



The Winteraceae of the Old World.

VIII. Some *Zygogynum* species from New Guinea

W. Vink¹

Key words

new combination
New Guinea
new species
Winteraceae
Zygogynum

Abstract Four new species and one new combination in *Zygogynum* from New Guinea are described, additionally, 11 species are redescribed or discussed.

Published on 21 March 2016

INTRODUCTION

Winteraceae are represented in New Guinea by the genera *Drimys* and *Zygogynum*. They occur throughout New Guinea, except in the monsoonal areas, occupying a wide range of habitats with an optimum in montane forests. The only representative of *Drimys*, the very variable *D. piperita*, occurs from 880 to 4175 m, in forests and shrubberies, but it has also forms adapted to open (sub)alpine conditions (Vink 1970). In contrast, *Zygogynum* occurs from near sea level to c. 2800 m, and is exclusively found in closed forest or shrubberies, when occurring near sea level in several cases in areas where poor soils carry a deviating vegetation harbouring also other submontane elements like *Agathis* or *Araucaria* (e.g., Japen I., Sidoarsi Mts, Cyclops Mts, Etappenberg). Apart from a single report from lowland swamp forest (*Zygogynum cycloperensis*), the habitats are humid and well-drained.

The habit of *Drimys* ranges from very small shrubs and treelets to epiphytes and scramblers, with minute obovate to large cordate leaves, whereas *Zygogynum* shows shrubs to small trees (to c. 20 m high) only, with a much smaller variation in form and size of the leaves. Additionally, in *Drimys* the lower leaf side is bare (except for one form with papillae), whereas in *Zygogynum* at least the stomata and often also a smaller or larger part of the unspecialised cells are covered with cutin and white to grey wax, adding to the variation.

Compared with the *Zygogynum* species from New Caledonia (Vink 1993) the New Guinea representatives lack some distinctive characters. In New Caledonia the epidermal cells of the inflorescence axes and especially of the pedicels can have low to rather high, cylindrical papillae (Vink 1993: pl. 25), in New Guinea they are (almost) smooth. In New Guinea the outer petals are usually free, more rarely connate basally and only on the exterior side of the appressed margins (Vink 1977). In New Caledonia comparable conditions occur; in addition several species have the outer petals in the same manner connate up to halfway their length; *Z. pauciflorum* (Baker f.) Vink has the extreme form with the petals laterally connate over their entire thickness and forming a firm but rupturing cupule with thinner apical lobes. Petal colours show comparable ranges: from

greenish white to red or purple, less often yellow. Syncarpy occurs in several New Caledonian species, but is not found in New Guinea. Seeds from both areas show comparable ranges of surface morphology, but the New Guinea *Z. longifolium* (Fig. 3) has the most extreme surface ornamentation.

1. *Zygogynum archboldianum* (A.C.Sm.) Vink — Fig. 1

Zygogynum archboldianum (A.C.Sm.) Vink (1985) 53. — *Bubbia archboldiana* A.C.Sm. (1942) 433. — Type: *Brass* 12712 (holo A; iso BO, BRI, L, LAE).

Shrub 2–4 m high. *Branchlets* thick, black. *Leaves* scattered along branchlets; petiole 4–11 mm long, flat above, rounded or keeled below, black; blade narrowly obovate, (6–)10–17 by 2.5–5 cm, coriaceous, (light) reddish brown below, apex obtuse (or somewhat acuminate) to rounded (or slightly emarginate), base narrowly acute, slightly recurved; midrib impressed above, triangular below; secondary nerves at 55–70° with midrib, towards margin joined by a distinct single or double row of arcs, (weakly) prominulous on either side. On lower leaf surface only stomata white, rather large, solitary, well-spaced, also over secondary nerves; no oil cells visible. *Inflorescences* red, with 5–11 partial inflorescences, these 4–8 cm long, with thick axes, 9–17(–38)-flowered; *flowers* inserted on axes 1st (or 2nd) order; empty bracts below inflorescence 1–4; pedicels 2–5 mm. *Calyx* 2–3- or irregularly lobed, 2–3 mm long, thin, smooth. *Petals* 4–6, free, green, outer 4 elliptic to ovate, 5–6 by 3–4 mm, apex broadly rounded, inner one(s) obovate or elliptic, 2.5–5 by 2–2.3 mm, apex rounded to obtuse. *Stamens* 13–17, 1–2 mm long; thecae apically touching; connective not prolonged; pollen in tetrads. *Carpels* 8–10, free, 1.8–2.5 by 1.0–1.5 by 0.8–1.2 mm; stigma over 0.5–0.8 of carpel apex and descending over 2/3 of adaxial carpel side; ovules 11–20. Young *fruitlets* hard, globose, up to 5 mm diam, stipe minute.

Distribution — Papua, Kab. Jayawijaya.

Ecology — (Gap in) tall mossy forest, 900–2100 m altitude. Flowering February, young fruits March.

Specimens examined. INDONESIA, Papua, Kab. Jayawijaya, 18 km SW of Bernhard Camp, Idenburg R., *Brass* 12712 (A, BO, BRI, L, LAE), 2100 m alt.; 4 km SW of Bernhard Camp, *Brass* 13313 (A, BO, BRI, L), 900 m alt.

Notes — *Brass* 13313 was identified by Smith as *Bubbia idenburgensis* (here as synonym under *Z. umbellatum*); that spe-

¹ Naturalis Biodiversity Center, section Botany, P.O. Box 9517, 2300 RA Leiden, The Netherlands; vinkmen@xs4all.nl.

cies has, however, on the lower leaf side also the unspecialised cells white.

Zygogynum archboldianum may look like *Z. calothyrsum* but differs by the stigma extending over the larger part of the adaxial carpel side.

2. *Zygogynum bosavicum* Vink, sp. nov. — Fig. 1

Zygogynum bosavicum Vink. — Type: Damas LAE 58822 (holo L).

Shrub or understory tree, up to 8 m high. *Branchlets* rather slender, light to dark brown. *Leaves* scattered along branchlets, sometimes tufted terminally below infructescence; petiole 4–14 mm long, flat above, rounded below, dark brown; blade obovate,

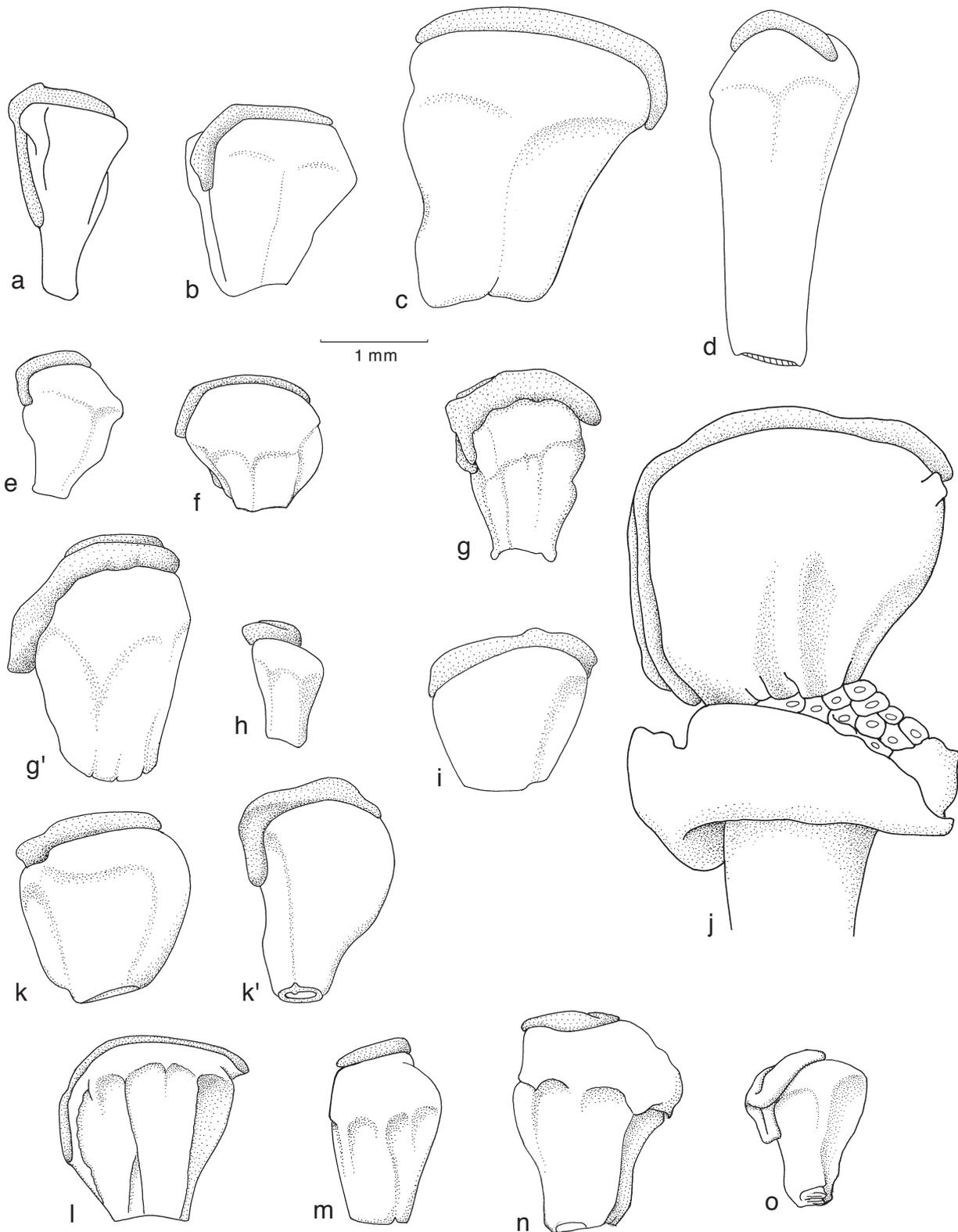


Fig. 1 Carpels, all with ventral side to the left, and at the same magnification. — a. *Zygogynum archboldianum*; b. *Z. bosavicum*; c. *Z. clemensiae*; d. *Z. crummatum*; e. *Z. cyclopsensis*; f. *Z. ledermannii*; g, g'. *Z. longifolium*; j. *Z. megacarpum*; h. *Z. montanum*; i. *Z. oligocarpum*; k, k'. *Z. polyneurum*; l. *Z. schrammii*; m. *Z. sororium*; n. *Z. staufferianum*; o. *Z. umbellatum* (a. Brass 12712; b. LAE 58822; c. Clemens 4596; d. LAE 69143; e. Royen & Sleumer 6396; f. Takeuchi 6212; g. Vink BW 8413; g'. Robbins 2004; j. Burley & Ismail 4618; h. LAE 61131; i. Schlechter 16470; k, k'. Jacobs 9489; l. Vink BW 8458; m. Ledermann 11898; n. Balgooy 968; o. Boden Kloss s.n.).

