

## THE GENUS MYXOPYRUM L. (OLEACEAE)

R. KIEW

Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia

### SUMMARY

The morphology and leaf anatomy of *Myxopyrum* is described and a key to the species is given. Of the 15 species previously described four species and two subspecies are recognised: *M. nervosum* Bl. (synonyms *M. horsfieldii*, *M. zippelii*) with one subspecies *coriaceum* (Bl.) Kiew (synonym *M. ellipticum*), *M. ovatum* Hill (synonyms *M. macrolobum*, *M. cordatum*, *M. philippinensis*), *M. pierrei* Gagnep. (synonym *M. hainanense*) and *M. smilacifolium* Bl. (synonym *M. serrulatum*) with one subspecies *confertum* (Kerr) Kiew. *Myxopyrum enerve* Steen. is *Chionanthus enerve* (Steen.) Kiew. Descriptions for the extra-Malesian species, *M. smilacifolium*, is given.

### INTRODUCTION

Hill (1910) reviewed the history of the genus and recognised ten species. *Myxopyrum smilacifolium* Bl. and *M. serrulatum* Hill from India (with *M. smilacifolium* var. *ilicifolium* Kurz recorded from Burma); *M. nervosum* from Malaya, Sumatra and Java; *M. coriaceum* Bl. and *M. ellipticum* Hill from Borneo; *M. horsfieldii* Hill from Java and *M. ovatum* Hill (Kei I.), *M. cordatum* Hill (Admiralty I.) and *M. macrolobum* Hill and *M. zippelii* from New Guinea.

Five species have since been described: *M. philippinensis* by Elmer (1912) from the Philippines, *M. pierrei* by Gagnepain (1933) from Indochina, *M. confertum* by Kerr (1938) from Thailand, *M. enerve* by Van Steenis (1967) from Borneo and *M. hainanense* by Chai (1974) from Hainan.

Hill divided the genus into two groups based on the length of the corolla tube (longer or shorter than the lobes). He also concluded *M. smilacifolium* and *M. serrulatum* (Indian species with a short corolla tube and long lobes) are closely related, as are *M. macrolobum*, *M. ovatum* and *M. cordatum* (New Guinea species also with a short corolla tube and long lobes) and *M. nervosum*, *M. ellipticum* and *M. horsfieldii* (with a longer corolla tube and short lobes). He considered the Indian species showed more affinity to the species in New Guinea than to those of Malaya, Borneo and Java, i.e., those with a longer corolla tube. Three species, *M. cordatum*, *M. coriaceum* and *M. zippelii*, were then imperfectly known, flowering specimens not being available. They could therefore not be placed in Hill's key which was based primarily on this flower character. In fact most specimens are collected in fruit so that a satisfactory key needs to be based on leaf and inflorescent characters.

Most of Hill's species, as well as those of Elmer, Kerr and Gagnepain were based on a single or very few specimens. Now that more specimens are available it has become clear that *Myxopyrum* species are extremely variable for many of the diagnostic characters used and that species delimitation needs to be re-examined.

In addition little was known about the genus. Over-emphasis on ovule number and position caused Johnson (1957) to remove *Myxopyrum* from its traditional position in subfamily Oleoideae to subfamily Jasminoideae. However, when a wider range of characters is considered, *Myxopyrum* is more closely allied with the tribe Oleeeae than any of the tribes of subfamily Jasminoideae. (It has in common with tribe Oleeeae the simple leaf, comparatively short corolla tube with 4 valvate lobes, short style, the fruit is not bilobed and flavones are present.) But it also shows differences, e.g., a climbing habit, quadrangular stem, triplinerved leaves, separate vascular strands in the petiole, ascending ovules and in addition Harborne & Green (1980) have identified three glycosides of apigenin from *Myxopyrum* which are not found in any other genus of the Oleaceae. This indicated it should be retained in a separate tribe, Myxopyreae Johnson, and placed within subfamily Oleoideae (Kiew, 1983).

#### MORPHOLOGY OF THE GENUS

Vegetatively, *Myxopyrum* is a very distinct genus in the Oleaceae; it is a twining plant with quadrangular young stems, the leaves are triplinerved and in some species are serrate towards the apex. As the stem grows older it develops a thick layer of soft cork and becomes terete. The triplinerved leaves have led specimens of *Myxopyrum* and *Strychnos* (Loganiaceae) to be confused. Species of *Strychnos* can be told apart as they possess a terete stem, usually have tendrils, the flowers have five stamens and the fruit may have many seeds.

The degree of serration of the leaf margin is very variable in species such as *M. nervosum* and *M. smilacifolium*, from almost spinose to obscurely dentate to entire. Only one species, *M. ovatum*, is as yet known only from specimens with leaves with an entire margin. This variation appears randomly through the species distribution and is not correlated with any other character so that taxa based on conspicuously serrate margins, such as *M. serrulatum* and *M. smilacifolium* var. *illicifolium* are not given taxonomic rank.

Leaf shape is also variable but the narrowly elliptic leaves of *M. nervosum* subsp. *coriaceum*, *M. smilacifolium* subsp. *confertum* and *M. pierrei* and the ovate or cordate leaves of *M. ovatum* enable them to be identified by their leaf width in combination with other characters (table 1).

The inflorescence is uniform in type throughout the genus. It is a lax panicle with opposed lateral branches of decreasing size towards the apex, these lateral branches bear further branches which terminate in cymules of flowers. Within a species there is great variation in length depending on the position of the inflorescence (shorter in terminal than in axillary inflorescences) and on age of the wood from which they are produced (longer on older wood). In addition it appears that the infructescence un-

Table 1. Character combinations for the identification of fruiting material of *Myxopyrum*.

