

AN ANNOTATED KEY TO THE SOUTH-EAST ASIATIC, MALESIAN, MASCARENE, AND AFRICAN SPECIES OF MYRIOPHYLLUM (HALORAGACEAE)

R. VAN DER MEIJDEN

SUMMARY

The area of distribution of most *Myriophyllum* species is insufficiently known. In this paper, many new localities are recorded for 16 species from SE. Asia, Malesia, Madagascar, and Africa, and a key is added.

One species from New Guinea, *M. coronatum*, is described as new (fig. 1). Of the other species the synonymy is complete, but no descriptions are given; of each the distribution and ecology is cited, and if necessary critical remarks are added.

Under the new species the second remark deals with the possible desirability of distinguishing subgenera or sections within the genus. It is concluded that, as the species show a reticulate affinity by parallelism, especially as regards reductions in both vegetative and sexual organs, the usefulness of distinguishing infrageneric taxa is debatable and not advisable.

INTRODUCTION

In 1966 my interest was drawn to the genus *Myriophyllum* by a New Guinean collection of *M. pedunculatum*, a species which before was only known from SE. Australia, Tasmania and New Zealand (van der Meijden, *Blumea* 14, 1966, 245). When later I finished a revision of the *Haloragaceae* for 'Flora Malesiana' (unpubl.; see also Identification Lists of Malesian specimens 30, 1967), the area of 4 of the 6 Malesian species turned out to be much wider than was known before. *M. dicocum*, for instance, was only known from N. Australia and Madura I., but has been found later in Woodlark I. (E. of New Guinea), but also as far as Calcutta and North Vietnam. *M. tuberculatum*, already known from eastern India and Malaya, appeared to occur also in southern and western India, SE. Borneo, SW. and SE. Celebes, two islands of the Moluccas, Flores, and very recently also in N. Australia.

As often occurs in water plants, the ranges of several *Myriophyllums* treated here show large disjunctions, the gaps being especially wide in the Malesian tropics. This is caused by several factors, viz. (i) they are generally inconspicuous plants and have, as is the case with many aquatics, certainly been neglected by plant collectors, (ii) in the Malesian tropics colossal areas are forested without suitable places for *Myriophyllums* to grow, (iii) their dispersal, obviously epizoid, occurs possibly rather erratic, (iv) some have probably a preference for certain ecological conditions of the waters. From the first factor mentioned it can be concluded that in the future some gaps may be 'filled' by further exploration and I hope that the present key may encourage field work. A few examples may show the size of such disjunctions.

Two Malesian localities are known from *M. spicatum*: Lake Toba (Sumatra) and Lake Lanao (Philippines), being at c. 3000 km distance, both at roughly 2000 km from the

nearest locality in North Vietnam, respectively Hainan. Recently, the same species is discovered in Central Africa (Raynal, Fl. Cameroun 5, 1966, 132), again at a distance of roughly 3000 km from the nearest localities in South and North Africa.

Strong disjunctions have been found in the area of *M. propinquum*, a species which was thought to be confined to the south and east of Australia, Tasmania, and New Zealand; the same species has been found in S. Yunnan (leg. E. E. Maire 412), and in my opinion the temperate E. Asiatic *M. ussuriense* agrees with it in all essential morphological characters as well as in the pollen (Praglowksi, in press), differing only in habit.

Raynal (Adansonia, 6, 1967, 539) suggested the Mascarene species *M. axilliflorum* to be possibly a subspecies of the S. Indian *M. oliganthum* (*M. intermedium* non DC.). I cannot share his opinion although admitting that both species are closely allied.

Another example of Mascarene-Asiatic relationship give the species *M. mezianum* and *M. siamense* (Tardieu Blot, Adansonia 5, 1965, 37). In 1967 a New Guinean collection was made which proved to belong to a new species, related to these; it is described in this paper as *M. coronatum*. These three species, which I will call the *mezianum-group*, are very small and inconspicuous, and their areas may be much larger than known at this moment.

It should be noted that vegetative material can almost never be recognized with certainty, and that the sculpture of the mature fruit, which is an important character in many species, becomes only clearly visible in dried material.

