolla, × 6; e–i. gynoecia showing differences in indumentum, × 12.5; j. fruit, × 1; k. seed, × 1; l. embryo embedded in albumen, × 1 (a: *NGF 16946*; b, g: *BW 33*; c, d, h: *Van Balgooy 6567*; e: *BW 4442*; f: *BW 2195*; i: *NGF 13191*; j–l: *BW 4883*).

by thickened tertiary nerves, above prominulous (to faint), below faint but distinct; tertiary nerves parallel-reticulate, often more or less descending, above faint to inconspicuous, below faint but usually distinct; petiole (3–)5–25(–30) by 1–3.5 mm, above flat to concave, laterally ridged, below rounded, base if thickened only slightly so, ferruginously or grey sericeous (or tomentose) and glabrescent, or glabrous. *Inflorescences* on bare branches at least 7 mm thick, throughout the crown, 3–multi-florous, often aggregated, 1.5–2 mm high, 2–10 mm in diam. *Indument* of flower parts silvery. *Pedicel* rather stout, terete (or angular) and smooth (or ribbed), (1.5–)2–8 by 0.5–1 (–1.2) mm, apically not appreciably (or slightly) thickened. *Sepals* 5, free, outer sepals ± patent, inner sepals ± erect (also in fruit), (depressed-)orbicular to broadly elliptic or broadly ovate, apex broadly rounded, inside glabrous; outer sepals 3–5.2 by 3–6.5 mm, outside glabrous, margins glabrous; inner sepals 3–4 by 2.5–6 mm, base rounded to eared, outside short-sericeous except along the ciliate margins. *Corolla* exsert, infundibular, 5-lobed, 5–7.5 mm long, inside glabrous, outside lobes short-sericeous except along the non-ciliate margins, tube short-sericeous to glabrous but usually partly sericeous below the medians of the lobes; tube cylindrical, 3–4 by 1.2–1.5 mm; lobes depressed-orbicular to broadly elliptic or obovate, 2.3–3.5 by 1.7–3.5 mm, broadly rounded, base straight to eared. *Stamens* 5, exsert, inserted in corolla throat; filaments straight and cylindrical, apex thinner and curved outwards, 3–3.5 mm long, glabrous; anthers basi-dorsifix, ovoid, 1.3–2 by 0.5–1 mm, apex acute and mucronate, base cordate, ventral connective usually more or less short-sericeous, in sicco anthers often open in closed buds probably artefact: closed in alcohol material. *Staminodes* 5, included, inserted in sinuses of corolla lobes, lanceolate-linear to linear or subulate, 1.4–2.8 by 0.2–0.5 mm, carinate, glabrous, apex sharply acute to slightly widened and then obtuse, truncate, or minutely bifid. *Gynoecium* obpyriform, 2.5–3.5 by 1–1.3 mm, with compitum. *Disk* apparently completely adnate, shallowly 5-lobed, on longisection often visible by darker tissue up to halfway the locules, 0.2–0.5 mm high, outside glabrous, apically (glabrous or) with c. 10 triangular groups of short straight hairs, to hairy. *Ovary* 5-celled with cells (partly) above top of 'disk'; 1–1.5 mm high, free apical part semiglobose to conical, c. 10-ribbed (or smooth), glabrous *(BW 4442)* to short-hairy as disk apex (*NGF 13191*); style narrowly conical, 1.5–2 mm long, basal part ribbed as ovary, upper part terete, glabrous; stigma indistinct. *Infructescences* as inflorescences, not or slightly enlarged. *Pedicel* 4–9 by 1.2–2.3 mm, apex not appreciably thickened. *Sepals* positioned as in flower, not incrassate; base of calyx often thickened. *Fruit* 1- or 2-seeded, ellipsoid to obovoid, 21–40 by 12–24 mm, apex (obtuse to) rounded, often somewhat oblique, ultimate apex often slightly sunken and containing the 0.5–1.5 mm long style, base acute to rounded, glabrous, just above glabrous base with a ring of hairs (disk); pericarp in vivo (dark) red to purplish black, fleshy, in alcohol 3–5 mm thick, in sicco 0.2–1 mm thick. *Seed* ellipsoid to spindle-shaped, 25–37 by 10–16 by 7–15 mm, apex rectangular to obtuse, base acute to rounded, testa light to dark brown, dull, brittle, 0.2 mm thick; scar as long as seed, width c. 40% of circumference of seed, apex acute to obtuse, base acute; albumen in 2 planoconvex lobes united at base and with impression of embryo; cotyledons foliaceous, ovate or elliptic to oblong, 17–26 by 11–12.5 mm, apex (narrowly) rounded, base truncate; radicle cylindrical, 4.5–5 by 1.6–2 mm, enclosed by albumen to for one third exsert. Dry *wood* light reddish brown, hard, s.g. 0.88 (0.78–0.97, n = 7).



Map 5. Distribution of *Pouteria keyensis* (H.J. Lam) Baehni (●) and *P. thyrsoidea* (C.T. White) T.D. Penn. (✱).

Distribution — Kei Is., Aru Is., New Guinea, Solomon Is. (30 collections seen).

Ecology — Very variable. Scarce or scattered, but usually locally (rather) common; in primary (or old secondary) forests on well-drained ridge tops, along water courses, as well as on marshy terrain or terrain inundated in the wet season, near Oriomo associated with *Acacia*, near Vanimo in littoral beach forest on shore line; on clay, sandy clay, clayey gravel, and limestone with thin clay cover; at 1–250 (and 1980) m altitude. Flowering: May to October; fruiting: July to February. On Aru Is. flowers visited by parrots (fide Van Balgooy).

Vernacular names — Aru Is.: local language: Giàwas hutan (= *"Eugenia* from the forest"). — Irian Jaya: Amberbaken language: Nero-u, Nifok; Awyu language: Jangkioh [Tanah Merah], Jegenie [Djair dial.]; Kemtuk language: Idom; Manikion language: Kabau, Sekouwguwa, Ugwokko; Nyau language: Temajo; Sidei language: Nirow; Skou language: Aa. — Papua New Guinea: Enga language: Tell; Kiunga dialect: Tumore; Kaporaka village, Milne Bay: Gida bo'li. — Solomon Is.: Kwara'ae language (notes by T.C. Whitmore): Ainunura (means: 'clean tree', referring to the epiphyte- and climber-free bole) and Lilibaiko (means: 'like a shark', referring to a similarity in appearance).

Note — The sterile collection *ANU 2879* is the only specimen from an inland, higher-altitude location.

Material seen (*: also wood sample):

INDONESIA. **Moluccas**. Kei Is., *Jaheri 138* (BO, holotype; L, isotype) fl. buds; Aru Is., Wamar Is., 9 km S of Dobo, 10 m alt., *Van Balgooy 6567* (L) fl.

NEW GUINEA. **Irian Jaya**. Subprov. Sorong. Misool Is., nr Fakal, *Pleyte 1073* (L) y. fl.; Salawati Is., Kaloal, 5 m alt., *Koster BW 1365* (L) ster. – Manokwari Subprov. Sidei, 5–40 m alt., *Mangold BW 2195* (L*) y. fl., *Iwanggin BW 5859* (L*) ster., *Koster BW 4442* (L*) fl., *BW 4492* (L*) ster., *Schram BW 6185* (L*) y. fr., *Koster BW 6727* (L*) ster.; Bericreek nr Andai, 130 m alt., *Koster BW 11970* (L) ster. – Fakfak Subprov. Fakfak R., N of Fakfak, 250 m alt., *Vink BW 12145* (L) fr.; Mimika, Kamarè (Oeta), 2 m alt., *bb 32943 (exp. Lundquist 224)* (L) ster. – Jayapura Subprov. Janim Besar, SW of Lake Sentani, 70 m alt., *Kalkman BW 3790* (L*) ster.; Sekoli, S of Lake Sentani, *Schram BW 9457* (L*) ster.; Holtekang, E of Jayapura, 1.5–2 m alt., *Chr. Versteegh BW 33* (L*) fl., *Brouwer BW 859* (L*) ster. – Merauke Subprov. Digul R., Sabekahang, 10 m alt., *Chr. Versteegh BW 4883* (L) fr. — **Papua New Guinea**. W Sepik Prov. Vanimo Subprov., Waterstone forestry station, mouth Wasu Crk, 6 km ESE of Vanimo, 1 à 2 m alt., *Wiakabu et al. LAE 50616* (L)

fr. – Madang Prov. Madang Subprov. Gogol R., 30 m alt., *Katik NGF 46665* (L) fl. – W Highl. Prov. Wabag Subprov., Pokaris nr Kompiam, 1980 m alt., *Flenley ANU 2879* (L) ster. – W Prov. Daru Subprov. Oriomo R., 34 miles from coast, *McVeagh NGF 13191* (L) fl. buds; ibidem, below Peawa, 5 m alt., *Henty NGF 49580* (L) fl. – Milne Bay Prov. *L.S. Smith NGF 2109* (L) ster.; Cameron Plateau, headwaters Gumini R., *Womersley NGF 19302* (L) ster.; Kaporika village, 120 m alt., *Henty NGF 16946* (L) fl. buds.

