

STUDIES IN MALESIAN VITACEAE

VII. The genus *Tetrastigma* in the Malay Peninsula

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Abstract

A revision of the genus *Tetrastigma* (Miq.) Planch. in the Malay Peninsula is presented. Twelve species are here redescribed and assigned to section *Tetrastigma* and section *Carinata* sect. nov. They are: *T. pedunculare* (Wall. ex Laws.) Planch., *T. papillosum* (Bl.) Planch., *T. pyriforme* Gagnep., *T. scortechinii* (King) Gagnep., *T. dubium* (Law.) Planch., *T. cruciatum* Craib & Gagnep., *T. lawsoni* (King) Burkill, *T. dichotomum* (Bl.) Planch., *T. lanceolarium* (Roxb.) Planch., *T. hookeri* (Laws.) Planch., *T. curtisii* (Ridl.) Suesseng., and *T. godefroyanum* Planch. Six species, namely, *T. papillosum*, *T. pyriforme*, *T. cruciatum*, *T. dichotomum*, *T. hookeri*, and *T. godefroyanum*, represent new additions to the flora of the Malay Peninsula, and two established species names are reduced, namely, *T. kunstleri* (King) Craib (to *T. lanceolarium*) and *T. wrayi* (King) Craib syn. nov. (to *T. dubium*). A general discussion on the growth habits and morphology of stem, inflorescence, flowers, fruits and seeds is also given.

Introduction

The largest genus of the Malayan Vitaceae is *Tetrastigma* (Miq.) Planch., which comprises 12 species. The genus is characterized by its 4-lobed or 4-cleft stigma in the pistillate flowers. In the other genera, the stigma is subcapitate (as in *Ampelocissus*, *Cissus*, and *Cayratia*) or entire (as in *Pterisanthes*). The value of the stigmatic characteristic of *Tetrastigma* was first recognised by Miquel (1861) when he included all the then known species of *Vitis* (*sensu lato*) which have a 4-segmented stigma under section *Tetrastigma* Miq. Later Planchon (1887) raised Miquel's section to generic status, a taxonomic decision which received mixed support from later taxonomists. Gilg (1896), Gagnepain (1910) and Suessenguth (1953), for instance, recognised *Tetrastigma* as a genus whereas King (1896) and Ridley (1922) did not. Ridley (1922) recognised 3 genera of Malay Peninsula Vitaceae viz. *Vitis* L., *Pterisanthes* Bl. and *Leea* L. ex Van Royen, and treated *Tetrastigma* as a section of *Vitis*, along with *Ampelocissus*, *Cissus* and *Ampelopsis*.

The first complete account of the Malayan *Tetrastigma* was given by King (1896), an account later adopted by Ridley (1922). Seven species, viz., *Vitis pedunculare*, *V. scortechinii*, *V. wrayi*, *V. lawsoni*, *V. kunstleri*, *V. lanceolarium* and *V. curtisii* were adequately described by Ridley (1922). In a recent study, the author (Latiff, 1978) recognised only six of the species described; the description of *V. wrayi* King was found to be based on two species, that of the vegetative parts agreeing with *Cayratia wrayi* (King) Craib and that of the reproductive parts with *T. dubium* which, as a name, has priority over *T. wrayi* (King) Craib.

HABIT AND MORPHOLOGY

Growth habits. All members of the Vitaceae except *Leea* climb by means of tendrils. The tendrils are borne opposite the leaves on the long vegetative shoots.

Tetrastigma species may be described as large vines; their stems are comparatively thick, woody and long. Their trailing stems may be found draping trees and shrubs along roads, river banks and in forest edges, especially at higher altitudes.

Stem. This description of stem morphology is based largely on the study of herbarium specimens, supported by limited field observations. The stems are striate and terete when young and later they either remain terete as in *T. pedunculare* and *T. pyriforme* or become flattened as in *T. lawsoni* and *T. cruciatum*. Stem lenticels are very prominent; they appear normal as in *T. pedunculare* or protrude externally as corky excrescences, a character diagnostic for *T. papillosum*.

Leaves. Only one species, i.e., *T. scortechinii* has simple leaves, its diagnostic character. Other species have compound leaves with leaflets ranging from 3 to 7. However, leaves of *T. cruciatum*, *T. dubium*, and *T. dichotomum* are predominantly trifoliolate while on the same stem some are simple. The simple leaves in these are comparatively larger than any single leaflet of the compound leaf. A few species, for instance, *T. pedunculare*, *T. papillosum*, and *T. curtisii* have only trifoliolate leaves.

In *Tetrastigma* the leaf-outline is found to be diagnostic for some species. *T. godefroyanum* and *T. curtisii* have obovate terminal leaflets. Specimens of *T. hookeri*, which have widely elliptical terminal leaflets, are distinguishable from those of *T. lanceolarium* which have lanceolate ones.

Inflorescences. The inflorescence in all species is pedunculate. In most of them, the peduncles are easily observed but in *T. cruciatum* and *T. lawsoni* they are very short, the inflorescence being almost sessile. The peduncle-length differs in inflorescences of different sexes. In *T. dichotomum*, *T. curtisii*, and *T. lanceolarium* the male inflorescences have a longer peduncle than those of the female. This has made identification of species based on general morphology difficult. The inflorescence in *Tetrastigma* species is a cyme which is of the following kinds: corymbose in *T. papillosum*, umbellate in *T. scortechinii*, *T. cruciatum* and *T. godefroyanum*, and dichotomous in others.

Flowers. *Tetrastigma* is dioecious, having pistillate and staminate flowers in different individuals while all the other genera of Vitaceae have bisexual flowers. The flowers of *Tetrastigma* are largely 4-merous but 5-merous ones are occasionally found. The calyx is small and subcupuliform. The petals are membranous, on the outside glabrous or slightly pubescent and are strongly reflexed in the bud.