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KEY TO THE SPECIES

1. All leaves alternate to opposite, entire or dentate, or the lower ones pinnate.
 2. ♂ Flower with 2 petals and 1 stamen. Bracteoles minute or 0.
 3. ♂ Flower stalked. Fruit with 4 mericarps 4. *M. bonii*
 3. ♂ Flower sessile. Fruit with 2 mericarps.
 4. Fruit with rows of distinct spines at the base.
 5. Spines present over the entire dorsal length of the mericarps. 2. *M. mezianum*
 5. Spines absent in the central part of the mericarps. 1. *M. coronatum*
 4. Fruit with rows of tubercles at the base. 3. *M. siamense*
 2. ♂ Flower with 4 petals and 4 or 8 stamens. Bracteoles small but conspicuous, at least those of the ♂ flowers.
 6. Leaves 2—15 mm long, always opposite. Stamens 8.
 7. Flowers (1—)2(—3) on each branchlet, strictly monoecious, on each branchlet of one sex. Stems upwards very much sympodially branched, with very short internodes 0.3—1 mm long. Leaves caducous. Sepals in ♂ flowers 0 16. *M. pygmaeum*
 7. More flowers on each branchlet, the upper ♂, the lower ♀, or plant dioecious. Stems with much longer internodes, monopodially branched. Leaves not caducous. Sepals in ♂ flower very conspicuous. 15. *M. pedunculatum*
 6. Leaves 10—30 mm long, mostly alternate. Stamens 4.
 8. Flowers (1—)3—5 together, distinctly stalked. Fruit c. 1.2 by 1 mm, with dorsally rounded mericarps 6. *M. oliganthum*
 8. Flowers solitary, sessile or nearly so. Fruit c. 2.5 by 2 mm, in transverse section ± quadrangular with sharp ribs and slightly concave sides 8. *M. tuberculatum*
1. At least the lower leaves in whorls, nearly always pinnate.
 9. Leaf-base ± dilated, those of a whorl, at least in sterile branches, enclosing the stem at the nodes in the upper parts. Bracteoles subulate, sometimes with 1 or 2 lateral laciniae. 13. *M. brasiliense*
 9. Stem always visible on the nodes between the leaf-bases. Bracteoles either not subulate, or with more laciniae.

10. Bracteoles digitate or pinnate.
11. Fruit cruciform in section, finely tubercled, rarely smooth.
12. Stamens 8. Anthers linear, 1.5—1.8 mm. Petals 1.5—2 mm. . . . 10. *M. indicum*
12. Stamens 4. Anthers oblong, 0.6—0.8 mm. Petals c. 1 mm long. . . . 9. *M. tetrandrum*
11. Fruit in transverse section quadrangular with rounded edges, smooth. . . . 11. *M. verticillatum*
10. Bracteoles simple, not dissected: ovate, rhomboid, or lanceolate.
13. Fruit with 2(—4) mericarps, smooth or indistinctly lengthwise lineolate, stalked. . . . 5. *M. dicocum*
13. Fruit with 4 mericarps of which sometimes 1—2 are visible but reduced and unfertile, not lineolate.
14. Flowers (1—)2—6 together in the leaf-axil; the middle flower ♂, shortly but distinctly stalked.
15. Flowers (1—)3—5(—6) together in the leaf-axil. Fruit rounded, shallowly 4-sulcate, tuberculate. Anthers c. 1 mm long 6. *M. oliganthum*
15. Flowers 1—3 together. Fruit ± cruciform, dorsally narrowly winged, smooth or punctate. Anthers c. 2 mm long 7. *M. axilliflorum*
14. Flowers always solitary, either all sessile, or the ♂ flowers stalked.
16. ♂ Flower distinctly stalked. Stamens inserted on a 0.1—0.2 mm high androphore. Mericarps apically spreading by the cushion-like thickened style-bases. 14. *M. propinquum*
16. All flowers sessile. Androphore 0. Mericarps not spreading at apex.
17. Mericarps dorsally rounded. Sepals in ♂ flowers distinct, c. 0.5 by 0.5 mm. Stamens 8. Petals caducous 12. *M. spicatum*
17. Mericarps dorsally acute. Sepals indistinct. Stamens 4. Petals strongly recurved after anthesis, persistent until fruit is set 8. *M. tuberculatum*

I. *Myriophyllum coronatum* v. d. Meijden, spec. nov. — Type: *C. E. Ridsdale NGF 33585* (holotype in L, also distr. to A, BO, BRI, CANB, K). — Fig. 1 a—c.