	Leaf width (cm)	Inflorescence length (cm)	Fruit size (mm)
<i>M. nervosum</i>			
subsp. <i>coriaceum</i>	3–7.5	8	12×10–20×15
subsp. <i>nervosum</i>	(4–)5–8(–11.5)	(3.5–)5–10(–14)	17×12–20×20
<i>M. ovatum</i>	6–14.5	6–20(–32)	9×8–20×15
<i>M. pierrei</i>	4–7.5	(6–9–)21–35	13×16–19×17
<i>M. smilacifolium</i>			
subsp. <i>confertum</i>	3–4.5(–6)	1–5(–6.5)	8×10–15×10
subsp. <i>smilacifolium</i>	4–8(–10)	7–19	5×5–10×13

dergoes some growth. Although the range of inflorescence length overlaps between species, it can be used to recognise species in conjunction with other characters (table 1).

The calyx is uniform for all species – it is shortly tubular at the base with 4 short acute lobes about 1 mm long and is pubescent outside. The corolla is very small; usually between 1 and 3 mm long but reaching 5 mm in a few species. There are two forms of corolla: the urceolate flower with a thick fleshy tube and rounded lobes, shorter than the tube, which scarcely open (such as that of *M. nervosum*); and the flower with a campanulate tube and oblong to linear lobes which are longer than the tube and open, often to become recurved. The lobes are valvate, usually 4 but 5 lobes have been noted for several specimens of *M. ovatum*.

The stamens are subsessile and are contained within the corolla tube and scarcely protrude above it. The anther is oblong, extrorse and about 1 mm long. Rarely three stamens are encountered in *M. ovatum* and *M. smilacifolium*.

The ovary is ovoid with a sessile 2-lobed stigma. The 2 locules each contain 2 ovules, though one or both may abort so that after the corolla has fallen the ovary may have between 4 and 1 ovule and similarly the fruit may have between 4 and 1 seed. Neither ovule number, nor seed number, can therefore be used as a taxonomic character as suggested by Gagnepain (1933). Blume (1850) recorded 1–3 ovules per locule but 3 ovules have not been reported since, perhaps he meant 1–3 ovules in the ovary.

In all species the ovules are ascending. I have observed this for *M. nervosum* and its subsp. *coriaceum* and *M. ovatum*. Hill gives drawings of dissected flowers on herbarium sheets of *M. horsfieldii*, *M. ellipticum* and *M. nervosum* and Gagnepain illustrates *M. pierrei*, all showing ascending ovules. In addition Kerr (1938) describes the ovules of *M. confertum* as ascending. The single record of *Myxopyrum* possessing pendulous ovules is that of Van Steenis (1967) for *M. nervosum*.

The fruit is a berry; globose when it contains a single seed, broader than long when it contains two seeds. The outer pericarp is fleshy and either orange, crimson

or purple when ripe. The inner layer dries woody and the septum between the locules is papery. The seeds contain copious horny endosperm, covered by a papery testa. Blume recorded the seeds of *M. nervosum* as enveloped by mucilage, hence the generic name (slimy wheat). The dry seeds of some specimens of *M. nervosum*, its subsp. *coriaceum* and *M. pierrei* are surrounded by copious viscous oil, perhaps a remnant of that mucilage. Apart from *M. smilacifolium* which generally has smaller fruits (5 by 5 mm), most species have fruits ranging in size from 10 by 10 mm to 20 by 20 mm.

#### LEAF ANATOMY OF THE GENUS

*Myxopyrum* is little known anatomically. Solereder (1908) described the peltate glandular hairs of *M. smilacifolium* as consisting of a head of 4 cells and that the stomata of this species were unusual for the family (which has the anomocytic type) as 3–4 of the neighbouring cells were slightly different from the other epidermal cells. Rao & Das (1979) recorded the presence of foliar sclereids in *Myxopyrum*.

The leaf anatomy of three species was examined. *Myxopyrum nervosum* (from fresh specimens collected from Pasoh Forest Reserve, Malaysia and Kebun Raya, Bogor, Indonesia), *M. ovatum* (from herbarium specimens: *Edaño 41711*, *Katik 46864*, *Lam 2619*, *Ramos & Edaño 33666*) and *M. pierrei* (*How 73504*). For each specimen TS of the petiole, and TS, maceration and clearings of the lamina were made.

The wood anatomy of *Myxopyrum* is currently under investigation by Baas and colleagues at the Rijksherbarium, Leiden.

**Petiole** — Outline TS deeply or shallowly grooved, winged above, 1750–3330  $\mu\text{m}$  across. Cuticle surface smooth. Epidermis rectangular in TS with slightly convex outer surface in *M. nervosum* and *M. ovatum*, papillose in *M. ovatum*, papillose only in groove in *M. pierrei*, rectangular below. Trichomes infrequent, sunken glandular peltate, 25  $\mu\text{m}$  long in *M. nervosum*, *M. ovatum*, *M. pierrei*; sunken eglandular peltate, 30–70  $\mu\text{m}$  long in *M. ovatum*, unicellular, 35–50  $\mu\text{m}$  long in *M. pierrei*. Ground tissue parenchymatous, with few to many brachysclereids associated with vascular tissue. Ascicular crystals present in all species, associated with prismatic crystals in *M. ovatum*. Perivascular sclerenchyma absent, except in some specimens of *M. ovatum* (*Edaño 41711*). Vasculature of 3 major strands (these coalesce in *M. pierrei* and *M. ovatum*) with between 1 and 7 pairs of lateral traces (fig. 1).