The stigma which is either 4-cleft or 4-lobed in the pistillate flowers is an important single character for recognizing the genus. It is entire in the staminate flowers. The four narrow segments of the stigma are orientated in different ways: vertically, as in *T. pedunculare* or horizontally as in *T. dubium*. In other species, the four segments are not very conspicuous because the stigmatic surface is densely covered with simple multicellular hairs or cilia. The ciliate stigma is perhaps an adaptive feature to ensure the better deposition of pollen grains in dioecious plants like *Tetrastigma*. Within the Vitaceae, it is only in *Tetrastigma* that staminodes are present in the pistillate flowers. In shape and position, these are suggestive of

reduced stamens.

Fruits. The fruits of Vitaceae are berries. In *Tetrastigma* the degree of pulpiness varies from species to species. For example, the berries of *T. hookeri* are very pulpy, moderately so in *T. scortechinii* and *T. dubium* while those of *T. godefroyanum* contain hardly any pulp.

In section *Tetrastigma* the variation in size, shape and surface features of the berries is quite useful for species identification. For example, *T. hookeri* has the largest berries (c. 3.5 cm in diameter) and *T. dubium* has the smallest (c. 0.9 cm in diameter) in that section. The dried berries of *T. godefroyanum* are smooth and hard, whilst those of *T. curtisii* are wrinkled and soft. Generally, *T. lawsoni* and *T. dichotomum* are similar but their berries differ in number and shape. The former has globose berries, usually 1–3 per fructification while the latter has ellipsoid ones, usually more than 3 per fructification. Within section *Carinata* the difference in fruit size is also useful for separating the three Malayan species. The fruits are c. 0.7 cm long in *T. pedunculare*, c. 1.4 cm in *T. pyriforme* and c. 0.9 cm in *T. papillosum*.

Seeds. The difference in fruit and seed morphology form the basis for creating two sections in this genus as described in the latter part of the paper (under taxonomic treatment).

Size in general is not useful for distinguishing species even though seeds in *T. pedunculare* and *T. papillosum* are relatively small (0.5 × 0.4 cm). Shape has been found to be diagnostic for the two sections. In section *Tetrastigma* the shape is plano-convex, globose or oblong while in section *Carinata* it is convex-carinate.

The two sections in *Tetrastigma* may also be recognised by the differences in their testa sculpturing or ornamentation. Observations made on all the Malay Peninsular species show differences in their testa pattern which suggest a grouping into the following types (Table 1).

Table 1.
Testa types in *Tetrastigma*.

Type	Sect. <i>Tetrastigma</i>	Sect. <i>Carinata</i>
1. Ridged		<i>T. pedunculare</i> <i>T. papillosum</i>
2. Tuberculate		<i>T. pyriforme</i>
3. Glabrous	<i>T. lawsoni</i> <i>T. dubium</i>	
4. Rugulose	<i>T. lanceolarium</i> <i>T. hookeri</i> <i>T. curtisii</i>	
5. Furrowed	<i>T. dichotomum</i> <i>T. cruciatum</i> <i>T. scortechinii</i>	
6. Reticulate	<i>T. godefroyanum</i>	

Another character which distinguishes the two sections is the position of the chalazal knot on the dorsal surface of the seeds. In section *Tetrastigma* the chalazal knot extends $\frac{3}{4}$ - or full-way the dorsal surface while in section *Carinata* it extends $\frac{1}{2}$ -way the surface. On the ventral surface the infolds are deep and converging in section *Carinata* but shallow and parallel in section *Tetrastigma*.

Host-parasite relationships. *Rafflesia arnoldi* R. Br., with flowers 1 m across, was the first parasite reported on Vitaceae. Brown (1842) collected it in Sumatra, growing on the roots of (what he reported) a species of *Cissus*. As *Tetrastigma* is now known to be the only host of the parasitic *Rafflesia*, it is very likely that Brown misidentified the host. In the State of Perak in the Malay Peninsula, *T. scortechinii* is said to be the host of *R. hasseltii* Suring. (B. C. Stone, 1978, pers. comm.).

Stirling (1939) reported the occurrence of *Sapria himalayana* Griff. as a parasite on the roots of *T. cruciatum*. The seeds of this parasitic member of the Rafflesiaceae are said to be deposited (and to germinate) in cracks in the roots or stems of the host. Species such as *T. cruciatum*, *T. scortechinii*, *T. lawsoni* and *T. lanceolarium* have characteristic straplike stems which are easily broken or cracked, thereby providing a suitable niche for the seeds of the parasite. The physiological relationships between these parasites and their hosts have been the subject of a few investigations (Stirling, 1939; Brown, 1912). Recently, a *Rhizanthus* species has been noted to be parasitic on stems of *T. dubium* in the State of Pahang (Francis S. P. Ng, 1982, pers. comm.). Speculation on the evolutionary relationships between these plants is currently given attention to by W. Meijer (1982, pers. comm.).

***Tetrastigma* (Miq.) Planch.**

Tetrastigma (Miq.) Planchon in DC., Monog. Phan. 5 (1887) 423; Suessenguth in Engler & Prantl, Nat. Pfl. Fam. 20d (1953) 318; Backer & Bakhuizen v. d. Brink, Fl. Java 2 (1965) 88.

Vitis sect. *Tetrastigma* Miquel, Ann. Mus. Bot. Lugd.-Bat. 1 (1862) 72; King, J. As. Soc. Beng. 65, 2 (1896) 386; Ridley, Fl. Mal. Penin. 1 (1922) 470.

Type species: *T. lanceolarium* (Roxb.) Planch.