Terrestre vel semi-aquaticum. Caulis valde ramosus. *Folia* opposita, superiora semi-opposita usque alterna; immersa opposita, pinnata, ambitu 0.5—1.2 mm longa et 0.6—1.5 mm lata, lobis 2—5 filiformibus c. 0.1 mm latis; aëria linearia, integra vel interdum ± pinnata, integra, 3—10 mm longa, 0.3—1.2 mm lata, apice quasi pulvinulo colore saturatiore incrassata, plana, patentia. *Flores* in axillis superioribus solitarii, superiores ♂, inferiores ♀. Bracteolae inconspicuae vel nullae. *Flores* ♂ subsessiles. *Sepala* 0. *Petala* 2, linearia, plana, integra, acuta, ante anthesin erecta et usque ad 1 mm longa, post anthesin distincte recurvata. *Stamen* 1; filamentum usque ad 0.5 mm longum; anthera elliptica, mucronata, 0.2—0.6 mm longa, 0.1—0.4 mm lata. *Ovarii* rudimentum nullum. *Flores* ♀ sessiles. *Sepala* et *petala* nulla. *Styli* breviter conici, apice pilis nonnullis obsiti. *Fructus* c. 1 mm longum. *Mericalpia* 2, ± oblonga, basi cristis dorsalibus c. 3 instructa, cristis ipsis spinis tenuibus elongatis et curvatis 3—5 instructis, lateribus seriebus nonnullis subirregularibus tuberculorum induta, apicem versus paullo attenuata, laevia vel paucituberculata, apice ipso in coronam asymmetricam spinarum ± patentium 8—12 dilatata; spinae apicibus recurvatae, dorsales lateralibus distincte longiores, maximae 0.8 mm longae.

Terrestrial or semi-aquatic. Stem much branched. *Leaves* opposite, the upper ones semi-opposite to alternate; immersed leaves opposite, pinnate, 0.5—1.2 by 0.6—1.5 mm in outline, with 2—5 c. 0.1 mm wide filiform lobes; aerial leaves linear, entire or less often ± pinnate, 3—10 mm long, the entire ones 0.3—1.2 mm wide, with a dark cushion-like thickening above at apex, flat, patent. *Flowers* solitary in the upper leaf-axils, the upper ♂, the lower ♀. Bracteoles inconspicuous or absent. ♂ Flower nearly sessile. *Sepals* 0. *Petals* 2, linear, flat, entire, acute, erect before anthesis and up to 1 mm long, strongly recurvate after anthesis. *Stamen* 1; filament up to 0.5 mm; anther elliptic, 0.2—0.6 by 0.1—0.4 mm, mucronate. Rudiment of *ovary* 0. ♀ Flower sessile. *Sepals* and *petals* 0. *Styles* shortly conical, distally set with long hairs. *Fruit* c. 1 mm long. *Mericalps* 2, ±

oblong, at the base with *c.* 3 dorsal crests, these with 3—5 thin long spines curved upwards, and laterally with some irregular rows of tubercles, upwards slightly narrowing, smooth or with some tubercles, widening at the top in an asymmetrical crown of *c.* 8—12 \pm patent spines with recurvate tips, which are dorsally distinctly longer than laterally, the longest up to 0.8 mm long.

Distribution: New Guinea, Papua, Western Dist., near Weam.

Ecology: Collected at *c.* 30 m altitude, in wet depression of savannah.

