

A REVISION OF THE GENUS TRIMENIA (TRIMENIACEAE)

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INTRODUCTION

Trimenia was first described by Seemann (1871) and based upon a single specimen from Kandavu, Fiji Islands. This specimen he had referred earlier in a preliminary list of Vitian Plants (1861) to a species of *Weinmannia* because 'in habit this singular plant is so very much like some species of *Weinmannia*' (Seemann 1871). He suggested it to belong to the tribe of *Ternstroemiaceae* DC. of *Theaceae*, 'though the panicles are pluriflorous'. Bentham & Hooker (1880) did not share this view and although the systematic position was not certain as they said, they regarded it to have more affinity to *Monimiaceae*. Some time elapsed before Perkins & Gilg (1901) and Perkins (1925) placed the taxon definitely in the *Monimiaceae* as the tribe *Trimenieae*.

Gibbs (1917) regarded this tribe to be a distinct family, *Trimeniaceae*, although she did not state the reasons for this decision. On the basis of more extensive material Gilg & Schlechter (1923) disputed this point of view; they postulated that the features upon which the diagnosis of the family was based were not clear and distinct enough to justify a separation between *Monimiaceae* and *Trimeniaceae* as distinct families, although it seemed clear to them that the *Trimenioideae* should have to be considered as a distinct subfamily of *Monimiaceae*. This subfamily should include four genera viz.: *Xymalos*, *Idenburgia*, *Piptocalyx*, and *Trimenia*.

The view of Gibbs was shared by Money, Bailey & Swamy (1950) after an extensive study of the anatomy of the *Monimiaceae*. I agree that *Trimeniaceae* are best regarded as a distinct family, including two genera viz.: *Trimenia* and *Piptocalyx*. The main characters upon which the discrimination is based will be given below.

The study of Money et al. l.c. has pointed out that *Xymalos* should be regarded as belonging to *Monimiaceae*, although it has some affinities with *Trimeniaceae*.

Idenburgia was reduced to the Guttiferous genus *Nouhuysia* by Van Steenis (1952). Later he merged this taxon with *Sphenostemon*, a genus which Baillon had described in the *Aquifoliaceae* (Van Steenis, 1955). Van Steenis l.c. kept it there, giving no alternative as to affinity. Bernardi (1964) discussed its affinities in a somewhat wider scope but came to the same conclusion namely that it could fit in *Aquifoliaceae*. He opposed Erdtman (1954) who removed *Sphenostemon* from both *Guttiferae* and *Aquifoliaceae* and proposed to raise it, on the strength of its characteristic pollen, to a family of its own, *Sphenostemonaceae*, with affinities to several families of the *Celastrales*. Hutchinson (1959) accommodated *Sphenostemon* in *Trimeniaceae*, a point worthy to consider.

I am not able to take position in this matter and must conclude that the systematic place of *Sphenostemon* is still under dispute.

The taxonomic position of *Trimeniaceae sens. str.* has been discussed by Money et al. l.c., the family having evident relationships, not only to *Monimiaceae* and *Lauraceae*, but also to *Austrobaileya* and *Chloranthaceae*.

MORPHOLOGICAL AND ANATOMICAL NOTES

1. Leaves. The indumentum varies from entirely absent (*T. neocaledonica*) to dense and ferruginous, sometimes partly persistent in maturity (*T. weinmanniifolia* ssp. *marquesensis*) but usually disappearing with age. In the latter case the midrib (and sometimes the primary lateral nerves too) often retain the indumentum to various degree. In mature leaves of *T. papuana* the midrib is villous on the lower surface, especially near the base of the leaf, in a specimen of New Britain (*T. weinmanniifolia* ssp.) the midrib is villous only on the upper surface, and in *T. weinmanniifolia* ssp. *marquesensis* the midrib and primary lateral nerves are villous on both surfaces of the leaf. The hairs are unicellular and non-glandular.

In the parenchym of the leaf (and of the axes too) etherial oil cells and mucilage cells are conspicuously developed (Money et al. l.c.). These cells are visible to the naked eye as translucent dots. The contents are clear or brown as stated by Metcalfe & Chalk (1965). Mucilage cells are absent in *Monimiaceae* (Money et al. l.c.). Except in *T. neocaledonica*, where the margin is entire, the leaves are more or less glandular-toothed, bearing a cluster of oil glands at the extreme tip of each tooth. The serration varies from a very regular pattern of sinae and angulae to a pattern where the margin seems to be entire with an occasional angulus in the shape of a cluster of glands.

Young leaves are thinly chartaceous, they soon harden and become pergamentaceous, the upper surface is shiny and covered by a waxy layer, the lower surface is paler and dull, but never covered with wax.

According to Money et al. l.c. the upper side of the leaf does not possess a hypoderm-layer as regularly found in *Monimiaceae*; a palisade-parenchym layer has not developed either, instead the mesophyll consists entirely of spongy tissue. The stomata, which are confined to the lower surface, are Rubiaceous, whereas they are of the Ranunculaceous type in *Monimiaceae*. *Trimenia* has a two trace-unilacunar node and resembles in this respect *Austrobaileya*; *Monimiaceae*, on the contrary, have a 1 or 3—more trace-unilacunar node.

The lateral nerves emerge from the midrib at an angle of about 80 degrees and run almost parallel for the first half, than they ramify and become less distinct from the tertiary venation and near the margin an irregular network is formed. The branched nerves are connected at the margin into an intramarginal nerve, running at a distance of 1—2 mm from the margin; in *T. neocaledonica* even in the margin.