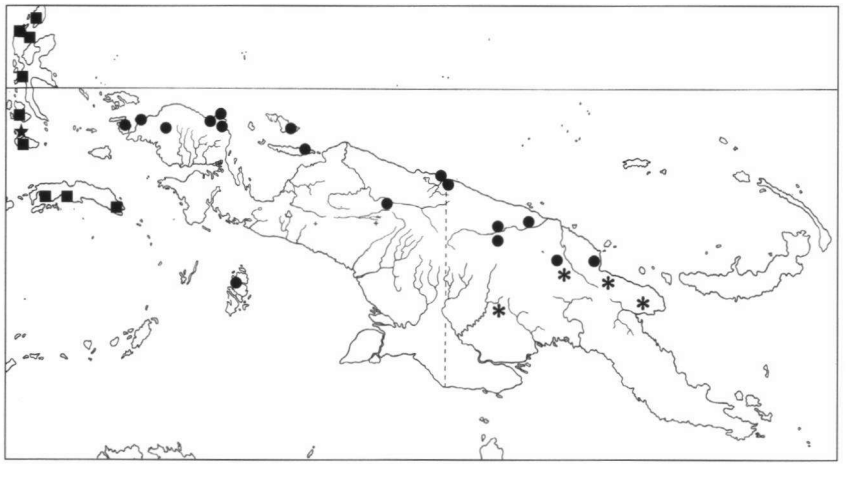
SOLOMON ISLANDS. E Vella Lavella, nr Navurai, 210 m alt., *Wall & Nakis BSIP 17503* (L) ster. – Nggela, Sole R., 30 m alt., *Mauriasi et al. BSIP 18159* (L) ster. – San Christobal, Wairaha R., 5 miles from coast, 150 m alt., *Whitmore BSIP 4246* (L) ster.; ibidem, 240 m alt., *Whitmore BSIP 4378* (L) y. fr.

18. **Pouteria** (sect. *Pierrisideroxylon*) **menait** Vink, *spec. nov.* — Map 6

Arbor. Ramuli tenues vel crassi, breve sericei, glabrescentes. Folia exstipulata, obovata vel raro late elliptica, (9–)15–38(–47.5) × (4.5–)8–16(–19) cm, papyracea vel subcoriacea, apice rotundato raro acuminato, basi acuta (vel attenuata) raro obtusa, subtus (sparse) abbreviate ferrugine sericea, interdum glabrescentia; nervi secundarii (7–)15–28 angulo (55–)60–70°, prope marginem sine conjunctionibus diminuentes; nervi tertiarii plus minusve sinuate transversi; petioli (1–)1.5–4(–6) cm longi, glabrescentes. Inflorescentiae multiflorae. Pedicelli 4–21 mm longi, breviter sericeo-tomentosi. Sepala (4–)6(–8), late ovata ad triangulari-ovata ad orbiculata, 1.5–2.3 × 1.8–3.5 mm, basi 1 mm connata, interiora basi auriculata, extus breviter sericeo-tomentosa (vel glabra), intus glabra. Corolla exserta (5- vel) 6- (vel 7-)lobata, 11 mm longa, glabra apicibus autem ciliatis ubi juventute; tubus 2.3–2.5 mm longus lobi 3.5–3.7 × 2–2.7 mm. Stamina 5–7, fauce inserta, glabra; filamenta tantum recurvata; antherae ovoideae apice apiculato basi cordata. Staminodia 2–6, apice acuto basi angustis vel dilatatis quadratis vel dentatis. Discus ovario adnatus apice discreto villosus extus basin versus glaber; ovarium 5- vel 6-loculatum, apice disco discreto glabro; stylus glaber 3–3.5 mm longus; stigma indistinctum vel minute lobatum. Fructus immaturus pedicello 10–28 × 2.5–4 mm, parce breviter sericeo vel glabro, sepalis erosis recurvatis 2.5–3 mm longis, 1–3-seminalis, ellipsoideus, 25–41 × 15–20 mm, glaber, supra basin annulo hispido; semen immaturum fusiforme ca. 30 × 5 × 5 mm, cicatrice equilonga angusta; embryo ignotus. — Typus: *Takeuchi 6276* (L).

Tree 18–46 m high, bole 7–35 m, diam. above buttresses 35–70 cm; buttresses 0–4 m high, spreading 0–4.5 m, 5–15(–20) cm thick. Bark (light creamish to) light to dark or reddish brown, smooth to little fissured, not (or little) peeling, 0.1–1(–2.5) mm thick; inner bark 8–14 mm thick, slash (light) brown to red, inside white to light brown. Wood not differentiated into sapwood and heartwood, white (to yellow or light- to red-brown). Branchlets slender to stout, with flattened sides or with rounded ribs, becoming terete, solid or hollow, (4–)5–10 mm in diam., short ferruginously sericeous (or velutinous), glabrescent. Innovations short ferruginously sericeous or velutinous. Stipules absent. *Leaves* spirally arranged, scattered along ends of branchlets; blade obovate, or rarely broadly elliptic, (9–)15–38(–47.5) by (4.5–)8–16(–19) cm, papyraceous to subcoriaceous, apex rounded, rarely with a rounded or acute short acumen, base acute (to attenuate), rarely obtuse, often oblique, shortly decurrent along upper sides of petiole; above with light brown to white soft appressed hairs, soon becoming glabrous, below short ferruginously sericeous (in Waskuk Hills specimens with scattered minute appressed silvery hairs), sometimes becoming glabrous; midrib flat to shallowly grooved and often (slightly) crested as well above, very prominent and rounded (or triangular) below; secondary nerves (7–)15–28, at (55–)60–70°,

(almost) straight, near margin diminishing until inconspicuous, sometimes (partly) joined by thickened tertiary nerves, flat but distinct to prominulous above, prominent below; tertiary nerves transverse, more or less sinuous, well-spaced, faint to prominulous on either side; petiole (10–)15–40(–60) by 2–2.5(–4) mm, canaliculate above, but usually distally canaliculate and proximally flat, rounded below, base usually not thickened, short ferruginously sericeous, glabrescent. *Inflorescences* between and below the leaves, multi-florous, containing flowers of about the same age, rarely leaving somewhat bulgy scars; sometimes also on only apically leafy lateral shoots. *Pedicel* rather slender, 4–21 by 0.5–1 mm, (thinly) light brown to ferruginously short sericeous-tomentose; sometimes a bracteole inserted halfway pedicel. *Calyx* (4–)6(–8)-lobed, lobes imbricate, outside (thinly) short sericeous or sericeous-tomentose, but parts covered in bud glabrous, or inner sepals glabrous, margins not ciliate, inside glabrous, apices often with tufts of hairs; tube 1 mm; outer lobes ovate to triangular-ovate, 1.5–2.3 by 1.8–2.5 mm, acute and apiculate to rounded to retuse, base somewhat rounded; inner lobes broadly ovate to triangular-ovate to orbicular, 2–2.3 by 2–3.5 mm, apex acute to retuse and often apiculate, base eared. *Corolla* exsert, (5- or) 6- (or 7-)lobed, 11 mm long, glabrous but apices ciliate when young; tube 2.3–2.5 mm; lobes elliptic-oblong, 3.5–3.7 by 2–2.7 mm, apex broadly rounded to retuse, base rounded. *Stamens* 5–7, included, inserted in corolla throat, glabrous; filaments subulate to cylindrical, in larger buds and open flowers apex curved outwards, 2.5–3.3 mm long; anthers ovoid, 1–1.5 by 0.5–1 mm, apex mucronulate, base cordate. *Staminodes* 2–6, inserted in sinuses of corolla lobes, subulate to ovate-lanceolate, 0.5–2 by 0.2–0.7 mm, glabrous, apex narrowly acute, base straight or widened and with shoulders or teeth. *Disk* for 0.3–0.5 adnate, 1–1.3 mm high, 0.5–0.8 mm thick, outside shallowly 10–12-lobed, adnate part glabrous outside, free part densely light brown villous on all sides. *Ovary* 5- or 6-celled, cells surrounded by adnate part of disk, apical free part ovoid to conical, 0.6–1.5 by 0.5–1.5 mm, glabrous (surrounded by hairs of disk); style cylindrical to ribbed, 3–3.5 mm long, exsert from closed corolla, glabrous; stigma



Map 6. Distribution of *Pouteria menait* Vink (●), *P. orkor* Vink (✱), and *P. vrieseana* (Burck) Baehni (■; ★ ex litt.).

indistinct or with 5 or 6 tiny lobes folded towards centre. *Infructescences* between and below the leaves, slightly burly. *Pedicel* terete or slightly angular, 10–28 by 2.5–4 mm, thickened at apex, very thinly short sericeous to glabrous. *Calyx* tube ruptured, lobes reflexed, 2.5–3 mm long, becoming eroded, glabrous on either side. *Immature fruit* 1–3-seeded, ellipsoid, 25–41 by 15–20 mm, apex rounded to acute, with tiny style remnant, base cuneate; glabrous, base surrounded by ring of hairs, but ultimate base largely glabrous (disk). *Immature seeds* spindle-shaped, 30 by 5 by 5 mm, apex acutish, base narrowly acute; scar as long as seed, narrow; embryo unknown. Dry *wood* creamish white, rather soft, s.g. 0.42 (0.35–0.49, n = 7).