(4–)7–15 by (2–)2.5–6 cm, coriaceous, light greyish brown below, apex obtuse and up to 5 mm (broad-)acuminate, base narrowly acute, recurved; midrib impressed above, prominent below; secondary nerves at (60–)70–80(–90)° with midrib, towards margin joined by a distinct – usually double – row of arcs, (slightly) impressed above, prominulous to prominent below. On lower leaf surface stomata large, white, well-spaced to dense, solitary to clustered, not over secondary nerves; usually no oil cells visible. *Inflorescences* with (3–)5–8 partial inflorescences, these (2.5–)5–11 cm long, with rather thin axes, c. 6–18-flowered, flowers inserted on axes (1st or) 2nd to 3rd (or 4th) order; pedicels 2–10 mm. Only *fruits* seen. *Calyx* 0.4–0.7 mm long. *Carpels* 3–5; in old carpels stigma over whole length of apex and descending adaxially half way down. *Fruitlets* a hard berry, globose to obovoid, up to 8 mm high; terete stipe (0–0.5 or) 1 mm long, stigma apical-ventral, 2–5 mm long, outer layer of rather thin fruitwall with small clusters of brachysclereids, pulpa not between seeds. *Seeds* several, narrowly obovoid to ellipsoid, rarely slightly curved, 3.5–4(–4.5) by 1.5–2 by 1.5(–2) mm; testa dark grey, smooth.

Distribution — PNG, Western and Southern Highlands.

Ecology — Montane (mixed, laurofagaceous, *Nothofagus-Syzygium*, *Araucaria-Nothofagus*) forests, 700–1900 m altitude. Fruiting July–September.

Vernacular names — Karli (Enga lang.), Tifep (Mendi lang.).

Galls — Galls are present in one specimen (LAE 57353), and form a train of globose, 2–3 mm large thickenings next to or close to the midrib. About 1/3 of a gall is on the upper leaf side and slightly darker than the dry leaf; the more bulgy lower side is dark grey-brown, but the epidermis shows the normal distribution of white stomata; here are also the small, ellipsoid exit openings, with a distinctly demarcated narrow border of small cells.

Specimens examined. PAPUA NEW GUINEA, W. Highlands Prov., Kiunga Dist., Ok Kam, Moiyokabip (NE of Tabubil), *Frodin UPNG 4465* (L), 1350 m alt.; Pokaris nr Kompam, *Flenley ANU 2883* (K, L), 1860 m alt.; S. Highlands Prov., Mt Bosavi, *Jacobs 8745* (L), 1250–1350 m alt., *Gideon LAE 57353* (L), 1500 m alt., *Damas LAE 58822* (L), 800–900 m alt., *Katik LAE 77988* (L), 700 m alt.; Lake Kutubu, Tabage, *Coon & Kairo 475* (L); Mendi valley, above Kiburu, *Schodde 1389* (A, CANB, K, L, LAE).

Note — Although only fruits are known, this is an easily recognizable species, characterized by the strong, dark coloured secondary nervation on the lower leaf side and the more or less distinctly recurved base of the coarse leaves. However, in *ANU 2883* and *Schodde 1389* the secondary nerves and their extra arcs are less strongly developed.

3. *Zygogynum bullatum* (Diels) Vink — Fig. 2

Zygogynum bullatum (Diels) Vink (1985) 53. — *Drimys bullata* Diels (1916) 243. — *Bubbia bullata* (Diels) A.C.Sm. (1942) 426. — Type: *Schultze Jena 342* (holo B).

Treelet 2 m high. *Branchlets* rather stout, brown. *Leaves* scattered along branchlets; petiole 6–13 mm long, slightly grooved above, rounded below, dark brown; blade elliptic to obovate, 6–14.5 by 2–5 cm, subcoriaceous, strongly bullate between secondary and tertiary nerves, purplish grey below, apex acute to obtuse and up to 6 mm broadly to narrowly rounded-acuminate, base narrowly acute; midrib strongly impressed above, prominent below; secondary nerves at 75–85° with midrib, towards margin joined by a distinct double row of arcs, secondaries and main tertiaries impressed above, prominent below. On lower leaf surface stomata white, dense, leaving only islands of non-white unspecialised cells, not over secondary and tertiary nerves; no or few oil cells visible. *Inflorescences* with 3–5 partial inflorescences, these 4–7 cm long, with rather thin axes, few-flowered, flowers inserted on axes 2nd order; pedi-

cels 3–10 mm long, slender. Only *fruits* seen. *Calyx* 0.5–1 mm long. *Carpels* 3–4. *Fruitlets* a hard berry, obovoid to globose, up to 6 mm high; distinct stipe 0.7–1 mm long, stigma apical, 2–4 mm long, outer layer of rather thin fruitwall with small clusters of brachysclereids, pulpa not between seeds. *Seeds* few, curved-ellipsoid, c. 3 by 1.7 by 1.5 mm; testa dull black, subsmooth.

Distribution — PNG, Sepik area, Mt Stolle.

Ecology — Montane mossy forest at 2000 m altitude. Fruiting September.

Specimens examined. PAPUA NEW GUINEA, Sepik (Kaiserin Augusta Flusz) area, without further locality, *Schultze Jena 342* (B); Mt Stolle, trail from summit to Mekil Research Station, *Regalado & Katik 1281* (L), 2000 m alt.

Note — Although the flowers of this species are not known, it is highly distinctive by its medium sized leaves that are strongly bullate between the secondary and main tertiary nerves and have the lower side purplish grey with outstanding dark nervation.

4. *Zygogynum clemensiae* (A.C.Sm.) Vink — Fig. 1

Zygogynum clemensiae (A.C.Sm.) Vink (1985) 53. — *Bubbia clemensiae* A.C.Sm. (1942) 431. — Type: *Clemens 5157* (holo A n.v.).

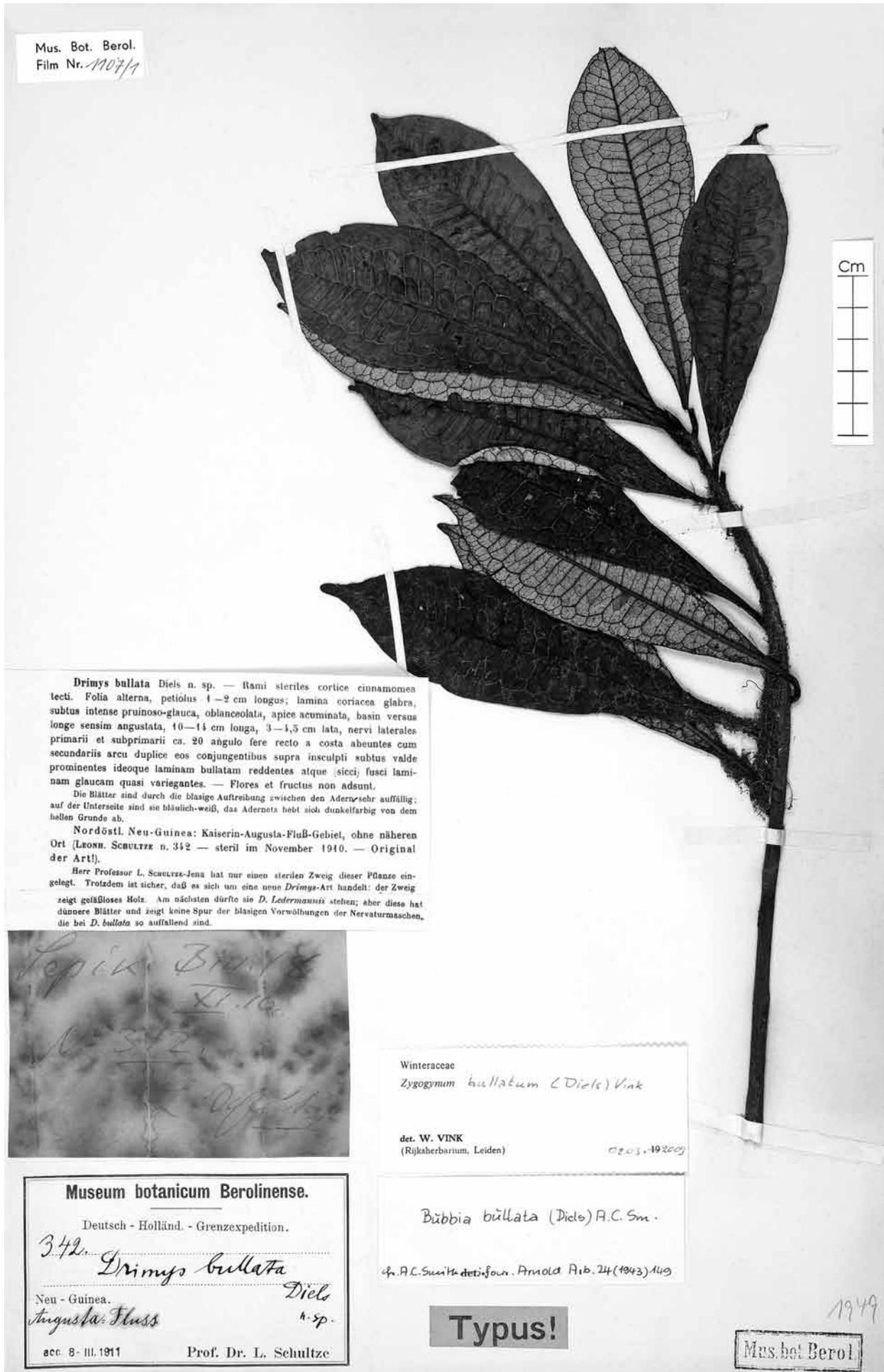
Shrub or treelet. *Branchlets* (rather) stout, brown. *Leaves* scattered along branchlets; petiole 5–20 mm long, flat to broadly grooved above, rounded below, dark brown; blade elliptic to obovate, 11–29 by 4–10 cm, subcoriaceous, light yellowish, pale green, greenish brown, or glaucescent below; apex obtuse or rounded to slightly emarginate, base acute or slightly attenuate; midrib slightly grooved to slightly raised above, prominent below; secondary nerves at 55–75(–90)° with midrib, arcingly joined at some distance from midrib, prominulous on either side. On lower leaf surface stomata white, solitary or also in well-spaced clusters, also (but sometimes scarcely) over secondary nerves; oil cells many or indistinct. *Inflorescences* with 3–6 partial inflorescences, these 2–7 cm long, with stout axes, 1–3-flowered; empty bracts below inflorescence 3–7; pedicels 5–30 mm long, in solitary flowers 10–70 mm long, stout. *Calyx* 2–3- or irregularly lobed, 2–3 mm long, rather thin, smooth. *Petals* 8, in 2 series or all in one series, 1/4–3/4 connate but petals of inner series free, dark maroon, elliptic-oblong, thick, 11–17 by 5–12 mm, apex rounded. *Stamens* 70–(fide Smith)125, 2–3.5 mm long, filaments inflated, white; thecae apically separate or touching; connective not prolonged; pollen in tetrads. *Carpels* 5–11, free, in bud free or coherent, c. 3 by 3 mm, with relatively long apex; stigma as long as carpel apex or slightly protruding abaxially; ovules 15–20 seemingly in more than one row. *Fruitlets* a hard berry, obovoid to globular, green, up to 15 mm diam; base obconical to rounded, stigma apical, 5–8 mm long, distinct; outer layer of fruitwall with clusters of brachysclereids; pulpa not between seeds. *Seeds* 5–∞, obovoid, up to 5 by 3 by 3 mm; testa rather thick, dull grey-brown and locally black, or black, on free surface with tendency to form ribs.