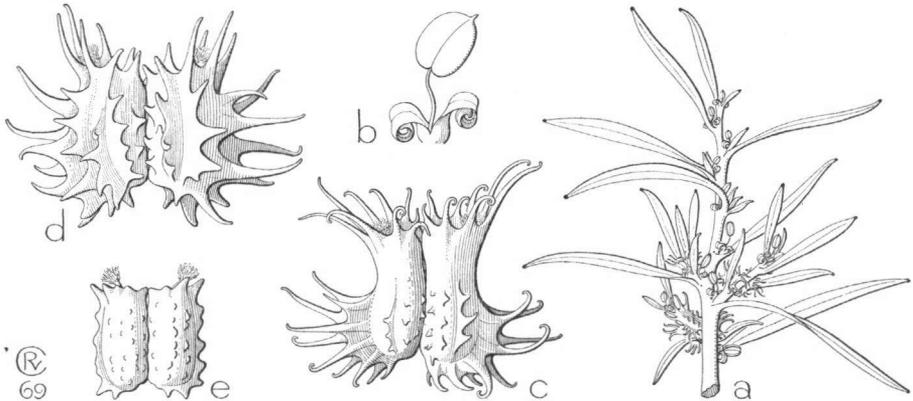


Fig. 1. *Myriophyllum coronatum* v. d. Meijden. a. Branchlet, $\times 5$, b. δ flower, $\times 20$, c. ripe fruit, $\times 20$. — *M. mezianum* Schindler. d. Ripe fruit, $\times 20$. — *M. siamense* (Craib) Tardieu Blot. e. Ripe fruit, $\times 20$ (a—c. Ridsdale NGF 33585, d. Perrier de la Bâthie 19310, e. Bon 5290).

Remarks. 1. Closely allied to *M. mezianum* and *M. siamense*. The three species (called here the 'mezianum-group') differ in the sculpture of the ripe fruits, as is shown in fig. 1. It should be noted that fully mature fruits are compulsory for proper identification; the isotype studied of *M. mezianum* (Scott Elliot 2963, K) has young fruits which are indistinguishable from ripe fruits of *M. siamense*. The species of the *mezianum-group* have many characters in common: reduction of the δ flower (sepals 0, petals 2, stamen 1), reduction of the η flower (sepals 0, petals 0, mericarps 2), and reduction of the bracteoles (extremely short or absent), and share the same serial branching (upper, first developed bud gives one flower; second, lower bud gives a short flowering branchlet). Ecologically, the species seem to behave similar.

2. Two species, very different from each other, might be allied to the *mezianum-group*: *M. bonii* and *M. dicoccum*. The first species has also such reduced δ flowers and bracteoles, but differ. in having 4 mericarps and a stalked δ flower. The fruits of *M. dicoccum* have 2 mericarps which are, however, in other respects quite unlike those of the *mezianum-group*, and the species differs in nearly all characters from the *mezianum-group*.

This led me to a critical examination of Schindler's subgeneric classification. Schindler (Pfl. Reich Heft 23, 1905) distinguished three subgenera in his monograph: (*Eu-*)*Myriophyllum*, *Brachytheca*, and *Dicarpum*, differing in the number of stamens [8—4, 4, and 2(—4?) respectively], in the sex of the flowers (bi- or reduced to unisexual, unisexual, and unisexual respectively), and in the number of mericarps (4, 4, and 2 respectively).

Subg. *Brachytheca* has the following combination of characters: stamens 4, leaves non-verticillate, flowers unisexual. In subg. (*Eu-*)*Myriophyllum*, however, comparable combinations of characters are found, e.g.: stamens 8, leaves non-verticillate, flowers unisexual,

or: stamens 4, leaves verticillate, flowers unisexual. There is, therefore, no principal reason for distinguishing subg. *Brachytheca*.

Schindler attributed only two species to his subg. *Dicarpum*, *M. dicocum* and *M. mezianum*, but he had no material of the first species and copied Bentham's description of it (Fl. Austr. 2, 1864, 489); for some reason Bentham had doubts as to the number of stamens, but this is 4 indeed, although I counted in one flower even 8 stamens.

In his original description, Schindler assigned *M. mezianum* to have 2 stamens, a mistake already corrected by Craib (Fl. Siam. Enum. 1, 1931, 591). Subg. *Dicarpum sensu* Schindler is, therefore, very heterogeneous.

In many *Myriophyllum* species reductions have occurred independently in some generative and vegetative parts; analogous reductions of homologous parts seem to have occurred rather frequently in different, not closely allied species (e.g. two mericarps in the *mezianum*-group and in *M. dicocum*; 4 stamens in *M. tetrandrum* which is closely allied to *M. indicum* with 8 stamens, but not so closely allied to *M. tuberculatum* with 4 stamens).

Concluding, I think it serves no good use to distinguish subgenera or even sections in the genus, as the number of such sections would amount up to c. 20 for c. 40 species in all.