Distribution — North New Guinea from Raja Ampat Is. to Madang (24 collections seen).

Ecology — Canopy tree scarce to common in primary lowland forest on well-drained land but also in river floodplain forest (Idenburg R.) or swamp forest (Waskuk Hills), on (sandy) clays, at 5–800 m altitude. Flowering and fruiting: May to January.

Vernacular names — Biak language: Siep; Manikion language: Menait; Maybrat language: Asi; Moi language: Aitimie, Megaes; Nemo language: Rihi; Ambunti area: Semen me.

Etymology — The vernacular name 'menait' was given to this species by the Manikion tree expert Jacob Ainjoessi, who worked in forest inventories between 1948 and 1962 and who proved to be an invaluable asset to the inventory teams, both by his expertise and his great personality (in a very small body).

Uses — Leaves used as wrapper for sago porridge; edible larvae obtained from dead wood (*Takeuchi & Regalado 10292*).

Notes — This species is close to *P. anteridifera*, but its calyx is glabrous on the inside and also on the outside on those parts that are covered in bud, and the longer petioles are (distally) canaliculate. From *P. vrieseana* the present species differs by the very short, appressed indumentum on the lower side of the leaves and the glabrous fruits.

Within *P. menait* the specimens from the western part of its distributional area differ from the others by sericeous instead of rather long patently hairy terminal buds; in the Waskuk Hills specimens the indument of leaves and flowers is exceptionally thin.

Material seen (*: also wood sample):

NEW GUINEA. **Irian Jaya**. Subprov. Sorong. Salawati Is., Kaloal, 8 m alt., *Koster BW 1432* (L*) ster.; Warsamson valley, 50–60 m alt., *Iwanggin BW 5604* (L*) fl. buds, *Schram BW 12276* (BO, L, LAE) ster.; E of Ayawasi, Fait ceweh, 440 m alt., *Polak 1360* (L) ster. – Subprov. Manokwari. Prafi, 100–250 m alt., *Koster BW 354* (L*) ster., ibidem, 150 m alt., *Bouwer BW 379* (L*) ster., *Schram BW 549* (L*) ster.; Noeni, 60 m alt., *Menusefer BW 8178* (L*; A, CANB, LAE, S, n.v.) fl. buds; Warmare, c. 20 km SW of Manokwari, 120 m alt., *Kokkelink BW 15579* (BO, CANB, L, LAE) ster. – Subprov. Biak–Numfor. Biak Is., near Mansforbo, 35–55 m alt., *V.W. Moll BW 9580* (L*; CANB, KEP, n.v.) ster., *BW 9649* (L*; A, BRI, CANB, KEP, LAE, S, n.v.) fl. buds, *BW 9651* (L; A, BRI, CANB, DD, KEP, LAE, P, n.v.) old fl. – Subprov. Yapen–Waropen. Yapen Is., Sumberbaba, *Koster BW 11169* (BO, CANB, L*; LAE, n.v.) ster. – Subprov. Jayawijaya. Idenburg R., Bernhard Camp, 800 m alt., *Brass & Versteegh 13158* (L) ster. – Subprov. Jayapura. Mouth of Tami R., 15 m alt., *Schram BW 2816* (L) old fl., y. fr.; Nemo (nr Mosso), alt. 5 m, *Schram BW 2778* (L*) ster. — **Papua New Guinea**. E Sepik Prov. Mt Hunstein, *Takeuchi 5327* (L) fl., ibidem, 450 m alt., *Takeuchi 6276* (L, holotype) fl. buds, y. fr.; Ambunti Distr., Wagu, 55 m alt., *Hoogland & Craven 10447* (L) y. fr.; Waskuk Hills, Garuka–Ambunti track, 30–150 m alt., *Takeuchi & Regalado*

10292 (L) fl., *Regalado & Takeuchi 1499* (L) fl. buds; Angoram Distr., upper Karawari R., 725 m alt., *Dornstreich 70* (L) ster. – Madang Prov. W of Aiome, rd to Akiapa, 90 m alt., *Frodin NGF 26929* (L) old fl.; Gogol, 30–40 m alt., *Kerenga LAE 73820* (L) y. fr.

Doubtful: Indonesia. Aru Is., Dosinamalaoe, 30 m alt., *bb (Buwalda) 25362* (L) ster.

19. Pouteria (sect. *Pierrisideroxylon*) **orkor** Vink, *spec. nov.* — Fig. 6, Map 6

Arbor. Ramuli crassi, conglutinate sericei, glabrescentes. Folia exstipulata, late elliptica, 18–36.5 × 13–24 cm, crasse chartacea, apice late rotundato vel usque ad 0.5 cm acuminato, basi late rotundata ultimo breviter angustata et acuta vel obtusa, supra argente undulate sericea, glabrescentia, subtus ferrugine ad olivace sericea vel rare tomentosa; nervi secundarii 14–21 angulo 70–80° prope marginem arcuate conjuncti; nervi tertiarii sinuati transversi; petioli 3.5–7 cm longi, glabrescentes. Inflorescentiae multiflorae. Pedicelli 9–12 mm longi, tomentosi. Sepala 5, late ovata ad triangulari-ovata, basi 1–1.7 mm connata, extus adpresse tomentosa, intus glabra; exteriora 2–2.5 × 2–2.5 mm; interiora 2–2.5 × 2.8–3.5 mm, basi rotundata ad auriculata, extus prope marginem non-ciliatum glabra. Corolla 5-lobata, ca. 6.5 mm longa, glabra vel extus aliquot pilosa; tubus ca. 3 mm longus, lobi ca. 3.5 × 2.5 mm. Stamina 5, fauce inserta, glabra; filamenta ca. 6 mm longa apice recurvato; antherae ovoideae apice apiculato basi cordata. Staminodia 5, subulata ad tenuiter lanceolata cum vel sine dentibus lateralibus, 1.5–2.5 by 1 mm, acuta, glabra. Discus annularis basi ovarii adnatus extus glaber apicaliter et intus hispidus; ovarium disco inclusum, 5-loculatum; stylus glaber, ca. 3.5 mm longus; stigma indistinctum. Fructus immaturus pedicello 13–17 × 3–7 mm, parce pilifero vel glabro, sepalis erosis patentibus, 2- vel 3-seminalis, obovoideus, 41–45 × 26–30 × 19–24 mm, glaber, supra basin annulo hispido; semen semi-ellipsoideum, ca. 24 × 12 × 9 mm, cicatrice fere equilonga ca. 3.5 mm lata; cotyledones foliaceae. — Typus: *Sayers NGF 21329* (holo L; iso BM; LAE n.v.).

Tree up to 30 m high; bole up to 15 m, dbh up to 60 cm, buttresses up to 1.5 m high, flanges up to 4 m high. Bark light (reddish) brown, shallowly fissured, lenticellate; inner bark light brown, speckled with orange or dark brown. Wood white or cream, strongly smelling of unripe mangoes. In innovations outer layer of indument consisting of hair-branches aligned parallel to the surface and cemented together into a rather smooth cover. Upon stretching of the branches and leaves this light (grey- to ferruginous-)brown layer breaks up, initially giving branches and petioles a scaly or scurfy appearance. The remaining indument is silvery to ferruginous, wavy-silky, but on the lower leafside of *Hoogland 9170* consisting of widely spaced non-appressed branched hairs. Branchlets 5–8 mm in diam., flattened and rounded-triangular in cross section, hollow or solid, more or less glabrescent. Stipules absent. *Leaves* scattered; blade broadly elliptic, 18–36.5 by 13–24 cm, strongly chartaceous, apex broadly rounded, 0–5 mm acuminate, base broadly rounded but ultimately shortly narrowed and acute to obtuse, often oblique, when mature above glabrous, below ferruginously to olivaceous silky or sericeous(-tomentose); midrib impressed above, strongly prominent and rounded to triangular below; secondary nerves 14–21, at 70–80° to the midrib, straight, near margin archingly joined, prominulous but distinct above, prominent below; tertiary nerves transverse, slender, well-spaced, more or less sinuous, prominulous on either side or prominent below; petioles 3.5–7 cm long, terete with a narrow closed groove (in distal part) above, base not to slightly thickened, glabrescent. *Inflorescences* with many (40–100) flowers, forming burls in axils of leaves, sometimes with buds in different stages of development. *Pedicels* 9–12 by 1–1.5 mm, brownish grey tomentose.

