

PENTAPHYLACACEAE (C. G. G. J. van Steenis, Leyden)

1. PENTAPHYLAX

GARDNER & CHAMPION, in Hook. J. Bot. & Kew Gard. Misc. 1 (1849) 245; CHAMPION, Trans. Linn. Soc. Lond. 21 (1853) 114, t. 12; MATTFELD, in E. & P. Pfl. Fam. 20 b (1942) 13.—Fig. 1.

Evergreen, subglabrous shrubs or trees. Twigs lengthwise grooved and ridged. Buds perular. *Leaves* simple, entire, penninerved, spirally arranged; midrib and petiole sulcate. Stipules absent. *Flowers* bisexual, actinomorphic, rather small, in \pm sessile, bracteate, axillary pseudo-spikes or -racemes whether or not provided with reduced leaves at the apex and later terminating into a foliate twig, flowering from the base upwards; exceptionally some flowers or some inflorescences in twos, the upper flower expanding first. Bracteoles 2, appressed to the calyx, persistent, \pm carinate, ciliate. *Sepals* 5, slightly unequal, roundish, imbricate, ciliate, persistent, sometimes splitting (retuse) later. *Petals* 5, white, thickish, obovate-oblong, rounded or shallowly emarginate, imbricate in bud, free but coherent mutually and with the stamens, dropping often together. *Stamens* 5, basifixed, inflexed in bud, later erect, alternating with the petals and shorter than these; filaments thickish, flattened in the middle, narrowed towards the anther; anther-cells 2, free, roundish, each cell with a minute appendage representing a terminal pore. Disk absent. *Ovary* superior, 5-celled, ovate. Ovules 2 in each cell, collateral, pendent, attached at the inner angle, feebly campylotropous, apotropous, with 2 teguments and a dorsal raphe. *Style* 1, long-persistent, cylindrical; stigma broadened, feebly or distinctly star-shaped by 5 acute, minute to distinct stigmatic arms. *Capsule* ellipsoid, loculicidally dehiscent in the upper half or down to the base, valves long persistent, each bearing a septum along the middle; exocarp either freed and withering or disrupted along the midrib of the carpels, midribs persistent, representing 5 additional narrow 'valves'; endocarp and septa woody, after dehiscence leaving a persistent, \pm 5-angular columella. Endocarp and seedcoat showing a peculiar transverse-fibrous tissue. *Seeds* elongated, resembling thin, narrow lemon-sectors, sometimes thin above (in the basal part) so as to appear seemingly \pm winged, but sometimes appearing to be empty. Embryo horse-shoe-shaped; radicle terete; albumen scarce.

Distr. Two *spp.* in SE. Asia (Hongkong, Hainan, Kwantung, and Tonkin) and *Malaysia*: Malay Peninsula, N. Sumatra. Fig. 2.

Ecol. Rain-forests and subalpine brushwood, in *Malaysia* and Indo-China exclusively above 1200 m altitude.

Uses. Sometimes cultivated for ornamental purposes.

Taxon. The taxonomic affinity of this mono-generic family is still not unanimously agreed on. HOOKER (J. Bot. *l.c.*) assumed it to belong to the *Theaceae*, in a rather isolated position possibly approaching the *Gordonieae*. This view was shared by BENTHAM (J. Linn. Soc. Bot. 5, 1861, 59 and Fl. Hongk. 1861, 28), who placed it in close proximity to *Eurya*, by CHOISY (Mém. Soc. Phys. & Hist. Nat. 14, 1855, 169), maintained by BENTHAM & HOOKER (Gen. Pl. 1, 1862, 183), and is still upheld by HUTCHINSON (Fam. Fl. Pl. 1, 1926, 174).

On the other hand BAILLON (Hist. Pl. 4, 1873, 245) does not accept it as theaceous.

ENGLER assigned it in the rank of a family and arranged it within the *Celastrales* next to the *Corynocarpaceae*, *Aquifoliaceae*, and *Celastraceae* (Pfl. Fam. Nachtr. 1, 1897, 214, 350). He notes that the habit may be theaceous and that the fruit resembles that of *Clethra*, as do the porous anthers; *Clethra*, however, possesses 2 whorls of stamens and many ovules per cell. His view was shared by VAN TIEGHEM (in Morot, J. Bot. 14, 1900, 193); it differs from *Celastraceae* proper in several points *viz* by the absence of stipules, by a different structure of the ovule, and in the inflorescence. ENGLER maintained his view (Pfl. Fam. Nachtr. 3, 1908, 197), which is also accepted by MERRILL (Lingn.



