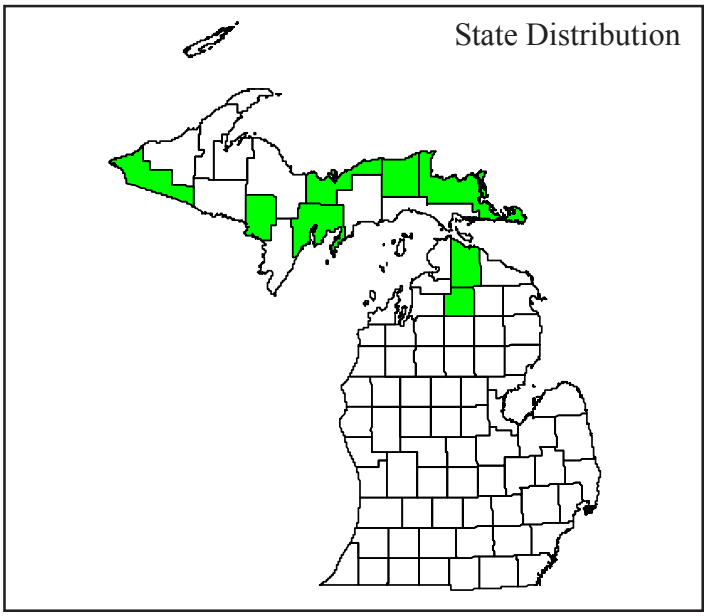
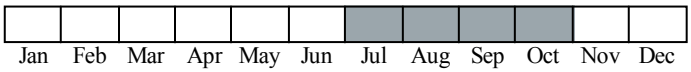
Botrychium mormo W.H. Wagner, Jr. — goblin moonwort

Photo by Dr. Stephen Solheim



Best Survey Period



Status: State threatened, Federal species of concern

Global and state rank: G3/S1S2

Other common names: grapefern, moonwort, little goblin, goblin fern

Family: Ophioglossaceae (adder's tongue family)

Synonyms: *Botrychium simplex* E. Hitchc. var. *tenebrosum* (A.A. Eaton) R.T. Clausen.

Taxonomy: Thought to be a variety of the more common, wide-ranging *B. simplex* (least moonwort), this tiny, somewhat fleshy grapefern was studied by Wagner & Wagner (1981) for three decades before its description as a distinct species. Notable characteristics of *Botrychium mormo*, as described by Wagner & Wagner, include its highly reduced, succulent habit, the tendency for gametophytes (the gamete-producing generation that gives rise to the aerial stems) to persist at the bases of plants, the disappearance of plants during periods of drought, and its occurrence in mesic northern hardwood forests. The genus *Botrychium* is divided into four subgenera and *B. mormo* has been placed within subgenus *Botrychium*, the largest group, comprised of 30 species.

Total range: *Botrychium mormo* is currently known only in the Midwest, where it is restricted to the northern portions of Minnesota, Wisconsin, and Michigan (Wagner & Wagner 1993). It is considered rare throughout its range, where it is known from relatively few localities in each of the known states. Casson (1994) cited a total of 27 locations for this species, with the majority of these occurring in Minnesota. A status survey for Wisconsin (Trick 1993) noted a total of six sites. More recent inventories in potential habitats, however, have led to the identification of many new sites in Minnesota and Wisconsin over the last few years, some of these supporting reportedly large populations. Two new sites have been discovered within the last two years in Michigan's Upper Peninsula, where additional new sites should be expected as well.

State distribution: Goblin moonwort has been documented as occurring in northern Lower Michigan in Cheboygan and Otsego counties and in the Upper Peninsula ranging from Gogebic to Chippewa counties. The majority of these occurrences were identified in the early to mid-1950's, with the species not being found again until 1994 and 1995, when it was discovered in two new localities in the western Upper Peninsula (Dickinson and Gogebic counties). A total of 10 occurrences have been documented thus far in Michigan.

Recognition: This tiny, easily overlooked fern ranges to no more than about 8-10 cm (ca 3-4 in) in height, though frequently it is considerably smaller, and is characterized by its **highly reduced habit** in comparison to most other moonworts. *B. mormo* plants are somewhat **yellowish-green and shiny** in appearance, with **succulent stems terminating in a blunt to slightly elongated fertile segment bearing the deeply embedded, fleshy-looking sporangia**. The sterile portion of the plant, the leaf blade (trophophore), is quite variable. In more mature, larger plants, the narrow blade may bear two to three pairs of small, blunt lobes, whereas in smaller individuals, the

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blade may be virtually absent. The terminal portion bearing the sporangia (the sporophore) is blunt to elongate, ranging from about 0.2-3 cm (up to 1.2 in), bearing few to several compacted sporangia somewhat sunken to embedded within a fleshy stalk. Goblin fern is most similar to *Botrychium simplex* (least moonwort), a species with several varieties that tends to occur in different habitats (dry fields, bogs, swamps, roadsides, ditches). The most similar variety is *B. simplex* var. *tenebrosum* (A. A. Eaton) R. T. Clausen, which can be distinguished by its generally non-fleshy appearance, a duller, greener color, and the high attachment of the simple leaf blade.