Distribution — PNG, Madang to Morobe Provinces.

Ecology — Hill forest or stunted cloud forest on ultrabasics, at 1350–1860 m altitude. Flowerbuds January, August; flowering December; fruiting March, July.

Specimens examined. PAPUA NEW GUINEA, Madang Prov., Saidor Subprov., Wumundi, *Sayers NGF 19772* (A, L), 1500 m alt.; Eastern Highlands Prov., Numura, 6 miles from Kainantu towards Goroka, *Stauffer & Sayers 5611* (K, L, US), 1860 m alt.; Morobe Prov., Ogeramngang, *Clemens 4596* (A, B), 1740 m alt., Yunzaing, *Clemens 3629* (A), 1350 m alt.; Kamiali Wildlife Management Area, nr Blue Mt, *Takeuchi et al. 21068* (L).

Notes — This species is distinctive by the basally connate, dark maroon outer petals and the high number of stamens. *Zygogynum cruminatum* has also many stamens, but its numerous petals are free and the number of carpels is much higher.



Mus. Bot. Berol.
Film Nr. 107/1

Cm

Drimys bullata Diels n. sp. — Rami steriles cortice cinnamomea tecti. Folia alterna, petiölus 1–2 cm longus; lamina coriacea glabra, subtus intense pruinoso-glaucua, oblanceolata, apice acuminata, basin versus longe sensim angustata, 10–14 cm longa, 3–4,5 cm lata, nervi laterales primarii et subprimarii ca. 20 angulo fere recto a costa abeuntes cum secundariis arcu duplice eos conjungentibus supra insculpti subtus valde prominentes ideoque laminam bullatam reddentes atque (sicci) fuscii laminam glaucam quasi variegantes. — Flores et fructus non adsunt.

Die Blätter sind durch die blasige Auftreibung zwischen den Adern sehr auffällig; auf der Unterseite sind sie bläulich-weiß, das Adernetz hebt sich dunkelfarbig von dem hellen Grunde ab.

Nordöstl. Neu-Guinea: Kaiserin-Augusta-Fluß-Gebiet, ohne näheren Ort (LEONH. SCHULTZE n. 342 — steril im November 1910. — Original der Art!).

Herr Professor L. SCHEUZZER-JENA hat nur einen sterilen Zweig dieser Pflanze eingelegt. Trotzdem ist sicher, daß es sich um eine neue *Drimys*-Art handelt: der Zweig zeigt gefäßloses Holz. Am nächsten dürfte sie *D. Ledermannii* stehen; aber diese hat dünnere Blätter und zeigt keine Spur der blasigen Vorwölbungen der Nervaturmaschen, die bei *D. bullata* so auffallend sind.

Lepid. Brunt II. 10
n. 342

Winteraceae
Zygogymum bullatum (Diels) Vink
det. W. VINK
(Rijksherbarium, Leiden) 0203-19209

Museum botanicum Berolinense.
Deutsch - Holländ. - Grenzexpedition.
342. *Drimys bullata* Diels
n. sp.
Neu - Guinea.
Augusta-Fluss
acc. 8. III. 1911 Prof. Dr. L. Schultz

Bubbia bullata (Diels) A.C. Sm.
cf. A.C. Smith det. in foun. Arnold Arb. 24 (1943) 149

Typus!

1949
Mus. bot Berol.

Fig. 2 *Zygogymum bullatum* (Diels) Vink (Schultze Jena 342, holotype).

A large, still closed bud of *Clemens 4596* showed an aberrant state for the stamens: the thecae were already open, those of the higher stamens widely open, those of the lower stamens just opening. In this case the flower is not protogynous as is usual in the family, and stamen dehiscence is centrifugal instead of the usual centripetal mode. The carpels in this bud were developed normally.

5. *Zygogynum cruminatum* Vink — Fig. 1

Zygogynum cruminatum Vink (1985) 52. — Type: *Kairo NGF 44125* (holo L; iso BRI, CANB, K, LAE n.v.).

Small tree 5–15 m high, but dbh said to reach 70 cm. Bark vertically fissured, mid-green; wood straw, hard, heavy. Young branches rather thick, drying black. Leaves at the end of branchlets; petiole 1–2 cm long, shallowly grooved to flat above, rounded below; blade obovate-oblong to oblong, (12–)15–24 by (3.5–)5–9 cm, (sub)coriaceous, in sicco greenish grey to (brownish) black below; apex obtuse to broadly rounded, base acute; midrib (slightly grooved to) flat above, prominent and sharp below; margins in vivo and in sicco narrowly recurved; secondary nerves at 65–80° with midrib, arcingly joined at some distance from margin, prominulous on either side. On lower leaf surface only stomata white, solitary; oil cells not apparent. Inflorescences with 3–4 partial inflorescences, these 1-flowered; only buds seen, these drying black; pedicels 23–50 mm long. Calyx shallowly or irregularly ruptured, rather thin, granulose. Petals 15–19 in 2–3 series, free. Stamens c. 200–275; thecae apically touching. Carpels 22–52, free, rather slender; stigma as long as carpel apex, sometimes very shortly but not abruptly descending adaxially; ovules 9–10. Fruitlets unknown.

Distribution — PNG, Morobe Province.

Ecology — Ridge forest dominated by *Nothofagus* or *Pandanus* at 1600–2200 m altitude. Flowerbuds May to August. Petals stated to be yellowish green or creamy white.

Specimens examined. PAPUA NEW GUINEA, Morobe Prov., Langimar rd c. 2 km off Aseki-Menyamyra rd, Aseki, *Kiapranis & Lawong LAE 69143* (L), 1600 m alt.; Wangini village nr Aseki, *Streimann & Kairo NGF 27601* (L), 2200 m alt.; Head of Baime Ck, Yamap, Wau subdist., *Kairo NGF 44125* (BRI, CANB, K, L), 1800 m alt.

Note — I have seen ovules only in a single bud, in other cases they were too young to be counted. *Zygogynum clemensiae* also has numerous stamens, but fewer carpels and fewer petals, of which the outer ones are basally connate.

6. *Zygogynum cyclopensis* Vink, sp. nov. — Fig. 1, 3

Zygogynum cyclopensis Vink. — Type: *Van Royen & Sleumer 6396* (holo L; iso A, LAE).