Fig. 1. *Pentaphylax euryoides* GARDN. & CHAMP. *a*. Sterile twig, N. Sumatra, $\times 2/3$, *b*. flowering, Malaya, $\times 2/3$, *c*. ditto, $\times 2/3$, *d*. fruiting, N. Sumatra, $\times 2/3$, *e*. flower, $\times 5$, *f*. flower beyond anthesis, $\times 5$, *g*. stamens, $\times 6$, *h*. pistil, $\times 6$, *i*. stigma, $\times 18$, *j-l*. anthers, $\times 13$, *m*. dehiscent fruit, $\times 3$, *n*. seed, $\times 3$ (*a*. after bb 3819, *c*. H. C. ROBINSON, *d*. VAN STEENIS 8984, *e-f*. Herb. Bog. 55404, *m*. SF 20617).

Sc. J. 5, 1927, 115), by LEMÉE (Dict. Descr. 5, 1934, 134), by MAURITZON (Bot. Notiser 1936, 187, fig. 7A-C), by PULLE (Compend. 1938, 294), by MATTFELD in the new edition of the Pflanzenfamilien (20b, 1942, 13-21), and by GAGNEPAIN (Fl. Gén. I.-C. Suppl. 1, 1943, 333). METCALFE & CHALK (Anat. Dict. 1, 1950, 207) basing themselves on wood-anatomical data of BEAUVISAGE and of HEIMSCH also assume the genus related to *Cyrrillaceae* and consider it better placed in the *Celastraceae* or *Theaceae* than in the *Terebinthales*. Dr KOBUSKI (*in litt.*) is of opinion that it should be excluded from the *Theaceae*.

HALLIER (Beih. Bot. Centr. Bl. 39, ii, 1921, 133, 176) inserts the genus in *Linaceae* as a special tribe *Pentaphyllaceae*.

The structure of the pollen apparently does not furnish a clue for a decision of the affinity; ERDTMAN (Pollen Morph. 1952, 317-318, fig. 185A) remarks that more or less similar pollen grains are found in *Clethraceae*, *Cyrrillaceae*, and *Theaceae* (*Eurya*).

Identification with HUTCHINSON's key (Fam. Fl. Pl. 1, 1926) leads to *Cyrrillaceae*, although in this book *Pentaphyllax* is arranged under *Theaceae*. This is possibly due to his (erroneous) drawing of anthers with slits in RIDLEY's Flora of the Malay Peninsula.

Though I dare not say whether the genus deserves indeed the merit of family rank, it deviates in several ways so remarkably from other plants, that it seems convenient to treat it separately.

Morph. The colour of the dried leaves often reminds of *Eurya* and *Symplocos* apparently due to the accumulation of alum according to HALLIER (Beih. Bot. Centr. Bl. 39, ii, 1921, 128) and CHENERY (Kew Bull. 1948, 176).

The inflorescences (spikes or racemes) are really twigs; they often end into a leafy continuation and later develop into normal twigs leaving the remains of the dehisced fruits laterally on bracteate twig parts lower down. This character is variable, however, as in some flowering specimens, described as *P. malayana* and *P. spicata*, the leafy continuation is not present.

VAN TIEGHEM (*l.c.*), followed by MATTFELD (*l.c.*), suggests the existence of 10 valves in the capsule, 5 of which would be sterile and narrow and be represented only by the midribs of the carpels. I assume this interpretation is wrong, as the midribs take always with them an irregular portion of marginal tissue of the exocarp. In some cases the whole pericarp remains standing after dehiscence, the midribs withstanding withering best.

In one of the type specimens of *P. spicata* twin-flowers and twin-spikes occur, but on the same specimen both solitary flowers and solitary spikes are present as well.

Notes. The species described are very closely related and for this reason I felt necessitated to revise the whole genus. There is a great range in the variability of the size of the leaves, their texture, and in the size of the plant, no doubt at least in part correlated with habitat. Diagnostic characters appear to be feeble. All specimens from different localities differ mutually in minor details. After a careful scrutiny of the rather scarce flowering materials hitherto collected I have come to the conclusion that there is only one taxon deserving specific rank. See further under the species.

1. *Pentaphyllax euryoides* GARDNER & CHAMPION, in Hook. J. Bot. & Kew. Gard Misc. 1 (1849) 245; BENTH. Fl. Hongk. (1861) 28; CHAMPION, Trans. Linn. Soc. Lond. 21 (1853) 116, t. 12; MERR. Lingn. Sc. J. 5 (1927) 115; MATTFELD, Pfl. Fam. ed. 2, 20b (1942) 21, fig. 5; GAGNEPAIN, Fl. Gén. I.-C. Suppl. (1943) 333.—*P. malayana* RIDL. J. Linn. Soc. Bot. 38 (1908) 305; Fl. Mal. Pen. 1 (1922) 206, fig. 21; STEEN. Bull. Bot. Gard. Btzg III, 17 (1948) 404.—*P. arborea* RIDL. Fl. Mal. Pen. 5 (1925) 291.—*Theaceae* gen. nov. ENDERT, Med. Boschb. Proefst. 20 (1928) 216.—*P. racemosa* MERR. & CHUN, Sunyatsenia 1 (1930) 66, incl. *P. montana* RIDL. *errore*; J. Arn. Arb. 19 (1938) 41.—*P. spicata* MERR. J. Arn. Arb. 19 (1938) 40; GAGNEP. Fl. Gén. I.-C. Suppl. (1943) 333, fig. 32 (9-16).—Fig. 1.