**Lamina** — Isobilateral, 130–150  $\mu\text{m}$  thick in *M. pierrei*, 200–250  $\mu\text{m}$  in *M. nervosum*, *M. ovatum*. Midrib grooved above in *M. nervosum*, *M. pierrei*, plane above in *M. ovatum*; prominent below in all species. Cuticle surface smooth on both surfaces, 2.5–5  $\mu\text{m}$  thick adaxially, 2.5  $\mu\text{m}$  thick abaxially. Epidermis outer wall thinner than cuticle, anticlinal wall moderately thickened in *M. pierrei*. Epidermal cells oval to square or polygonal in surface view, anticlinal walls sinuous or straight, rectangular in TS, taller adaxially (7–25  $\mu\text{m}$ ) than abaxially (7–12  $\mu\text{m}$ ). Hypodermis of 1 or 2 layers above midrib (absent in *M. pierrei*). Stomata on abaxial surface only, anomocytic, flush with surface. Trichomes peltate glandular with stalk sunken and head of 4 (sometimes 6 or 8) cells, slightly protruding above the surface, usually present on the abaxial surface, present on adaxial surface of *M. nervosum*, *M. pierrei*; eglandular

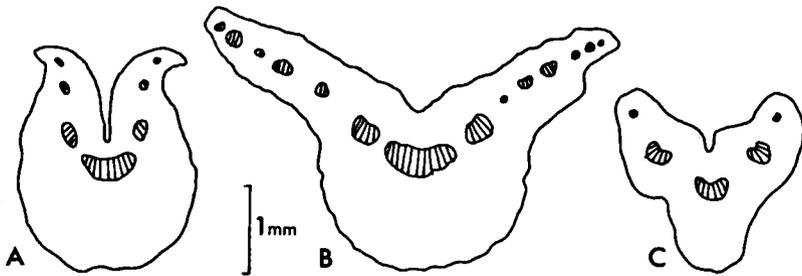


Fig. 1. Petiole vasculature of *Myxopyrum*. A. *M. nervosum* (Pasoh For. Res.); B. *M. ovatum* (Lam 2619); C. *M. pierrei* (How 73504).

peltate trichomes present on adaxial surface of *M. ovatum*. Palisade mesophyll 1 to 2 layers, cells 15–37.5  $\mu\text{m}$  tall, in *M. nervosum* and *M. pierrei* the palisade is scarcely differentiated from the spongy mesophyll. Spongy mesophyll compact to moderately compact. Ascicular crystals usually present in spongy mesophyll, sometimes in palisade. Sclereids associated with veins, filiform, 550–2000  $\mu\text{m}$  long and 125–250  $\mu\text{m}$  wide. Midrib crescent-shaped in TS, secondary veins arranged in row below palisade.

The foliar anatomy of these specimens examined indicates that the anatomy of the genus is uniform. All species show features typical of the family, such as presence of glandular and eglandular peltate trichomes, acicular crystals, anomocytic stomata and foliar sclereids. Solereder (1908) had noted that the neighbouring cells of the stomata are slightly different from the surrounding epidermal cells, but from examination of these specimens the neighbouring cells are scarcely different enough to be classed otherwise than anomocytic. The foliar sclereids are of the most common type (filiform) found in the Oleaceae (Kiew & Che Su, 1982) but they are unusual in that they are terminal (i.e., associated with veins). In species of other genera, e.g. *Olea* and *Chionanthus* the filiform sclereids are diffuse.

The uniformity in anatomy means that it is not helpful in determining the relationship between species, though *M. pierrei* shows several characters not shared by the other species so far examined: e.g., the presence of unicellular hairs on the petiole, the single pair of lateral traces in the petiole (fig. 1) and the thickened anticlinal epidermal walls of the adaxial surface of the lamina.

#### ECOLOGY

All species are recorded from the lowlands below 1000 m, both in primary forest or in exposed areas such as open thickets or seashores. *Myxopyrum nervosum* has been recorded from swampy areas and its subspecies *coriaceum* is confined to the poor acid soil of peat swamp and more rarely of heath forest.

Nothing is known of the pollination or fruit dispersal of any species of this genus.

## TAXONOMY OF THE GENUS

The genus is uniform with regard to habit, venation, size of flower, type of inflorescence and fruit. Form of corolla is the only qualitative and dichotomous character in the genus. Although there is variation in leaf shape and size, length of inflorescence and size of fruit, none of these is discontinuous and there is considerable overlap between species for each character. The species recognised here are nevertheless discrete and fruiting material can be identified by using a combination of these three characters (table 1).

Other characters (degree of serration of margin, leaf texture, flower size) are variable within species and are not useful taxonomically. This has led to a considerable reduction in the number of species, in particular Hill's species, which in most cases were based on minute differences in flower size and degree of serration of the margin.

Six taxa are recognised here, four species and two subspecies. Two species are relatively common and widespread: *M. smilacifolium* (the most northern species which stretches from India through Burma to Indochina) and *M. nervosum* (based on Sundaland but extending into Celebes and New Guinea). The other species, although ranging over a wide area (fig. 2) are known from relatively few collections. *M. pierrei* ranges from Indochina to Sabah in Borneo and *M. ovatum* ranges from the Philippines to New Guinea and New Britain.

The geography of the species explains Hill's statement that the species of India and New Guinea were more closely related (both possessing a short corolla tube) than to *M. nervosum* (with a longer corolla tube). *Myxopyrum* probably had a northern origin with its centre of diversity in the Thai-Indochinese region and has spread into Malesia along two tracks: *M. nervosum* has spread through Malaya, Sumatra and Java to New Guinea and Celebes, producing the subspecies *coriaceum* with thick leaves with entire margins in Borneo which is probably ecologically adapted to the impoverished acid soils of peat swamp and heath forest. The other track from the centre of diversity is through the Philippines to New Guinea and *M. ovatum* has retained the short corolla tube of the Indian and Indochinese species.