2. *Myriophyllum mezianum* Schindler, Pfl. Reich Heft 23 (1905) 104; Raynal, Adansonia 6 (1967) 540. — **Fig. 1 d.**

Distribution: Madagascar, 3 localities (see Raynal for map).

Ecology: In lakes and fresh water marshes near the coast.

Remark. Closely allied to *M. coronatum* (see there).

3. *Myriophyllum siamense* (Craib) Tardieu Blot, Adansonia 5 (1965) 37, fig. 1—4; Fl. Laos, Camb. & Vietn. 4 (1965) 128, fig. 1—4. — *M. mezianum* Schindler var. *siamense* Craib, Fl. Siam. Enum. 1 (1931) 591. — **Fig. 1 e.**

Distribution: Thailand (Nakhon Si Thammarat, Songkhla), Vietnam (Prov. Than Hoa; Prov. Lang Bian; Danhim; Prov. Phu Quoc).

Ecology: (Fresh?) water marshes near the coast, in small mats.

Remark. Closely allied to *M. coronatum* (see there).

4. *Myriophyllum bonii* Tardieu Blot, Adansonia 5 (1965) 39, fig. 5; Fl. Laos, Camb. & Vietn. 4 (1965) 127, fig. 5.

Distribution: North Vietnam (Luang Su).

Ecology: Unknown.

Remark. Allied to the *mezianum*-group (see *M. coronatum*).

5. *Myriophyllum dicocum* F. v. M., Trans. Phil. Inst. Vict. 3 (1859) 41; Schindler, Pfl. Reich Heft 23 (1905) 104; Back. & Bakh. f., Fl. Java 1 (1963) 266. — *M. humile* (non Morong) Schindler, Pfl. Reich Heft 23 (1905) 101 *pro specim. Thomson*; Guillaumin, Fl. Gén. I-C. 2 (1920) 718. — *M. intermedium* (non DC). Tardieu Blot, Fl. Laos, Camb. & Vietn. 4 (1965) 126, for the cited specimen only.

Distribution: Australia (N. Australia: Robinson R.; Queensland: Mareeba R.), New Guinea (Woodlark I.), NE. Java (Madura I.), India (Calcutta Yeels, leg. T. Thomson), Vietnam ('Tonkin', leg. *Balansa* 1428).

Ecology: In shallow open water of lakes and rivers, in the lowland, ascending up to 500 m.

Remark. The species is very variable in all parts. Schindler erroneously referred the specimens from Calcutta Yeels (leg. T. Thomson) to the North American species *M.*

humile Morong, as has also been done by Guillaumin for the Balansa specimen; Tardieu Blot gives a description and figure which fit *M. oliganthum*, but not at all the cited specimen of Balansa, kindly loaned to us by Prof. A. Aubréville. As far as I can judge from the available material, *M. humile* resembles *M. dicoccum*, and a closer comparison seems desirable. See also under *M. coronatum* and in the Introduction.

6. *Myriophyllum oliganthum* (W. & A.) F. v. M., *Fragm. Phyt. Austr.* 10 (1876) 54. — *Haloragis oligantha* W. & A., *Prod.* (1834) 338, non Arn. 1836. — *M. intermedium* (non DC.) Wight, *Ill.* 2 (1850) 23, t. 102, excl. fig. 8; Miq., *Fl. Ind. Bat.* 1, 1 (1856) 634; Clarke, *Fl. Br. Ind.* 2 (1878) 433, excl. syn. *M. variaefolium* Hook. f.; King, *J. As. Soc. Beng.* 66, ii (1897) 311; Schindler, *Pfl. Reich Heft* 23 (1905) 96; Gamble, *Fl. Pres. Madras* 1 (1919) 454; Ridl., *Fl. Mal. Pen.* 1 (1922) 692; Tardieu Blot, *Fl. Laos, Camb. & Vietn.* 4 (1965) 126, fig. 6—10, excl. the cited specimen and syn. *M. humile* (non Morong) Guillaumin; Adansonias 5 (1965) 38, fig. 6—10, for the figures only. — *M. indicum* (non Willd.) Trimen, *Fl. Ceyl.* 2 (1894) 149, p.p., excl. CP 1549.

Distribution: India (S. India: Nilgiri Hills, Mysore).

Ecology: In wet muddy places in stagnant very shallow water, in the mountains.