Large, woody, dioecious vines. Stem terete or flattened, conspicuously lenticellate. Leaves simple or/and compound. Tendrils simple, leaf-opposed, not ending with an adhesive disc. Inflorescence axillary and pedunculate, a cyme, the cyme umbellate, corymbose or dichotomous. Flowers 4(5)-merous; unisexual, pedicellate. Calyx subcupuliform to disciform. Petals reflexed in mature flowers. Disc adnate to ovary in pistillate flowers, 4-lobed, free in staminate flowers. Filaments filiform. Anthers orbicular to ovate-oblong. Staminodes filiform. Style terete, short. Stigma minute and entire in staminate flowers, large, 4-lobed, and ciliolate in pistillate flowers. Ovary undeveloped in staminate flowers, 2-loculate, the locules 2-ovulate each in pistillate flowers. Berries pyriform to globose. Seeds with dorsal side convex and ridged or furrowed, ventral side convex or carinate; endosperm T- π , M- π , π , or π -shaped in cross-section.

Distribution. About 95 species, in tropical and subtropical Asia, in Malesia(c. 57), Taiwan(4), India(12), Thailand(16), and Indochina(22).

Ecology. Occurs in all kinds of habitat from sea-level to high mountains.

Key to the Species

1. Berries pyriform when dry, 3- to 4-seeded; seeds convex-carinate, the chalaza extending $\frac{1}{2}$ -way across the surface, the ventral infolds converging; endosperm π -shaped in cross-section
2. Leaves 5-foliolate; berries 0.8–1.0 cm long; seeds 0.7 cm long, the beak inconspicuous 12. *T. pyriforme*
2. Leaves 3-foliolate; berries 0.5–0.7 cm long; seeds 0.5 cm long, the beak prominent
 3. Terminal leaflet broadly elliptical to rhombic; lenticels of old stems not modified; inflorescence dichotomous; leaflets with fine glaucous indumentum beneath; staminodes as long as gynoecium 10. *T. pedunculare*
 3. Terminal leaflet narrowly elliptical; lenticels of old stems modified to spinelike corky excrescences; inflorescence corymbose; leaflets glabrous beneath; staminodes $\frac{1}{2}$ the length of gynoecium 11. *T. papillosum*
1. Berries globose or ellipsoid when dry, 1- to 2-seeded; seeds globose or plano-convex, the chalaza extending $\frac{3}{4}$ -way or more across the surface, the ventral infolds parallel; endosperm M- to π -shaped in cross-section
 4. Leaves simple, pubescent beneath, leaf-base semi-cordate; anthers kidney-shaped 1. *T. scortechinii*
 4. Leaves compound (simple leaves sometimes present on the same individual), glabrous beneath; leaf-base acute or obtuse; anthers orbicular or ovate-oblong
 5. Flowers glabrous
 6. Leaves 5- to 7-foliolate; seed testa reticulate; endosperm π -shaped in cross-section; bark usually shredding; inflorescence usually borne on lateral branches 9. *T. godefroyanum*
 6. Leaves simple to 3-foliolate; seed testa rugulose; endosperm M-shaped in cross-section; bark usually glossy; inflorescence on the main stem
 7. Stigma-lobe pointed; staminodes $\frac{1}{2}$ length of the gynoecium; seeds 0.6 cm long, the chalazal knot clavate and extending $\frac{3}{4}$ -way across the surface; leaves chartaceous 2. *T. dubium*
 7. Stigma-lobe rounded; staminodes as long as gynoecium; seeds 1.2 cm long, the chalazal knot elongate and extending completely across the surface; leaves coriaceous 5. *T. dichotomum*
 5. Flowers pubescent
 8. Stigma-lobe pointed, glabrous; flowers flat-topped; leaflets with decurrent bases 4. *T. lawsonii*
 8. Stigma-lobe rounded, ciliate; flowers conically topped; leaflets with acute base
 9. Venation between the secondary veins of leaves very prominent; seed testa reticulate; endosperm π -shaped in cross-section 8. *T. curtisii*
 9. Venation obscure; seed testa rugulose or furrowed; endosperm π -shaped in cross-section
 10. Leaves membranous, simple to 3-foliolate; seeds obovoid; inflorescence very condensed, 1 cm in diameter 3. *T. cruciatum*

10. Leaves coriaceous, 3- to 7-foliolate; seeds ellipsoid; inflorescence lax, 5–13 cm in diameter
11. Leaflets lanceolate to narrowly elliptical, the margin obscurely dentate; berries 1.5–2.0 cm in diameter; seeds 12.0×0.6 cm 6. *T. lanceolarium*
11. Leaflets very broadly elliptical, the margin dentate; berries 3.2–3.5 cm in diameter; seeds 1.8×0.8 cm 7. *T. hookeri*

I. Sect. *Tetrastigma*

Baccæ globose vel ellipsoidae. Semina 1–2, globose vel plano-convexa, postice sulcis rectis parallelis 2 leviter exarata. chalaza per $\frac{3}{4}$ vel totum longitudinis seminis deorsum extensa, antice sulcis; endospermium in sectione transversali M-forme ad Ψ -forme.

Type: *T. lanceolarium* (Roxb.) Planch.

1. *Tetrastigma scortechinii* (King) Gagnep.

T. scortechinii (King) Gagnepain, Not. Syst. 1 (1911) 376; Suessenguth in Engler & Prantl, Nat. Pfl. Fam. 20d (1953) 321.

Lectotype: King's Coll. 2897, Larut, Perak (*SING!*, isolectotype *K!*).

Vitis scortechinii King, J. As. Soc. Beng. 65, 2 (1896) 392; Ridley, Fl. Penin. 1 (1922) 474.

Stem 0.9–1.2 cm in diameter (young), flattened, 2.7–3.1 cm wide (old). Leaves simple $15.4\text{--}19.2 \times 8.5\text{--}10.3$ cm, ovate-oblong, acuminate, semicordate at base, sinuate-bristled, subcoriaceous, glabrous above, pubescent beneath, the petiole 3.4–4.6 cm. Peduncle 2.9–3.1 cm; cyme umbellate. Staminate flowers c. 5 mm long, oblong, the stigma-lobe rounded. Pistillate flowers c. 6 mm long, oblong, the stigma-lobe rounded. Berries 0.4–0.6 cm in diameter globose, usually 2-seeded; seed 0.4–0.5 cm in diameter, globose, the endosperm M-shaped in cross-section.