Best survey time/phenology: Due to the obscure nature of this species and the fact that many mature plants may never rise above the leaf litter, inventory for this species is usually difficult. Surveys may require scraping away patches of leaf litter once appropriate habitat has been identified. Surveys can be conducted in July when plants first begin to emerge and preferably later when it is more fully developed. This species can be identified well into October.

Habitat: This species occurs primarily in humus-rich, mesic northern hardwood forests dominated by *Acer saccharum* (sugar maple), *Tilia americana* (American basswood), *Betula alleghaniensis* (yellow birch), and *Fraxinus americana* (white ash). East of Marquette, Michigan, *Fagus grandifolia* (American beech) becomes a codominant. Other overstory trees present may include *Quercus rubra* (red oak), *Tsuga canadensis* (Eastern hemlock), *Carya cordiformis* (bitternut hickory), *Abies balsamea* (balsam fir), and both *Populus grandidentata* (bigtooth aspen) and *P. tremuloides* (trembling aspen). In the mesic northern hardwood communities, goblin moonwort grows in rich leaf mold where it is often associated with a diverse groundcover flora, including many spring ephemerals typical of mesic forests throughout the state. Common groundcover associates include such plants as *Trillium grandiflorum* (large-flowered trillium), *Asarum canadense* (wild ginger), *Allium tricoccum* (wild leek), *Actaea pachypoda* (doll's eyes), *Thalictrum dioicum* (early meadow-rue), *Athyrium felix-femina* (lady fern), *Dryopteris* spp. (woodferns), *Osmorhiza claytonii* (sweet cicely), *Aralia nudicaulis* (wild sarsaparilla), *Trientalis borealis* (starflower), and numerous other species (Trick 1993). Several other grapeferns can occur with *B. mormo*, the most common being *B. virginianum* (rattlesnake fern) and *B. minganense* (mingan moonwort); others include *B. lunaria* (common moonwort), *B. lanceolatum* (narrow lance-leaved moonwort), *B. matricariifolium* (daisy-leaved moonwort), *B. dissectum* (dissected grapefern), and *B. multifidum* (leathery grapefern) (Wagner & Wagner 1981).

Biology: The biology of this obscure species, like many other moonworts, is poorly known. Plants emerge no earlier than about mid-August, with the sporangia not opening until late September and October. Small, mature plants less than 1.5 cm in size may be present, and in fact can frequently dominate a population but fail to emerge above the leaf litter (Wagner & Wagner 1981). These individuals have been observed by scientists who have searched intensively in known sites by scraping away patches of litter. No long-term monitoring studies have been conducted on this species, though one project is in progress by D. Farrar of Iowa State University. However, those experienced with this species have observed that goblin moonwort tends to disappear during droughty years, remaining dormant within the groundcover litter or producing very small plants that do not develop leaves (trophophores). When found during drought years underneath the litter layer, the plants appear whitish and lacking in chlorophyll (Wagner & Wagner 1981).

Conservation/management: Devising adequate conservation and management strategies for *B. mormo* is difficult, owing in part to our lack of knowledge of the specific range, extent, and status of occurrences. Recent inventories in Minnesota and Wisconsin have reportedly resulted in significant finds, inferring that this species is possibly much more widespread than previously thought, especially since the apparent habitat is not uncommon. Coffin & Pfannmuller (1988) suggest that the current concentration of records in Minnesota is largely due to the proximity of Lake Itasca Biological Station and the resulting intensity of local field work. Inventory work, however, remains a laborious task, due to the extremely small size of this plant and its tendency to remain dormant or exist in even more reduced form during low precipitation years. A draft conservation strategy has been prepared for goblin fern occurrences in the Chippewa National Forest in Minnesota (Casson et al. 1994). Although the plan provides relatively little specific guidance, it does set forth a policy for developing strategies on specific research needs, long-term monitoring, and habitat/forest stand studies to be able to better manage and conserve goblin moonwort.

The most pressing need for Michigan populations of *B. mormo* is to conduct statewide status surveys, preferably in non-droughty years, to determine the extent and condition of occurrences and compile much more detailed information on microhabitat. The study of stand histories in sites where this species is extant may help understand how current management can be guided. Although goblin moonwort occurs in mature northern hardwood forests, it has also been documented in somewhat disturbed, relatively young, second-growth stands, and thus some level of disturbance may benefit colonization and establishment. It is evident that little else can be done at this time until more comprehensive status surveys have been conducted and information from ongoing monitoring studies and demographic investigations in Minnesota and Wisconsin becomes available.

Comments: Wagner and Wagner (1993) theorize that herbivores, such as small mammals, may be attracted to goblin moonwort because of its succulent nature. They

further theorize that the sporangia possibly require passage through an animal's digestive tract to assist in spore dispersal. *Botrychium mormo* is cited as the smallest known North American moonwort (Lellinger 1986).

Research needs: Studies on population demographics, breeding system, and microhabitat requirements (including the role of disturbance), as well as more thorough status surveys, especially in Michigan, are needed to help determine the most appropriate management strategies for this species.

Related abstracts: mesic northern forest, assiniboia sedge, fairy bells, ginseng, green spleenwort, Hart's-tongue fern, large toothwort, showy orchis, walking fern, red-shouldered hawk

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Abstract citation

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