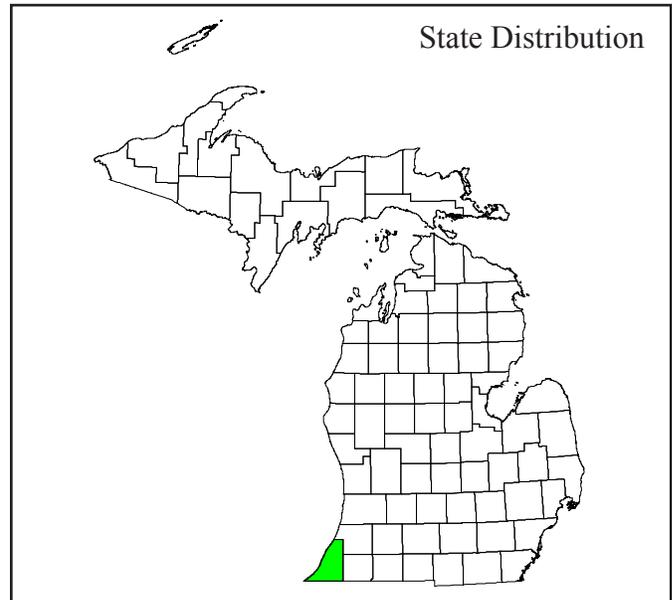
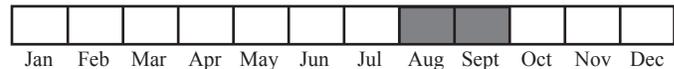


Linda Ellis- Univ. Wisc. Stevens Point



Best Survey Period



**Status:** State threatened

**Global and state rank:** G4/S1

**Other common names:** water-meal

**Family:** Lemnaceae (duckweed family)

**Synonyms:** *Wolffia brasiliensis* Weddell, *W. punctata* Grisebach

**Taxonomy:** Long known under the synonyms listed above, this species is now widely recognized as *W. brasiliensis* by the Flora of North America (2000). The former name of *W. papulifera* is retained here solely to conform to the current state Technical List, and it is anticipated that the modern treatment will be adopted during the next biennial review. A detailed molecular analysis of the relationship between Lemnaceae and the Aroid family (Araceae) is provided by Rothwell et al. 2004.

**Range:** Watermeal is an extremely wide-ranging species, occurring from the United States south through Mexico, Central America, South America, and into the West Indies. In the United States, this species is found principally in the eastern region, where it is distributed from New Jersey to Florida, ranging west through Illinois and Missouri and south to eastern Texas, with

an outlying distribution in Oklahoma and markedly disjunct occurrences in Washington, Oregon, and northern California (Flora of North America 2000). It is considered rare in California, Delaware, Georgia, Illinois, Kansas, Maryland, New Jersey, North Carolina, and West Virginia (NatureServe 2007).

**State distribution:** Watermeal is known only from two localized occurrences in southwest Lower Michigan, where it was discovered in 1986 within an inundated shrub swamp near a major highway junction in Berrien County, and in another site within the same general area.

**Recognition:** The genus *Wolffia* constitutes the smallest flowering plants known, consisting of a highly reduced plants lacking roots, distinct stems, and attaining less than 1.6 mm in length (Flora of North America 2000). Due to this simplified morphology or form, the body of these tiniest of vascular plants is referred to as a “frond”. Owing to the infrequent flowering and fruiting in most species of *Wolffia*, and the Lemnaceae overall, reproduction occurs primarily through a type of budding via the production of new or “daughter” fronds that arise from pouch-like areas located at the bases of mother fronds. Flowers, when produced, represent a highly reduced inflorescence. The individual flowers, which lack sepals or petals, are usually bisexual and 1 per frond (Bernard et al. 1990), developing from a cavity in the middle of the dorsal or upper side, consisting of a



simple, bilobed stamen, and a single, bottle-like ovary with short styles.

***W. papulifera* forms boat-shaped fronds up to ca. 1.5 in length, and is characterized by the presence of pigment cells in vegetative tissue and a distinct conical rise termed a papilla in the middle of the dorsal side.** Examination to detect the aforementioned features requires adequate magnification, with 10-20X magnification strongly suggested as opposed to a standard 10X hand lens. *W. papulifera* is similar to Michigan's two common watermeal species, *W. borealis* and *W. columbiana*. In contrast, *W. columbiana* forms roundish (globular) fronds and lacks pigment cells in vegetative tissue, whereas *W. borealis* (long known in manuals as *W. punctata*, a misapplied name) principally differs in the absence of a papilla on the upper surface of the frond.

**Best survey time/phenology:** This plant was found in fertile condition in early September, and although flowers are helpful in identifying *Wolffia* species, they are not necessary for determination in this comparatively distinctive watermeal. Nonetheless, based on the limited observations and collections, it is reasonable to presume that this species is best sought late in the season, from August through September,

**FQI Coefficient and Wetland Category:** 10, OBL

**Habitat:** In Michigan *W. papulifera* is known from a small woodland pond and in shallow water along the edge of a buttonbush swamp (inundated shrub swamp). In the former locality, it is associated with duckweed (*Lemna minor*) and one of the common watermeal species (*W. columbiana*). In the latter site, the dominant species is buttonbush (*Cephalanthus occidentalis*), with *W. columbiana* also noted as an associate. Throughout its range, *W. papulifera* occurs in the relatively non-acidic, quiet waters of temperate and subtropical regions (Flora of North America 2000). According to Jacobs (1949) this species should be sought wherever other duckweeds occur and in aquatic environments where the pH is not below 6.0.

**Biology:** As discussed above, flowering and fruiting are uncommon in watermeal species, although it appears to be somewhat more frequent in *W. papulifera* as indicated by the literature (Saeger 1929). Hess (1986) found both of the Michigan collections to be in peak

flowering condition, from which he provided detailed illustrations of this species in full anthesis. In addition to the forms of reproduction noted above, the fronds of *Wolffia* may also form or produce turions, which essentially comprise buds that sink to the bottom substrate and are capable of overwintering. In addition to be an important food source to waterfowl, all species of duckweed (Lemnaceae) can be easily transported by water birds and thus are readily distributed at least locally. Flora of North America (2000) notes that duckweeds are known to have a very high productivity and nutrient value, lending these species to a number of described cultural uses.

**Conservation/management:** Both of Michigan's known populations occur within or partly within a state park where they will be protected. Plants within or near a state right-of-way (ROW) in one of the occurrences have been duly noted and have been highlighted for protection by the Michigan Department of Transportation (MDOT).

**Comments:** One of the cultural uses alluded to above is the consumption of *Wolffia* fronds as a vegetable in southeastern Asia.

**Research needs:** The primary need for this species at present is more extensive inventory, focusing on southern Lower Michigan, to determine its status in the state. As the smallest known flowering plant, *Wolffia* is Michigan's most obscure rarity and thus is undoubtedly overlooked. Any site with habitat suitable for *W. columbiana* and *W. borealis* is likely to be of potential for *W. papulifera*.

**Related abstracts:** Inundated shrub swamp, Blanchard's cricket frog, Blanding's turtle, eastern box turtle, regal fern borer, and spotted turtle.

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