Ecology. On the margin of limestone vegetation and lowland dipterocarp-forest. This species is believed to be the host for *Rafflesia hasseltii* Suring. (B. C. Stone 1978, pers. comm.)

Distribution. Known only from collections in Gopeng, Larut and G. Pondok (Perak), and Sungai Jelai (Pahang).

Observation. This is the only simple-leafed species in the Peninsula, recognised by its ovate-oblong, pubescent leaves and compact inflorescence.

Specimens examined. PERAK, Goping, April 1884, Wray Jr. 5998 (*K. BM*); Larut, March 1882, King's coll. 2897 (lectotype, *SING*); G. Pondok, 7.6.1930, Henderson 23793 (*SING*). PAHANG, Sg. Jelai, July 1903, Machado s.n. (*SING*).

2. *Tetrastigma dubium* (Laws.) Planch.

T. dubium (Laws.) Planchon in DC. Monog. Phan. 5 (1887) 437; Suessenguth in Engler & Prantl., Nat. Pfl. Fam. 20d (1953) 324.

Type: Hooker f. s.n., Sikkim, India (Isotype, K!)

Vitis dubia Lawson in Hooker f. Fl. Brit. Ind. 1 (1875) 661.

Vitis wrayi King, J. As. Soc. Beng. 65, 2 (1896), in part; Ridley, Fl. Mal. Penin. 1 (1922) 475 in part.

T. wrayi (King) Craib, Fl. Siam. Enum. 1 (1926) 314; Suessenguth in Engler & Prantl., Nat. Pfl. Fam. 20d (1953) 323.

Stem 1.8–2.4 cm in diameter. Leaves simple or digitately 3-foliate, chartaceous, glabrous; simple leaves 10.2–12.8 × 4.6–5.2 cm, ovate-oblong, acuminate, rounded at base, entire, the petiole 7.4–9.8 cm; compound leaves with terminal leaflets 9.8–19.2 × 4.3–10.6 cm, elliptical, acuminate, entire, acute at base; the petiolule 1.6–4.5 cm; lateral leaflets 5.7–17.4 × 3.4–8.2 cm, oblong, oblique, the apex and margin as in terminal leaflets, the petiolule 0.3–1.4 cm. Peduncle 1.7–2.2 cm; cyme dichotomous. Staminate flowers c. 3 mm, pubescent. Pistillate flowers c. 3 mm long, pubescent, the staminode c. 1 mm, the stigma-lobe terete. Berries 0.5–0.8 cm in diameter, globose, usually 2-seeded; seeds 0.6 × 0.4 cm, globose, the endosperm M-shaped in cross-section.

Ecology. On the margin of the lowland dipterocarp-forest, and submontane forest.

Distribution. India, Burma, Thailand and the Malay Peninsula.

Observation. The specimens of the Malay Peninsula have two forms of leaves, simple and 3-foliate, but in India variants with (a) 3- and 5-foliate leaves (on the same specimen) and (b) with 5-foliate ones only, are frequently seen.

Specimens examined. PERAK, Larut, in April 1890, Wray Jr. 3945 (K, SING); Taiping, 26.1.1923, Henderson 10328 (SING). SELANGOR, Dusun Tua, May 1896, Ridley s.n. (SING); Gombak, 20 m.s., 25.9.1979, Latiff 61 (UKMB). KELANTAN, Kg Parit, 2.2.1923, Haniff & Nur 10359 (SING). JOHORE, G. Pantl, Dec. 1899, Ridley s.n. (SING). KEDAH, G. Baling, 25 Nov. 1941, Corner & Nauen s.n. (SING). PENANG, Govt. Hill, 5.4.1968, Sidek 236 (K, SING).

3. *Tetrastigma cruciatum* Craib & Gagnep.

T. cruciatum Craib & Gagnepain, Kew Bull. (1911) 31; Craib, Fl. Siam Enum. 1 (1926) 312; Suessenguth in Engler & Prantl. Nat. Pfl. Fam. 20d (1953) 320.

Type: Kerr 599, Chiang Mai, Thailand (isotype, K!, BM!).

Old stem flattened, 0.9–1.2 cm thick, 3 cm wide. Leaves simple or 3-foliolate, membranous, glabrous, the petiole 0.8–2.4 cm; simple leaves $9.5\text{--}11.2 \times 3.6\text{--}5.2$ cm, oblong, acuminate, rounded at base, subentire; compound leaves with terminal leaflets $7.9\text{--}9.2 \times 3.7\text{--}4.8$ cm, elliptical, the apex, base and margin as in simple leaves, the petiolule 0.3–0.5 cm; lateral leaflets $7.5\text{--}8.9 \times 3.6\text{--}4.3$ cm, elliptical, oblique, decurrent, the petiolule 0.2–0.4 cm. Peduncle 0.1–0.3 in diameter; cyme umbellate. Pistillate flowers c. 5 mm long, pubescent, the staminode c. 0.8 mm, the stigma-lobe rounded and ciliate. Staminate flowers not observed. Berries 0.9×0.6 cm, subglobose; seeds 0.7×0.5 cm, the testa furrowed, the endosperm M-shaped in cross-section.

Ecology. On the margin of lowland dipterocarp-forest and mostly on limestone hills (e.g. Pulau Langkawi).

Distribution. Thailand and the Malay Peninsula.

Observation. This species is recognized by its very condensed inflorescence, flattened stem and membranous leaves. The first collection, of Griffith, in Malacca, was misidentified by Ridley as *T. lanceolarium*. The other collections are from Perlis. This species constitutes another addition to the flora of the Malay Peninsula.

