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New Materials of the Genus *Myriophyllum* L. (Haloragaceae) in Taiwan

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ABSTRACT : A newly recorded species, *Myriophyllum dicoccum* F. Muell., and the most commonly cultivated and nearly naturalized species, *M. aquaticum* (Vell.) Verdc., are described. A key to four species of this genus in Taiwan is given.

KEY WORDS : ***Myriophyllum*, New record, Taiwan.**

INTRODUCTION

Myriophyllum is almost cosmopolitan. However, the distribution of the approximately 60 species has three main centers: Australasia, North America and India/Indo-China (Orchard, 1986). The botanical exploration of Taiwan by the Japanese in the early 1900s led to the discovery of the first Taiwanese species: *M. spicatum* (Hayata, 1912). Despite the fact that Japanese botanists had made extensive collection in the lowland areas, it was not until 1930 that the second species, *M. ussuriense* was recognized and reported by Yamamoto (Yamamoto, 1930). Recently, on a visit of the first author to the TAI herbarium, the specimens of the genus *Myriophyllum* collected from Taiwan were examined. Materials from other herbaria HAST, NTUF, TAI, TAIF, TNM and PE were also studied. One of the four Taiwanese species, *M. dicoccum* is reported from Taiwan for the first time, and *M. aqaticum*, a common exotic plant, is described here as a supplement to "Flora of Taiwan Vol. 3" (Huang 1977, 1993). A key to the four species in Taiwan is also provided.

Taxonomic treatment

Key to the species of *Myriophyllum* in Taiwan

1. All leaves alternate or irregularly arranged; ovary mainly bilocular; mericarps cylindrical, stigmas not fimbriate ..... 1. *M. dicoccum* F. Muell.

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1. All leaves in whorls; ovary strictly quadrilocular; mericarps ovoid, but not seen in Taiwanese *M. aquaticum*; stigmas fimbriate.
   2. Emergent stems glabrous; emergent leaves in whorls of 4-6, narrowly oblanceolate, ovate or obovate, pinnate or entire.
      3. Emergent leaves in whorls of (4-)5-6, narrowly oblanceolate, pinnate, glaucous; plants dioecious, Taiwanese plants with female flowers only; bracteoles subulate .... 2. *M. aquaticum* (Vell.) Verdc.
      3. Emergent leaves in whorls of 4, small, ovate or obovate, entire, green to reddish-purple, plants monoecious, with both male and female flowers; bracteoles broadly ovate ..... 3. *M. spicatum* L.
   2. Emergent stems with crisped hairs; emergent leaves in whorls of (2-) 3-4, linear or lanceolate, entire or with 3-13 pectinate laciniae ..... 4. *M. ussuriense* (Regel) Maxim.

1. Myriophyllum dicoccum F. Muell. in Trans. Philos. Inst. Victoria **3:** 41. 1859; Benth., Fl. Austr. 489.1864; Schindler in Engler, Pflanzenreich. Heft **23:** 104. 1905; Back. *et* Bakh. f., Fl. Java **1:** 266. 1963; Meijden *et* Caspers in van Steenis, Fl. Males. ser. 1, **7 (1):** 257, *fig.12 d-f.* 1971; Aston, Aquat. Pl. Austr. 89, *fig. 33b-c.*1973; Orchard in Brunonia **8:** 227, *fig. 21.* 1986, *et* in A. S. George, Fl. Austr. **18:** 70. 1990. Type: Australia, Northern Territory, Robinson River, no date, *F. Mueller s. n.* (holotype, *MEL 62413*). Fig. 1

Myriophyllum humile auct. non Morong: Schindler in Engler, Pflanzenreich. Heft **23:** 101. 1905, *pro coll.* Ind.; Gullaumin in Lecomte, Fl. Gen. Indo-Chine **2:** 718. 1920; How, Fl. Guangzhou 167. 1956.
Myriophyllum intermedium auct. non DC.: Tardieu-Blot, Fl. Laos, Camb. *et* Vietn. **4:** 126. 1965.

Perennial aquatic herbs, monoecious but with bisexual flowers also present. Stems 30-50 cm long, to 2 mm in diameter, branched, freely floating. Leaves dimorphic. Submerged (immersed) leaves scattered or in whorls of 4-5, broadly ovate in outline, 2-3 cm long, ca. 1-2 cm wide, patent to recurved, with 4-10 or more pairs of filiform, brown-tipped, finely mucronate, 5-10 mm long segments; emergent (aerial) leaves alternate, the upper ones narrowly oblanceolate to linear, shortly toothed above the middle or entire, 0.7-1.7 cm long, 0.5- 1. 5 mm wide, patent or upward erect-patent. Transitional leaves few, shortly pinnatisect. Bracteoles cucullate, acute, 0.7-0.8 mm long, red-hyaline. Male and bisexual flowers in irregular dichasia of 1-3 in axils of emergent leaves, female flowers born on the submerged parts. Male flowers 4-merous, sessile; sepals deltoid, 0.2 mm long; petals 1.8 mm long, tardily caducous, red; stamens 4, anthers stiffly erect, linear-lanceolate, ca. 1.5 mm long, 0.3 mm wide. Bisexual flowers similar to male flowers, ovary 4-celled, styles 4, fimbriate stigmas developing after pollen release. Female flowers 2-merous, pedicellate; sepals deltoid, 0.1 mm long; petals absent; ovary 2-locular; styles clavate; stigmas non-fimbriate, red. Fruit sessile or shortly pedicellate (0.2 mm), of two kinds, 2-locular (developed in female flowers) or 4-locular (in bisexual flowers), olive-brown; mericarps cylindrical, 1-1.2 mm long, ca. 0.4 mm wide, truncate, smooth but minutely and sparsely tuberculate on dorsal surface, and indistinctly lengthwise lineolate, styles persistent.