Small tree 10–13 m high, dbh 15–45 cm. Branchlets rather slender to rather stout, (dark) brown. Leaves scattered along

branchlets or only at the end of branchlets; petiole 10–15 mm long, flat to grooved above, rounded below, dark brown to blackish; blade obovate to oblanceolate, (9.5–)15–25 by (3.5–)5–7 cm, (thick) chartaceous, in sicco below light brown to light grey with a purplish shade; apex acute to retuse or up to 1 cm broadly acuminate, base often with recurved margins and narrowly acute to attenuate; midrib impressed above, prominent below; secondary nerves at 50–70° with midrib, arcingly joined at some distance from margin, distinct above, prominulous below. On lower leaf surface stomata white, solitary or in short strings or small clusters, also over secondary nerves; oil cells scattered or indistinct. Inflorescences with 3–11 partial inflorescences, these 5–15 cm long, with rather thin to rather stout axes, 7–43-flowered, flowers inserted on axes (1st or) 2nd to 4th order, empty bracts below inflorescence 0–10; pedicels 1–7 mm long, slender, in fruit rather stout. Calyx 2-lobed, reflexed, 0.7–1.3 mm long, thin, smooth. Petals 4, free, elliptic to obovate, cream to yellow, 3–4 by 1.8–2.7 mm, apex broadly rounded. Stamens 10–13, 0.9–1.5 mm long, filaments often inflated; thecae apically separated; connective not prolonged; pollen in tetrads. Carpels 1–4, free, 1.3–1.7 by 0.7–1.3 by 0.7–1.2 mm; stigma usually 2/3 as long as carpel apex and shortly descending adaxially; ovules 16–27. Fruitlets a hard berry, (obovoid-)globose, green or greenish yellow, 9–12 mm long; base rounded, with 1–2 mm long distinct stipe; fruitwall with clusters of brachysclereids; pulpa weakly developed. Seeds c. 9–12, obovoid, straight to slightly curved, 3.8–4.5 by 2.0–2.3 by 1.6–2.0 mm; testa rather firm, smooth, nitidous, grey to black.

Distribution — Papua, Cyclops Mts, and PNG, Angorum Sub-province.

Ecology — Rainforest along creek or lowland swamp forest at 300–510 m altitude.

Specimens examined. INDONESIA, Papua, Kab. Jayawijaya, Cyclops Mts, *Westerhuis BW 5429* (A, BO, CANB, L, LAE, PNH), 510 m alt.; *Van Royen & Sleumer 6328* (A, L, LAE), 6396 (A, L, LAE), 450 m alt. — PAPUA NEW GUINEA, East Sepik Prov., Angoram Subprov., Wogupmeri R., Latoma village, *Leach NGF 34348* (A, L), 305 m alt.

7. *Zygogynum ledermannii* (Diels) Vink, comb. nov. — Fig. 1, 4

Zygogynum ledermannii (Diels) Vink. — *Drimys ledermannii* Diels (1916) 243. — *Bubbia ledermannii* (Diels) B.L.Burt (1936) 3; A.C.Sm. (1943) 149. — Type: *Ledermann 8990* (holo B).

Shrub 1–3 m high or treelet. Branchlets slender, (very) dark brown. Leaves scattered or in groups separated by long internodes; petiole 5–12 mm long, shallowly grooved to flat above, rounded below; blade (narrowly) obovate to obovate-oblong, 7–15 by 2.5–5 cm, membranous to chartaceous, in sicco greenish to dark grey below; apex acute and up to 10 mm rounded broad-acuminate, base acute; midrib impressed above, promi-

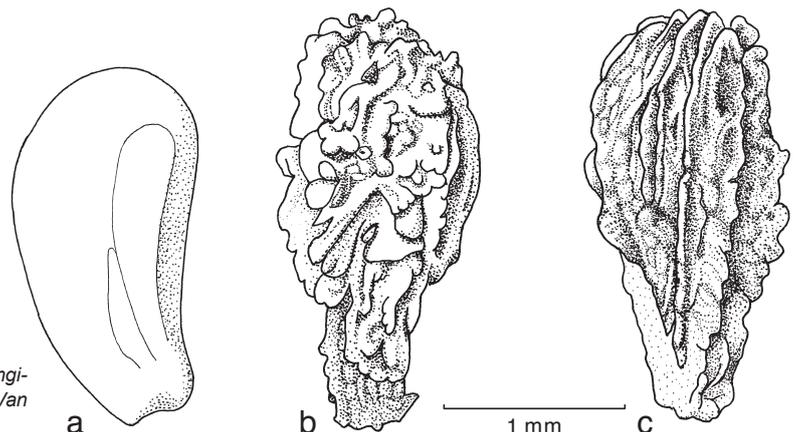


Fig. 3 a. *Zygogynum cyclopensis* Vink. Seed, lateral. — b, c. *Z. longifolium* (A.C.Sm.) Vink. Seed from lateral and abaxial sides resp. (a: *Van Royen & Sleumer 6396*; b, c: *Takeuchi 11084*).

nent below; secondary nerves at 60–80° with midrib, arcingly joined at some distance from margin, prominulous on either side. On lower leaf surface only stomata white, solitary and/or in strings, pro specimen usually over (part of) secondary nerves or usually not so; oil cells scattered to not apparent. *Inflorescences* with c. 3 partial inflorescences, these 2 cm long, with rather thin axes, 3–7-flowered, flowers inserted on axes 1st (or 2nd) order; empty bracts below inflorescence 1; pedicels 2–5 mm long, rather slender. Only *buds*, old *flower*, and young *fruitlet* seen. *Calyx* 3–4-lobed, 0.7–1 mm long, thin, rough by many oil cells. *Petals* (5–)6 in 2 series, free or for up to 0.3 of their length abaxially connate. *Stamens* 12; thecae apically touching. *Carpel* solitary; stigma as long as carpel apex, sometimes very shortly but abruptly descending adaxially; ovules 30–32. *Fruitlet* probably a rather hard berry; when immature globose, green turning pink, 8 mm diam; base rounded, without stipe. *Seeds* not seen.

Distribution — PNG, Sepik area: Etappenberg and Hunstein Range.

Ecology — Undergrowth in hill forest at 450–850 m altitude. Flowering July, October; young fruit July.

Specimens examined. PAPUA NEW GUINEA, East Sepik Prov., Etappenberg, *Ledermann* 8973 (B†), 8973a (K), 8990 (B), 850 m alt.; Hunstein Ra., Mt Samsai, *Takeuchi* 6212 (L), 450 m alt.

Notes — This species has thin, dark, pointed leaves and a solitary carpel.

The presence of stomata over the secondary nerves is variable. The connation of the petals is variable even within a flower and is of the same type as described for the species from New Caledonia (Vink 1977: 229).

The type material lacks flowers, only old carpels are preserved. In the *Winteraceae* infestations of the leaves are rare, but in *Z. ledermannii* two collections show similar striplike damage, probably made by a mite.

8. *Zygogynum longifolium* (A.C.Sm.) Vink — Fig. 1, 3

Zygogynum longifolium (A.C.Sm.) Vink (1985) 53. — *Bubbia longifolia* A.C.Sm. (1942) 429. — Type: *Brass* 13868 (holo A).

Bubbia monocarpa A.C.Sm. (1942) 428. — Type: *Kanehira* & *Hatusima* 12105 (holo A; iso BO).

Drimys monogyna Kaneh. & Hatus. (1943) 147, f. 17. — Type: *Kanehira* & *Hatusima* 12105 (holo FU n.v., photo in L; iso A, BO).

Drimys oligocarpa Diels (1924) 79, non Schltr.

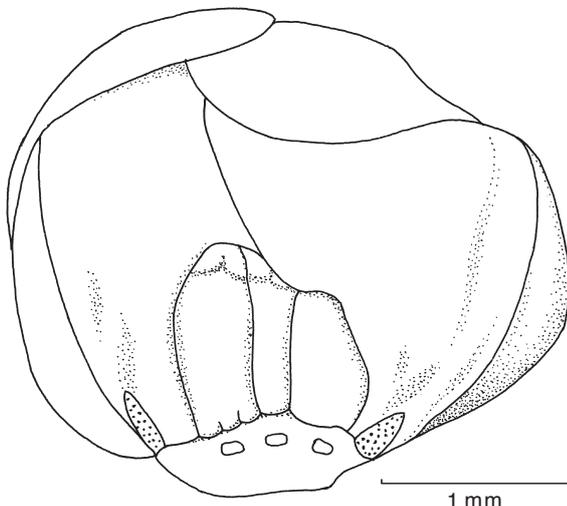


Fig. 4 *Zygogynum ledermannii* (Diels) Vink. Flowerbud; calyx and one outer petal removed, showing three stamens. The removed petal was basally connate with the adjoining petals and left there scars on the abaxial sides of the thick margins (from *Takeuchi* 6212).

Shrub or treelet 1.5–4.5 (or more?) m high, dbh up to 10 cm, little branched. *Branchlets* rather slender to stout, light to greyish brown, often with myrmecodome. *Leaves* crowded at the end of branchlets; petiole 5–10(–15) mm long, almost flat above, rounded below, blackish; blade obovate to oblanceolate, 17–43 by 5.5–15 cm, (thick) chartaceous, said to be bullate in vivo (*Takeuchi* 11084), in sicco (light brown to) purplish grey below; apex obtuse to acute and ultimately up to 1.5 cm rounded broad-acuminate, base sometimes with recurved margins, (narrowly) acute; midrib impressed above, strongly prominent below; secondary nerves at 50–80° with midrib, arcingly joined at some distance from margin, distinct above, prominulous to prominent below. On lower leaf surface stomata white, in short strings, or forming a labyrinth, not over secondary nerves; oil cells scattered, rarely indistinct. *Inflorescences* with 2–6 partial inflorescences, these 8–18 cm long, sometimes pendulous, with very slender axes, 6–30-flowered, flowers inserted on axes (1st or 2nd to 3rd (to 6th) order; empty bracts below inflorescence 0–4; pedicels 1–12 mm, in fruit up to 20 mm long, slender. *Calyx* 2–3 (or 4-, or irregularly) lobed, 1–2 mm long, thin, smooth. *Petals* 4–6(–7), free, elliptic to obovate, greenish red to very dark red, outer ones 3.5–6 by (1.5–)2–3.5 mm, inner ones if present 4.5–6 by 2.5–3 mm, apex (broadly) rounded. *Stamens* 11–21, 1.5–3.5 mm long, filaments often inflated, red or olivaceous; thecae apically slightly separate to touching; connective not prolonged; pollen in tetrads. *Carpels* (1–)2–3(–4), free, 1.5–3 by 1–2 by 1–1.5 mm, green; stigma (almost) as long as carpel apex or slightly longer at one or both ends or slightly descending adaxially; ovules 10–32. *Fruitlets* a soft berry, globose, pink, orange or red, in sicco usually strongly flattened and in centre showing seeds, 14–25 mm diam; base usually abruptly obconical, sometimes with up to 1.5 mm long distinct stipe, or rounded; fruitwall without brachysclereids; placenta sometimes strongly plate-like enlarged; pulpa in thin layers between the seeds and following seed sculpture but usually not completely enveloping seeds. *Seeds* several to many (c. 5–16), obovoid and narrowed to constricted in lower part, 5–7.5 by 2.5–4.5 by 2–3.5 mm; testa thin, brittle, (brownish) grey to dull black, pusticular, or pusticular and apically with tendency to ribs, or with thin irregular flanges.