Specimens examined. MALACCA, *sine loc.*, Griffith 1323 (K). PERLIS, Kaki Bukit, 11.6.1938, Kiah 35243 (L, SING). KEDAH, P. Langkawi, 11.11.1980, Latiff 290 (UKMB).

4. *T. lawsoni* (King) Burkill

T. lawsoni (King) Burkill, Dict. Econ. Prod. Mal. Penin. 2 (1935) 2286; Suessenguth in Engler & Prantl, Nat. Pfl. Fam 20d (1953) 325.

Lectotype: King's Coll. 6287, Larut, Perak (K!, isoelectotypes BM!, SING!).

Vitis lawsoni King, J. As. Soc. Beng. 65, 2 (1896) 394; Ridley, Fl. Mal. Penin. 1 (1922) 474.

Stem flattened, 2.2–2.8 cm wide, 1 cm thick, tuberculate. Leaves 3-foliolate, coriaceous, glabrous, the petiole 2.2–4.3 cm; terminal leaflets $10.7\text{--}13.8 \times 4.8\text{--}5.8$ cm, elliptical to lanceolate, caudate, decurrent at base, obscurely bristled, the petiolule 1.4–1.8 cm; lateral leaflets $9.4\text{--}10.6 \times 2.7\text{--}3.8$ cm, elliptical to oblong, leaf-base decurrent, the apex and margins as with terminal leaflets. Peduncle 0.4–0.5 cm, cyme dichotomous. Staminate flowers c. 3 mm long. Pistillate flowers c. 4 mm long, ovoid, the staminode c. 0.2 mm, the stigma-lobe terete. Berries 1.7–2.0 cm in diameter globose, 1–3 per fructification; seeds 1.2×0.6 cm, oblong, the endosperm M-shaped in cross-section.

Ecology. On the margin of lowland dipterocarp-forests of the West Coast of the Malay Peninsula.

Distribution. Malay Peninsula.

Observation. This species is superficially quite similar to the 3-foliolate form of *T. lanceolarium* but differs in fruit and seed morphology. The fructification usually has 3 berries.

Specimens examined. SELANGOR, Ulu Gombak, 20.9.1926, *Strugnell 12459* (SING); Bangi, 8.12.1981, *Latiff PUS 184* (UKMB). PERAK, Larut, May 1884, *King's coll. 6134* (SING). PENANG, Gardens' Waterfalls, 5.2.1916, *Burkill 1218* (K, SING). KEDAH, Relau, 1.8.1938, *Baba 21486* (K, SING), Singapore, *sine loc.*, *sine die*, *Ridley 4649* (K).

5. *Tetrastigma dichotomum* (Bl.) Planch.

T. dichotomum (Bl.) Planchon, in DC., Monog. Phan. 5 (1887) 441; Suessenguth in Engler & Prantl, Nat. Pfl. Fam. 20 d (1953) 323; Backer & Bakhuizen v.d. Brink, Fl. Java 2 (1965) 89.

Lectotype: Blume s.n. (L!).

Cissus dichotoma Blume, Bi jdr. 1 (1825) 186.

Stem 0.8–1.2 cm in diameter, lenticellate. Leaves simple or 3-foliolate, coriaceous, glabrous; simple leaves 8.7–10.2 × 3.4–4.8 cm, elliptical, acuminate, obtuse at base, serrate, the petiole 2.7–6.1 cm; compound leaves with terminal leaflets 5.7–9.4 × 2.5–4.4 cm, elliptical, acuminate, decurrent at base, serrate, the petiolule 1.5–2.1 cm; lateral leaflets 4.8–9.7 × 2.1–5.5 cm, the outline, apex, base and margin as in terminal leaflets, the petiolule 0.8–1.0 cm. Peduncle 4.7–5.4 cm; cyme dichotomous. Staminate flowers obovoid. Pistillate flowers oblong, the staminode c. 0.6 mm, the stigma-lobe rounded. Berries 1.2–2.2 × 0.6–1.0 cm ellipsoid, usually 1-seeded; seed 1.2 × 0.5 cm, oblong, the endosperm π -shaped in cross-section.

Ecology. On the fringe of hill dipterocarp-forests and submontane forests.

Distribution. Java, Sumatra and the Malay Peninsula.

Observation. This species is recognized by its decurrent and glossy leaflets, and ellipsoid berries. Its leaves are mostly 3-foliolate but occasionally larger, simple leaves have been observed on the same plant. In the Malay Peninsula it is only recorded from Maxwell Hill, Cameron Highlands, Gunung Berumbun, and these represent additional records for the flora of the Malay Peninsula.

Specimens examined. PERAK, Maxwell Hill, 4.12.1965, *Md. Shah & Sidek 1081* (SING, K). PAHANG, Gunung Berumbun, 21 Nov. 1903, *Ridley 13554* (SING); Cameron Highlands, 15.5.1936, *Holttum 31262* (L, K, SING). Cameron Highlands, 21.4.1930, *Henderson 23627* (K, SING). Genting Highlands, 19.10.1977, *Latiff & Mohd. Kassim* s.n. (UKMB).

6. *T. lanceolarium* (Roxb.) Planch.

Tetrastigma lanceolarium (Roxb.) Planchon in DC. Monog. Phan. 5 (1887) 423; Suessenguth in Engler & Prantl, Nat. Pfl. Fam. 20d (1953) 323; Backer & Bakhuizen v.d. Brink, Fl. Java 2 (1965) 89.

Type: Roxburgh 2429 (CAL, water-colour painting at K!)

Cissus lanceolarium Roxburgh Fl. Ind. 1 (1820) 430.

Vitis lanceolarium (Roxb.) Wallich in Wight & Arnott, Prod. Fl. Ind. Orient. 1 (1834) 128; King, J. As. Soc. Beng. 65, 2 (1896) 395; Ridley, Fl. Mal. Penin. 1 (1922) 475.