Flowering from August to September; fruiting from September to October.
Habitat: in lakes or ponds at low altitude.

TAIPEI City: Neihu, *G. Masamune, s. n.* September 26, 1939.

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Fig. 1. *Myriophyllum dicoccum* F. Muell. (*G. Masamune, s. n.* September 26, 1939, TAI), a newly recorded species to Taiwan.

Distribution: Occurs almost throughout northern Australia north of ca. 18°S (Orchard 1986, 1990); reported also for E. New Guinea (Meijden and Caspers, 1971), NE. Java (Backer and Bakhuizen, 1963), E. lndia and N. Vietnam (Meijden 1969, Meijden and Caspers, 1971), and northward to Guangdong of S. Mainland China (How, 1956).

2. **Myriophyllum aquaticum** (Vell.) Verdc. in Kew Bull. **23:** 36. 1973; Orchard in Brunonia **2:** 249. 1980; in *l. c.* **4:** 33, *fig. 2.* 1981; in *l. c.* **8:** 180. 1985; *et* in A. S. George, Fl. Austr. **18:** 62. 1990.

> *Enydria aquatica* Vell., Fl. Flumin. 57. 1825. Type: from Brazil, J. M. da C. Vellozo, *non vidi*, probably lost. Lectotype: J. M. da C. Vellozo., Fl. Flumin. Icones **1:** *t. 150.* 1831 (selected by A. E. Orchard in Brunonia **2:** 249. 1980).
> *Myriophyllum brasiliense* Cambess. in A St. Hilaire *et al.*, Fl. Bras. Merid. **2:** 252. 1830; Schindler in Engler, Pflanzenreich. Heft **23:** 88, *fig. 25.* 1905; Back, *et* Bakh. f., Fl. Java **1:** 266. 1963; Meijden in Blumea **17:** 171. 1969; Meijden *et* Caspers in van Steenis, Fl. Males. ser. 1, **7** (**1**): 253, *fig. 14 a-c.* 1971. Type: from Brazil, *A. St. Hilaire 1082* (MPU, herb. Cambess).

Perennial stout aquatic or marsh-dwelling herbs. Dioecious, male plants absent in Taiwan. Stems to 1 m long, 4-5 mm in diameter, branched mostly at the base only, glaucous, rooting freely from lower nodes, glabrous. Leaves all whorled, slightly dimorphic. Submerged leaves in whorls of (4-)5-6, oblanceolate in outline, rounded at apex, (1.7-)3.5-4.0 cm long, (0.4-)0.8-1.2 cm wide, pectinate, with 25-30 linear pinnae up to 0.7 cm long, the lower leaves usually decaying rapidly. Emergent leaves glaucous, in whorls of (4-)5-6, erect near apex, more or less spreading in lower parts, narrowly oblanceolate in outline, rounded at apex, (1.5-)2-3.5 cm long, (0.3-)0.5-0.8 cm wide, pectinate, with (18-)24-36 pinnae in the upper four fifths (lower 4-6 mm of leaf rachis naked), pinnae linear-subulate, 4.5-5.5 mm long, 0.3 mm wide, tips very shortly apiculate, slightly incurved. Numerous pale hydathodes present at base of leaves. Female flowers solitary in the axils of the middle and upper emergent leaves, 4-merous. Pedicel 0.2-0.5 mm long. Bracteoles white, subulate, with dilated base, sometimes with 1 lacinia, 1-1.5 mm long. Sepals 4, white, deltoid, 0.4-0. 5 mm long, 0.2-0.3 mm wide, acute, entire or scarcely serrate, smooth. Petals reduced. Styles 4, clavate, 0.1-0.2 mm long, stigmas white, densely fimbriate. Ovary pyriform, 0.6-0.7 mm long, 0.6 mm wide.

Flowering from May (at low altitude in Taipei City) to July (at altitude of 900 m, Taichung Co.); fruit not seen, reproduction is entirely vegetative.

Habitat: cultivated in ponds or aquaria.

Taipei City: June 19, 1996, *Z. Y. Li 11005* (female, PE). Taichung Co.: in pond at altitude of 900 m, *Z. Y. Li et al. s. n.* July 2, 1996 (female, PE).