2. Inflorescence. The inflorescence is a raceme of varying complexity; the racemes are usually axillary, in *T. papuana*, however, also terminal. The most simple type is realised in *T. neocaledonica*, although some doubt has to be expressed because I had only one specimen of this species to my disposal. This species has a simple raceme with 2—3 pairs of decussate flowers on a main axis which ends in a terminal flower. A more complex type is found in *T. weinmanniifolia*. The main axis bears 1—5 pairs of decussate lateral axes and higher up 1—5 pairs of decussate single flowers, thus forming a compound raceme. The lateral axes, which are never ramified, bear up to 13(—19) flowers. Lateral axes and flowers are basically opposite, though often subopposite; the flowers on the lateral axes are occasionally even alternate. All axes end in a terminal flower. The peduncle is moderately long, measuring about $\frac{1}{3}$ of the length of the total inflorescence. Only in *T. neocaledonica* the peduncle is shorter, about $\frac{1}{5}$ of the length of the inflorescence. The most complex type is found in *T. papuana*. Here the compound racemes together often form a terminal, leafy panicle. Such a panicle consists of 2—4 pairs of opposite, compound

racemes, each one in the axil of a leaf, and a terminal one. Often there is also a second, ascendingly serial, small, not ramified raceme in each axil, which is sometimes reduced to only one flower; on the peduncle of that serial raceme there are occasionally two empty bracts. The leaves in the panicle are usually smaller than the other leaves, their size decreasing in apical direction, the leaf-shape remaining similar to the other leaves.

The pedicels are short, not longer than 1 mm, except in *T. neocaledonica* where they may reach a length of 4 mm. There is no clearly defined differentiation into pedicel and receptacle. The receptacle is approximately cylindrical with a flat or slightly convex apex, upon which the stamens and pistil are arranged. Bracteoles are absent.

The term 'raceme' has been used in a purely descriptive sense because in a strict raceme flowers are not decussate and there should be no terminal flower. But the flowers come to anthesis in an acropetal way and there are no clear bracteoles. Morphological interpretation seems not easy; it is not impossible that each flower is a cyme reduced to one flower and it might be that the two outer 'tepals' are really bracteoles. A detailed morphological study necessary to reveal the true nature of the inflorescence for which fixed developmental stages are necessary, was beyond the scope of this herbarium study.

3. Flowers. The flowers of *Trimenia* exhibit transitions between bisexuality and unisexuality. *T. neocaledonica* has definitely bisexual flowers. *T. papuana* is polygamous, part of the flowers being bisexual, others unisexual, both types occurring in the same panicle. In the male flower the pistil is rudimentary, rarely absent. In the female flower the pistil is well developed and the stamens are obviously sterile; they are smaller than the fertile ones and as far as I could conclude from the examination of herbarium specimens, pollen is absent at least at the beginning of anthesis. *T. weinmanniifolia* bears only unisexual flowers; ssp. *weinmanniifolia* is distinctly monoecious, the other two subspecies seem to be dioecious but the material available was too scarce to be certain about this.

4. Tepals. The receptacle bears a varying number of scale-like tepals which are caducous prior to anthesis. Most of the tepals are spirally arranged and not decussate as stated by Money et al. (1950, p. 387); at most six pairs of the outer tepals are decussate. It is possible to distinguish three different intergrading types of tepals:

1. The decussate 2—6 outer tepals are broadly ovate to ovate-oblong, fleshy or rather thickly membranaceous; their base is truncate, sometimes emarginate, often saccate; their apex is rounded or obtuse.
2. The other, spirally arranged tepals are almost symmetrically elliptic, membranaceous with a more or less fleshy base, except:
3. the 1—4 innermost tepals (rarely absent in *T. weinmanniifolia* ssp. *weinmanniifolia*, not present in *T. neocaledonica*) which are spatulate and convex, enclosing the stamens and ovary.

The tepals increase gradually in length towards the apex, the spatulate ones being almost twice as long as the outermost ones.

5. Stamens. The number of stamens is variable. The connective is produced at apex into a more or less pointed tongue-shaped appendix. The elongate anthers open lengthwise, almost strictly latrorse except in *T. neocaledonica* where the dehiscence is extrorse. The pollen is polyporate or with two irregular unthickened areas, while in *Monimiaceae* the pollen is monocolpate, dicolpate, or acolpate (Money et al. l.c.).

6. Pistil. In female flowers the pistil is barrel-shaped, somewhat narrowed at base and

sometimes at apex. The stigma is sessile and calyptriform, at apex truncate to various degree, and coarsely papillose.

Both the extent to which the apex of the stigma is flattened and the length of the papillae depend on age. In bud the stamens are firmly pressed against the pistil, somewhat overtopping it. The papillae are then rather short and the pressure of the stamens finds expression in 4—8 radiating impressions through which the stigma seems to be divided in superficial lobes. The patent papillae elongate with age. The consequence is that the pattern of lobes obscures and the apex of the stigma becomes flat.

In male flowers the rudimentary pistil, which is always without locule and ovule, may have different shapes:

1. Small, in its appearance similar to a fertile one, although often laterally compressed; glabrous or strigose; rarely there may be two. Occurring in both species.
2. Pistillode very short, terminating in an expanded stigmatic surface; glabrous. In *T. weinmanniifolia* ssp. *weinmanniifolia*.

The following types occur in *T. papuana* only:

3. Pistillode slender, clavate, about half the normal length; glabrous.
4. Pistillode a slender stalk of normal length (i.e. the same length as or slightly shorter than the stamens), either terminating in a stigmatic surface and glabrous or not ending in such a surface and strigose.

Finally in both species the pistillode may be absent or invisible.

The ovule is pendulous and anatropous.

7. Fruit. The fruit is berry-like and juicy; green and hard when immature and succulent with dark red juice when ripe. The colour of the ripe fruit is deep cherry-red to purple or black.

8. Seed. The seed is ovoid or obliquely ovoid with a very hard testa. The latter is smooth or with regular radiating ridges or with an irregular pattern of ridges. The embryo is situated in the apical part of the abundant gelatinous endosperm.

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TRIMENIA

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Gilg & Schltr, Bot. Jahrb. 58 (1923) 245; Perk., Gattungen der Monimiac. (1925) 22; F. Brown, Bull. Bish. Mus. 130 (1935) 82; Money, Bailey & Swamy, J. Arn. Arb. 31 (1950) 372—404, t. i—iv; Lem. & Pich., Rev. Gén. Bot. 61 (1954) 87, 91, t. 1—4.