Distribution — Papua, Japen I. to PNG, Bismarck Ra.

Ecology — Rainforest at 60–540 m altitude. Flowering March, July–September, fruiting (April) July–October.

Lam (1928, 1945) gives a description of the lowland forest of his collection site at Prauwenbivak (*Lam* 794, as *Drimys oligocarpa*, det. Diels; 110 m alt.). Kanehira & Hatusima (1943) refer to *Agathis*-forest; the localities on Japen I. and on the Sidoarsi Mts are also in or close to *Agathis*-forests. *Agathis* often occurs on ultrabasic soils.

Galls — *Zygogynum longifolium* is one of the few species with myrmecodomies in the twigs.

The sterile collection *Vink* 17494 from Lei R. on the W side of the Doma Peaks looks like the present species, but the altitude of 2780 m is very aberrant. One leaf of this collection has on the lower side a 10 cm long row of 11 galls and 5 scars of galls. These galls are globose, c. 3.5 mm diam, brown when dry, densely pusticular, and subapically with a double line reminding of a stigma (but without stigmatal papillae). On the upper side of the leaf the insertions of the galls are visible as slightly raised rings c. 2 mm diam.

Specimens examined. INDONESIA, Papua, Kab. Yapen-Waropen, Japen I., Woda, *Koster* BW 11194 (L, LAE), 11196 (K, L, LAE), 60 m alt.; ibidem, Soemboi R. near Seroei, *Aet* & *Idjan* 539 (A, BO, L, PNH, SING); Kab. Nabire, Nabire area, Dallman R., *Kanehira* & *Hatusima* 12105 (A, BO, FU n.v.), 500 m alt.; Napan Dist., Akama, *Ijiri* & *Niimura* 464 (L); Kab. Sarmi, Sidoarsi Mts, *Vink* BW 8413 (A, K, L), 200 m alt.; Kab. Jayawijaya, Idenburg R., *Feuilletau de Bruyn* 50 (BO, L), 60 m alt., ibidem, Prauwenbivak, *Lam* 794 (BO, L, U), 1165 (L), 1225 (BO, L), 120 m alt.; Bernhard Camp, *Brass* 13868 (A), 175 m

alt.; ibidem, Pagai ('Mamberamo R.'). *Sauveur* 3005, 3005a (L). — PAPUA NEW GUINEA, East Sepik Prov., Ambunti Subprov., Yapa (Hunstein) R., *Hoogland & Craven* 10535 (A, L), 120 m alt.; Hunstein Ra., *Takeuchi* 6064 (L), 125 m alt.; Prince Alexander Ra., Maprik, *Robbins* 2004 (CANB), 540 m alt.; Passam Rd off Wewak-Maprik Rd, *Robbins* 2131 (CANB), 300 m alt.; Madang Prov., Bismarck Ra., *Takeuchi* 11084 (L), 600 m alt.

Doubtfully this species: PAPUA NEW GUINEA, West Sepik Prov., Bewani Subprov., Bewani, *Wiakabu LAE* 73772 (L), 160 m alt.; S. Highlands Prov., Tari Subprov., Lei R., 2780 m alt., *Vink* 17494 (A, BO, CANB, L, LAE).

Notes

- Petal arrangement. The arrangement of the petals shows a peculiar variation. If 4 or 6 petals are present, these are inserted in two alternating pairs or as two triplets, but 6 petals can also be arranged as 4 outer and 2 inner ones. In *Z. schramii* the 6 petals are all inserted in a single row, with any additional petal in a second series.
- Stamens. *Wiakabu LAE* 73772 deviates by its high number of stamens: 33–36 vs 11–21 in the other specimens.
- Seeds. In the specimens from Japen I. at the western end of the distributional area the seeds are pusticular and have only a few ribs or very short flanges, whereas in the specimens from the mainland the seeds have distinct, thin, irregular flanges (Smith: 'plicate-rugose'). Smith described the seeds as 7–9 by 5 mm, but I have seen no seeds longer than 7 mm in the material seen by him.

Bubbia monocarpa and *Drimys monogyna* are described on duplicates of the same collection; it differs from the other material only in the lower number of carpels: usually one, sometimes two, a condition also encountered in *Z. schramii*.

For comparison with *Z. schramii*, also from the Sidoarsi Mts, see there. *Zygogynum montanum* from Papua New Guinea is similar (also with myrmecodomies reported), but it lacks the purplish leaf colour, it has a shorter stigma, and smooth seeds.

9. *Zygogynum megacarpum* (A.C.Sm.) Vink — Fig. 1

Zygogynum megacarpum (A.C.Sm.) Vink (1985) 53. — *Bubbia megacarpa* A.C.Sm. (1942) 434. — Type: *Brass* 10249 (holo A; iso BO, BRI, L, LAE).

Treelet 3–8 m high, dbh c. 10 cm. Bark reddish brown, rugose. *Branchlets* rather slender to stout, light to medium brown. *Leaves* scattered along branchlets; petiole 6–12 mm long, with raised margins above, rounded below, dark brown; blade narrowly obovate to oblanceolate (or narrowly elliptic), 10–18 by 3–5.5 cm, (thick) chartaceous, in sicco brown below; apex broadly rounded to obtuse or with an up to 0.5 cm long rounded acumen, base often with recurved margins, (narrowly) acute; midrib impressed above, strongly prominent below; secondary nerves at 55–70° with midrib, arcingly joined at some distance from margin, (rather) distinct above, weak to distinct below. On lower leaf surface probably only stomata white, solitary and in small strings and clusters, also over secondary nerves; oil cells many. *Inflorescences* with 3–7 partial inflorescences, these 4–8 cm long, with firm axes, rather many-flowered, flowers inserted on axes (1st or) 2nd to 3rd order; empty bracts below inflorescence 0–3; pedicels 3–13 mm, rather slender. *Calyx* 2–3- or irregularly lobed, 0.8–1.5 mm long, thin, smooth. *Petals* 4 (rarely 5), free, elliptic to obovate, white, 5–7 by 4–5 mm, apex broadly rounded. *Stamens* 15–21, 1.3–1.6 mm long, thecae at wide angle, apically slightly separate to touching; connective not prolonged; pollen in tetrads. *Carpel* solitary, squarish but somewhat narrowed at base, 2–3 by 2.5–3.5 by 1.5–2.5 mm; stigma over entire carpel apex and descending at the ventral side almost to the base; ovules c. 50–68. *Fruit* a soft berry, red, globose to transverse-ellipsoid, 3–3.5 by 3–4 cm in sicco; pulpa in thin plates completely enveloping seeds. *Seeds* many, usually flattened, obovoid and tapering towards

base to comma-shaped, 4–6 by 2.5–4 mm; testa thin, grey, finely low-pusticular.

Distribution — Papua: Kab. Jayawijaya.

Ecology — Near streams in montane (*Casuarina-Podocarpus-Dacrydium*) forest at 2100–2800 m altitude. Flowering May, October; fruiting October.

Specimens examined. INDONESIA, Papua, Kab. Jayawijaya, 9 km NE of Lake Habbema, *Brass* 10249 (A, BO, BRI, L, LAE), 2800 m alt.; Km 48 on Wamena–Pass Valley Rd, *Burley & Ismail* 4618 (L), 2100 m alt.

Notes — This species is characterized by its solitary carpel, with the stigma over the entire apex continuing almost to the base of the ventral side, developing into a relatively large fruit. Due to the collecting method, the white layer on the lower leaf surface disappeared almost entirely.

10. *Zygogynum montanum* (Lauterb.) Vink — Fig. 1

Zygogynum montanum (Lauterb.) Vink (1985) 53. — *Tetralthalamus montanum* Lauterb. (1905) 319; (1923) 15; B.L.Burt (1938) 458. — *Bubbia montana* (Lauterb.) A.C.Sm. (1942) 426. — Type: *Schlechter* 13984 (holo B†; iso BO, K).