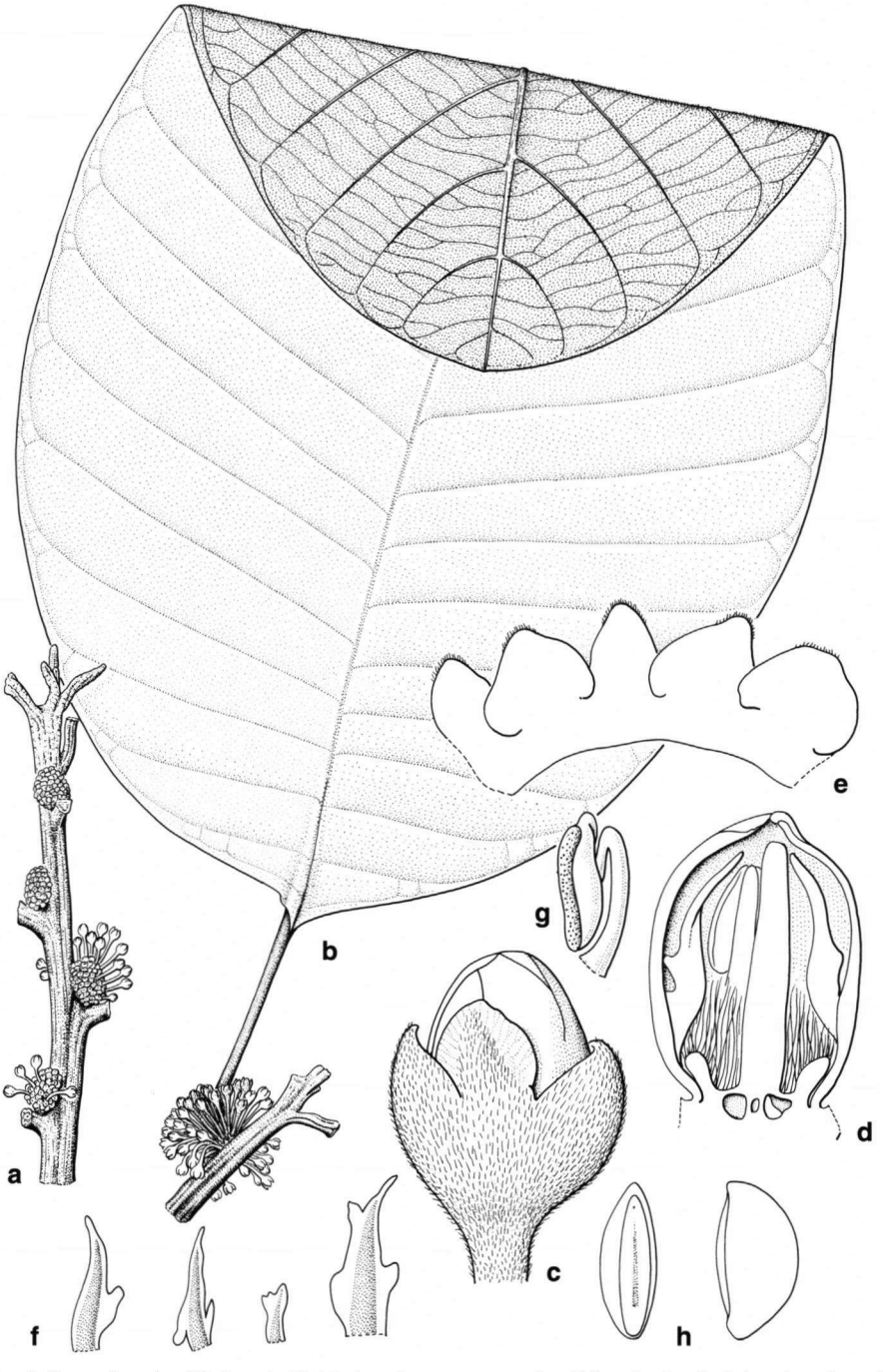


Fig. 6. *Pouteria orkor* Vink. a, b. Habit, in a. leaves removed, × 0.5; c. bud, × 6; d. longisection of bud, calyx removed, × 12; e. inside of calyx, × 6; f. staminodes from one bud, × 12; g. stamen from bud, filament curved, × 12; h. seed, × 1 (all: *NGF 21329*).

Calyx 5-lobed; (appressed-)tomentose outside, but margins covered in bud glabrous and not fimbriate, glabrous inside; tube 1–1.7 mm; outer lobes triangular-ovate, 2–2.5 by 2–2.5 mm, apex acute, base straight to rounded; inner lobes broad- to triangular-ovate, 2–2.5 by 2.8–3.5 mm, apex obtuse to rounded or truncate, base broadly rounded to eared. *Corolla* exsert, 5-lobed, c. 6.5 mm long, glabrous or outside with a few scattered hairs, margins not ciliate; tube c. 3 mm; lobes ovate, c. 3.5 by 2.5 mm, broadly rounded. *Stamens* 5, exsert, inserted in corolla throat, glabrous; filaments subulate, c. 6 mm, apical part recurved outwards in bud; anthers (no mature one seen) ovoid, apex (bifid-)apiculate, base deeply cordate. *Staminodes* 5, inserted in sinuses of corolla lobes, (angular-)subulate or narrowly lanceolate, with (or without) lateral teeth usually at base, 1.5–2.5 by 1 mm, acute, glabrous. *Disk* ring-shaped, basally adnate to ovary, 0.6–0.9 mm high, 0.3 mm thick, outside glabrous, at top short and on inside long very light brown villous. *Ovary* completely surrounded by adnate part of disk, 5-celled; style c. 3.5 mm, glabrous; stigma indistinct. *Fruits* 2- or 3-seeded. *Pedicel* 13–17 by 3–7 mm, with some scattered hairs or glabrous. *Calyx* eroded, remnants patent. *Immature fruits* obovoid, 41–45 by 26–30 by 19–24 mm (in vivo said to be 75 by 62 mm, fallen fruits said to be 125 mm long), glabrous, 0.2–0.5 mm above base with ring of hairs (disk), apex obtuse to rounded and minutely indented around the 0.5–2.5 long style (remnant), base acute to attenuate; pericarp rather thick. *Seeds* flattened semi-ellipsoid, c. 24 by 12 by 9 mm, apex rounded, base acute, testa dark brown, 0.7–1.5 mm thick; scar nearly as long as seed, c. 3.5 mm wide; cotyledons foliaceous; albumen copious.

Distribution — NE Papua New Guinea (4 collections seen).

Ecology — Canopy tree in mixed forest or emergent in low forest at 1250–1500 m altitude. Flowering: October; young fruit: June to October.

Field notes — Petals lime green; filaments greenish white; anthers dark cream; style green.

Vernacular name — Budemu: Orkor.

Note — This species is characterised by its large almost round leaves, floccose young indument, and the glabrous outside of the disk. Its relations are clearly with the group of species around *P. anteridifera*. The type of indument occurs also in several other species, e.g. *P. macropoda* (sect. *Oligotheca*) and *P. ridsdalei* (sect. *Pierrisideroxylon*).

Material seen:

NEW GUINEA. **Papua New Guinea**. S Highl. Prov. Mt Bosavi, 1500 m alt., *Damas LAE 58872* (L; K, LAE, n.v.) fr. – W Highl. Prov. Jimi Valley, below Dagarunga Ridge, 1500 m alt., *Henty & Streimann NGF 38912* (L) fl. buds, y. fr. – Madang Prov. Saidor Subprov., Naho-Rawa, Budemu, 1245 m alt., *Sayers NGF 21329* (BM, L, type) fl., y. fr. – Morobe Prov. Huon Pen., E slope Mt Rawlinson, Gang Creek, 1320 m alt., *Hoogland 9170* (L) y. fr.