Distribution: native to South America: Brazil (Santa Catharina and Rio Grande do Sul), Uruguay (Durazno), Argentina (Buenos Aires, Corrientes and Tucuman), Chile (Santiago, Valdivia and Valparaiso), Peru, Paraguay. Outside of South America the cultivated or naturalized plants are known from Mexico, Nicaragua, United States, England, Austria,

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France, South Africa, Zimbabwe, Rhodesia, Madagascar, Malaysia, the Philippines, Japan, Hawaii, Indonesia, Australia. New Zealand and Mainland China.

3. **Myriophyllum spicatum** L., Sp. Pl. 992. 1753; DC., Prodr. **3:** 68. 1828; Schindler in Engler, Pflanzenreich. Heft **23:** 90. 1905; Hayata, Icon. Pl. Form. **2:** 15; Ohwi, Fl. Jap. 660. 1965; T. C. Huang in Li *et al.* (eds.), Fl. Taiwan **3:** 903. 1977; Aiken *et* McNeill in Journ. Linn. Soc. Bot. **80 (3):** 216. *fig. 3.* 1980; T. C. Huang in T. C. Huang *et al.* (eds.)., Fl. Taiwan, 2nd ed. **3:** 973. 1993. Type: described from Europe. Lectotype: Burser Herbarium Vll (1) 79 at UPS (selected by Aiken*et* McNeill in Journ. Linn. Soc. Bot. **80 (3):** 216. *fig. 3.* 1980).

Flowering from August to October; fruiting from October to November.
Habitat: in ponds, lakes or marshy places at low altitude.

Taipei City: NTU Campus, *C. M. Kuo 5897* (TAI). Taipei Co.: Shenkeng, *T. Kawakami 5742* (HAST); Yingko, *S. Sasaki s. n.* September 9, 1908 (TAI). Taoyuan Co.: Tachi, *L. S. Liao s. n.* August 2, 1960 (TAI); *C. I. Peng 13526* (HAST). Hsinchu Co.: Hsinfeng, *C. I. Peng 6391* (HAST). Chiayi Co.: *C. E. DeVol 9014, 9016* (TAI); Potzu, *M. Kitashima s. n.* July 24, 1913 (TAI). Taitung Co.: *Y. Yamamoto s. n.* August 8, 1931 (TAI). It was also recorded from Kaohsiong, Miaoli and Pingtung.

Distribution: native to the north temperate zone of Eastern Hemisphere, rare in the tropics, introduced and naturalized in North America. The history of the spread of this species in the United States was documented by Reed (1977) and in Canada by Aiken *et al.* (1979).

4. **Myriophyllum ussuriense** (Regel) Maxim. in Bull. Acad. Imp. Sci. St.-Pétersb. **19:** 182. 1873; Kom, Fl. Mansh. **3 (1):** 113. 1905; Schindler in Engler, Pflanzenreich. Heft **23:** 86. 1905; Yamamoto in Trans. Nat. Hist. Soc. Form. **20:** 102. 1930. Ohwi, Fl. Jap. 661. 1965; W. T. Wang (ed.), Icon. Corm. Sin. **2:** 1023, *fig. 3776.* 1972; T. C. Huang in Li *et al.* (eds.), Fl. Taiwan **3:** 903, *pl. 859.* 1977.

Myriophyllum verticillatum L. var. *ussuriense* Regel, Tent. Fl. Ussur, 60, *tab. 4, fig. 2-5.* 1861. Type: between Songacha River and Kengka (Xingkai) Lake, probably near Longwangmiao, R. Maack *s. n.* August, 1859 (LE.).
Myriophyllum propinquum auct. non Cunn.: Y. P. Yang in Bot. Bull. Acad. Sin. 28: 199. 1987; T. C. Huang in T. C. Huang *et al.* (eds.), Fl. Taiwan, 2nd ed., **3:** 973, *pl. 485.* 1993.

Flowering from April to September; fruiting from July to November.
Habitat: in ponds or marshy places at low altitude.

Taipei City: cultivated in the shallow pond in Taiwan Forestry Research Institute, *Z. Y. Li 11006* (male, PE). Taoyuan Co.: *S. Sasaki s. n.* April 21, 1929 (male and female, TAI); Nankan, *Y. Kudo 578* (male, TAI); same locality, *Y. Yamamoto s. n.* May 5, 1929 (male, TAI). Hsinchu Co: Hukou, *H. Simada 4343B* (female, TAI).

Distribution: native to Eastern Asia: China (N. Taiwan, Anhui, Zhejiang and Heilongjiang), Korea and Japan.

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台灣產小二仙草科之狐尾藻屬（聚藻屬）新資料

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摘　　要

本文記述台灣狐尾藻屬一新記錄種，雙室狐尾藻 *Myriophyllum dicoccum* F. Muell.，以及常見栽培和新近歸化的粉綠狐尾藻 *M. aquaticum* (Vell.) Verdc.，並提供台灣產狐尾藻屬四種植物的檢索表。

關鍵詞：狐尾藻屬，新記錄，台灣。

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