

## MARSILEACEAE CLOVER FERN FAMILY

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Perennial aquatic herbs, usually floating-leaved, sometimes stranded on mud, heterosporous. ROOTS adventitious, mostly appearing fascicled from the stem nodes, usually pinnately branched. RHIZOMES stoloniform, usually with several to numerous branches, long-creeping (shorter in terrestrial forms), terete, glabrous or with short appressed medially-attached hairs (in terrestrial forms). LEAVES alternate, 2-ranked, long-petiolate (this varying with water depth). BLADES palmately 4-foliolate in ours, the leaflets wedge-shaped, lacking a costa, the venation forming numerous elongate simple areoles. SORI borne in sporocarps, these produced from the petiole base or the proximal portion of the petiole, solitary or in small loose clusters, the peduncles shorter than the petioles. SPOROCARPS of 1 type, oblong-oval to quadrangular or nearly circular in outline, mostly flattened, densely pilose with loose shaggy hairs when young, glabrescent with age, hard-walled, dehiscing along the rim, containing numerous sori of megasporangia and microsporangia, these attached to a hygroscopic gelatinous ring (sorophore). INDUSIA sac-like, membranous, ephemeral when hydrated. SPORANGIA membranous-walled, lacking an annulus, ephemeral once hydrated. MEGASPORES 1 per megasporangium, ovoid to globose, with a small hemispheric apical papilla, the surface smooth to faintly granulate, pale yellow to yellow. MICROSPORES 20–64 per microsporangium, trilete, globose, thin-walled, pale yellow. GAMETOPHYTES reduced, developing mostly inside the spores, the archegonia and antheridia protruding from the spore wall. —3 genera, ca. 55 spp., nearly worldwide.

The small genus, *Pilularia* A. Braun (6 species), is unique in the family in its subterranean nearly globose sporocarps and bladeless leaves (most easily recognized by their circinate vernation). The single North American species, *P. americana* A. Braun (American pillwort) is an inconspicuous plant easily overlooked by collectors. Its known distribution in the United States is widespread but quite sporadic, in part due to under collection, but also because of disjunct dispersal by migratory waterfowl. This species has been reported from southeastern California and should be searched for in Arizona. It is usually found among the emergent graminoid

vegetation along the margins of ponds, ephemeral pools, and other bodies of still water.

### **Marsilea L.** Clover Fern

Colonial aquatic perennial herbs. PETIOLES slender, lax in floating-leaved forms. LEAFLETS 4, wedge-shaped, sometimes with narrow brown or reddish brown lines or streaks along the veins. SPOROCARPS positioned aboveground (rarely subterranean elsewhere), oblong-oval to ovate or quadrangular in outline, flattened, attached laterally to the stalk tip, the stalk tip often extended past the attachment point as a low tubercle or tooth, in some species a second tooth produced along the acroscopic portion of the rim distal to the stalk tip, the surface with evident venation, tan to grayish brown or dark brown at maturity, dehiscing into 2 valves.  $X = 20$ . —Ca. 45 spp., nearly worldwide. (for Luigi Marsigli, Italian mycologist).

The sporocarps of *Marsilea* species, which have a long fossil history, also are extremely long-lived. Samples from century-old herbarium specimens have been germinated successfully in the laboratory. The life cycle is also completed extremely quickly (most ferns require several months), perhaps as an adaptation to fluctuating water levels, and less than a week usually is necessary following sporocarp germination for fertilization and the subsequent generation of new sporophytes.

Sporocarps are required for most species determinations in *Marsilea*. In the Arizona species, these tend to be produced only during the under collected “terrestrial phase” when plants stranded by receding waterlines produce stems with relatively closely spaced nodes and short-petiolate leaves. Thus, the distributions of the two species present in Arizona are not fully understood.

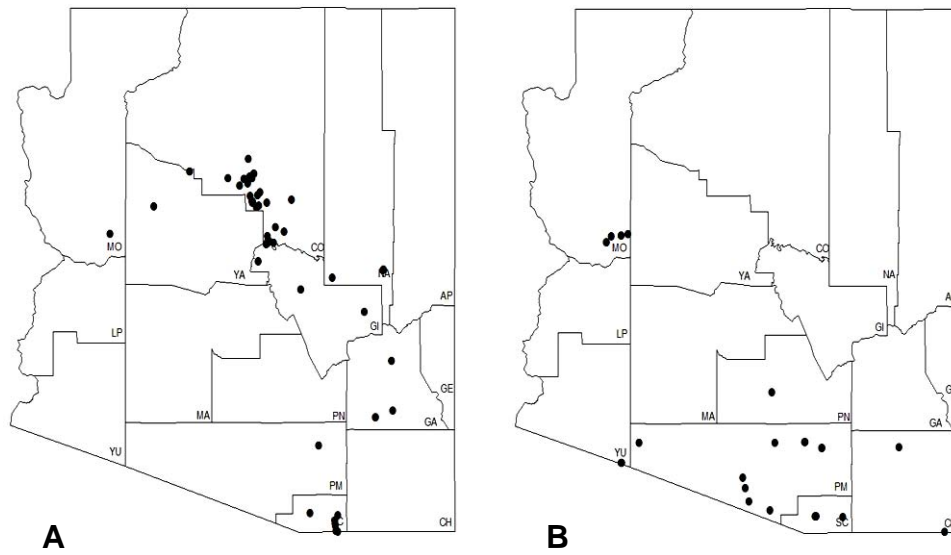
1. Sporocarps mostly 3–5 mm long, 2–3 mm wide, the tooth distal to the stalk tip absent or poorly developed, less than 0.2 mm long; leaflets symmetrically cuneate, the lateral margins relatively straight ..... *M. mollis*
- 1' Sporocarps mostly 4–7 mm long, 3–6 mm wide, the tooth distal to the stalk tip well-developed, 0.4–1.2 mm long; leaflets often slightly asymmetrically cuneate, with 1 of the margins shallowly concave ..... *M. vestita*