20. Pouteria (sect. *Pierrisideroxylon*) ridsdalei Vink, *spec. nov.*

Arbor. Ramuli tenues, sericei, glabrescentes. Folia exstipulata, elliptica, (3.5–)5–13 × (1.5–)2.5–5 cm, crasse chartacea, apice acuto et indistincte acuminato, subtus crebre conglutinate sericea glabrescentia; nervi secundarii 7–11 angulo 40–60°, prope marginem sine conjunctionibus diminuentes; nervi tertiarii reticulati ad parallele reticulati; petioli 1–3.5 cm longi, sericei, glabrescentes. Inflorescentiae 2–5-florae. Pedicelli 6–8 mm longi, sericei vel adpresse tomentosi. Sepala 5, late ovata ad orbicularia, basi connata,

extus rare sericea, intus sparse sericea saepe basin versus glaber; exteriora 3–4.5 × 4–6.5 mm; interiora 3–3.5 × 3–5 mm, basi auriculata, extus prope marginem ciliatum glabra. Corolla 5-lobata, 4–5 mm longa, extus rare sericea basi dense breviter trichosa loborum marginibus glabris; tubus 0.5–1.5 mm longus, intus glaber; lobi 3–4 × 2.5–3 mm, intus rare vel sparse sericei. Stamina 5, fauce inserta; filamenta 2–2.5 mm longa, glabra vel sparsim trichosa; antherae late ovideae, 1–2 × 1.5–2 mm, apice retuso basi cordata (rare) sericea. Staminodia 5, quadrata vel ovata, 0.5–1.5 × 0.2–1 mm, extus sparse sericea intus glabra. Discus adnatus lobatus adpresse tomentosus; ovarium conoideum 5-loculatum, 0.5–0.7 × 1 mm, adpresse tomentosum; stylus crassus, 1.5–2 mm longus, 5-porcatus, rare vel sparse sericeus; stigma semiglobosus. Fructus ignotus. — Typus: *Ridsdale 1695* (L).

Tree 12–20 m high, dbh 15–25 cm. Branchlets rather slender, angular, soon becoming terete, 2–5 mm in diam., light brown sericeous, hairs forming together an almost smooth, nitidulous surface, glabrescent. Stipules absent. *Leaves* spirally arranged, scattered along ends of branchlets; blade elliptic, (3.5–)5–13 by (1.5–)2.5–5 cm, strongly chartaceous, apex acute and with up to 1 cm long indistinct acumen, base acute, tapering into petiole; above glabrous and dull, below very light brown sericeous and hairs forming together an almost smooth, nitidulous cemented surface, becoming floccose, glabrescent; midrib flat to raised above, prominent below; secondary nerves 7–11, at 40–60°, straight to slightly curved, near margin diminishing until inconspicuous, prominulous above, prominent below; tertiary nerves reticulate to parallel reticulate, prominulous to very faint on either side; petiole 1–3.5 cm long, flat and sometimes with a minute crest above, rounded below, not thickened at base, indumentum as lower side of blade. *Inflorescences* between and below the leaves and sometimes on short leafless shoots, 2–5-florous. *Pedicel* 6–8 by c. 1 mm, sericeous to appressed-tomentose. *Calyx* 5-lobed; tube 0.3–0.5 mm, glabrous inside; outer lobes broadly ovate to suborbicular, 3–4.5 by 4–6.5 mm, obtuse to broadly rounded, outside thinly sericeous with tuft of dark hairs at apex, inside sparsely sericeous especially towards apex, often glabrous near base; inner lobes (sub)orbicular, 3–3.5 by 3–5 mm, broadly rounded, eared at base, indumentum as outer lobes but outside with glabrous zones along ciliate margins. *Corolla* slightly exsert, 5-lobed, campanulate, 4–5 mm long; tube 0.5–1.5 mm long, outside thinly sericeous but with ring of dense short hairs at very base, inside glabrous; lobes spreading, reflexed, ovate, 3–4 by 2.5–3 mm, rounded, outside thinly sericeous but glabrous along margins, inside thinly to sparsely sericeous. *Stamens* 5, slightly exsert only because corolla lobes are reflexed, inserted in corolla throat; filaments cylindrical, straight (also in bud), 2–2.5 mm long, glabrous or with scattered hairs in apical half; anthers broadly ovoid, 1–2 by 1.5–2 mm, apex retuse, base cordate, (thinly) sericeous. *Staminodes* 5, inserted in sinuses of corolla lobes, square to ovate, 0.5–1.5 by 0.2–1 mm, acute to truncate, or dentate, or apiculate, outside sparsely sericeous, inside glabrous or with some scattered hairs. *Disk* adnate, apex free, with 5 folded, alternipetalous lobes, 0.3–0.5 mm high, 0.2–0.7 mm wide, appressed-tomentose. *Ovary* 5-celled, with compitum, conical, partly surrounded by disk, 0.5–0.7 by 1 mm, free part appressed-tomentose; style stout, 1.5–2 mm long, with 5 alternipetalous ribs, thinly to sparsely sericeous up till stigma, denser so on ribs; stigma with 5 tiny lobules folded towards centre. *Fruits* unknown.

Distribution — Philippines, Mindoro, Mt Halcon area near Paitan, c. 13° 12' N, 121° 12' E: *Ridsdale 1695, 1732* (L), fl.

Ecology — Ridge forest dominated by gymnosperms and *Tristania*, on gravel/sand derived from quartz, at 1200 m altitude, and mossy cloud forest on slopes at 1350 m altitude. Flowering: May 1986.

Etymology — This species is named after the collector of the only material known up till now, Dr. Colin Ernest Ridsdale (see Flora Malesiana I, 8, 1974, LXXX).

Note — At first sight this species looks like *Pouteria (Planchonella) obovata*, but the indument of the flowerparts, especially of the inner side of the calyx, of the corolla, and of the androecium, is quite different. *Pouteria obovata* is very variable in its leaf characters and therefore the description of the leaves of that species engulfs that of the present species. It is only to connoisseurs of *P. obovata* that *P. ridsdalei* 'does not seem right'; thus, sterile material cannot be identified.

21. Pouteria (sect. *Pierrisideroxylon*) **thyrsoidea** (C.T. White) T.D. Penn. — Map 5

Pouteria thyrsoidea (C.T. White) T.D. Penn. (1991) 202. — *Planchonella thyrsoidea* C.T. White (1950) 109; Van Royen (1957) 359, f. 37; Whitmore (1966) 110. — Type: *Hebblethwaite NGF 562* (holo A n.v.; iso L).

Tree up to 40(–50) m high, bole cylindrical, straight, 9–20(–33) m, dbh 30–95(–120) cm; buttresses usually present, up to 2.5(–5) m high, usually equal, often steep, rarely concave, thin to thick. Bark smooth, sometimes with shallow longitudinal fissures, rarely grid-cracked, often with vertical rows of lenticels, grey or light brown, sometimes reddish brown or (very) dark brown, sometimes blotched green; inner bark 5–15 mm thick, slash (white to) pink to red, sometimes marbled pink or straw, inside (white to) pink to red. Sapwood straw and not clearly defined, but usually not distinguishable; wood white to cream or straw, rarely pinkish, soft to hard. *Branchlets* subterete, ribbed, or (strongly) angular, solid or hollow, 5–17 mm in diam., with flowers or fruits below the leaves up to 25 mm in diam., brown to dark ferruginously short-patent tomentose withering blackish (or grey-brown). Innovations (brown to) dark ferruginously short-patent hairy. Stipules absent. *Leaves* spirally arranged, in large tufts at the end of branchlets; blade obovate to obovate-spathulate (-oblong, -lanceolate), 18–56 by 6–17(–22) cm, chartaceous, apex (acute to) obtuse (to rounded) and 0–10 mm acuminate, base often attenuate, abruptly acute to rounded to truncate to shallowly cordate; young leaves densely ferruginously tomentose on either side; adult leaves above (very) thinly colourless (to light brown) sericeous, glabrescent, below (reddish) ferruginously sericeous, or this layer (partly) overtopped by short erect hairs, quickly to tardily becoming thinly light brown to colourless sericeous, indument denser on midrib and nerves; midrib above shallowly impressed and crested, proximally changing into broad and convex, below very prominent and (triangular to) rounded; secondary nerves (11–)14–32, at (50–)55–70(–80)°, straight or slightly curved, near margin diminishing until inconspicuous or (partly) joined by thickened tertiary nerves, prominent to prominulous above, prominent below; tertiary nerves transverse, more or less sinuous, well-spaced, faint but distinct to prominulous above, prominulous to prominent below; petiole 1–15 by (2–)3–5(–7) mm, (broadly grooved to) flat to convex or with two longitudinal ribs above, triangular to rounded below, (dark) brown to ferruginously tomentose withering to light brown to brownish or greyish black. *Inflorescences* between and below the leaves: 8–many-flowered fascicles on leafless axes, these