Type species: *Trimenia weinmanniifolia* Seem. 1871.

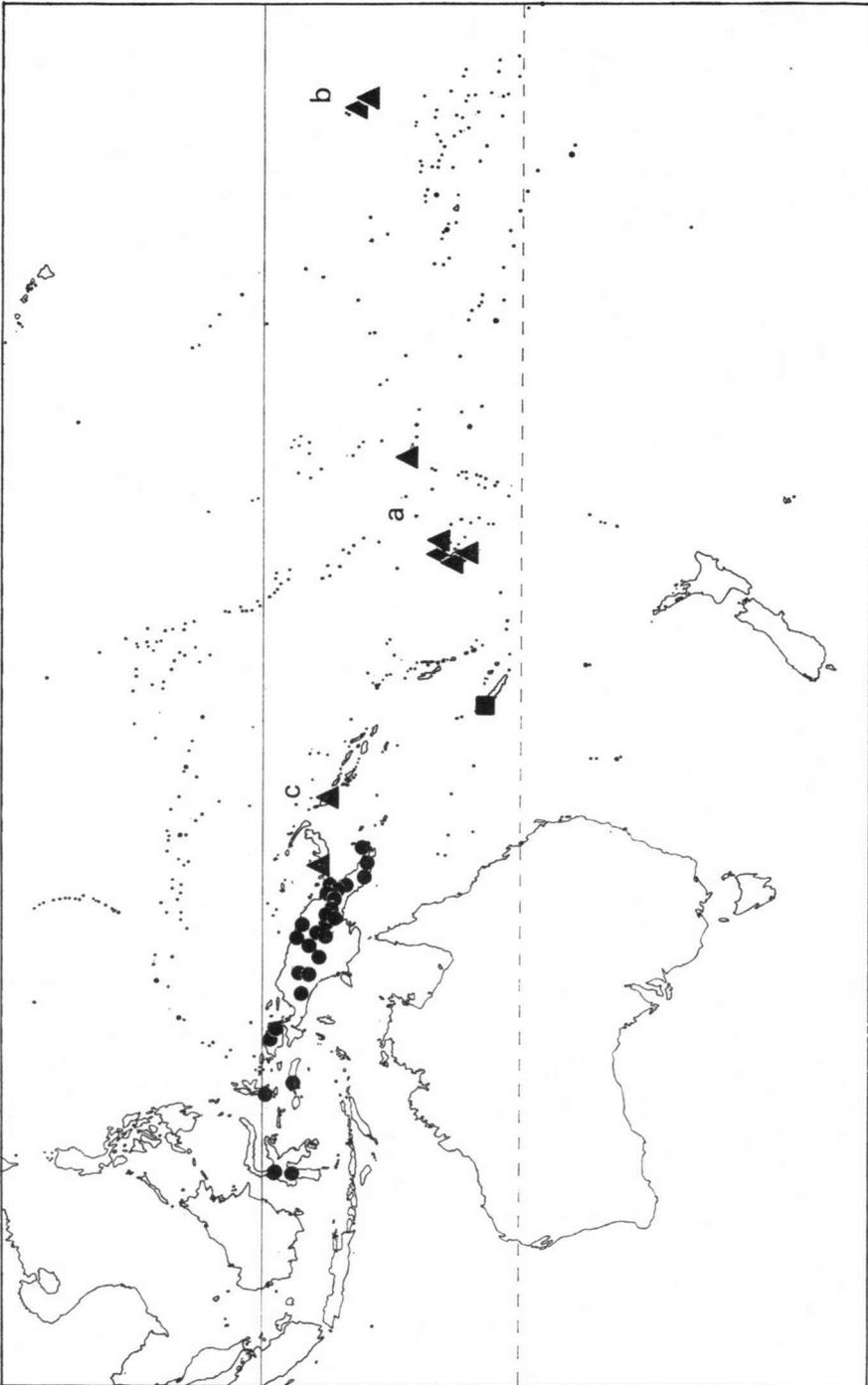
Small trees or shrubs, up to 20(—25) m, glabrous or reddish tomentose-villous or woolly and partly or entirely glabrescent. Branches and branchlets somewhat quadrangular, bark longitudinally fissured. *Leaves* decussate, simple, obovate to ovate-lanceolate, base cuneate, apex acute to acuminate; entire or more or less serrate, pergamentaceous, shiny and covered by a thin waxy layer above, dull and paler beneath, provided with many more or less translucent dots, pinninerved, nervation distinct, midrib sunken above, prominent below, the 11—26 pairs of nerves connected near the margin, forming an intramarginal nerve, usually sunken above, sometimes flat or slightly prominent, more or less elevated below, venation rather prominent above, less conspicuous below; petiole above flat or grooved. *Inflorescence* axillary, sometimes also terminal, pyramidal to cylindrical, equal to or shorter than the subtending leaf (up to 10 cm long and 7 cm wide), a (usually) compound raceme with 1—5 pairs of decussate lateral branches, and above these 1—5 pairs of decussate, often subopposite or even alternate flowers, main axis and lateral branches terminating into a flower, lateral branches with 3—13(—19) flowers; racemes together sometimes forming a terminal, leafy panicle. *Bracts* caducous or not, broadly ovate or deltoid to ovate-lanceolate, boat-shaped, fleshy, often swollen in the median line, base more or less saccate, rarely auriculate, apex obtuse, margin entire, with many translucent dots. *Flowers* uni- or bisexual; pedicel terete; receptacle continuous with the pedicel, cylindrical, flat or slightly convex at apex, glabrous. *Tepals* caducous at anthesis, (8—)10—38, imbricate, spirally arranged, but the 2—6(—8) lower ones distinctly decussate; outermost tepals ovate to nearly orbicular or reniform, up to 3 mm long, thick-membranaceous, base swollen and saccate, apex rounded or obtuse, rarely acute, grading in apical direction into larger ones, ovate to obovate, up to 4½ mm long, membranaceous, base somewhat fleshy, slightly saccate to rounded, apex rounded; (0—)1—4 innermost tepals spatulate, convex, up to 5 mm long, thin-membranaceous, enclosing the stamens and pistil; all tepals entirely glabrous or ciliate, with many translucent dots. *Stamens* 9—23, at apex of receptacle in (1—)2—3 rows, glabrous, provided with many oil glands, less developed in female flowers, filament short, linear; connective produced at apex into a tongue-shaped appendix; anthers basifixed, linear, laterally or extrorsely dehiscent. *Pistils* 1 (or 2), rudimentary or absent in male flowers, superior; ovary 1-celled, sessile, barrel-shaped, shorter than the stamens, with 5—9 more or less distinct lengthwise ridges, glabrous or sparsely strigose, especially on the ridges; stigma sessile, calyptriform, truncate to various degree, coarsely papillose, with more or less distinct lobes roughly corresponding to the ridges; ovule 1, pendulous, anatropous. *Fruit* berry-like, green and hard when immature, purplish or bluish black and soft and juicy when ripe, up to 7½ by 5 mm, glabrous. *Seed* ovoid or obliquely ovoid, up to 4 by 3 mm; testa very hard and thick, smooth or with a pattern of more or less irregular ridges; embryo erect, apically in the abundant, gelatinous endosperm.