**Marsilea mollis** B. L. Rob. & Fernald (soft-hairy). Chihuahuan Water Clover. —PETIOLES 1–20 cm long, glabrous or sparsely appressed-hairy. LEAFLETS 4–17 mm long, broadly wedge-shaped, broadly rounded at the tips, symmetrically cuneate, sparsely pilose adaxially, moderately to densely pilose abaxially, the lateral margins straight or nearly so. SPOROCARPS solitary, appearing somewhat nodding, produced from the tip of short peduncle attached at or rarely just above the petiole base, (2.4–)3–5 mm long, 2–3 mm wide, oblong-ovate in outline, the tooth distal to the stalk tip, absent or less commonly poorly developed, less than 0.2 mm long, bluntly triangular (Fig. 2C). MEGASPORES 460–580  $\mu\text{m}$  in diameter (excluding the apical papilla). MICROSPORES 60–80  $\mu\text{m}$  in diameter.  $2n = 40$ . —Shallow water and margins of ponds, lakes, stock tanks, cienegas, and less commonly streams and marshy meadows: Coconino, Gila, Graham, Mohave, Navajo, Pima, Santa Cruz, Yavapai cos. (Fig. 1A); 1350–2250 m (4400–7400 ft); AZ, TX; s to Argentina.

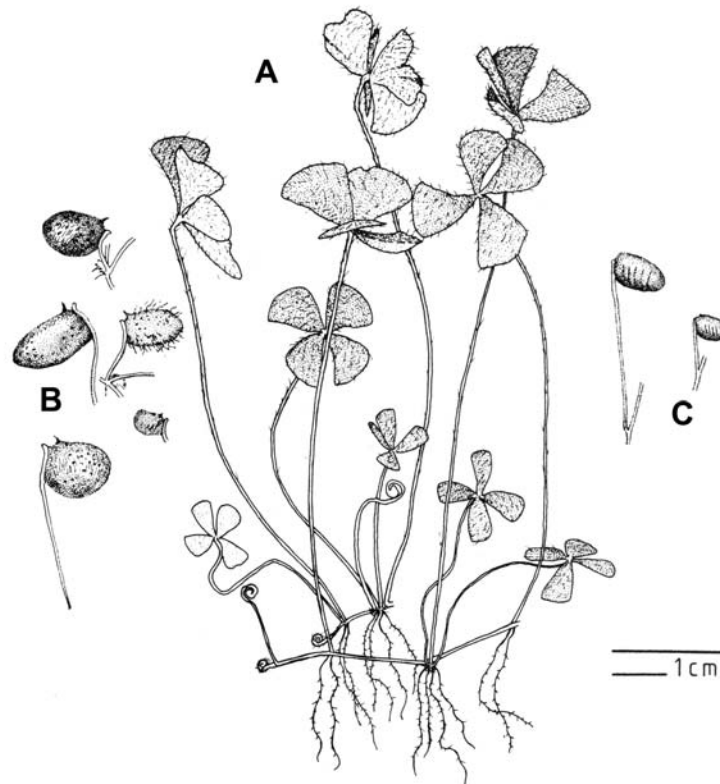
**Marsilea vestita** Hook. & Grev. (clothed [hairy]). Hairy Water Clover (Fig. 2A). —PETIOLES 1–35 cm long, glabrous or sparsely appressed-hairy. LEAFLETS 5–22 mm long, wedge-shaped to broadly wedge-shaped, broadly rounded to nearly truncate at the tips, often slightly asymmetrically cuneate, glabrous to more commonly moderately pilose on both surfaces, the lateral margins straight or more commonly 1 margin shallowly concave. SPOROCARPS solitary, appearing more or less perpendicular to the peduncle produced from the tip of a short peduncle attached at or rarely just above the petiole base, (3.6–)4–7 mm long, 3–6 mm wide, oblong-quadrangular to broadly oval in outline, the tooth distal to the stalk tip well-developed, 0.4–1.2 mm long, sharply and narrowly triangular (Fig. 2B). MEGASPORES 450–515  $\mu\text{m}$  in diameter (excluding the apical papilla). MICROSPORES 65–80  $\mu\text{m}$  in diameter.  $2n = 40$ . [*M. fournieri* C. Chr., *M. mucronata* A. Braun, *M. tenuifolia* Engelm. ex A. Braun, *M. uncinata* A. Braun]. — Shallow water and margins of ponds, lakes, stock tanks, reservoirs, and streams: Cochise, Mohave, Pima, Pinal, Santa Cruz, Yuma cos. (Fig. 1B); 450–1650 m (1400–5400 ft); WA to MN, s to CA.

#### LITERATURE CITED

- JOHNSON, D.M. 1986. Systematics of the New World Species of *Marsilea* (*Marsileaceae*). *Systematic Botany Monographs* 11: 1–87.
- JOHNSON, D.M. 1993. *Marsileaceae*. Pp. 331–335. In *Flora of North America* Editorial Committee (eds.). *Flora of North America North of Mexico*. Vol. 2. Oxford University Press, New York.



**Marsileaceae** Figure 1. Distribution of: (A) *Marsilea mollis*; (B) *Marsilea vestita*.



**Marsileaceae** Figure 2. *Marsilea*: (A) habit of *M. vestita*, plant from California; (B) five sporocarps of *M. vestita*, showing variation in size and in length of peduncle; (C) two sporocarps of *M. mollis* from the same collection, the larger from a plant in cultivation (scale bars: A short and B,C long) – (image: ‘figure 17’, in David M. Johnson. 1986, used with permission of the author).