solitary in axils of leaf scars, 5–15 by 0.2–0.25 cm, ribbed, light brown to ferruginously tomentose, ultimately glabrescent, rarely also some fascicles axillary to highest leaves. *Bracts* (replacing leaves) fugacious, ovate-boatshaped, 3.5–5 by 1–2 mm, apex acute, ferruginously tomentose on either side. *Pedicel* subterete, 2.5–6 by 0.5–1 mm, yellowish brown to ferruginously tomentose with additional patent hairs. *Calyx* (4–)5–7(–8)-lobed, indument outside as pedicel but parts covered in bud without patent hairs; tube 0.7–1.3 mm, glabrous inside; lobes (broadly) elliptic or ovate to lingulate, 2–3 by 1.2–3 mm with inner lobes usually the narrower ones, apex acute to obtuse, base straight to rounded, inside colourless to light brown puberulous but often central basal part glabrous or inner lobes only apically with scattered hairs. *Corolla* exsert, 5–7-lobed, 4.5–6.5 mm long, glabrous but apices of lobes ciliate (when young); tube 2–3 mm long; lobes broadly elliptic or elliptic-ovate to oblong, 2.5–3.5 by 1.3–2.5 mm, apex broadly rounded to truncate or notched, base straight to slightly rounded. *Stamens* exsert, 5–7, inserted in corolla throat, glabrous; filaments strapshaped, 3–5.5 mm long, apical 0.5–2 mm recurved outwards both in bud and in open flowers; anthers dorsifix, ellipsoid to ovoid, 1–1.5 by 0.5–0.8 mm, apex acute to obtuse, mucronate, base (slightly) cordate. *Staminodes* 5–7, inserted in sinuses of corolla lobes, subulate to lanceolate, 1.5–3 by 0.2–0.5 mm, glabrous, apex sharply acute, base widened, sometimes shouldered or toothed. *Disk* for 0.5–0.8 adnate with its free part erect to slanting, 0.6–1 mm high, 0.3–0.5 mm thick, 5–7-lobed, lobes with thickened apical and/or lateral edges, abaxially glabrous, apex and inside of free part of disk (thinly) yellowish brown hirsute. *Ovary* 5–7-celled, ovoid, 0.7–1.3 by 0.5–1 mm, cells surrounded by adnate part of disk, free part glabrous, or ovary completely surrounded by adnate part of disk; style cylindrical, slightly widened at base, 2.5–4.5 mm long, terete to (basally) ribbed, glabrous; stigma indistinct. *Infructescences* between and/or below the leaves; leafless infructescence branches 3–5 mm in diam., indument withered. *Pedicel* terete, 12–22 by 3–4 mm, apex usually thickened, (sub)glabrous. *Calyx* eroded, outside with indument remnants, inside glabrous or, if present, lobes with indument remnants. *Fruit* 2- or 3-seeded, fusiform to ellipsoid (or obovoid), 30–70 by 18–30 mm, glabrous; apex acute to rounded or truncate, style 0.2–0.5 mm; base acute to rounded or truncate, but mostly attenuate, with remnants of a ring of hairs just above the glabrous ultimate base (disk); pericarp 4–8 mm thick. *Seed* hemifusiform, laterally flattened, 25–54 by 8–14 by 5–8 mm, apex acute and 3–10 mm rostrate, base acute but ultimately rounded; testa nitidous, dark brown, (light) brown along scar, 0.8–1.3 mm thick; scar as long as seed rostrum excepted, 2–3.5 mm wide; cotyledons foliaceous, radicle exsert, cylindrical; albumen copious.

Distribution — Island arch N and NE of New Guinea: Schouten Is.: Biak; Bismarck Archipelago; Solomon Is. (44 collections seen).

Ecology — Locally common with tendency to gregariousness; mostly in lowland well-drained primary forest on alluvium in valleys, but occasionally also on ridge sides/tops, in swampy primary forest (once), in periodically swamped forest (twice), in advanced regrowth (also saplings), on shallow soil over coral limestone (Biak Is., on New Britain), or in coastal fringe forest. Altitudinal range: 0–150 m. Flowering: October to June; fruiting: November to July. Probably a long-lived pioneer.

Conspicuous tree: usually buttressed, columnar (rather) smooth straight bole often with lichen flecks as bark is persistent; rather small crown with large coppery leaves

in tufts at the end of branches, resembling *Campnosperma* but with denser tufts and more 'golden' in colour. Large diameters must be common: collectors tend to pick 'easier' trees, but of the herbarium collections 12 are from trees 10–49 cm dbh and 23 from trees 50–120 cm dbh.

Vernacular names — Irian Jaya: Biak language: Mapper, Mopin. — Papua New Guinea, New Britain: La'bega, Laine; Nakanai language: Maili. — Solomon Islands: Kwara'ae language: Kete; Roviana language: Viluhi.

Uses — Timber for houses and big canoes; dried fruits strung on string and used as dance rattle (note: in none of the herbarium specimens the seeds lie loose in dry fruits).

Timber saws well, particularly after drying. Machines easily to fine surfaces. Peeling properties good but care is needed to avoid breakage. Seasoning properties good but liable to staining; liable to pinhole borer and termite attack; all wood easily treated with all types of preservatives. Gluing properties good. (Keating & Bolza, 1982: 275).

Notes — The Biak specimens differ from those of the Bismarck Archipelago and the Solomon Is. only in the indument of the lower leaf surface: in the latter it is sericeous, but in the Biak specimens the sericeous layer is (partly) overtopped by short erect hairs and thereby the indument has a less smooth appearance.

The shape of the leafbase is rather variable and specimens with long pedicels and acute leafbase tend to look like *P. anteridifera*. Characteristic are the long leafless inflorescence axes and the rostrate seeds.

In 1961 I took a 30 cm high seedling from Biak Is. and planted it in the grounds at the back of the office of Forestry at Reremi, Manokwari, Irian Jaya. In 1993 it was reportedly 20 m high.

Material seen:

NEW GUINEA. **Irian Jaya**. Biak Is.: 50 m alt., *Van Dijk bb 30909* (BO), *bb 30910* (BO), *bb 30911* (BO, L), *bb 30922* (BO), *bb 30924* (BO), *bb 30926* (BO, L), all ster.; rd Biak–Korim, 60 m alt., *Vink BW 12066* (L; LAE n.v.) y. fr.; rd Sorido–Korim, 50 m alt., *J.J.F.E. de Wilde 1246* (L) y. fr.; Soemberdisapi on rd Biak–Siabes, *O. Moll BW 7024* (L; LAE n.v.) ster.; rd Biak–Parieri, 10 m alt., *Kostermans & Soegeng 911c* (L) ster.; Masi, 32 m alt., *Schram BW 9343* (L; A, BM, CANB, LAE, P, n.v.) fl. — **Papua New Guinea**. Bismarck Archipelago. – Manus Is., *Hebblethwaite NGF 562*, type (L; A, n.v.) fl. – New Ireland, SW corner of Kapsu plantation, 15 m alt., *Coode et al. NGF 29649* (L) y. fr. – New Britain. Talasea Distr. Mora Mora–Rikau Rd, *K.J. White NGF 10868* (L) y. fr. – Hoskins Distr. Tabai–Rikau Rd, sea level, *Coode & Lake NGF 32613* (L) fl., y. fr.; Commodore Bay, Walo, 150 m alt., *Henty & Lelean NGF 29482* (L) fl., ibidem, 60 m alt., *Henty & Lelean NGF 29490* (L) fr. – Kandrian Distr. Pulie R., 15 m alt., *K.J. White NGF 10077* (L) ster., ibidem, 30 m alt., *Henty & Frodin NGF 27216* (L) y. fr.; Fullerborn Hbr, 15 m alt., *Sayers NGF 21810* (L) y. fr. – Rabaul Distr. Matanakunei, 8 m alt., *Ridsdale & Katik NGF 36796* (L) fr.; Powell Hbr, 30 m alt., *Foreman LAE 52099* (L) fr. — **Solomon Islands**. Bougainville Is., Buin Distr., 12 miles N of Tonolei Hbr, 90 m alt., *Foreman NGF 45711* (L) fl. buds.

SOLOMON ISLANDS. Choiseul Is. Wasile R., 15 m alt., *Gafui et al. BSIP 17377* (L) fl.; Vacha R., 5 m alt., *Whitmore's coll. BSIP 5680* (L) fr.; Kolombanara R., 30 m alt., *Gafui et al. BSIP 18905* (L) y. fr.; Oaka R., 30 m alt., *Gafui et al. BSIP 18406* (L) fr. – New Georgia Group. Baga Is. *Whitmore's coll. BSIP 2941* (L) y. fr.; *Bengough BSIP 4534* (L) fl. – Kolombangara Is. Sandfly Hbr, 30 m alt., *Whitmore BSIP 1479* (L) fr.; nr Ariel Cove, *F.S. Walker & C.T. White BSIP 84a* (L) fl.; Bambari Hbr, 10 m alt., *Mauriasi et al. BSIP 8559* (L) fl. buds. – New Georgia Is. Viru Hbr, 30 m alt., *Self & Ben BSIP 19209, 19210* (L) y. fr. – Vangunu Is. Between Vura village and Gevata R., *Whitmore BSIP 925* (L) fr. – Santa Isabel Is. Allardyce Hbr, *Whitmore's Coll. BSIP 3559* (L) fl.

buds, *3660* (L) fr.; Bagi R., 1 mile S of Allardyce Hbr, *Whitmore BSIP 2195* (L) old fl. – Guadalcanal Is. Rere R., *Whitmore BSIP 3824* (L) old fl.; Nilumbu R., *Whitmore BSIP 2556* (L) fr. – Malaita Is. NE Malaita, 135 m alt., *Mauriasi et al. BSIP 13458* (L) fr.; Hauhui R., *F.S. Walker & C.T. White BSIP 84* (L) ster. – San Christobal Is. Maru Bay, Hareniia, 120 m alt., *Gafui et al. BSIP 12868* (L) fl.; Onibia area, 90 m alt., *Gafui et al. BSIP 12654* (L) y. fr.