The account here provides a key to identify all species, descriptions of the extra-Malesian species, *M. smilacifolium* with its subsp. *confertum*, and nomenclatural changes for the Malesian species. Descriptions of the Malesian species will appear in the Flora Malesiana account.

## REFERENCES

- HARBORNE, J.B. & P.S. GREEN. 1980. A chemotaxonomic survey of flavonoids in leaves of the Oleaceae. *J. Linn. Soc. Bot.* 81: 155–167.  
HILL, A.W. 1910. The genus *Myxopyrum* (Oleaceae). *Kew Bull.*: 37–44.  
JOHNSON, L.A. 1957. A review of the family Oleaceae. *Contr. N. S. W. Natl. Herb.* 2: 395–418.  
KIEW, R. 1984. Two unusual *Chionanthus* (Oleaceae) species from Borneo and the position of *Myxopyrum* in the family. *J. Arn. Arbor.* (in press).

- KIEW, R. & I. CHE SU. 1982. Comparative study of leaf anatomy of Malaysian species of *Chionanthus* and *Olea* (Oleaceae) with special reference to foliar sclereids. *J. Linn. Soc. Bot.* 84: 79–101.
- RAO, T. A. & S. DAS. 1979. Leaf sclereids – occurrence and distribution in the angiosperms. *Bot. Notis.* 132: 319–324.
- SOLEREDER, H. 1908. Systematic anatomy of the dicotyledons. Transl. by L. A. Boodle & F. E. Frisch, Oleaceae: 521–526, 982. Clarendon Press, Oxford.

## KEY TO THE SPECIES OF MYXOPYRUM

- 1 a.\* Corolla urceolate, thick and fleshy . . . . . 2  
 b.\* Corolla thin and campanulate . . . . . 3  
 2 a. Leaf narrowly elliptic, thickly coriaceous . . 1b. *M. nervosum* subsp. *coriaceum*  
 b. Leaf ovate, elliptic; if narrowly elliptic then chartaceous or subcoriaceous  
     1a. *M. nervosum* subsp. *nervosum*  
 3 a. Leaves ovate to cordate, less than twice as long as wide . . . . . 2. *M. ovatum*  
 b. Leaves elliptic to ovate, twice as long as wide . . . . . 4  
 4 a. Inflorescence large, 6–35 cm long, with large fruits, 13 × 16–19 × 17 mm  
     3. *M. pierrei*  
 b. Inflorescence 1–19 cm long, with fruits 5 × 5–10 × 13 mm . . . . . 5  
 5 a. Inflorescence 7–19 cm long . . . . . 4a. *M. smilacifolium* subsp. *smilacifolium*  
 b. Inflorescence 1–6.5 cm long . . . . . 4b. *M. smilacifolium* subsp. *confertum*

\* Fruiting material can be identified using the combination of characters given in table 1.

1. *Myxopyrum nervosum* Blume – Fig. 1, 2.a. subsp. *nervosum*

- M. nervosum* Bl., *Bijdr.* (1826) 683; *Mus. Bot.* 1 (1850) 320, t. 51; DC., *Prod.* 8 (1844) 290; Miq., *Fl. Ind. Bat.* 2 (1857) 549; Clarke in Hook. f., *Fl. Brit. India* 3 (1882) 618; King & Gamble, *Mat. Fl. Mal. Pen.* 4 (1905) 272; Hill, *Kew Bull.* (1910) 42; Koord., *Exk. Fl. Java* 3 (1912) 51; Ridley, *Fl. Mal. Pen.* 2 (1923) 320; Kerr in Craib, *Fl. Siam. Enum.* 2 (1939) 420; Backer & Bakh. f., *Fl. Java* 2 (1965) 215. – Type: *Blume s.n.* (L!), Salak, Java.
- M. horsfieldii* Hill, *Kew Bull.* (1910) 44. – Type: *herb. T. Horsfield* (K!), Java.
- M. zippelii* Hill, *Kew Bull.* (1910) 44. – Type: *Zippel Herb. Lugd. Bat.* 908, 161–792 (L!), New Guinea.

b. subsp. *coriaceum* (Bl.) Kiew, *stat. nov.*

- M. coriaceum* Bl., *Mus. Bot.* 1 (1850) 320, non *Chondrospermum ?coriaceum* Wall., *Cat.* no 2838 (= *Strychnos nux-vomica?*) in Hill, *Kew Bull.* (1910) 44; Walp., *Ann.* 3 (1852) 18; Miq., *Fl. Ind. Bat.* 2 (1857) 550; Merr., *Enum. Born.* (1921) 489. – Type: *Korthals s.n.* (L!), Borneo.
- M. ellipticum* Hill, *Kew Bull.* (1910) 42; Merr., *Enum. Born.* (1921) 489. – Type: *Haviland 3039* (K!), Borneo.

Notes. *Myxopyrum nervosum* is the most common species of the genus, particularly in Java and Malaya. It stands apart from all other species of the genus by its flower form – it is the only species with an urceolate corolla tube which is thick and fleshy, the lobes (the same length or shorter than the tube) scarcely open. Blume (1826) noted that the corolla form most closely resembles that of *Noronhia* and certainly no other species in any genus of the Oleaceae of Malesia has a similar corolla.

Hill (1910) described *M. horsfieldii* as a new species, distinct from *M. nervosum* by its longer corolla (4.5 mm long as opposed to 2.5 mm in *M. nervosum*) and smaller leaves up to 13 by 6 cm in *M. horsfieldii* and larger than 13 by 6 cm in *M. nervosum*. Remeasurement of the corolla length of the type specimen of *M. horsfieldii* shows the flowers to be 3 mm long, i.e. no different from *M. nervosum* where flower size can vary from 1 to 3 mm within a single inflorescence, e.g. *Koorders 31195*. There is also no difference in leaf size so that *M. horsfieldii* cannot be maintained as a separate species.