Shrub 2 m high. *Branchlets* slender, dark brown, sometimes with myrmecodome. *Leaves* scattered; petiole 8–25 mm long, grooved to flat above, rounded below, dark brown; blade narrowly obovate, 7–27 by 2.5–8.5 cm, chartaceous, greenish grey to light brown below; apex acute and 0–27 mm (broadly) acuminate, base (narrowly) acute (to slightly attenuate); midrib impressed above, prominent below; secondary nerves at 55–70° with midrib, arcingly joined at some distance from midrib, prominulous on either side. On lower leaf surface stomata white, dense, solitary and in clusters, also over secondary nerves; oil cells in young leaves very distinct, in mature leaves less distinct to obscure. *Inflorescences* with 3–5 partial inflorescences, these 3–11 cm long, with very slender axes, 7–50-flowered, flowers inserted on axes (1st or) 2nd to 3rd (to 4th) order; empty bracts below inflorescence 0–3; pedicels 2–10 mm long, very slender, with minutely convex cells and oil cells. *Calyx* 2–3- or irregularly lobed. *Petals* 4–8, free, obovate to oblong, green or greenish white, outer ones 4–6 by 2–4 mm, inner ones 3.5–4 by 1.5–1.8 mm, apex rounded. *Stamens* 10–17, 1 mm long; thecae apically touching; pollen in tetrads. *Carpels* 2–5, free to coherent, 1.3–1.5 by 1–1.3 by 1–1.3 mm; stigma 0.3–0.6 as long as carpel apex, not descending adaxially; ovules 3–6. *Fruitlets* a soft berry, globose, red, in sicco flattened and in centre showing seeds, 15 mm diam; apparently without stipe; fruitwall without brachysclereids; pulpa not between seeds. *Seeds* several, obovoid with shortly narrowed base, 7–7.5 by 4.5–5 by 4–4.5 mm; testa hard, dull black, smooth.

Distribution — PNG, Bismarck Mts to Mt Dayman.

Ecology — Undergrowth in (*Lithocarpus-Castanopsis-Anisoptera*) forest at 240–1200 m altitude. Flowering January–July, fruiting July.

Specimens examined. PAPUA NEW GUINEA, Gulf Prov., above Purari R., 63 km NE from Baimuru, *Croft LAE* 61131 (L), 240 m alt.; Madang Prov., Bismarck Ra., *Schlechter* 13984 (B†, BO, K), 1200 m alt.; Morobe Prov., Gurakor, *Brass* 29487 (A, CANB, L, US), 640 m alt.; Milne Bay Prov., Maneau Ra., N slopes of Mt Dayman, *Brass* 23545 (A, LAE), 700 m alt.

Notes — This species is distinct by its thin leaves, delicate flowers and a soft berry with relatively large smooth seeds; the low number of ovules is notable.

Zygogynum longifolium from Papua is very similar (often also with myrmecodomies), but its leaves are purplish grey below, its stigma is as long as the carpel apex, and the seeds are rough or with ribs or flanges.

Zygogynum oligocarpum has also a longer stigma; the apex of its leaves is more rounded.

The *Z. montanum* collection from the Bismarck Ra. has 7 or 8 petals in two series, the other collections have 4–6 petals in one (4 petals) or two (2 by 3 petals) series.

11. *Zygogynum oligocarpum* (Schltr.) Vink — Fig. 1

Zygogynum oligocarpum (Schltr) Vink (1985) 53. — *Drimys oligocarpa* Schltr. (1913) 71, f. 1. — *Bubbia oligocarpa* (Schltr.) B.L.Burt (1936) 3. — Type: *Schlechter 16470* (holo B; iso P).

Shrub or tree up to 15 m high. *Branchlets* rather slender, brown. *Leaves* scattered; petiole 8–20 mm long, (almost) flat above, rounded below, brown; blade obovate, 14–27 by 5.5–9 cm, chartaceous; apex acute to obtuse and ultimately rounded, base acute; midrib impressed above, prominent below; secondary nerves at 60–70° with midrib, arcingly joined at some distance from margin, prominulous on either side. On lower leaf surface stomata covered with alveolar material, dense, solitary and in small clusters, also over secondary nerves; oil cells not apparent. *Inflorescences* with 3–5 partial inflorescences, these with thin axes, c. 9-flowered; flowers inserted on axes 1st to 2nd order; empty bracts below inflorescence 1–7; pedicel 7–10 mm long, slender. *Calyx* 2- or irregularly lobed, 1 mm long, thin, smooth. *Petals* 5–7, free, elliptic, yellowish or greenish white, outer ones 5 by 3 mm, inner ones 3 by 2 mm, apex broadly rounded. *Stamens* 9–18, c. 1.6 mm long, thecae apically touching; carpels 1–2, free, 2–2.5 by 1–1.5 by 1 mm; stigma as long as carpel apex, not or shortly descending adaxially. *Fruitlets* unknown.

Distribution — PNG, East Sepik Prov.

Specimens examined. PAPUA NEW GUINEA, East Sepik Prov., Minjem Valley, Wobbe, *Schlechter 16470* (B, P), 400 m alt.

Notes — The above description deviates somewhat from that by Schlechter as the second specimen he used (*Moszkowski 281*) is no longer available. In the type material the wax on the stomata has deteriorated, so the original colour of the lower leaf side is unknown.

I observed 9 and 10 stamens; judging by the floral remnants of Schlechter's analysis the number of 18 in the original description is correct.

Zygogynum oligocarpum differs from *Z. montanum* by the distinctly longer stigma.

12. *Zygogynum polyneurum* (Diels) Vink — Fig. 1

Zygogynum polyneurum (Diels) Vink (1985) 54. — *Drimys polyneura* Diels (1916) 244. — *Bubbia polyneura* (Diels) B.L.Burt (1936) 3. — Type: *Ledermann 8986* (B).

Shrub or treelet 2–18 m high. *Branchlets* rather stout, (light) brown. *Leaves*: petiole (2–)3–15(–20) mm long, broadly grooved to flat above, rounded below, (greyish to dark) brown; blade oblanceolate, 13–25 by 3.3–8(–10) cm, thick-chartaceous, in sicco light grey below; apex acute and 0–1.5 cm (broadly) acuminate, base cuneate; midrib broad, impressed above, strongly prominent below; secondary nerves at 55–70° with midrib, arcingly joined at some distance from margin, faint above, distinct to faint below. On lower leaf surface stomata and unspecialised cells white, also over secondary nerves; oil cells (not apparent to) abundant. *Inflorescences* with 5–10 partial inflorescences, these 3–10.5 cm long, with firm axes, 3–22-flowered, flowers inserted on axes 1st or 2nd (to 3rd) order; empty bracts below inflorescence few; pedicels 1–7 mm long, rather firm. Only young *buds* and *fruitlets* seen. *Calyx* 2-lobed. *Petals* 4, free. *Stamens* 8–27; thecae apically distinctly but shortly separated to touching; connective not prolonged. *Carpels* 2–10, free; stigma as long as or shortly overtopping

carpel apex, but adaxial side of carpel can be short and thus in fruit stigma apical to apico-ventral; ovules 6–13. *Fruitlets* a soft berry, globose to obovoid, red turning (bluish) black, usually in sicco showing seeds, up to 9 mm diam, base obtuse to rounded, without or with a 0.3–2 mm long stipe; stigma 2–6 mm long; fruitwall without brachysclereids; pulpa almost not between seeds. *Seeds* 3–15, ellipsoid or obovoid, somewhat curved, 2.7–4 by 1.5–3 by 1.3–2.3 mm; testa thin, brittle, dark grey to dull black, very finely pusticularly ribbed.

Distribution — W. part of PNG.

Ecology — Mid-montane or *Agathis*-forest at 650–2000 m altitude. Flowerbuds and fruits September–December.

Specimens examined. PAPUA NEW GUINEA, West Sepik, Sandaun Prov., N slopes Bewani Mts, Mt Yungat, *Kerenga LAE 56548* (CANB n.v., L), 1030 m alt.; Telefomin Dist., Busilmin, *Vinas & Wiakabu LAE 59392* (L), 1500 m alt.; Mt Stolle, *Salas & Stephens KP 163* (L), *Regalado & Katik 1258* (L), 1600 m alt., *1265* (L), *1282* (L), 2000 m alt.; East Sepik Prov., Etappenberg, *Ledermann 8986* (B), 850 m alt., *9242* (K); S. Highlands Prov., Mt Bosavi, *Jacobs 9489* (L, US), 600–700 m alt.

Notes — In very young buds of *Ledermann 9242* I could observe a free apex of the floral axis, surrounded by the carpels.

In general the secondary nerves are far apart in relation to their length; however, in the type material this pattern is distorted by distinct intercalaries, hence the name. *Zygogynum polyneurum* is distinguished from *Z. umbellatum* (see *Notes* there) by the soft fruitlets lacking brachysclereids in their walls, often showing the seeds in sicco.

13. *Zygogynum schramii* Vink, *sp. nov.* — Fig. 1

Zygogynum schramii Vink. — Type: *Vink BW 8458* (holo L; iso A, BO, CANB, K, LAE, MAN n.v.).

Etymology. This species is named in honour of Ferdinand August Willem (Wim) Schram, 2 Aug. 1928 (Batavia) – 6 Apr. 2012 (Amsterdam), forest ranger and collector at the Forestry Herbarium at Manokwari, West New Guinea 1953–1962, who also took part in the survey that yielded the type material. See *Flora Malesiana* I-5, 1958: CCCXIX, and I-8, 1974: LXXXVII – LXXXVIII (photo).

Tree 12 m high, dbh 10 cm. *Branchlets* rather slender, brown. *Leaves* confined to the end of branchlets; petiole 10–15 mm long, almost flat to rounded above, rounded below, brown; blade obovate to oblanceolate, 9–26 by 4.5–7 cm, chartaceous, in sicco light brown to purplish grey below; apex broadly acute to obtuse and ultimately up to 1 cm rounded broad-acuminate, base narrowly acute; midrib impressed above, prominent below; secondary nerves at 50–70° with midrib, arcingly joined at some distance from margin, distinct above, prominulous below. On lower surface only stomata white, solitary, well-spaced, not over the most prominent secondary nerves; oil cells widely scattered. *Inflorescences* with 3–4 partial inflorescences, these 1–3 cm long, with thin axes, 1–5-flowered, if more than 1-flowered flowers inserted on main axis; empty bracts below inflorescence 1–5; pedicels in bud 3–13 mm long. Only buds known. *Calyx* (2–)3(–4)-lobed, thin, smooth. *Petals* 6–7, free. *Stamens* 33–39; thecae apically slightly separated to touching; connective not prolonged. *Carpels* 1(–2); stigma as long as carpel apex and adaxially descending almost to base of carpel; ovules 54–64. *Fruitlets* a soft berry, globose, 16–20 mm diam, green, later greenish white and red; base abruptly 2–3 mm obconical; fruitwall without brachysclereids; pulpa also between seeds. *Seeds* several, obovoid, c. 3–4 mm long; testa thin, brittle, pusticularly ribbed.