Distribution: 3 species from Central Malesia (Celebes, Moluccas) to East Polynesia (Marquesas Islands). Fig. 1.

KEY TO THE SPECIES

1. Leaves obovate, entire. Bracts persistent. Stamens extrorsely dehiscent. Plant entirely glabrous.

1. *T. neocaledonica*



1. Leaves elliptic to lanceolate, sometimes widest below but never above the middle, margin more or less serrate, occasionally a few leaves entire. Bracts fugacious. Stamens laterally dehiscent. Plant not glabrous in all parts, at least bracts and tepals hairy.
2. Plants polygamous (♂, ♂, ♀). Filaments relatively long and thin, mature anthers only twice as long as the filaments. Seed smooth 2. *T. papuana*
2. Flowers functionally unisexual. Filaments relatively short and thick, mature anthers at least four times as long as the filaments. Seed with 5—7 lengthwise ridges or with a network of irregular ridges. 3. *T. weinmanniifolia*

1. *Trimenia neocaledonica* Baker f., J. Linn. Soc., Bot. 45 (1921) 384, t. 21, fig. 8—11.
— Syntypes: *Compton 1582 & 1796*, not seen, BM?

Shrub or small tree, *c.* 9 m, glabrous in all parts. *Leaves* obovate, index *c.* 2, 5—9 by 2 $\frac{3}{4}$ —4 $\frac{1}{2}$ cm; apex acuminate, obtuse; margin entire; bright green, midrib reddish; 11—15 pairs of nerves, sunken above, prominent below; petiole 7—10 mm. *Inflorescences* axillary, much shorter than the subtending leaf, up to 17 mm long, with 2—3 pairs of flowers; peduncle up to 3 mm. Bracts persistent, deltoid, *c.* $\frac{1}{2}$ mm long. *Flowers* bisexual, 4 by 3 mm; pedicel 2—4 mm; receptacle short, *c.* $\frac{3}{4}$ mm. *Tepals* 8(—12), 2 lower pairs decussate, almost reniform, 2 by 2 mm, innermost tepals grading from round, 3 by 3 mm, into elliptic, 4 by 2 mm; all tepals very thin at the more or less irregular margin. *Stamens* 12, *c.* 3 mm long; filaments short and thick, $\frac{3}{4}$ mm; appendix of the connective $\frac{1}{4}$ mm; anthers 2 mm, extrorsely dehiscent, white at anthesis; filament, connective, and anthers with many oil glands. *Ovary* 2 $\frac{1}{2}$ by 1 mm, with 6 radiating ridges. *Fruit* not seen.

Distribution: New Caledonia (Ignambi, Mt. Panié).

Ecology: Forests, *c.* 360—1000 m.

Notes. 1. Only 3 specimens are known, the two syntypes, one from Ignambi and one from Mt Panié, and the specimen I have seen from Ignambi (*Hürlimann 1902*).

2. The single specimen seen conforms with the description of Baker and shows it to be a very characteristic species. It differs from the other two much more closely related species by the total absence of the indument, the obovate entire leaves, the simple racemes, and the extrorsely dehiscent stamens.

2. *Trimenia papuana* Ridl., Trans. Linn. Soc., II, Bot. 9 (1916) 144; Gibbs, Contr. Phytogeogr. Fl. Arfak Mts (1917) 136; Gilg & Schltr., Bot. Jahrb. 55 (1919) 195, 199; *ibid.* 58 (1923) 248; A. C. Smith, J. Arn. Arb. 23 (1942) 442. — Type: *Kloss s.n.* (Wollaston Exped., Camp VIIb, 3900 ft; on label: Camp VIc), holotype in K.

T. arfakensis Gibbs, Contr. Phytogeogr. Fl. Arfak Mts (1917) 136; Gilg & Schltr., Bot. Jahrb. 58 (1923) 248; Kan. & Hat., Bot. Mag. Tokyo 56 (1942) 262, t. 10. — Type: *Gibbs 5743*, holotype in K, isotype seen from L.

T. myricoides Gilg & Schltr., Bot. Jahrb. 58 (1923) 248; A. C. Smith, J. Arn. Arb. 23 (1942) 442, *in obs.* — Syntypes: *Ledermann 8466, 8505, 12505* seen from K, *9944, 10923, 11016, 11232* not seen (probably lost), lectotype chosen: *Ledermann 12386*, holotype in L, isotype seen from K.