Serration of the leaf margin is also variable. Chartaceous leaves are often finely serrate towards the margin, whereas thicker leaves are obscurely toothed. *Myxopyrum zippelii* Hill is based on a sterile specimen which has thin leaves with serrate margins and so falls within the conspectus of *M. nervosum*.

*Myxopyrum coriaceum* Bl. represents the other extreme of leaf form. It has extremely coriaceous leaves, with entire recurved margins. At first it appears that it is a distinct species with narrowly elliptic, very coriaceous leaves. Leaf shape, however, is variable in *M. nervosum* from ovate to narrowly lanceolate. Leaf texture ranges from chartaceous to subcoriaceous. It is the extreme coriaceousness of *M. coriaceum* that falls outside the range of *M. nervosum*, other characters, such as inflorescence length and fruit size do not differ from that of *M. nervosum* (table 1). In Borneo, *M. nervosum* is uncommon and includes plants with narrowly elliptic, chartaceous leaves from primary lowland forest (*Kostermans 21687*) and ovate, coriaceous leaves from hill forest 300–650 m a.s.l. (*Clemens s.n.*, 1929). *M. coriaceum* is confined to the acid soil of peat swamps and heath forest. It is likely therefore that coriaceousness is a response to environment (higher altitude or nutrient poor acid soil) and in such thick leaves a recurved margin and obscured venation is common. Since *M. coriaceum* is confined to a specific habitat, it is considered here as a subspecies of *M. nervosum*.

*Myxopyrum ellipticum* Hill also has coriaceous leaves but they are ovate and it has slightly larger flowers, 4 mm long. However, both this leaf form and the narrowly elliptic leaf form of subsp. *coriaceum* can be found on a single plant (*Anderson S 30037*) from Stapok Forest Reserve, Sarawak, where other specimens, typical of subspecies *coriaceum*, have also been collected. *Myxopyrum ellipticum* is therefore regarded as synonymous with subsp. *coriaceum* because it has coriaceous leaves and is also confined to peat swamp and heath forest.

Dried fruits of subsp. *coriaceum* frequently contain copious amounts of viscous oil. Occasional fruits of subsp. *nervosum* and *M. pierrei* also have oily seeds. Blume (1826) described the seeds as mucilaginous and it is this feature that gives the name to the genus. These are the only oil fruits of any oleaceous species in Malesia and its presence may be related to bird dispersal.

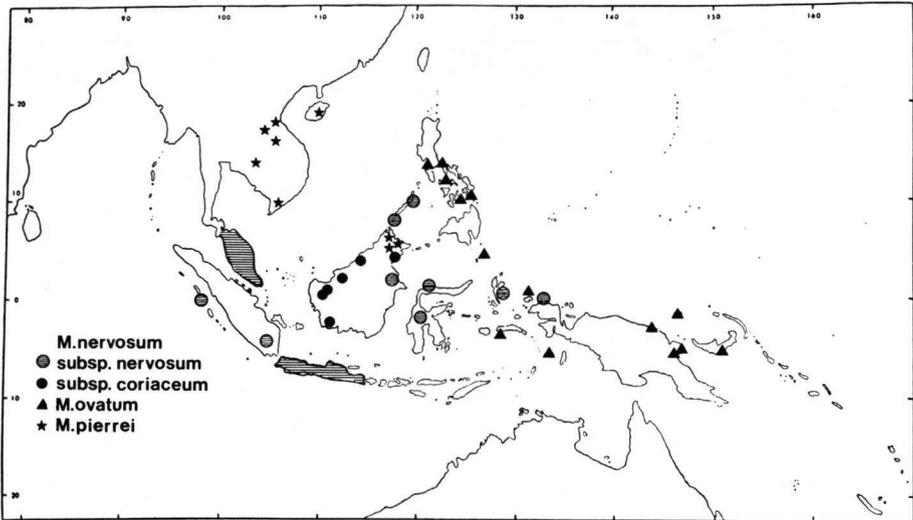


Fig. 2. Distribution of Malesian species of *Myxopyrum*.

## 2. *Myxopyrum ovatum* Hill – Fig. 1, 2.

*M. ovatum* Hill, Kew Bull. (1910) 41; Lingelsh., Bot. Jahrb. 61 (1927) 3; Nova Guinea, Bot. 14 (1927) 329. – Type: *Beccari s.n.*, VIII-1873 (FI, drawing K!), Kei I., New Guinea.

*M. macrolobum* Hill, Kew Bull. (1910) 42; Lingelsh., Bot. Jahrb. 61 (1927) 3; Nova Guinea, Bot. 14 (1927) 329. – Type: *Beccari PP 942* (FI, drawing K!), New Guinea.

*M. cordatum* Hill, Kew Bull. (1910) 44; Lingelsh., Bot. Jahrb. 61 (1927) 2; Nova Guinea, Bot. 14 (1927) 329. – Type: Moseley Challenger Exp. (K!), Admiralty I., New Guinea.

*M. philippinensis* Elmer, Leafl. Philip. Bot. 4 (1912) 1483. – Type: *Elmer 12333* (K!), Sibuyan I., Philippines.

*M. smilacifolium* auct. non Bl.: Clarke in Hook. f., Fl. Brit. India 3 (1882) 618, p.p.; Hemsl., Bot. Challenger 1, 3 (1885) 241; Warburg, Bot. Jahrb. 13 (1891) 403; K. Sch. & Laut., Fl. Schutzgeb. (1900) 498; Lingelsh., Bot. Jahrb. 61 (1927) 2.