Distribution — Papua: Sidoarsi Mts (only known from type).

Ecology — Primary forest at 660 m altitude. Flowerbuds and fruits in May.

Specimens examined. INDONESIA, Papua, Kab. Sarmi, Sidoarsi Mts, *Vink BW 8458* (A, BO, CANB, K, L, LAE), 660 m alt.

Notes — The six petals are inserted in one series; if the 7th petal is present, this is in the second series. Although in 5 buds only solitary carpels were seen, the only fruit available is bicarpellate, the two fruitlets coherent by interwoven cells of the adaxial stigma parts.

Zygogynum schramii differs from *Z. longifolium* by the small inflorescences, the long stigma, and the high number of stamens. *Zygogynum archboldianum* has a comparable long stigma, but it has many carpels and coriaceous leaves.

14. *Zygogynum sororium* (Diels) Vink — Fig. 1

Zygogynum sororium (Diels) Vink (1985) 54. — *Drimys sororia* Diels (1916) 245. — *Bubbia sororia* (Diels) A.C.Sm. (1942) 427. — Type: *Ledermann 11661* (B†); neotype here chosen: *Ledermann 11898* (holo B).

Tree(let) 3–20 m high. *Branchlets* rather stout, dark grey-brown. *Leaves*: petiole 10–20 mm long, flat above, rounded below, dark brown; blade obovate-oblong, 14–22 by 4.5–9 cm, thin-coriaceous, in sicco light purplish brown below; apex acute to obtusely rounded, base acute and shortly abruptly attenuate; midrib almost flat above, strongly prominent below; secondary nerves at 70–80° with midrib, arcingly joined at some distance from margin, prominulous on either side. On lower leaf surface stomata white, in clusters, or forming a lax labyrinth, not over secondary nerves; oil cells scattered, indistinct. *Inflorescences* with 5 partial inflorescences, these 6–11 cm long, with rather stout axes, many-flowered, flowers inserted on axes 2nd or 3rd order; empty bracts below inflorescence unknown; pedicels 1–5 mm long, rather stout. *Calyx* 2–3- or irregularly lobed, 1–1.5 mm long, rather thin, basally bullate. *Petals* 8–12, free, (broad) elliptic to obovate, white, outer ones 5–6 by 3–4 mm, middle ones 5–7 by 2.5–3 mm, inner ones 4–5 by 1–2 mm, apex broadly rounded, inner ones obtuse to acute. *Stamens* 12–22, 1.3–1.6 mm long; thecae apically touching; connective not prolonged; pollen in tetrads. *Carpels* 4–5, free, 2–2.5 by 1.3–1.5 by 1.2–1.5 mm; stigma about 2/3 of carpel apex, not descending adaxially; ovules c. 21. *Fruitlets* unknown.

Distribution — PNG: Schrader Mts.

Ecology — Montane (mossy) forest at 1900–2070 m altitude. Flowering May, June.

Specimens examined. PAPUA NEW GUINEA, East Sepik Prov., Schraderberg, *Ledermann 11661* (B†), *11898* (B), 2070 m alt., *12141* (B†).

Notes — This species is similar to *Z. calothyrsum* except for the smaller flowers: petals (4–)5–7 mm vs 5.5–17 mm; and an often different arrangement of the stomata. In *Z. calothyrsum* the white stomata on the lower leaf side are mostly in strings, sometimes solitary or in a labyrinth; when the latter is the case, the size of the flowers, if present, is decisive for the identification.

For the time being, this species is upheld, although further studies of the very variable *Z. calothyrsum* (that includes *Z. calophyllum*) may show that the differences are drowned in the general variability.

15. *Zygogynum staufferianum* Vink, sp. nov. — Fig. 1

Zygogynum staufferianum Vink. — Type: *Van Balgooy 968* (holo L; iso A, BISH, CANB, CHR, K, LAE, NSW, P, US, Z).

Etymology. Named after Hans Ulrich Stauffer (9 Aug. 1929–21 Aug. 1965), see Hürlimann 1966, Van Steenis 1974, Endress 1990.

Tree(let) 5–15 m high. *Branchlets* rather slender to rather stout, brown to grey to black. *Leaves* scattered along branchlets; petiole 5–10 mm long, flat with narrow thin edges above, rounded below, dark brown; blade elliptic to narrowly elliptic, 3.5–14 by 1.5–3.5 cm, thinly coriaceous, flat or – more often – slightly bulging up between the secondary nerves, in sicco grey-green

on either side, apex (obtuse to) narrowly rounded, base acute to attenuate; midrib impressed above, prominent below, brown; secondary nerves at (65–)70–80° with midrib, arcingly joined at some distance from margin, distinct to prominulous on either side. On lower leaf surface stomata white, solitary (and in short strings or small clusters), not over secondary nerves; oil cells not apparent. *Inflorescences* with 4–7 partial inflorescences, these 1–10 cm long, with rather slender axes, 3–20-flowered, flowers inserted on axes 1st or 2nd (or 3rd) order, empty bracts below inflorescences 0–9(–20); pedicels 2–10 mm long, rather slender, also in fruit. *Calyx* 2–3-lobed, not reflexed, 0.8–2 mm long, thin, smooth. *Petals* 7–10, free, obovate(-oblong), yellowish to pale green, sometimes tinged with red, 5–9 by 2–4 mm, inner ones somewhat longer and narrower than outer ones, apex (broadly) rounded. *Stamens* 17–29, 1–2.5 mm long, filaments sometimes inflated; thecae apically touching (or slightly separated); connective not prolonged; pollen in tetrads. *Carpels* 2–5, free, 2–3 by 1–2 by 1–2.3 mm; stigma 0.4–0.7 times as long as carpel apex, not descending adaxially; ovules 14–24. *Fruitlets* a rather soft berry, globose, red, up to 11 mm diam, with 2/3–2 mm cylindrical to conical stipe; fruitwall without brachysclereids; pulpa also between the seeds. *Seeds* (narrowly) obovoid, straight, 2.7–4.5 by 1.2–2.0 mm; testa low-pusticular to subsmooth, (brownish) black.

Distribution — PNG: Western and Eastern Highlands Provinces.

Ecology — Montane (tall, mossy, ridge-)forest at 2400–2770 m altitude. Flowering and fruiting May–July.

Vernacular names — Benamze (Chimbu lang.), Kup (Hagen: Wankl dial.), Ratoaigeh (Goroka: Goreipa dial.).

Specimens examined. PAPUA NEW GUINEA, Western Highlands Prov., Tomba, S. slope of Mt Hagen Ra., *Hoogland & Pullen 6145* (A, BO, CANB, K, L, LAE, US), 2550 m alt.; Tambul, *Womersley NGF 14252* (L, LAE), 2400 m alt.; Eastern Highlands Prov., Marafunga Mill, W. of Fatima R., *Grubb & Edwards 61* (L), 2600 m alt.; Mt Wilhelm, east slopes, *Brass 30374* (A, CANB, K, L, US), 2770 m alt.; *Brass 30486* (CANB, K, L, US), 2600 m alt.; Mt Wilhelm, Komamemambuno, *Van Balgooy 968* (A, BISH, CANB, CHR, K, L, LAE, NSW, P, US, Z), 2750 m alt.; Keglsugl sawmill, *Kairo & Streimann NGF 35774* (A, L); Goroka Subprov., Asaro-Mairifutuca divide, 1/2 mile S of Daulo camp, *Pullen 448* (A, BO, CANB, L, LAE, US), 2400 m alt.

Notes — In several triads with dimerous terminal flowers the lateral flowers showed trimerous calices and corollas.

This species has a special 'look' by the relatively narrow leaves, with the secondary nerves at a wide angle, on the lower leaf side often between slightly sunken areas.

16. *Zygogynum umbellatum* (Ridl.) Vink — Fig. 1

Zygogynum umbellatum (Ridl.) Vink (1985) 54. — *Drimys umbellata* Ridl. (1916) 11. — *Bubbia umbellata* (Ridl.) Dandy (1934) 41; A.C.Sm. (1943) 150. — Type: *Boden Kloss s.n.* (K).

Bubbia glauca A.C.Sm. (1942) 433, (1943) 150. — *Zygogynum glaucum* (A.C.Sm.) Vink (1985) 54. — Type: *Brass 7191* (holo A n.v.; iso BO, BRI, L, LAE).

Bubbia idenburgensis A.C.Sm. (1942) 432, (1943) 150. — Type: *Brass 13028* (holo A n.v.; iso BO, BRI, L).