Shrub or tree, up to 20(—25) m. Branches and branchlets with brown to grey-brown bark, reddish tomentose-villous when young, glabrescent. *Leaves* oblong to lanceolate, sometimes widest below the middle, 2—12 $\frac{1}{2}$ by $\frac{3}{4}$ —3 $\frac{1}{2}$ cm (index *c.* 2—5); apex broadly acuminate to caudate, rarely acute, margin more or less distinctly serrate, sometimes quite entire, young leaves brownish, mature leaves to dark green above, light to medium green

Fig. 1. Distribution of the genus *Trimenia*. *T. papuana* (dots), *T. neocaledonica* (square), *T. weinmanniifolia* (triangles): a. ssp. *weinmanniifolia*, b. ssp. *marquesensis*, c. ssp. *bougainvilleensis*.

below, old leaves sometimes wine-red, slightly villous-strigose when young, glabrescent, midrib and nerves often in maturity villous below, 12—18(—22) pairs of nerves, flat above, hardly elevated below; petiole 8—12 mm, reddish tomentose, glabrescent. *Inflorescences* axillary or terminal, shorter than the subtending leaf, up to 6½ cm long and 5½ cm wide, with 1—5 pairs of lateral branches and above these 1—4 pairs of flowers; peduncle up to 15 mm, peduncle and other axes villous, glabrescent; the racemes together often forming a terminal leafy panicle. *Bracts* fugacious, bracts on main rachis ovate-lanceolate, c. 3 mm long, in apical direction grading to broadly ovate, c. 1 mm long; strigose, especially at the margin. *Flowers* uni- or bisexual, up to 4 by 2 mm; pedicel short, c. 1 mm, villous, mostly glabrescent; receptacle c. 1½ mm long. *Tepals* 11—19(—21), 4(—6) lower ones decussate, broadly ovate, 1½ by 1½ mm, grading into larger spirally arranged tepals, elliptic to ovate, 3 by 2 mm, 2—4 innermost tepals spatulate, 3 mm long, all ciliate in the upper half, the outermost more densely so, when in bud white to pale yellow-green, often pale-brown at base, yellow-brown or reddish-brown when older, dark brown at anthesis. *Stamens* 9—22, 2—3½ mm long; filaments slender, c. 1 mm; appendix of connective c. ¼ mm; anthers up to 2 mm, laterally dehiscent, without or with few oil glands, white or pinkish-white or creamy, pale brown when older. *Pistils* 1 (or 2), in male flowers rudimentary, rarely absent; ovary 2 by ¾ mm, with 6—9 more or less distinct ridges, sparsely strigose, especially on the ridges, yellow to green; stigma white or pale brown. *Fruit* up to 7½ by 5 mm, dark purple when ripe. *Seed* obliquely ovoid, up to 4 by 3 mm, testa smooth, light orange.

Distribution: Central and East Malesia (Celebes, Moluccas, New Guinea).

Ecology: Common undergrowth tree on edges, crests, in gullies, or on exposed places in primary or secondary low- or midmountain forests at 1000—2700 m. On brown stony forest clay or on infertile stony sand in riverside or stream bank vegetation. Drainage medium or fair.

Vernacular names (all from New Guinea): *arunan* (Enga), *daloe* (Dani), *edigea* (Kapauku), *kohbig* (Tomba), *kora-kiyei* (Wonatabe), *kuje kuje*, *porlyporl* (Mendi), *nerch*, *tuna(ch)* (Enga), *niebalaa* (Keban), *taingga*, *tañ-ja* (Huli), *wakolo* (Wapi).

Uses: According to Womersley it is used as a treatment for dysentery (New Guinea: Okapa area).

Field notes: Outer bark grey-brown, quite smooth, with scattered lenticels, c. 2 mm thick; scrape dark green; blaze pinkish straw to red-brown with few dilating rays; exudate watery. Sapwood pale straw to light reddish brown; heartwood dark pink to red with conspicuous, light brownish to white rays. Bark with a peppermint-like odour. According to Van Royen leaves very bitter when chewed.

Note. Until now three species have been distinguished: *T. papuana*, *T. arfakensis*, and *T. myricoides*. From the diagnoses given by the authors the characters cited in the table on next page are considered to be the most significant.

In my opinion these characters are not reliable for specific delimitation. *T. papuana* is a very variable species, especially in leaf-shape and indumentum of mature parts. Young parts and (young) inflorescences, however, are rufous-tomentose without any exception. Neither the leaf-index nor the acumination nor the serration supplies consistent characters for specific or subspecific delimitation. Fig. 2 shows that the indices of the leaves do not provide any division at all.

The texture of the leaf is rather uniformly pergamentaceous. The racemes are compound; simple racemes (as in *T. neocaledonica*) are very rare. The specimens from the Arfak Mountains ('*arfakensis*') have indeed somewhat smaller racemes, as stated by Gibbs l.c. (not simple!) but the difference is slight and small racemes are also observed in the specimens

Gibbs (1917)	<i>T. papuana</i>	<i>T. myricoides</i>	<i>T. arfakensis</i> Leaves non-acuminate, serrate, membranaceous; racemes small and simple; rufous tomentum on the young parts and inflorescence
Gilg & Schltr (1918)	Leaves lanceolate, coriaceous	Leaves elliptic to lanceolate, chartaceous	
Baker (1921)	Leaves lanceolate, coriaceous, obscurely serrate		Leaves oblong, serrate

from Celebes and the Moluccas. The latter specimens have 1—4 pairs of branches with up to 9 flowers on each branch and above these 1—3 pairs of flowers, while the specimens from New Guinea (other than '*arfakensis*') have 1—5 pairs of side branches with up to 13 flowers and above these 1—4 pairs of flowers.

3. *Trimenia weinmanniifolia* Seemann, Fl. Vitiens. (1871) 425, t. 99 ('*weinmanniaefolia*'); Perk. & Gilg in Engl., Pfl. Reich 4 (1901) 22; Gilg & Schltr, Bot. Jahrb. 55 (1919) 199; *ibid.* 58 (1923) 246; Christ., Bull. Bish. Mus. 128 (1935) 88, 89; F. B. H. Brown, *ibid.* 130 (1935) 83, 84. — Type: *Seemann 198*, holotype in K, isotypes seen from A, P.