Notes. Moseley's specimen from Admiralty I. was the first from the New Guinea region. Of the three species then known (*M. coriaceum*, *M. nervosum*, *M. smilacifolium*), it most resembled *M. smilacifolium* in flower form and so Clarke (1882) gave the distribution of *M. smilacifolium* as including New Guinea. With the addition of Beccari's collections from New Guinea, it became obvious that Moseley's specimen did not belong to *M. smilacifolium* and Hill (1910) described it as a new species, *M. cordatum*. At the same time Hill (1910) described another two new species, *M. ovatum* and *M. macrolobum*, from New Guinea, both based on Beccari's collections. *Myxopyrum cordatum* was based on a fruiting specimen and was distinguished by its cordate leaf base. *Myxopyrum ovatum* and *M. macrolobum* were separated by minute differences in corolla length: *M. ovatum* having a corolla tube 1.5–1.75 mm long and

corolla lobes 3 mm long as opposed to a tube 2–2.5 mm long and lobes 3.5–4.5 mm long in *M. macrolobum*.

Additional material shows that there is a single broad-leaved species with an entire leaf margin in New Guinea and that its distribution extends northwards into the Philippines (fig. 2). It is nowhere common, and unlike the other *Myxopyrum* species, it has been collected from rivers and beaches. Corolla length is variable and cannot be used to separate taxa, unlike corolla form (campanulate or urceolate) which is constant within species. Leaf shape in this species also varies from ovate to cordate. Specimens with cordate leaves were described by Hill as having 5 veins, in fact they have a single pair of longitudinal veins but in cordate leaves the marginal loop in the basal region of the leaf is thick and prominent. Inflorescence length is variable – a single specimen (e.g. *NGF 46864*) has inflorescences 6 cm long on young twigs and 20 cm long on old wood. Of the three names for New Guinea species described by Hill (1910) (*M. cordatum*, *M. macrolobum*, *M. ovatum*) *M. ovatum* is chosen as the most appropriate as not all specimens have cordate leaves or have exceptionally long corolla lobes.

Elmer (1912) described *M. philippinensis* from a specimen which has ovate leaves, 15 by 7–9 cm, apparently very different from other Philippine specimens which have cordate leaves (e.g. *Ramos 43178* with a leaf 23.5 by 14.5 cm). However, there is a complete range of leaf shape between these two extremes and some specimens, e.g. *Edaño 41711*, have leaves of both shapes and sizes on the same plant, the smaller leaves (14 by 6.5 cm) tending to be more ovate than the larger leaves (17.5 by 10.5 cm). *Myxopyrum philippinensis* does not differ in any other character and is regarded as synonymous with *M. ovatum*.

*Myxopyrum ovatum* is most closely related to *M. pierrei* (see there) and has apparently spread through the island chain from the Philippines to New Guinea with its most easterly recorded locality in New Britain (*Frodin NGF 26565*).

Hill (1910) described a fourth species, *M. zippelii*, from New Guinea. This is a specimen of *M. nervosum* (see there).

### 3. *Myxopyrum pierrei* Gagnep. – Fig. 1, 2.

*M. pierrei* Gagnep., Bull. Soc. Bot. Fr. 80 (1933) 78; Fl. Gén. Indo-Chine 3 (1933) 1084, t. 123; Kerr in Craib, Fl. Siam. Enum. 2 (1939) 421. – Lectotype: *Pierre 2804* (P!), Cochinchina.

*M. hainanense* Chia, Fl. Hainanica 3 (1974) 209 & Addenda (1974) 577. – Lectotype: *How 73504* (A).

#### *Extra-Malesian specimens examined:*

THAILAND. Kerr 17705 (BM, K), 18086 (K).

VIETNAM. *Pierre 2804* (A, P), *Poilane 7426* (P), 8050 (P); *Tsang 27015* (A, K, P).

LAOS. *Poilane 2399* (P).

CHINA. Hainan: *How 73504* (A, BO), 73889 (A); *Wang 34636* (NY), 34305 (NY).

Notes. The distribution of *M. pierrei* overlaps with *M. smilacifolium* in Indochina (fig. 2 & 3). It is readily distinguished from *M. smilacifolium* by its large fruit (13 ×

16–16 × 19 mm) and large inflorescences (up to 35 cm long) (table 1). It more closely resembles *M. ovatum* which also has large inflorescences. *Myxopyrum ovatum* is a distinct species with ovate to cordate leaves which are usually less than twice as long as wide and its fruits are generally smaller (9 × 8–15 × 15 mm); *M. pierrei* has elliptic to ovate-oblong leaves which are two or three times as long as wide.

Gagnepain (1933) described the flower as with a corolla and with a single ovule in each locule but examination of the type specimen (*Pierre 2804*) shows that it is in young fruit and it is probable that unfertilised ovules had aborted. The illustration for *M. pierrei* in *Flore Générale de l'Indo-Chine* shows the leaf as pinninerved because the lateral pairs of veins are drawn of equal size to the main pair of longitudinal veins. The venation is in fact triplinerved as in all other *Myxopyrum* species.

The Hainan specimens of *Myxopyrum* have leaves and fruits that are typical of *M. pierrei*, however their inflorescences are shorter. Chai (1974) describes the inflorescence as c. 4.5 cm long and the infructescence as c. 6 cm long, though one of the specimens he cited (*How 73504*) has inflorescences 5 to 6 cm long and an infructescence 9.5 cm long, which fall within the range of *M. pierrei*. *Myxopyrum smilacifolium* subsp. *confertum* has short inflorescences up to 6.5 cm in the infructescence but it differs from the Hainan specimens in having narrower leaves and smaller fruits (table 1). Chai describes the corolla tube as urceolate; however, the lobes are equal in length to the tube and the lobes are recurved as compared with the urceolate corolla of *M. nervosum* where the corolla tube is longer than the lobes which in the open flower are erect but not recurved.