Remarks. Specimens were often referred to *M. intermedium* DC.; see under *M. indicum*. *M. axilliflorum* is closely allied. See also under Introduction.

7. *Myriophyllum axilliflorum* Baker, *J. Linn. Soc.* 21 (1884) 340; Raynal, *Adansonias* 6 (1967) 539.

Distribution: One locality in Madagascar. See Raynal for map.

Ecology: Border of lake.

Remark. Closely allied to *M. oliganthum*; see also under Introduction.

8. *Myriophyllum tuberculatum* Roxb., *Fl. Ind.* 1 (1820) 471; Schindler, *Pfl. Reich Heft* 23 (1905) 96; Vasudevan & Kesan Nair, *J. Bomb. Nat. Hist. Soc.* 64 (1967) 391, fig. — *M. indicum* Griff., *Not.* 4 (1854) 687, non Willd. 1805, nom. homon., illeg. — *M. spathulatum* Blatt. & Hallbl., *J. Ind. Bot. Soc.* 2 (1921) 44, fig. (*ex descr.*). — *M. tetrandrum* (non Roxb.) Steen., *Webbia* 8 (1952) 435.

Distribution: India (Bombay: Khandala; Mysore; Kerala; Orissa; Bengal; Assam), Malaya (Kedah, Perlis), Borneo (Banjermasin), Celebes (Pangkadjene, Kendari), Moluccas (Halmahera; Sula Is.: Mangoli), Lesser Sunda Islands (Flores: Ruteng), Australia (Northern Territory: Fog Dam Sanctuary, leg. *den Hartog* 696).

Ecology: In shallow, stagnant water at low altitude.

9. *Myriophyllum tetrandrum* Roxb., *Fl. Ind.* 1 (1820) 470; Schindler, *Pfl. Reich Heft* 23 (1905) 96 — *M. indicum* (non Willd.) Prain, *Rec. Bot. Surv. Ind.* 3 (1908) 210.

Distribution: India (Bengal, Khasya), Thailand (Bang Saphan/Noi; Nakhon Si Thammarat), Malaya (Kangar, Perlis), Vietnam (8 localities in North, 1 in South Vietnam), Cambodia (Kep), S. China.

Remark. Closely allied to *M. indicum*. The species remained enigmatic in the past century to Indian botanists and all sheets I have seen from that period belonging to it were named *M. indicum*. Only Kurz (1871) used the name for a specimen collected by him in 1871 in Bengal. In spite of the differences observed (stamens 4 against 8), the agreement in characters of the fruit and of the bracteoles was considered of great significance. Recently, Dr J. Pragłowski (Solna), who just finished his morphological study on *Haloragaceae* pollen, informed me that the pollen of *M. tetrandrum* and that of *M. indicum*

are different, and as the differences found in *Myriophyllum* pollen are, generally speaking, rather small, this new evidence supports the idea of keeping both taxa as separate species.

10. *Myriophyllum indicum* Willd., Sp. Pl. 4 (1805) 407, non Griff. 1854; Schindler, Pfl. Reich Heft 23 (1905) 93. — *M. intermedium* DC., Prod. 3 (1828) 69, non auct. al.

Distribution: Ceylon, India (Coromandel).

Ecology: In very shallow open water, probably in the mountains.

Remark. Closely allied to *M. tetrandrum* (see there). The proper identity of *M. intermedium* DC., which name was used in many senses by later authors, e.g. for *M. oliganthum*, *M. axilliflorum*, *M. dicoccum*, and *M. propinquum*, could be established by the examination of fragments of the holotype at Genève kindly loaned to us by Prof. Miège.

11. *Myriophyllum verticillatum* Linné, Sp. Pl. (1753) 992; Schindler, Pfl. Reich Heft 23 (1905) 87; Ohwi, Fl. Japan (1965) 660. — *Pentapterophyllum minus* Hill, Br. Herb. (1756) 392, nom. illeg. — *M. spicatum* (non L.) Gaertn., Fruct. (1788) 331, t. 68.

Distribution: Europe (north to Lapland, not in Iceland and Greenland, south to the African Mediterranean), Asia (temperate and boreal, east to Kamchatka and Japan, south to Afghanistan and Kashmir), North America (Canada, from British Columbia to New Foundland, south to Maryland). Malesia (possibly found in West New Guinea: Wissel Lakes).