See for the synonyms under the subspecies.

Anat.: Perk., Bot. Jahrb. 25 (1898) 550; Lem. & Pich., Rev. Gén. Bot. 61 (1954) 80.

Monococious or ? dioecious shrub or small tree, up to 10 m. *Leaves* oblong to lanceolate, sometimes widest slightly below the middle, 5—14 by 1½—3½ cm (index *c.* 2—4), acute to caudate, apex obtuse or slightly pointed, margin distinctly serrate, 14—26 pairs of nerves, flat or somewhat elevated above, elevated below, venation rather prominent; petiole 1—3 cm. *Inflorescences* axillary, equal to or shorter than the subtending leaf, up to 10 cm long and 7 cm wide, 1—5 pairs of lateral branches and above these 2—5 pairs of flowers, the lateral branches with up to 13(—19) flowers; peduncle up to 35 mm. *Bracts* fugacious, those on rachis ovate to ovate-lanceolate, 2—4 mm long, in apical direction grading to broadly ovate, 1—3 mm. *Flowers* unisexual, up to 5 by 3 mm; pedicel 1—2 mm; receptacle 1—2½ mm. *Tepals* 14—38, the 4—6(—8) lower ones decussate, ovate to nearly orbicular, up to 3 by 1½ mm, ciliate in the upper half, grading into larger, spirally arranged tepals, elliptic to obovate, up to 4½ by 2½ mm; (0—)1—4 innermost tepals spatulate, up to 5 mm long. *Stamens* 9—23, up to 3½ mm long in male flowers, *c.* 2 mm in female flowers; filaments short and thick, *c.* ½ mm; anthers up to 2½ mm, laterally dehiscent; stamens entirely covered with oil glands. *Ovary* in male flowers rudimentary, rarely none or two; 2 by ¾ mm, with 5—8 more or less distinct ridges. *Fruit* up to 6 by 4½ mm. *Seed* ovoid, sometimes obliquely ovoid, up to 4 by 3 mm, testa with 5—7 lengthwise ridges or with a network of irregular ridges.

Distribution: Polynesia (from the Solomons to the Marquesas), 3 distinct subspecies.

Note. NGF 26808 (*Frodin*) from Mt. Talawe, New Britain, may represent a fourth subspecies. It seems to be nearest to *ssp. bougainvilleensis* but has much smaller inflores-

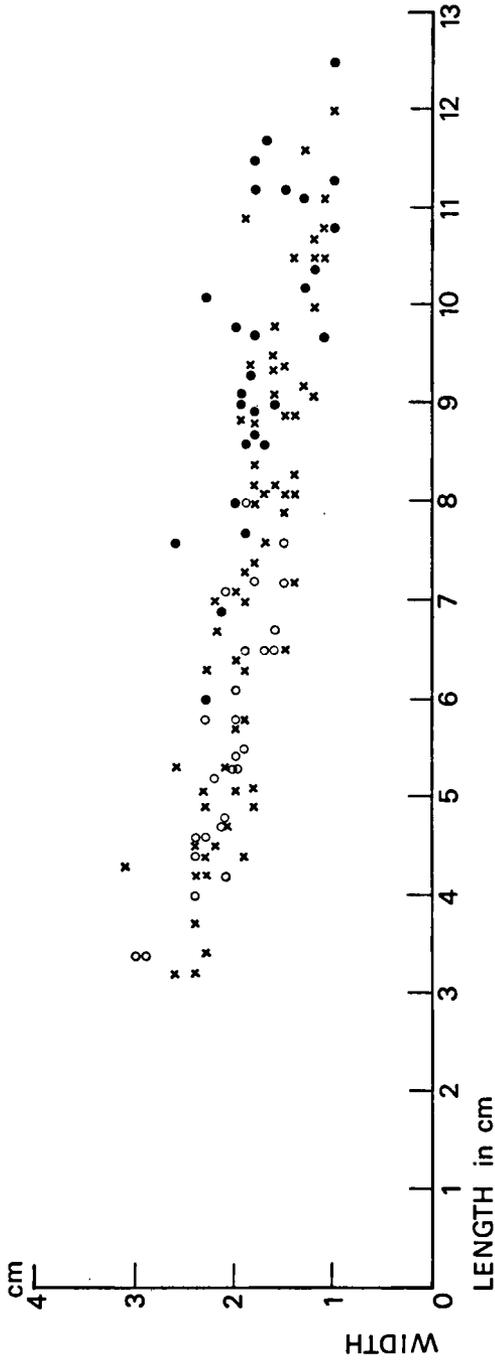


Fig. 2. Scatter diagram of leaf index in *Trimenia papuana*: 'myricoides' (dots), 'afjakensis' (circles), 'papuana sens. stricto' (crosses).

cences, the flowers are more robust but have only 12—16 tepals and 9—11 stamens. The leaves are early glabrescent except for the midrib and the lateral nerves which remain villous above. Female and fruiting material is needed to reach a definite conclusion.

KEY TO THE SUBSPECIES

1. Branches, branchlets, and leaves entirely glabrous, also when young. Seed obliquely ovoid, with an irregular pattern of ridges a. ssp. *weinmanniifolia*
1. Branches, branchlets, and leaves usually too, at least tomentose-villous or woolly when young. Seed ovoid, with 5—7 radiating ridges.
 2. Leaves 2—2½ times as long as wide, apex acute; midrib and lateral nerves villous in maturity. Stamens 18—23. b. ssp. *marquesensis*
 2. Leaves at least 2½ times as long as wide, apex acuminate to cuspidate; midrib and lateral nerves glabrous or glabrescent. Stamens 12—16. c. ssp. *bougainvilleensis*

a. ssp. *weinmanniifolia*.