#### 4. *Myxopyrum smilacifolium* Blume – Fig. 3.

##### a. subsp. *smilacifolium*

*M. smilacifolium* Bl., Mus. Bot. 1 (1850) 320; Kurz, For. Fl. Brit. Burma 2 (1877) 160; J. As. Soc. Beng. 46, ii (1877) 245; Clarke in Hook. f., Fl. Brit. India 3 (1882) 618, p.p.; Hill, Kew Bull. (1910) 40; Gagnep., Fl. Gén. Indo-Chine 3 (1933) 1083; Kerr in Craib, Fl. Siam. Enum. 2 (1939) 421. – *Chondrospermum ?smilacifolium* Wall., Cat. no. 2837; DC., Prod. 8 (1844) 301. – Type: Wallich, Cat. no. 2837 (Linn. Soc., London), Chittagong.

*M. smilacifolium* var. *ilicifolium* Kurz, For. Fl. Brit. Burma 2 (1877) 160; J. As. Soc. Beng. 46, ii (1877) 245; Hill, Kew Bull. (1910) 40; Kerr in Craib, Fl. Siam. Enum. 2 (1939) 421. – Lectotype: Kurz 2309 (K!), Pegu.

*M. serratum* Hill, Kew Bull. (1910) 41; Gamble, Fl. Madras 2 (1921) 798. – Lectotype: Bourdillon 555 (K!), S. India, Travancor.

*M. smilacifolium* auct. non Bl.: as recorded for Admiralty I. (see under *M. ovatum*).

Liana, c. 1 cm thick, bark of old stem white and papery. *Leaf* elliptic to ovate, (9–)12–17(–24.5) × 4.5–8(–10) cm, membranous to subcoriaceous, slightly glossy above, glabrous, base rounded to cuneate, apex acuminate. Margin usually obscurely serrate towards apex, or entire or deeply serrate to spinose, involute. Venation triplinerved with additional 3 pairs of lateral veins, impressed above, secondary veins prominent below, tertiary veins conspicuous above in dried state. *Petiole* 0.5–1.5 cm, thickened. *Inflorescence* terminal, sometimes axillary, paniculate, 7.5–19 cm,

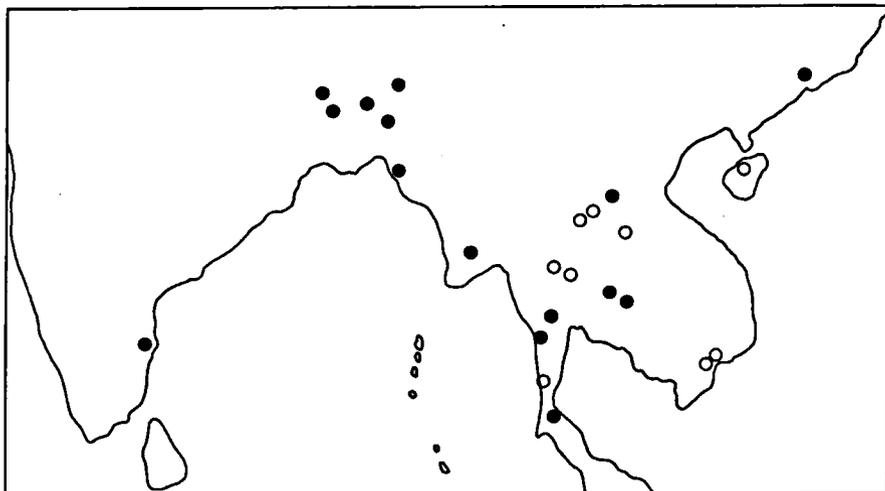


Fig. 3. Distribution of *Myxopyrum smilacifolium* Blume; ● subsp. *smilacifolium*; ○ subsp. *confertum*.

hanging like a bunch of grapes when ripe, rachis becoming thick in fruit, finely pubescent. Bracts apiculate, 1 mm. *Flowers* yellow, subsessile. *Calyx* less than 1 mm long, lobes ovate-acute, pubescent. *Corolla* tube campanulate, 1–1.5 mm long, lobes linear, opening recurved, 0.5–2.5 mm long. *Stamens* less than 1 mm long, subsessile, anthers elliptic. *Ovary* globose, less than 1 mm long, stigma sessile, bilobed. *Fruit* globose, 5 × 5–10 × 13 mm. Pericarp rugose when dry, woody 1 mm thick. *Seeds* 1–2.

**Distribution.** N. & E. India, Bangladesh, Burma, Thailand, Cambodia, Laos, China (Canton).

**INDIA.** Beddome s.n. (K), Bourdillon 555 (K), Chatterjee s.n. 1902 (A, P), Griffith 3696 (A, P), Herb. Gamble 368 (K), Gamble 1563a (K), Hooker s.n., 564, 2197 (all K), Hooker & Thomson s.n., Mt Khasia 1859 (A, L, P), s.n., Sikkim 1859 (P), Jenkins s.n. (K), Masters s.n. (L, P), Prazer s.n. 1890 (P), Wallich 2837 (K).