Vitis kunstleri King, J. As. Soc. Beng 65, 2 (1896) 396; Ridley, Fl. Mal. Penin. 1 (1922) 475

Tetrastigma kunstleri (King) Craib, Fl. Siam Enum. 1 (1926) 313; Suessenguth in Engler & Prantl, Nat. Pfl. Fam. 20d (1953) 325.

Young stem terete, 2.6–4.1 cm in diameter, old stem flattened, 6.0–11 cm across, tuberculate. Leaves 3-foliolate to pedately 5- to 7-foliolate, coriaceous, glabrous, the petiole 6.7–11.6 cm; terminal leaflets 13.6–20.5 × 4.2–9.4 cm, lanceolate, acuminate, acute at base, obscurely dentate, the petiolule 0.6–3.3 cm; lateral leaflets 5.8–13.4 × 2.6–6.7 cm, lanceolate, rounded at base, the apex and margin as in terminal leaflets, the petiolule 0.4–2.5 cm. Peduncle 0.5–2.0 cm; cyme dichotomous. Staminate flowers c. 2 mm long ovoid. Pistillate flowers c. 5 mm long, oblong, the staminode c. 0.5 mm, the stigma-lobe rounded, ciliate. Berries 1.5–2.0 cm in diameter, globose, 1-2-seeded; seed 1.2 × 0.6 cm, oblong, the testa rugulose, the endosperm π -shaped in cross-section.

Ecology. Mostly on the margin of lowland dipterocarp-forests, frequently on the margin of limestone vegetation and hill dipterocarp-forests. According to Willem Meijer (pers. comm.) this is the commonest host of *Rafflesia hasseltii*.

Distribution. India, Burma, Thailand, Vietnam, Laos, Kampuchea and Malesia.

Observation. In the Malay Peninsula it is the most widely distributed species, being recorded from various habitats throughout the Peninsula.

Specimens examined. PAHANG, Kuala Lipis, 22.11.1924, Burkill & Haniff 15765 (SING). KEDAH, P. Langkawi, Bt Batu, 5.11.1968, Keng et al. 72 (SING), Country Club, 14.11.1980, Latiff 279 (UKMB). NEGERI SEMBILAN, Bt Klanera, 7.3.1885, Alvins 935 (SING). JOHORE. Endau, 24.7.1977, Maxwell 77–362 (SING); P. Pemanggil, 21.1.1980, Latiff 122 (UKMB). PERAK, Bota Kiri, 14.3.1958, Md. Shah & Kadim 350 (K, KEP, SING). SELANGOR, Lake Garden, 31.7.1951, Woods 150 (SING); Gombak 13 m.s., 25.9.1979, Latiff 51 (UKMB). TRENGGANU, Kemaman, 12.11.1935, Corner s.n. (SING). PENANG, sine loc., Wallich Cat 6013 (K). SINGAPORE, Bukit Timah, in 1894, Ridley s.n. (SING). KELANTAN, Bertam Lama, 19.1.1981, Kamaruddin Mat Salleh 104 (UKMB).

7. *Tetrastigma hookeri* (Laws.) Planch.

T. hookeri (Laws.) Planchon in DC., Monog. Phan. 5 (1887) 428; Suessenguth in Engler & Prantl, Nat. Pfl. Fam. 20d (1953) 325; Backer & Bakhuizen v.d. Brink, Fl. Java 2 (1965) 89.

Lectotype: Hooker f. 162, Sikkim (K!).

Vitis hookeri Lawson in Hooker f., Fl. Brit. Ind. 1 (1875) 661.

Stem 2.2–2.8 cm in diameter, tuberculate. Leaves pedately 5-foliolate, coriaceous, glabrous, the petiole 10.7–16.2 cm; terminal leaflets 15.1–25.6 × 7.0–13.4 cm, broadly elliptical, caudate, acute at base, dentate, the petiolule 2.6–3.7 cm; lateral leaflets 12.4–22.8 × 5.1–9.4 cm, elliptical, becoming rounded, the apex and margin as with terminal leaflets, the petiolule 2.2–3.1 cm. Peduncle 2.3–2.5 cm; cyme dichotomous. Pistillate flowers c. 5 cm long, the staminode c. 1 mm long, the stigma-lobe rounded, ciliolate. Staminate flowers not observed. Berries 3.2–3.5 cm in diameter, globose, usually 1-seeded; seed 1.8 × 0.8 cm, ellipsoid, the testa rugulose, the endosperm π -shaped in cross-section.

Ecology. On the margin of hill dipterocarp-forests.

Distribution. India, Burma, Thailand, Java, Sumatra, Borneo and the Malay Peninsula.

Observation. The earliest record of this species is a collection of Ridley from Penang Hill, which was identified as *Vitis lanceolarium* (synonym of *T. lanceolarium*). It is recognised by its largely broadly elliptical and dentate leaflets and large berries. It is closely related to *T. lanceolarium* but differs in the character of the leaves, berries and seeds. This species is another new record for the Malay Peninsula.

Specimens examined. SELANGOR, Ulu Gombak, 21.7.1968, Stone 8320 (K, KLU). PENANG, Government Hill, March 1915, Ridley s.n. (K). KEDAH, P. Langkawi, Selat Pancur, 11.11.1980, Latiff 180 (UKMB).

8. *Tetrastigma curtisii* (Ridl.) Suesseng.

T. curtisii (Ridley) Suessenguth in Engler & Prantl, Nat. Pfl. Fam. 20d (1953) 325.

Vitis curtisii Ridley, J. Roy. Soc. Str. Br. 75 (1917) 24; Fl. Mal. Penin. 1 (1922) 474.

Lectotype: Curtis 3363, Penang (K! isoelectotype SING).