T. vitiensis Ridl., Trans. Linn. Soc., II, Bot. 9 (1916) 144, *nomen, in errore*.

Shrub or small tree, up to 10 m. Branches and branchlets glabrous. *Leaves* lanceolate to ovate-lanceolate, 5—14 by 1½—3½ cm (index *c.* 3½); apex cuspidate to caudate, obtuse or slightly pointed; entirely glabrous; 16—26 pairs of nerves; petiole 10—20 mm, glabrous. *Inflorescences* up to 9 by 4 cm, 1—4 pairs of lateral branches with up to 9 flowers on each branch, peduncle and other axes almost entirely glabrous. *Bracts* grading from ovate-lanceolate, *c.* 3 mm long, to ovate, *c.* 2 mm long, sometimes auriculate at base, with a few strigose hairs outside. *Flowers* up to 5 by 2½ mm; pedicel 1 mm, glabrous; receptacle 1—2½ mm. *Tepals* 14—38, outermost ovate to elliptic, *c.* 2 by 1 mm, ciliate in the upper half, grading into elliptic to obovate, *c.* 4 by 2 mm, glabrous or slightly ciliate at apex, (0—)1—3 innermost ones spatulate, *c.* 4 mm long, entirely glabrous; green or white-green when young, brown when older. — *Male flowers*: stamens 9—12, *c.* 3 mm long, appendage of connective *c.* ½ mm, anthers *c.* 2½ mm, white or yellow-white; pistil rudimentary, rarely 0 or 2, ½—1 mm long, glabrous, stigmatic surface sometimes expanded, 3- or 4-lobed. — *Female flowers*: sterile stamens 10—11, *c.* 2 mm long, anthers thin, *c.* 1½ mm; pistil 1, ovary 2 by ¾ mm, glabrous, with 4—7 radiating ridges. *Fruit* red to rich purple, stigmatic surface pink; seed obliquely ovoid, testa covered with a pattern of irregular ridges.

Distribution: Polynesia (Fiji and Samoa).

Ecology: In primary and secondary forests on exposed places, along tracks or streams, at 700—1700 m.

Vernacular names: Fiji: *langolango* (Vanua Levu), *vovo* (Viti Levu); Samoa; *togo vao*, *oleana vao*, *matalafi* (Savai'i).

Note. The specimens from Samoa differ from the Fiji collections in the usually larger leaves, the smaller racemes, the shorter receptacles, and the usually smaller number of tepals. However, the differences do not allow a distinct separation and in my opinion they have to be considered as belonging to the same subspecies.

b. ssp. *marquesensis* (Brown) Rodenburg, *nov. stat.*

T. marquesensis F. B. H. Brown, Bull. Bish. Mus. 130 (1935) 82. — Type: *Mumford & Adamson 471*, BISH.

Shrub, *c.* 4 m. Branches and branchlets densely reddish woolly, female specimens obviously glabrescent. *Leaves* ovate-oblong to oblong, 7½—13½ cm (index 2—2½); apex acute to slightly acuminate; villous when young, especially near the base and along the midrib, slightly glabrescent except midrib and nerves; 14—18 pairs of nerves, nerves

and veins slightly elevated on both surfaces; petiole 15—30 mm, reddish tomentose-villous, slightly glabrescent. *Inflorescences* up to 10 by 7 cm, 2—3 pairs of lateral branches with up to 9 flowers on each branch, peduncle and other axes densely villous. *Bracts* grading from ovate-oblong, *c.* 4 mm long, base truncate, to ovate, *c.* 3 mm long, base rounded, slightly saccate, villous, especially outside and on the margin. *Flowers* (only male flowers known) up to 5 by 3 mm; pedicel $1\frac{1}{2}$ —2 mm, villous; receptacle *c.* 2 mm. *Tepals* 17—22, 4 lower ones decussate, ovate, 3 by $1\frac{1}{2}$ mm, apex obtuse, base saccate, ciliate in the upper half, grading into elliptic, $4\frac{1}{2}$ by $2\frac{1}{2}$ mm, apex and base rounded, glabrous, 2—4 innermost ones spatulate, *c.* 5 mm long, glabrous. *Stamens* 18—23, *c.* $3\frac{1}{2}$ mm long; appendage of connective *c.* 1 mm, pointed; anthers *c.* $2\frac{1}{2}$ mm. *Ovary* rudimentary, *c.* $\frac{1}{4}$ mm long, glabrous. *Fruit* red or dull red. *Seed* ovoid, 3 by 2 mm, testa with 5—7 lengthwise ridges.

Distribution: Polynesia (Marquesas Islands).

Ecology: In forests of the cloud zone, at *c.* 1000 m.

Note.: The fruiting specimen (Mumford & Adamson 579, BISH) is almost entirely glabrous, except for the innovations. As I have seen only five specimens, four of them with male flowers and one with fruits, it is not justified to draw conclusions whether this subspecies is monoecious or dioecious; neither is it clear whether the difference in the indumentum is a matter of age or merely due to the variability within the subspecies. More material will be necessary for a definite conclusion.

c. ssp. bougainvilleensis Rodenburg, *ssp. nov.*

Type: Schodde (& Craven) 3909, holotype in L, isotypes (not seen) in A, BRI, CANB, K, and LAE. Bougainville, lake Loluru.

Folia oblonga ad lanceolata, 5—8½ × 1¼—3 cm, acuminata ad cuspidata, adulta glaberrima. Tepala exteriora fere orbiculata, omnia saltem apicibus ciliata. Stamina in flore ♂ 10—16.