22. Pouteria (sect. *Pierrisideroxylon*) vrieseana (Burck) Baehni — Map 6

Pouteria vrieseana (Burck) Baehni (1942) 336; T.D. Penn. (1991) 202. — *Sideroxylon vrieseanum* Pierre ex Burck (1886) 18; Boerl. (1900) 27; Merr. (1921) 483. — *Siderocarpus vrieseanus* (Burck) Pierre (1890) 31. — *Planchonella vrieseana* (Burck) Dubard (1912) 59; H.J. Lam (1925) 198, 266; (1927) 467, f. 27; K. Heyne (1927) 1245; (1950) 1245 [excl. vern. *Mopin* = *Pouteria thyrsoidea* (C.T. White) T.D. Penn.]; P. Royen (1957) 330. — *Xantolis vrieseana* (Burck) Baehni (1965a) 23, f. 15. — Type: *De Vriese 42* (holo L; see Van Royen, 1957: 331).

Tree 30–40 m high, bole 12–22 m, diam. above buttresses 28–52 cm; buttresses 1.2–2.2 m high, spreading 0.8–2 m, 5 cm thick; *prop roots* (*De Vogel 4517*) dense, 1.5 m high, 2–2.5 cm in diam., covering an area of 2 m in diam. Bark grey or grey-brown, smooth but finely cracked, very thin; inner bark 7–17 mm thick, slash cream to light brown, sometimes mottled with brown, outside mottled with brown, inside whitish. Sapwood (light) cream to light brown, with a gradual transition to darker or ochre-cream heartwood. Branchlets (rather) stout, with flattened sides, soon becoming terete with rather thick inflorescence scars, solid or hollow, (4–)6–13 mm in diam., villous but soon becoming puberulous and then glabrescent. Innovations villous. Stipules absent. *Leaves* spirally arranged, scattered along ends of branchlets; blade obovate, (14–)22–52 by (6–)10–24 cm, chartaceous, apex rounded and 0–12 mm acuminate, base cuneate, just above petiole sometimes obtuse or attenuate, somewhat decurrent along upper sides of petiole; above light ferruginously tomentose, very soon becoming glabrous, below midrib and secondary nerves dark ferruginously puberulous with soon disappearing light ferruginous long hairs, intercostals with dark ferruginous well-spaced erect hairs, ultimately whole lower surface glabrous; midrib grooved and sometimes crested above, very prominent and rounded below; secondary nerves (14–)18–30, at 60–70°, straight, near margin diminishing until inconspicuous or (partly) joined by thickened tertiary nerves, flat or slightly raised above, prominent below; tertiary nerves transverse, more or less sinuous, widely spaced, faint above, prominulous below; petiole 7–25 by (2–)3–4 mm, canaliculate (to flat) above, base not thickened, indument as lower side of midrib. *Inflorescences* between and below the leaves, multi-florous, usually containing flower(bud)s in different stages of development, leaving (rather) bulgy scars. Lam (1925) reports cleistogamy. *Pedicel* slender, 20–45 by 0.8–0.1 mm, ferruginously villous-puberulous. *Calyx* 5- (or 6-)lobed, outside (villous-)puberulous but margins covered in bud with (almost) glabrous zone and ciliate, inside glabrous or sometimes with some hairs near apex of lobes; tube 0.8–1.5 mm; outer lobes orbicular to ovate, 3–4.5 by 2.5–4.5 mm, rounded to acute, base straight; inner lobes orbicular to ovate, 3–4.5 by 3–3.5 mm, rounded to acute (to acuminate), base broadly rounded to eared. *Corolla* exsert, 5- (or 6-)lobed, 6–10 mm long, glabrous or sometimes outside with thin bundles of hairs on midribs of tube and/or base of lobes, lobes not ciliate; tube 2–3 mm long; lobes elliptic to ovate, 5–6.5 by 2–3 mm, rounded. *Stamens* in-

cluded, 5 (or 6), inserted in corolla throat, glabrous; filaments cylindrical, 4.5–6 mm long, apical 0.8–1 mm curved outwards both in bud and in open flowers; anthers ellipsoid to ovoid, 2–2.3 by 1–1.3 mm, apex obtuse to truncate, base deeply cordate. *Staminodes* 5 (or 6), inserted in sinuses of corolla lobes, narrow-lanceolate to subulate, 1–5 by 0.2–1 mm, glabrous, apex acute, base not toothed. *Disk* adnate, apex free, 0.7–1 mm high, 0.3–0.4 mm thick, outside with 5 or 6 vertical grooves, whether or not alternate with the same number of shallow grooves, glabrous, apex densely light ferruginously villous. *Ovary* 5- (or 6-)celled, (lower half of) cells surrounded by adnate part of disk, distal part free, conical, 1 by 1–1.5 mm, light ferruginously villous; style subulate, 3.5–6 mm long, glabrous but at very base villous as ovary; stigma of tiny lobes folded together. *Infructescences* below the leaves, slightly burly. *Pedicel* terete, 40–60 by 2–3.5 mm, almost not thickened at apex, glabrous. *Calyx* 5–10 mm in diam., lobes partly eroded, patent. *Fruit* 1–6-seeded, ellipsoid, somewhat angular, 50–65 by 20–45 mm, apex rounded to acute, with tiny style remnant, base cuneate to attenuate, villous by patent simple hairs, ultimate base glabrous (disk), pericarp in sicco 2–7 mm thick. *Seed* obliquely ellipsoid, laterally flattened, 40–45 by 15–18 by 8–13 mm, apex subacute, base acute, testa nitidous, brown, 1.5–2 mm thick; scar as long as seed, 2–4 mm wide; albumen copious; cotelydons foliaceous; radicle exsert, conoid-oblong, 3–4 mm long.

Distribution — Indonesia, Moluccas: Morotai to Ceram (9 collections seen).

Ecology — Canopy tree in forests at 0–60 m altitude on alluvial flats. The few reports do not give a clear picture of flowering and fruiting times.

Vernacular name — Morotai: Litoko.

Notes — Lam (1925) reports cleistogamy, apparently based on his own collection. However, I have not found such flowers in the Leiden material. On the other hand, open flowers with empty pollen sacs still have their filaments recurved as they are in bud, in contradiction to Van Royen's description saying that in juvenile flowers the filaments are not recurved.

The specimen *Binnendijk 14602*, the only record for Buru Is. (Lam, 1925) represents an unidentified species of *Palaquium*.

Material seen:

INDONESIA. **Moluccas**. Morotai, Mariloko, E of Puilowo, 20 m alt., *Lam 3665* (L) old fl. – Halmaheira. C part, Akelamo Oba, 25 m alt., *De Vogel 4424, 4517* (L) fl.; West Pitoe, 40 m alt., *Beguin 2261* (L) fr.; Soea, Tobaroe, 60 m alt., *Beguin 1984* (L) fl. – Bacan (Batjan), *De Vriese 42* (L, holotype) buds, old fl.; *De Vriese s.n.* (L) old fl., y. fr. – Obi. Galala, *Atasrip s.n.* dd. 1899 (L) fr. – Ceram. Awahya, *Binnendijk s.n.* (L) old fl.; Kairatu, Gemba, 0–5 m alt. *Kuswata & Soepadmo 157* (L) fr.; Artafela, 60 m alt., *bb 25818* (L) ster.

23. Pouteria (sect. *Pierrisideroxylon*) whitmorei Vink, *spec. nov.*

Arbor. Ramuli crassi (sub)glabri. Folia exstipulata subsessilia obovato-spathulata, 32–53 × 14–25 cm, papyracea vel subcoriacea, apice late rotundato et 1–5 mm late acuminato, vel late obtuso, basi abrupte rotundata; utrinque glabra vel paululum adpresse piliferae; nervi secondarii 15–19 angulo 50–65° prope marginem plerumque sine conjunctionibus deminuentes; nervi tertiarii distantes transversi sinuati; petioli 0–3 × 5–6 mm glabri. Flores ignoti. Infructescentiae ramulorum defoliatorum. Pedicellus 4–16 × 4–8 mm. Calyx recurvatus vel patens tubo 0.5–1 mm lobis late ovatis vel subquadratis 3–3.5 ×

5–9 mm. Fructus 7- vel 8-locellatus, 5–7-seminalis, (anguste) ellipsoideus 40–50 × 21–32 mm marcide tomentosus glabrescens basi pilis ferrugineis annulatis. Semen hemifusiforme 37–40 × 9–14 × 5–7 mm apice et basi acuto; testa subnitida fusca hilum versus fulvescens; hilum semine equilongum 0.5–1.5 mm latum; albumen parvum; cotyledones foliaceae, radicula exserta cylindrica 5 mm longa. — Typus: *Kotali et al BSIP 11182* (L).