Ecology: In rather deep or shallow, stagnant or slowly streaming fresh water. Terrestrial forms occur frequently, are fully developed, and often set better fruit than the aquatic form. In temperate and boreal regions winterbuds are produced.

Remark. The New Guinean collection (*Eyma 4733*) is sterile. Identification of vegetative plants is extremely difficult in this genus. In my opinion, which was recently and independently supported by Sinclair (Gard. Bull. Sing. 22, 1967, 230), the collection may belong to *M. verticillatum*, although it is not impossible that it should turn out to belong to *M. propinquum*.

12. *Myriophyllum spicatum* Linné, Sp. Pl. (1753) 992; Schindler, Pfl. Reich Heft 23 (1905) 90; Koord., Exk. Fl. Java 2 (1912) 708, excl. syn. *M. pusillum* Bl.; Merr., Enum. Philip. 3 (1923) 221; Tardieu Blot, Fl. Laos, Camb. & Vietn. 4 (1965) 125; Raynal, Fl. Cameroun 5 (1966) 132, fig. — *Pentapterophyllum spicatum* (L.) Hill, Br. Herb. (1756) 392. — *M. spicatum* L. var. *muricatum* Maxim., Diagn. Pl. 15 (1873) 183; Ohwi, Fl. Japan (1965) 661. — *M. exalbescens* Fern., Rhodora 21 (1919) 120.

Distribution: North America (from Aleutian Is. to New Foundland and Greenland, south to S. California and Maryland), Europe (north to Iceland; including the African Mediterranean and Macaronesia), Africa (Cameroun, Zambia, Rhodesia, South Africa), Asia (temperate and boreal, east to Kamchatka, Japan, Hainan, and North Vietnam, south to Afghanistan and Kashmir); also Sumatra (Lake Toba) and the Philippines (Mindanao: Lake Lanao, leg. *Clemens 450*, not seen). Once recorded from New Zealand (Allan, Handb. Fl. New Zeal. 1940, 285) but not in Allan, Fl. New Zeal. (1961).

Ecology: In rather deep to shallow, stagnant or slowly streaming, fresh or brackish waters, mainly in the lowland, ascending to c. 1600 m (Alps, Himalaya). Terrestrial forms are rare and sterile. Winterbuds small.

Remark. Very variable species. Reductions occur not rarely in the inflorescence, with the upper part strongly elongating, the lower part compact.

13. *Myriophyllum brasiliense* Cambess. in A. St. Hilaire, Fl. Bras. Mer. 13, 2 (1829) 182; Schindler, Pfl. Reich Heft 23 (1905) 88; Back. & Bakh f., Fl. Java 1 (1963) 266. — *M. proserpinacoides* Gill. ex Hook. & Arn., Bot. Misc. (1833) 313.

Distribution: Native to South America (E. Brazil, Uruguay, Argentina, Chile) and often cultivated elsewhere in ponds or aquaria; naturalized in Japan ('Yamamoko in Settsu'), in Australia (Blue Mountains), in W. Java (locally abundant), and in SE. North America (casually to New York).

Ecology: In Java cultivated in fish ponds; naturalized in ditches, ponds, and rice-fields, from 400 to 1500 m, freely floating to creeping-ascending.

Remark. All naturalized specimens are sterile or have only ♀ flowers and do not produce fruit. Apparently also in South America fruits rarely occur. The only description of the ripe fruit was given by Schindler. An illustration of an apparently ripe fruit is found in Gleason (New Britt. & Brown Ill. Fl. 2, 1952, 601).

14. *Myriophyllum propinquum* A. Cunn., Ann. Nat. Hist. I, 3 (1839) 30; Schindler-Pfl. Reich Heft 23 (1905) 89, incl. var. *tenuifolium* Schindler, l.c. 90. — *M. variaefolium* Hook. f. in Hook., Ic. Pl. 3 (1840) t. 289. — *M. verticillatum* β *ussuriense* Regel, Tent. Fl. Ussur. (1861) 60. — *M. ussuriense* (Regel) Maxim., Diagn. Pl. 15 (1873) 183; Schindler, Pfl. Reich Heft 23 (1905) 86; Ohwi, Fl. Japan (1965) 661. — *M. intermedium* (non DC.) Clarke, Fl. Br. Ind. 2 (1878) 433, *pro syn.* *M. variaefolium*.