Shrub, *c.* 5 m. Branches and branchlets reddish villous when young, glabrescent. *Leaves* oblong to lanceolate, 5—8½ by $1\frac{3}{4}$ —3 cm; apex acuminate to cuspidate, obtuse; glabrous, very sparingly villous when young, especially below, near the base; (14—)16—20 pairs of nerves, flat above; petiole 12—15 mm, reddish tomentose-villous, early glabrescent. *Inflorescences* up to 8½ by 5½ cm, equal to or somewhat shorter than the subtending leaf, but never shorter than $\frac{2}{3}$ of the leaf-length, 2—5 pairs of side branches with up to 13(—19) flowers on each branch; peduncle up to $2\frac{1}{2}$ cm, peduncle and other axes villous, hardly glabrescent. *Bracts* grading from ovate, *c.* 2 mm long, to broadly ovate, *c.* 1 mm, strigose-tomentose, especially at the margin. *Flowers* up to $3\frac{1}{2}$ by 2 mm; pedicel 1 mm, sparsely strigose-tomentose; receptacle *c.* $1\frac{1}{2}$ mm. *Tepals* 17—22, the 4(—6) decussate ones nearly orbicular, *c.* $1\frac{1}{2}$ mm, grading into elliptic to obovate, $2\frac{1}{2}$ by 2 mm, 2—4 innermost tepals spatulate, *c.* $2\frac{1}{2}$ mm long, all tepals ciliate, the innermost ones only at apex, light red-brown to brown. *Stamens* 12—16, *c.* 3 mm long in male flowers, *c.* 2 mm in female flowers; appendage of connective *c.* $\frac{1}{4}$ mm; anthers *c.* 2 mm. *Pistil* rudimentary in male flowers; ovary 2 by $\frac{3}{4}$ mm, in male flowers *c.* 1 mm; with 6—8 ridges; sparsely strigose, especially on the ridges, pale green. *Fruit* glossy, dark crimson. *Seed* ovoid, $2\frac{1}{2}$ by $1\frac{3}{4}$ mm, testa with 6—7 distinct radiating ridges.

Distribution: Melanesia (Solomon Islands: Bougainville).

Ecology: Exposed places in mid-montane forests, at 1500—1700 m.

Field notes: Bark brown to light grey. Wood white, pinkish creamy towards the centre.

Note. The lengthwise ridges on the testa are in this subspecies much more prominent than in *ssp. marquesensis*.

NOMEN EXCLUDENDUM

'*Trimeria grandifolia* Warb. ex Index Kewensis, Suppl. 1 (1906) 439, *sphalm.* for *Trimeria grandifolia* (Hochst.) Warb. (*Flacourtiaceae*).

IDENTIFICATION LIST

- ANU 2060 (Flenly), 2443 (Flenly), 2691 (Flenly): 2.
 bb 23046, 23231 : 2. Brass 10862, 11292, 11601, 11764, 12628, 22772, 23175, 23200, 27005, 29569, 31188, 31812 : 2. Bristol 2132, 2133 : 3a. BW 3082 (Versteegh), 10369 (Versteegh), 10372 (Versteegh), 10476 (Versteegh) : 2.
 Carr 13991, 14409, 14416, 14570, 14774, 14775: 2. Christophersen 793: 3a. Christophersen & Hume 2074, 2083: 3a. Clemens 2415, 3346, 3347, 4513, 7671a, 9403b, 11210bis, 41013: 2. Compton 1582, 1796: 1. Coode, Katik & Kairo see NGF.
 Darbyshire 316 : 2.
 Eyma 1648, 2588, 2748, 4413 : 2.
 Flenly see ANU. Frodin see NGF.
 Gibbs 5743 : 2. Gillespie 4382, 4843 : 3a. Gressitt 2379, 2383, 2400, 2435 : 2. Gyldenstolpe s.n. : 2.
 Hartley see NGF. Henty see NGF. Hoogland 9232 : 2. Hoogland & Pullen 5958, 6157 : 2. Hoogland & Schodde 6891 : 2. Horne 859 : 3a. Hürlimann 1902 : 1.
 Kalkman 4348, 4349 : 2. Kanehira & Hatusima 13450, 14051 : 2. Kloss s.n. : 2. Kostermans 2089, 2227, 2506 : 2.
 Lavarack & Ridsdale see NGF. Ledermann 8466, 8505, 9944, 10923, 11016, 11232, 12386, 12505 : 2. Manner & Street 408 : 2. Millar see NGF. Millar & Holtum see NGF. Mumford & Adamson 142, 471, 500, 579, 1006 : 3b.
 Nauaii see NGF. NGF 4455 (Womersley), 4479 (Womersley), 6902 (Womersley & Floyd), 8441 (Womersley & Millar), 11654 (Hartley), 11735 (Hartley), 11788 (Hartley), 12162 (Millar), 12496 (Hartley), 12589 (Sayers), 12608 (Womersley & Thorne), 15767 (Millar & Holtum), 17159 (Nauaii), 17648 (Womersley), 17829 (Womersley), 18245 (van Royen), 19957 (Sayers), 23655 (Millar), 24671 (Womersley), 26204 (Frodin) : 2; 26808 (Frodin) : 3 ssp.; 27004 (Henty), 28422 (Frodin), 28429 (Frodin), 28491 (Frodin), 29038 (Henty), 30243 (Ridsdale), 30310 (Ridsdale) : 2; 31286 (Lavarack & Ridsdale) : 3c; 32896 (Coode, Katik & Kairo), 37287 (Womersley, Vandenberg & Galore), 39694 (Vandenberg & Millar), 39814 (Vandenberg, Katik & Kairo), 42007 (Womersley, Vandenberg & Galore), 42154 (Vandenberg) : 2.
 Pulle 709 : 2. Pullen 1426, 2837 : 2.
 Rachmat 911 : 2. Ridsdale see NGF. Robbins 396, 537 : 2. Van Royen (see also NGF) 4364 : 2. Van Royen & Sleumer 7435, 7453, 7875, 8023 : 2.
 Sayers see NGF. Schodde 1338, 1522 : 2. Schodde (& Craven) 3737, 3909 : 3c. Seemann 198 : 3a. Smith 664, 1888, 5639, 8355 : 3a.
 Vandenberg see NGF. Vandenberg, Katik & Kairo see NGF. Vandenberg & Millar see NGF. Versteegh see BW. Vink 16804 : 2. Vodonaivalu & Koroiveibau 15889, 16134 : 3a.
 Womersley see NGF. Womersley & Floyd see NGF. Womersley & Millar see NGF. Womersley & Thorne see NGF. Womersley, Vandenberg & Galore see NGF.