Tree 6–24 m high, up to 70 cm dbh; buttresses equal to steep, up to 2.5 m high, thick. Bark (*BSIP 11182*) smooth, dark brownish red, slash living bark reddish; wood hard, light brown. Branchlets stout, 9–11 mm in diam., solid or with formicarium, ribbed, with withered indument or glabrous. Innovations: very young leaves densely ferruginously sericeous-tomentose on either side. Stipules absent. *Leaves* spirally arranged, subsessile, crowded on apices of branchlets; blade obovate-spathulate, 32–53 by 14–25 cm, papyraceous to subcoriaceous, apex broadly rounded and 1–5 mm broadly acuminate, or broadly obtuse, base abruptly rounded; glabrous or with scattered appressed light brown to whitish hairs, these denser on midrib and nerves below, dull and (dark) grey-green above, dull and (grey-)brown below; midrib broad and flat or convex above, strongly prominent and rounded below; secondary nerves 15–19, at 50–65°, straight, near margin diminishing until inconspicuous, sometimes joined by thickened tertiary nerves, prominulous to prominent above, prominent below; tertiary nerves transverse, sinuous, well-spaced, faint to prominulous on either side; petiole 0–3 by 5–6 mm, flat to convex above, rounded below, glabrous. *Flowers* unknown. *Infructescences* somewhat burly, below the leaves on branches 1–3 cm thick. *Pedicel* cylindrical, 4–16 by 4–8 mm, surface withered. *Calyx* 5- or 6-lobed, recurved (or patent), glabrous on either side; tube 0.5–1 mm; lobes broadly ovate to squarish, 3–3.5 by 5–9 mm, broadly rounded (to truncate). *Fruit* 7- or 8-locellate, 5–7-seeded, (narrowly) ellipsoid, 40–50 by 21–32 mm, withered tomentose, glabrescent; apex acute, and truncate to rounded, and centrally depressed around a sturdy style 2.5 by 1.5 mm, which is appressedly ferruginously hairy in its lower half, and has a capitate, lobed stigma; base cuneate or obtuse to rounded, ultimate base with a ring of straight ferruginous hairs (disk); pericarp 2–4 mm thick. *Seed* hemifusiform, laterally flattened, 37–40 by 9–14 by 5–7 mm, apex sharply acute, base acute but ultimately rounded; testa subnitidous, dark brown becoming yellowish brown towards scar and apex, 0.7–2 mm thick; scar as long as seed, 0.5–1.5 mm wide; cotyledons foliaceous, radicle exsert, cylindrical, 5 mm long; albumen thin.

Distribution — Solomon Islands.

Ecology — Well-drained primary forests on hill sides and ridge tops at 30–210 m altitude. Fruiting: March to August.

Vernacular name — Kwara'ae language: Kete (the same name as for *P. thyrsoidea*).

Etymology — This species is named after Dr. Timothy Charles Whitmore, from 1962 till 1964 Forest Botanist at Honiara, Solomon Islands (see Flora Malesiana I, 5, 1958, CCCXXXII, and 8, 1974, CV). Added in proof: Tim died on 14 February 2002.

Note — *Pouteria whitmorei* is closely related to *P. thyrsoidea* (see also vernacular name); it differs by the absence of leafless inflorescence axes, by (almost) glabrous leaves, and by hairy (though glabrescent) fruits. Although the seeds are apically sharply acute, rostrate ones like in *P. thyrsoidea* have not been seen. The high number of fruit locules is remarkable.

Material seen:

SOLOMON ISLANDS. Choiseul Is. Kolombanara R., *Corner 1241* (L) fr.; E Choiseul, W of Taora R., alt. 30 m, *Whitmore's coll. BSIP 5297* (L) fr. — S. Vella Lavella Is. Oula R. area, alt. 30 m, *Kotali et al. BSIP 11182* (holotype, L) fr. — E Guadalcanal, Volimatahu R. area, Marau, alt. 210 m, *Gafui et al. BSIP 9379* (L) fr.

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IDENTIFICATION LIST

Pouteria

1 = *P. occidentalis* (H.J. Lam) Baehni
2 = *P. pullenii* Vink
3 = *P. densinervia* (K. Krause) Baehni
4 = *P. dies-reginae* (P. Royen) Vink
5 = *P. garcinioides* (K. Krause) Baehni
6 = *P. gillisonii* Vink
7 = *P. lamii* Baehni
8 = *P. lanatifolia* (P. Royen) Vink
9 = *P. ledermannii* (K. Krause) Baehni
10 = *P. monticola* (K. Krause) H.J. Lam
12 = *P. rhopalocarpa* P. Royen
13 = *P. wandae* Vink
14 = *P. anteridifera* (Lane-Poole) Baehni
15 = *P. cyclopensis* (P. Royen) T.D. Penn.
16 = *P. kaernbachiana* (Engl.) Baehni
17 = *P. keyensis* (H.J. Lam) Baehni
18 = *P. menait* Vink
19 = *P. orkor* Vink
20 = *P. ridsdalei* Vink
21 = *P. thyrsoidea* (C.T. White) T.D. Penn.
22 = *P. vrieseana* (Burck) Baehni
23 = *P. whitmorei* Vink

ANU series 2683: cf 10; 2879: 17 — Atasrip s.n. dd 1899: 22 — Avé 4163: 13; 4276: 10.
bb series 25362: cf 18; 25818: 22; 30909: 21; 30910: 21; 30911: 21; 30922: 21; 30924: 21; 30926: 21; 32943: 17 — Beguin 1984: 22; 2118: 1; 2261: 22; 2264: 1 — Binnendijk 14602: 22 — Blackwood 258: 10 — Brass 23349: 10; 27014: 16; 29691: 10; 31722: 10; 32395: 16 — Brass & Versteegh 11904: 10; 12585: 4; 13150: 4; 13158: 18; 14107: 1 — BSIP series 84: 21; 84a: 21; 925: 21; 1479: 21; 2195: 21; 2556: 21; 2941: 21; 3559: 21; 3660: 21; 3824: 21; 4246: 17; 4378: 17; 4534: 21; 5297: 23; 5680: 21; 8559: 21; 9379: 23; 11182: 23; 12654: 21; 12868: 21; 13458: 21; 17377: 21; 17503: 17; 18159: 17; 18406: 21; 18905: 21; 19209: 21; 19210: 21 — BW series 33: 17; 354: 18; 379: 18; 549: 18; 859: 17; 929: 9; 1365: 17; 1432: 18; 1735: 9;

2055: 8; 2107: 12; 2195: 17; 2778: 18; 2816: 18; 3790: 17; 3899: 9; 4442: 17; 4492: 17; 4883: 17; 5318: 10; 5604: 18; 5859: 17; 6185: 17; 6186: 9; 6190: 9; 6427: 9; 6670: 1; 6727: 17; 6757: 9; 6762: 9; 6952: 9; 6993: 9; 7024: 21; 7180: 9; 7621: 9; 7687: 9; 8178: 18; 9343: 21; 9457: 17; 9580: 18; 9649: 18; 9651: 18; 10757: 10; 10970: 9; 11139: 9; 11169: 18; 11737: cf 9; 11796: 9; 11832: 9; 11970: 17; 11999: 9; 12066: 21; 12145: 17; 12276: 18; 12301: 9; 13368: 10; 13505: 9; 14067: 8; 14156: 8; 14218: 8; 14299: 8; 14349: 8; 15579: 18; 15729: 9.

Carr 12607: 14; 12608: 14; 13624: 10; 14158: 10; 15189: 10; 15372: 16; 15373: 16; 15420: 16; 15562: 16 — Clemens 1155: 9; 2030: 16; 8588: 9 — Corner 1241: 23 — Craven & Schodde 1071: 10.

De Vogel 4424: 22; 4517: 22 — De Vriese 42: 22 — J.J.F.E. de Wilde 1246: 21 — Dornstreich 70: 18.

Hartley 9851: 14; 13125: 9 — Höft 3521: 10 — Hoogland 3980: 14; 4258: 14; 4521: 14; 4619: 2; 4626: 3; 9170: 19 — Hoogland & Craven 10447: 18.

Jacobs 8737: 10 — Jaheri 138: 17.

Kaernbach 19: 16 — Kalkman 4417: 10 — Kanehira & Hatusima 13891: 8 — Kanis 1243: 2 — Kapi Rau 262: 10 — Kostermans & Soegeng 911c: 21 — Kuswata & Soepadmo 157: 22.

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