**BANGLADESH.** Hasal et al. 4060 (L).

**BURMA.** Keenan s.n. 1874 (K), Keenan et al. 3868 (A, K), Kurz 2309 (K), Parker 2612 (K).

**THAILAND.** Kerr 6040 (BM, K, P), 10516 (BM), 18086 (P), Kostermans 811 (L), Put 4123 (BM), K, P).

**CAMBODIA.** Pierre s.n. 1970 (P).

**LAOS.** Spire 207 (P).

**CHINA.** Canton: Poilane 963 (A, P).

**Ecology.** Evergreen forests 700–1000 m (Gamble, 1921)

**Notes.** *Myxopyrum smilacifolium* var. *smilacifolium* is variable and widespread and is distinguished from all other species by its smaller fruits. Even this character, however, exhibits variation on a geographical basis – thus plants of the coastal and western localities in India produce inflorescences with many tiny fruits, 5 × 5 mm in

size, compared with plants collected from the more eastern localities of Laos and Cambodia which produce fruits that are considerably larger, up to  $10 \times 13$  mm in size. (Both fruit sizes have been collected from Assam.) Apart from the larger fruit, these specimens exhibit no other differences when compared with the small-fruited specimens.

Another character that varies, apparently randomly throughout the range of *M. smilacifolium*, is the degree of serration of the leaf margin. In *M. smilacifolium*, the leaf margin is frequently obscurely serrate towards the apex, but may be entire or spinose. The spinose margin, though conspicuous, does not correlate with other character differences, nor is it confined to specimens from a particular area. For these reasons both *M. serratum* Hill and *M. smilacifolium* var. *ilicifolium* Kurz are reduced to synonymy with *M. smilacifolium*.

Kurz (1877) reported the distribution of his *M. smilacifolium* var. *ilicifolium* as Martaban (Burma), Andaman and Cocos I. However, I have not located specimens of *Myxopyrum* from either the Andaman or the Cocos Islands.

**b. var. confertum** (Kerr) Kiew, *stat. nov.*

*M. confertum* Kerr, Kew Bull. (1938) 133; in Craib, Fl. Siam. Enum. 2 (1939) 420. — Type: Kerr 5099 (K!), Thailand.

Subsp. *confertum* differs in the following characters from subsp. *smilacifolium*: Old stem c. 7 mm thick, bark corky and light brown. *Leaf* narrowly lanceolate,  $8.5-15 \times 3-4.5(-6)$  cm, thinly coriaceous, base cuneate. Margin entire, sometimes coarsely serrate towards the apex. Venation triplinerved with 1 additional pair of lateral veins. *Inflorescence* axillary, 1–5 cm long, up to 6.5 cm in fruit. Bracts 1.5–2 mm long. *Corolla* tube campanulate, 1–1.5 mm long, lobes oblong, about a third the length of the corolla tube. *Fruit* globose,  $8 \times 10-15 \times 10$  mm, bright orange red when ripe.

Distribution. Thailand, Vietnam, Laos.

THAILAND. Collins 455 (BM, K, P), 1712 (BM), Kerr 5099, 5099A, 12823, 16448 (all BM, K, P), Phengnaran & Smitinand 447 (L, P), van Beusekom & Santisuk 2859 (L, P).

VIETNAM. D'Alleizette s.n. 1909 (L, P), Harmand 1291 (P), Pierre s.n. 1869 (P).

LAOS. Spire 806 (P).

Ecology. Evergreen forest (sometimes mixed dry deciduous forest), 10–500 m.

Notes. Within the eastern range of distribution of *M. smilacifolium* occurs *M. smilacifolium* subsp. *confertum* (*M. confertum* Kerr) (fig. 3). Kerr (1938) described this from a single specimen (Kerr 5099), though a similar specimen (Kerr 5099A) from the same locality he determined as *M. smilacifolium*. His type specimen is exceptional in its short inflorescence, 1–1.5 cm long. However, other specimens from Thailand, Laos and Vietnam also have short inflorescences (up to 6 cm long as opposed to up to 10 cm long in *M. smilacifolium*). They also differ from subsp. *smilacifolium* by a combination of the narrowly lanceolate leaf, c. 4 cm wide, and the larger fruit,  $15 \times 10$  mm in size. These last two characters show some overlap (table 1) but

if used in combination with inflorescence length one can in most cases distinguish these two taxa.

However, even the most reliable character, inflorescence length, breaks down. *Kerr 6040*, collected from Klawng Kung in Thailand, shows a wide range of inflorescence length on a single plant from 2.5 cm (in the BM specimen) to 4 cm (K) up to 9.5 cm (P). In view of this, *M. confertum* Kerr. cannot be maintained at species rank and is here reduced to subspecific level on the grounds that the great majority of the specimens of *M. confertum* can be distinguished using the combination of characters given in table 1 and that their occurrence is confined to a relatively compact area within the greater range of *M. smilacifolium*.

The variability and widespread distribution of *M. smilacifolium* is matched by that of *M. nervosum*. Besides the differences in fruit size (table 1), these two species also differ in flower form. *Myxopyrum smilacifolium* possesses a campanulate corolla tube with lobes (ranging from 0.3–0.5 mm in length in subsp. *confertum* to 0.5–2.5 mm in subsp. *smilacifolium*) which open recurved: *M. nervosum* has a thick and fleshy urceolate corolla tube with lobes (0.3–1 mm long) which scarcely open.

#### EXCLUDED SPECIES

*Myxopyrum enerve* Steen., *Blumea* 15 (1967) 152, fig. 3, = *Chionanthus enerve* (Steen.) Kiew, *J. Arn. Arbor.* 64 (1983) 589–596.

#### ACKNOWLEDGEMENTS

The author is grateful to Universiti Pertanian Malaysia for granting sabbatical leave which enabled this work to be completed, to Professor of Botany of Cambridge University and the Curators of the Herbaria at British Museum (Natural History) and Royal Botanic Gardens, Kew for permission to work in their institutes and to the Curators of the following herbaria for facilitating loans: Arnold Arboretum, National Herbarium Washington, New York Botanic Gardens, Paris, and Rijksherbarium Leiden.