Tree(let) 2–10 m high. *Branchlets* rather slender, brown. *Leaves*: petiole 8–20 mm long, broadly grooved to flat above, rounded below, dark brown; blade obovate to oblanceolate, 7–23 by 3–8 cm, chartaceous to thin-coriaceous, in sicco light grey (rarely brownish grey) below; apex acute and 0–1.8 cm (broadly) acuminate, base cuneate; midrib slender to broad, impressed above, (strongly) prominent below; secondary nerves at 55–75° with midrib, towards margin joined by a – sometimes double – row of arcs, faint to distinct on either side. On lower leaf surface stomata and unspecialised cells white, also over secondary nerves, sometimes tiny islands of unspecialised cells bare; oil cells (not apparent to) abundant, often black. *Inflorescences*

with 3–9 partial inflorescences, these (1–)3–11 cm long, with slender but under fruit firm axes, 3–15(–61)-flowered, flowers inserted on axes 1st or 2nd (to 3rd) order; empty bracts below inflorescence 0–6; pedicels 2–9 mm long, slender to rather firm. *Calyx* 2- or irregularly lobed, often reflexed, 0.4–1.4 mm long, smooth. *Petals* 4, free, elliptic to orbicular or (ovate-) oblong, (purple-)green, 2–4 by 1.5–4 mm, apex (broadly) rounded. *Stamens* 6–19, 1–1.5 mm long; thecae apically touching to distinctly separated; connective not prolonged, pollen in tetrads. *Carpels* 1–6, free, 1.5–2 by 1–1.5 by 0.8–1.5 mm; stigma 0.6–0.8 times as long as carpel apex, adaxially descending 1/4–1/3 carpel height; ovules 8–22. *Fruitlets* a hard berry, globose (to obovoid), red, in sicco not showing seeds, up to 12 mm diam, base obtuse to rounded with an up to 1.5 mm long stipe; stigma 3–6 mm long, apico-ventral; fruitwall with dense brachysclereids; pulpa from only as ridges on locule wall to completely separating seeds. *Seeds* 5–13, obovoid, 3–5.3 by 1.8–3.5 by 1.5–3.2 mm; testa rather thin, brittle, dull to shining black, (sub)smooth.

Distribution — Rare throughout New Guinea.

Ecology — In undergrowth of primary or mixed secondary forest at 100–1200 m altitude. Flowering November–February, fruiting March–July.

Vernacular name — Kakēta (Maybrat lang.).

Specimens examined. INDONESIA, Papua, Kab. Teluk Bintuni, Bomberai Peninsula, Sjuga-Wagura area, Armina, V.W. *Moll BW 13003* (A, BRI, CANB, K, L), below 400 m alt.; Kab. Sorong Selatan, Vogelkop Peninsula, Ayawasi, W. *Avé 4456* (L), 450 m alt.; Kab. Mimika, Mt Carstensz, camp Vlb, *Boden Kloss s.n.* (K), 1200 m alt.; Kab. Jayawijaya, Bernhard Camp, Idenburg R., *Brass 13028* (A n.v., BO, BRI, L). — PAPUA NEW GUINEA, Western Prov., nr junction Black R. with Palmer R., *Brass 7191* (BO, BRI, L, LAE), 100 m alt.; Gulf Prov., Lakekamu, Avi Avi R., *Takeuchi & Kulang 11547* (L), 175 m alt., *11568* (L), 335 m alt.; Morobe Prov., Aseki, *Schodde & Craven 5082* (A, L), 1200 m alt.

Notes — This species differs from *Z. polyneurum* only by the brachysclereids in the fruit wall, causing hard berries, but I prefer to uphold this fruit character as one of the few distinguishing characters in the papuasian species complex.

Zygogynum umbellatum occurs in lowland and lower montane habitats, rather unusual for New Guinea *Winteraceae*.

REFERENCES

- Burtt BL. 1936. *Bubbia haplopus*. Hooker's *Icones Plantarum* 34, t. 3315: 1–3.
- Burtt BL. 1938. The taxonomic position of *Tetrathalamus*. *Kew Bulletin* 1938: 458–460.
- Dandy JE. 1934. Some additions to the genus *Bubbia* (Winteraceae). *Journal of Botany* 72: 40–41.
- Diels L. 1916. Neue Magnoliaceae Papuasiens. *Botanische Jahrbücher, Systematik* 54: 230–245.
- Diels L. 1924. Magnoliaceae. *Nova Guinea* 14-I: 75–79.
- Endress PK. 1990. Institut für Systematische Botanik und Botanischer Garten der Universität Zürich – gestern und heute. *Botanica Helvetica* 100: 393.
- Hürlimann H. 1966. Hans Ulrich Stauffer: 1929–1965. *Adansonia* 6: 23–24.
- Kanehira R, Hatusima S. 1943. The Kanehira-Hatusima 1940 collection of New Guinea plants XIX. *The Botanical Magazine Tokyo* 57: 147–155.
- Lam HJ. 1928. *Fragmenta Papuana*, *Natuurkundig Tijdschrift voor Nederlandsch-Indië* 88: 217.
- Lam HJ. 1945. *Fragmenta Papuana*. *Sargentia* 5: 60.
- Lauterbach CAG. 1905. Familie Guttiferae. In: Schumann K, Lauterbach CAG, *Nachträge zur Flora der deutschen Schutzgebiete in der Südsee*: 319–320. Borntraeger, Leipzig.
- Lauterbach CAG. 1923. Die Guttiferen Papuasiens. *Botanische Jahrbücher, Systematik* 58: 1–49.
- Ridley HN. 1916. Report on the Botany of the Wollaston Expedition to Dutch New Guinea, 1912–13. *Transactions of the Linnean Society of London. Botany II*, 9: 1–269.
- Schlechter R. 1913. Neue Magnoliaceae Papuasiens. *Botanische Jahrbücher, Systematik* 50, I: 70–72.
- Smith AC. 1942. Studies in Papuasian plants V. *Journal of the Arnold Arboretum* 23: 417–443.
- Smith AC. 1943. Taxonomic notes on the Old World species of Winteraceae. *Journal of the Arnold Arboretum* 24: 119–164.
- Van Steenis CGGJ. 1974. *Flora Malesiana I*, 8: XCIV.
- Vink W. 1970. The Winteraceae of the Old World. I. Pseudowintera and *Drimys* – Morphology and taxonomy. *Blumea* 18: 225–354.
- Vink W. 1977. The Winteraceae of the Old World. II. *Zygogynum* – Morphology and taxonomy. *Blumea* 23: 219–250.
- Vink W. 1985. The Winteraceae of the Old World. V. Exospermum links *Bubbia* to *Zygogynum*. *Blumea* 31: 39–55.
- Vink W. 1993. Winteraceae. *Flore de la Nouvelle-Calédonie* 19: 90–171.

IDENTIFICATION LIST

- Aet & Idjan 539: 8 – ANU 2883: 2 – Avé 4456: 16.
- Boden Kloss s.n.: 16 – Brass 7191: 16; 10249: 9; 12712: 1; 13028: 16; 13313: 1; 13868: 8; 23545: 10; 29487: 10; 30374: 15; 30486: 15 – Burley & Ismail 4618: 9 – BW 5429: 6; 8413: 8; 8458: 13; 11194: 8; 11196: 8; 13003: 16.
- Clemens 3629: 4; 4596: 4; 5157: 4 – Coon & Kairo 475: 2.
- Feuilleateau de Bruyn 50: 8.
- Grubb & Edwards 61: 15.
- Hoogland & Craven 10535: 8 – Hoogland & Pullen 6145: 15.
- Ijiri & Niimura 464: 8.
- Jacobs 8745: 2; 9489: 12.
- Kanehira & Hatusima 12105: 8.
- LAE 56548: 12; 57353: 2; 58822: 2; 59392: 12; 61131: 10; 69143: 5; 73772: ?8; 77988: 2 – Lam 794: 8; 1165: 8; 1225: 8 – Ledermann 8973: 7; 8973a: 7; 8986: 12; 8990: 7; 9242: 12; 11661: 14; 11898: 14; 12141: 14.
- NGF 14252: 15; 19772: 4; 27601: 5; 34348: 6; 35774: 15; 44125: 5.
- Pullen 448: 15.
- Regalado & Katik 1258: 12; 1265: 12; 1281: 3; 1282: 12 – Robbins 2004: 8; 2131: 8 – Royen & Sleumer 6328: 6; 6396: 6.
- Salas & Stephens KP 163: 12 – Sauvour 3005: 8; 3005a: 8 – Schlechter 13984: 10; 16470: 11 – Schodde 1389: 2 – Schodde & Craven 5082: 16 – Schultze Jena 342: 3 – Stauffer & Sayers 5611: 4.
- Takeuchi 6064: 8; 6212: 7; 11084: 8 – Takeuchi et al. 11547: 16; 11568: 16; 21068: 4.
- UPNG 4465: 2.
- Van Balgooy 968: 15 – Vink 17494: ?8.

INDEX

Accepted names are in roman type. New names are in **bold** type and synonyms are in *italics*. The number after each name is the number of the species as used in the article.

Bubbia archboldiana A.C.Sm. 1
bullata (Diels) A.C.Sm. 3
clemensiae A.C.Sm. 4
glauca A.C.Sm. 16
idenburgensis A.C.Sm. 16
ledermannii (Diels) B.L.Burtt 7
longifolia A.C.Sm. 8
megacarpa A.C.Sm. 9
monocarpa A.C.Sm. 8
montana (Lauterb.) A.C.Sm. 20
oligocarpa (Schltr.) B.L.Burtt 11
polyneura (Diels) B.L.Burtt 12
sororia (Diels) A.C.Sm. 14
umbellata (Ridl.) Dandy 16

Drimys bullata Diels 3
ledermannii Diels 7
monogyna Kaneh. & Hatus. 8
oligocarpa Diels non Schltr. 8
oligocarpa Schltr. 11
polyneura Diels 12
sororia Diels 14
umbellata Ridl. 16
Tetrathalamus montanus Lauterb. 10
Zygogynum archboldianum (A.C.Sm.) Vink 1
bosavicum Vink 2
bullatum (Diels) Vink 3
clemensiae (A.C.Sm.) Vink 4
cruminatum Vink 5

Zygogynum (cont.)
cycloensis Vink 6
glaucum (A.C.Sm.) Vink 16
ledermannii (Diels) Vink 7
longifolium (A.C.Sm.) Vink 8
megacarpum (A.C.Sm.) Vink 9
montanum (Lauterb.) Vink 10
oligocarpum (Schltr.) Vink 11
polyneureum (Diels) Vink 12
schramii Vink 13
sororium (Diels) Vink 14
staufferianum Vink 15
umbellatum (Ridl.) Vink 16