Stem 1.7–2.5 cm in diameter. Leaves 3-foliolate, coriaceous, glabrous, the petiole 3.4–8.6 cm; terminal leaflets 9.1–12.3 × 4.6–6.2 cm, obovate, caudate, acute at base, subentire, the petiolule 2.4–4.7 cm; lateral leaflets 7.2–9.4 × 3.7–4.5 cm, oblong becoming obtuse, the apex and margin as with terminal leaflets, the petiolule 1.4–2.2 cm. Peduncle 0.4–0.6 cm, cyme dichotomous. Staminate flowers c. 4 mm long, oblong. Pistillate flowers c. 4 mm long, the staminode c. 0.5 mm, the stigma-lobe

rounded and ciliolate, Berries $1.3-1.7 \times 0.7-1.1$ cm, ellipsoid; seeds $1.2-1.6 \times 0.7-0.9$ cm, broadly ellipsoid, the testa reticulate, the endosperm π -shaped in cross-section.

Ecology. On the margin of the hill and lowland dipterocarp-forests.

Distribution. Malay Peninsula.

Observation. This species is recognized by its diffuse venation between the secondary veins, particularly conspicuous on the upper surface of the leaves.

Specimens examined. PENANG, West Hill, Oct. 1886, *Curtis 1051* (K, SING), Government Hill, March 1915, *Ridley s.n.* (K). SELANGOR, Ulu Langat, 15.11.1958, *Gadoh 1175* (SING). PAHANG, Raub, 15.4.1970, *Soepadmo 629* (KLU). KEDAH, Bt Perak, 27.11.1969, *Chan 13207* (KEP). NEGERI SEMBILAN, Ulu Bendul, 22.12.1979, *Latiff 92* (UKMB).

9. *Tetrastigma godefroyanum* Planch.

T. godefroyanum Planchon in DC., Monog, Phan. 5 (1887) 436.

Type: *Godefroy 663*, Kampuchea (Isotype, K!).

Stem 1.5–1.8 cm in diameter, the bark glaucous and usually shredding. Leaves pedately 5- to 7-foliolate, coriaceous, glabrous, the petiole 5.1–8.3 cm; terminal leaflets $5.2-8.1 \times 3.1-4.8$ cm, obovate to obovate-oblong, acuminate, obtuse at base, crenate, the petiolule 2.5–3.2 cm; lateral leaflets $4.8-7.9 \times 3.0-4.5$ cm, the outline, apex, base and margin as in terminal leaflets, the petiolule 1.7–2.7 cm. Peduncle 2.8–3.3 cm; cyme umbellate, usually borne on lateral branches. Staminate flowers not seen. Pistillate flowers c. 4 mm long, oblong, the staminode c. 0.6 mm, the stigma-lobe rounded. Berries $1.2-1.5 \times 0.9-1.1$ cm, ellipsoid, usually 1-seeded; seed 0.9×0.6 cm, the beak prominent, the testa reticulate, the endosperm π -shaped in cross-section.

Ecology. On the margin of lowland dipterocarp-forests.

Distribution. Vietnam, Laos, Kampuchea and the Malay Peninsula.

Observation. This species is recognized by its thinly pulped berries, hard seed and obovate leaflets which have abruptly caudate apices. This species is a new addition to the flora of the Malay Peninsula.

Specimens examined. SELANGOR, Ulu Langat, 1.5.1960, *Gadoh 2156* (KEP). KEDAH, P. Langkawi, Selat Pancor, 21.11.1934, *Henderson 28948* (K, SING); P. Dayang Bunting, 27.11.1934, *Henderson 18948* (K, SING); Ayer Hangat, 12.10.1970, *Chin 494* (KLU), P. Kedrah, 17.11.1941, *Corner s.n.* (SING), Dalam Ru, 6.3.1983 *Latiff & Rahim s.n.* (UKMB); G. Senyum, 30.7.1929, *Henderson 22372* (SING).

II. Sect. *Carinata* Latiff sect. nov.

Baccae pyriformes. Semina 3-4, postice carinata et tuberculata, chalaza per $\frac{1}{2}$ longitudinis seminis deorsum extensa, antice concavitibus divergentibus 2; endospermium in sectione transversali T-forme.

Type species: T. pedunculare (Wall. ex Laws.) Planch.

10. *Tetrastigma pedunculare* (Wall. ex Laws.) Planch.

T. pedunculare (Wall. ex Laws.) Planchon in DC., Monog Phan. 5 (1887) 438; Suessenguth in Engler & Prantl, Nat. Pfl. Fam. 20d (1953) 319.

Holotype: Wallich Cat. 6024, Penang (K!, isotype SING!).

Vitis peduncularis Wall ex Lawson in Hooker f., Fl. Br. Ind. 1 (1875) 655; King, J. As. Soc. Beng. 65, 2 (1896) 393; Ridley, Fl. Mal. Penin. 1 (1922) 474.

Stem 1.8-2.6 cm in diameter, lenticels conspicuous. Leaves digitately 3-foliolate, coriaceous, glabrous above, densely covered with glaucous fine indumentum beneath, the petiole 10.1-13.3 cm; terminal leaflets 16.8-22.2 \times 9.8-11.4 cm broadly elliptical to rhombic, acuminate, acute at base, serrate, the petiolule 2.4-3.2 cm; lateral leaflets 12.0-16.8 \times 8.9-11.8 cm, asymmetrically oblong, oblique, the apex and margin as in terminal leaflets, the petiolule 1.8-2.3 cm. Peduncle 1.2-1.8 cm. Cyme dichotomous, 10-12 cm in diameter often borne on older branches or stem. Staminate flowers oblong; pistillate flowers oblong, puberulose, the staminodes c. 1 mm long, the stigma-lobe terete. Berries 0.5-0.7 \times 0.4-0.5 cm; seeds 0.5 \times 0.4 cm, the testa ridged.

Ecology. On the margin of the hill and lowland dipterocarp-forest, sometimes on limestone hills.

Distribution. Borneo, Sumatra and the Malay Peninsula.

Observation. This species is recognized by its large dichotomously branched inflorescence which is often borne on older stems and the broadly elliptical to rhombic terminal leaflets. In general appearance, it is similar to *T. lauterbachianum* Gilg of New Guinea but differs in the characters of the inflorescence and the leaflets.