Distribution: New Zealand, Tasmania, Australia (S. Australia, Victoria, New South Wales, Queensland, West Australia); E. Asia: NE. China (Heilong Jang, Whusuli Jiang; Manchuria), Korea, Taiwan, Japan, S. China (S. Yunnan).

Ecology: In slowly streaming water of rivers and in stagnant, shallow water, often part of the year semiterrestrial, in the lowland.

Remarks. Extremely variable in the Australian region, especially in vegetative parts.

M. propinquum and *M. ussuriense* differ only in minor vegetative characters.

The area is strongly disjunct; the new record given here is from S. Yunnan (*E. E. Maire* 412). One sterile collection (*Eyma* 4733 from New Guinea (Wissel Lakes) might belong to this species although it has resemblance with 11. *M. verticillatum* (see there).

15. *Myriophyllum pedunculatum* Hook. f. in Hook., Lond. J. Bot. 6 (1847) 474; Schindler, Pfl. Reich Heft 23 (1905) 85; van der Meijden, Blumea 14 (1966) 245. — *M. longibracteolatum* Schindler, Pfl. Reich Heft 23 (1905) 84.

Distribution: New Zealand (also Chatham and Stewart Is), Tasmania, Australia (Victorian Alps, New South Wales, also recorded from W. Australia), New Guinea (E. Papua, Western Highlands, Morobe Dist.).

Ecology: In New Guinea in the upper montane and alpine zones, from 2300—3500 m, in the Australian region often descending to the lowland. In swamps, shallow pools, alpine bogs, and inundated riverbanks.

Remarks. In all but one collection I have seen, the leaves are entire, but in one collection from Victoria (leg. *A. C. Beauglehole* 5887) the medium and lower leaves are pinnate with few filiform lobes. This observation clearly shows the great modifiability of *Myriophyllum* leaves.

M. longibracteolatum differs only in quantitative characters.

M. votschii Schindler from New Zealand is closely allied and might also belong to *M. pedunculatum*.

16. *Myriophyllum pygmaeum* Mattf., Bot. Jahrb. 69 (1938) 275.

Distribution: New Guinea (Morobe Dist.: Mts Sarawaket and Albert Edward).

Ecology: In and along very shallow, boggy, partly dried up pools in alpine grassland, c. 3500—3700 m, growing in dense cushions.

DUBIOUS SPECIES

Ammannia pinnatifida Linné f., Suppl. (1781) 127. — 'Java'.

According to the description, this might be either a *Myriophyllum* or a *Limnophila* (*Scrophulariaceae*). The name is cited by DC. (Prod. 3, 1828, 69) as possibly synonymous with *M. intermedium* DC. The name is not cited in Koehne's monograph of the *Lythraceae* (Pfl. Reich Heft 17, 1903), nor in Index Kewensis. *Ammannia pinnatifida* is not in Thunberg's Herbarium at Uppsala (Dr. R. Santesson, in litt.), it is not at Stockholm (Dr. S. Ahlner, in litt.), and not in Retzius' Herbarium at Lund (Dr Norlindh, in litt.).

Myriophyllum pusillum Bl., Mus. Bot. Lugd. Bat. 1 (1849) 111; Miq., Fl. Ind. Bat. 1, 1 (1856) 634; Suppl. (1860—61) 128, 328; Kurz, Nat. Tijd. Ned. Ind. 27 (1864) 167; Warb., Bot. Jahrb. 13 (1891) 395; K. Sch. & Laut., Fl. Schutzgeb. (1901) 483.

Although the description is very brief, it is not improbable that *M. pusillum* is indeed a *Myriophyllum*. Unfortunately, the type material could even as early as 1900 not be located. All later records refer to sterile specimens, those by Miquel (1860) and Kurz are according to Mr Philcox, Kew (in litt.), probably *Limnophila* (*Scrophulariaceae*).

EXCLUDED SPECIES

Hottonia sessiliflora Vahl, Symb. 2 (1791) 36 = *Limnophila spec.* (*Scrophulariaceae*). Special thanks are due to Dr A. Skovsted, Copenhagen, for the loan of the holotype.