Bush or small tree, 2-9-12 m or medium-sized tree 24-38 m by 30-60 cm (unbranched part 10-17 m). Twigs often dark-coloured. Innovations sometimes slightly puberulous, red (RIDLEY). Leaves chartaceous to thick-coriaceous, very different in shape, oblong, elliptic, ovate-lanceolate, or lanceolate, sometimes oblique or even falcate, 3-8 by 1-2³/₄ cm; base cuneate to feebly rounded; apex tapering to distinct- or even long-acuminate, rarely blunt, tip blunt to rounded; nerves c. 6-8 pairs,

obliquely ascending and arching, not much more prominent beneath than are the tertiary veins; venation prominent on both sides, but less so in thick leaves; petiole 1/2-1 cm. *Pseudo-racemes* or *-spikes* c. 2¹/₂-5 cm. Bracts small, roundish to triangular c. 1 mm. Pedicels 0-2 mm. Bracteoles small, oblong to triangular or roundish, sometimes acutish, 1¹/₂-2¹/₂ by 1/2-2 mm, c. 1/4-1/2 times as long as the calyx. *Sepals* roundish, 1¹/₂-3 by 1³/₄-2¹/₂ mm. *Petals* 4¹/₂-5 by 2 mm. Filaments 3-4 by 1¹/₄-1¹/₂ mm. Anthers c. 1/2 mm. Style 1-2 mm. *Capsule* ellipsoid, rounded at both ends, sometimes slightly apiculate, c. 5-9 by 4-5 mm, at last black, taste astringent. *Seeds* linear-oblong, with slightly rounded outer margin, cuneate in cross-section, 4¹/₂-6¹/₂ by 1¹/₂-2 mm, rounded at both ends, red-coated.

Distr. SE. Asia (Kwantung: Lok Chang; Tonkin: Chapa, massifs of Fan Tre Pam & Tam Dao and Annam: Bach-ma pr. Hué, Bana pr. Tourane; Hainan, Hongkong), in *Malaysia*: Malay Peninsula (G. Tahan; Kluang Terbang; G. Mekuang Lebah; G. Ulu Kali; Fraser Hill) and N. Sumatra (Gajo Lands: VAN STEENIS 8421, 9089, 8984; Tapanuli: bb 3819, 5231, 5266). Fig. 2.

Ecol. Mountain forests and subalpine scrub-forest, 1200-3000 m, fl. Jan.-Febr., April-July, fr.

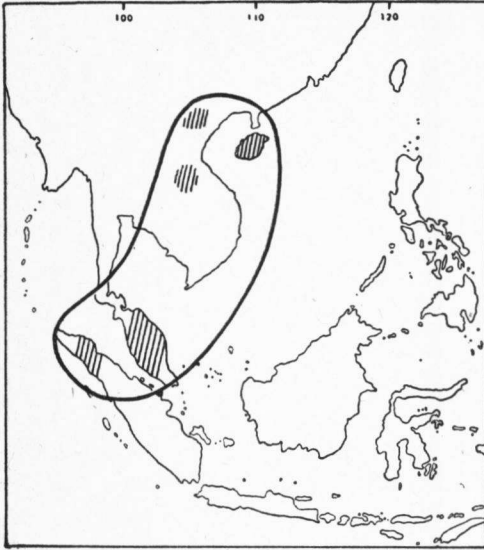


Fig. 2. Area of the genus *Pentaphylax*.

July–Sept. and (in Gajo Lands) Jan.–Febr.. In tall mountain forests this appears a tall tree with thin leaves; on exposed crests it is a gnarled, crooked treelet or bush with thick leaves.

Vern. *Madang lasiak*, *api-api*, Batak.

Notes. Originally I had the impression that two taxa were involved, one characterized by sessile flowers in defoliate spikes (*malayana*, *spicata*), the other having foliate racemes (*euryoides*, *racemosa*, *arborea*), but I can find no correlation with other characters (length of style, shape and size of bracteoles, size of the tree, etc.). There is quite some degree in variation of minute details in different specimens. In one specimen of *P. malayana* I found the lower flowers pedicelled and the upper flowers in the same inflorescence sessile and there are also specimens with sessile flowers in foliate spikes, necessitating the distinction of one taxon only. This is corroborated phytogeographically, as specimens with sessile and those with pedicelled flowers have exactly the same area. As to *P. racemosa*, MERRILL himself suggested reduction to *P. euryoides*. As to *P. spicata*, I saw of PÉTELOT 3213 an excellent flowering duplicate (BO); the leaf size is on the average somewhat larger and broader (5–10 by 2½–5 cm) than that in W. Malaysia, but nerves, leaf-shape and flowers agree.