Holotype: Wallich Cat. 6024, Penang (K!, isotype SING!).

Specimens examined. PAHANG, G. Benum, 23.3.1967, Whitmore 3395 (KEP, SING); Jerantut, 3.3.1967, Whitmore 3144 (KEP); Maran-Jerantut Road, 30.5.1979, Latiff & Md Kassim 1650a (UKMB). KELANTAN, Kuala Rek, 27.1.1923, Haniff & Nur 10176 (K, SING). JOHORE, P. Pemanggil, 29.1.1980, Latiff 140 (UKMB). SELANGOR, Ulu Gombak, 1.4.1921, Hume 9398 (SING); Genting Highlands, 10.9.1979, Latiff 19 (UKMB). PERAK, Larut, Dec. 1883, King's Coll. 5364 (K, SING). MALACCA, Bt Tampin, May 1896, Goodenough 1953 (SING); NEGERI SEMBILAN, G. Angsi, Feb. 1904, Ridley s.n. (SING); Ulu Bendul,

22.12.1979, *Latiff 90 (UKMB)*. KEDAH, Koh Mai, 7.4.1938, Kiah 35214 (*K, SING*).

11. *Tetrastigma papillosum* (Bl.) Planch.

T. papillosum (Bl.) Planchon in DC., Monog. Phan. 5 (1887) 429; Suessenguth in Engler & Prantl, Nat. Pfl. Fam. 20d (1953) 320; Backer and Bakhuizen v.d. Brink, Fl. Java 2 (1965) 88.

Lectotype: Blume s.n., Java (*L!* isolectotypes *K! BM!*)

Cissus papillosa Blume Bijdr. 1 (1825) 183.

Stem 1.4–1.8 cm in diameter, with spinelike corky excrescences. Leaves digitately 3-foliate, coriaceous, glabrous, the petiole 3.3–7.5 cm; terminal leaflets 8.2–9.7 × 3.6–4.8 cm, elliptical, acuminate, obtuse at base, coarsely crenate, the petiolule 2.7–3.3 cm; lateral leaflets 7.6–8.9 × 3.1–3.6 cm, elliptical, oblique, the apex and the margin as in terminal leaflets, the petiolule 1.0–1.4 cm. Inflorescence a corymbose cyme. Staminate flowers pubescent; pistillate flowers c. 2 mm long, pubescent, the staminode c. 0.5 mm, the stigma-lobe terete. Berries 0.6 × 0.7 cm. Seed 0.5 × 4.0 cm, the testa ridged.

Ecology. On the margin of hill and lowland dipterocarp-forests, rarely on limestone hills.

Distribution. Thailand, Borneo, Philippines, Celebes, New Guinea, Java, Sumatra and the Malay Peninsula.

Observation. The epithet *papillosum* refers to the papillate structures on the old stem. Strictly speaking these are not papillae but rather, spiny excrescences formed by the changes in the lenticels. Although Ridley himself collected the species in Johore, he did not distinguish it from *T. pedunculare*. Recently the author collected some specimens of the species in Frasers' Hill, Gombak and Genting Highlands. These constitute additional records to the flora of the Malay Peninsula.

Specimens examined. PAHANG, Cameron Highlands, 10.4.1934, *Symington 36201 (KEP)*; Fraser's Hill, 25.10.1979, *Latiff 77 (UKMB)*. JOHORE, Sg. Tebrau, March 1908, *Ridley s.n. (SING)*; G. Panti, in 1892, *Ridley 4180 (K, SING)*; G. Sumalayang, 19.2.1971, *Chin 715 (SING, KLU)*. SELANGOR, Gap 24.8.1959, *Burkill 1989 (K, SING)*; Genting Highlands, 25.10.1977, *Latiff 36 (UKMB)*; Genting Highlands, 10.9.1979, *Latiff 18 (UKMB)*; Ulu Gombak, 20 m.s, 25.9.1979, *Latiff 59 (UKMB)*.

12. *Tetrastigma pyriforme* Gagnep.

T. pyriforme Gagnepain, Bull. Soc. Bot. Fr. 91 (1944) 35; Suessenguth in Engler & Prantl, Nat. Pfl. Fam. 22d (1953) 327.

Type: *Poilane 25625*, Tonkin. Vietnam (isotype, *K!*).

Stem 2.0–2.1 cm in diameter, smooth. Leaves pedately 5-foliolate, coriaceous, glabrous, the petiole 6.5–11.2 cm; terminal leaflets 9–11.2 × 4.6–5.2 cm, elliptical, acuminate, acute at base, serrate, the petiolule 2.1–2.3 cm; lateral leaflets 7.9–9.3 × 3.8–4.4 cm, asymmetrically oblong, oblique, the apex and margin as in terminal leaflets, petiolule 2.0–2.1 cm. Peduncle 4.1–4.3 cm; cyme dichotomous. Flowers not observed. Berries 0.8–1.0 cm in length. Seeds 0.7 × 0.5 cm, the testa tuberculate.

Ecology. Known only from the hill forests in Cameron Highlands, Bukit Kemaman (Trengganu) and Maran-Jerantut Road.

Distribution. Vietnam, Laos and the Malay Peninsula.

Observation. This is the only species in the Malay Peninsula of sect. *Carinata* with 5-foliolate leaves. This species could not be identified with the literature of King (1896) and Ridley (1922). It was finally established by comparative studies with type material of Laos and Vietnam. The species is a new record for the Peninsula.

Specimens examined. PAHANG, Cameron Highlands, 2.4.1937, *Md. Nur* 32827 (*K, SING*). TRENGGANU, Bukit Kemaman, 26.11.1935, *Corner* s.n. (*SING*). PAHANG, Maran-Jerantut Rd, 30.5.1979, *Latiff & Md Kassim* 1650b (*UKMB*).

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