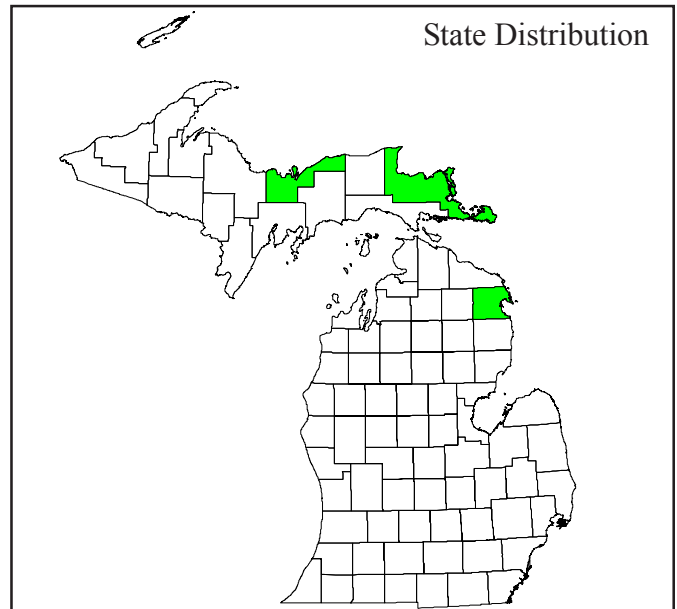
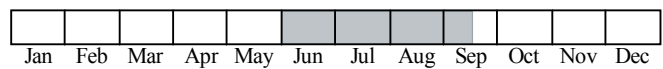




Photo by Susan E. Crispin



Best Survey Period



Legal status: State threatened

Global and state rank: G3/S1S2

Family: Ophioglossaceae (adder's-tongue family)

Other common names: Moonwort, grapefern.

Synonyms: *Botrychium matricariifolium* subsp. *hesperium* Maxon & Clausen; *B. X hesperium* (Maxon & Clausen) Wagner & Lellinger.

Taxonomy: Now considered a distinct species, *B. hesperium* was long puzzled over by botanists, who first described this moonwort as a subspecies of the common, wide-ranging *B. matricariifolium* (daisy-leaved moonwort) and in 1981 determined it to be a hybrid between *B. lanceolatum* (triangle moonwort) and *B. simplex* (least moonwort). Wagner and Wagner (1983) ultimately concluded that this taxon was a distinct species, based on studies of large populations in numerous localities. According to Wagner and Wagner, previous studies resulting in the classifications as above were based on data derived from scanty and poorly prepared collections.

Total range: *Botrychium hesperium* is concentrated in the Rocky Mountains in western North America, with

disjunct populations occurring in northern Michigan and in southern Ontario along the northern shore of Lake Superior. In the primary portion of its range, western moonwort occurs from British Columbia, southern Alberta and Saskatchewan south to Idaho, Montana, Wyoming, Colorado, and Utah to the northern tip of Arizona (Morin et al. 1993).

State distribution: Western moonwort is documented from fewer than 10 localities in northern Lower Michigan and the Upper Peninsula, occurring in Alpena County in Lower Michigan and at widely disparate localities across the Upper Peninsula (Chippewa, Alger, and Keweenaw counties).

Recognition: *Botrychium hesperium* is most similar to the common and wide-ranging *B. matricariifolium*, a species it is often associated with in Michigan and elsewhere. In western moonwort, the sterile portion of the leaf blade, the trophophore, is short-stalked, whereas the spore-bearing portion of the leaf, the sporophore, is relatively tall and robust, ranging up to twice the length of the sterile blade segment. The leaf blade, which is **oblong to broadly triangular (deltate)**, is divided into up to six pairs of **ascending pinnae** (leaflets) that are usually at least **slightly overlapping**. **The basal pinnae are often separated slightly more than the distance between the other pinnae, and these**



oblong pinnae tend to be distinctly larger and more strongly lobed. *B. matricariifolium* is a highly variable species that could be easily confused with *B. hesperium*, but is generally distinguished by its markedly smaller basal pinnae, as well as the presence of pinnae that are not strongly ascending nor particularly overlapping. Even good botanists will find this species to be relatively difficult to identify, as are others within this subgenus, and thus it is suggested that good herbarium collections be consulted and studied prior to conducting inventories for this taxon, in addition to reviewing relevant pteridophyte manuals, such as Morin et al. (1993).

Best survey time/phenology: This species emerges about midspring, persisting until senescence by early fall. June and July are likely the primary months for seeking and identifying this moonwort.

Habitat: In Michigan western moonwort is associated with several other *Botrychium* taxa in sand dunes, especially perched dune systems in the Upper Peninsula. It also inhabits a variety of habitats with sandy soils, such as outwash plains, and occurs with other botrychiums in grassy roadsides and rights-of-way. Associates include such species as *B. matricariifolium*, *B. campestre* (dunewort), *B. minganense* (mingan moonwort), *B. lunaria* (common moonwort), *B. acuminatum* (acute-leaved moonwort), and several grass and sedge species. In the main portion of its range in the Rocky Mountains, western moonwort typically grows on grassy slopes, on roadsides, and at the edges of lakes (Wagner and Wagner 1983). Plants have even been noted as occurring in gravelly road shoulders. Western associates include such species as *B. echo* (echo moonwort), *B. lanceolatum* (triangle moonwort), *Lonicera involucrata* (honeysuckle), *Potentilla fruticosa* (shrubby cinquefoil), and species of *Abies*, *Juniperus*, and *Ribes*.

Biology: Very little is known of the biology of this species, especially with regard to population structure, life history, and genetics. Plants emerge in late spring, and sporangia develop and release their spores by perhaps mid to late-summer. Spores of this fern family migrate into the soil and germinate to form subterranean gametophytes, from which aerial plants (sporophytes) develop. It is possible that as in other moonwort taxa,

this species may have the ability to remain dormant during droughty years.

Conservation/management: Because western moonwort is poorly known in Michigan, a statewide status survey would be useful in order to further direct conservation activities. In areas where populations of this species are relatively well known, such as at Grand Sable Dunes within Pictured Rocks National Lakeshore, this taxon is protected and at least occasionally monitored. Effective conservation and management actions will be dependent on attaining a better understanding of the life history and ecology of this species.

Comments: Western moonwort is among numerous *Botrychium* species described by the late Dr. Warren H. Wagner, Jr. are part of his landmark research in this difficult group of pteridophytes.

Research needs: Principal research needs include life history studies, including population monitoring, and possibly genetic studies to ascertain the structure of populations.

Related abstracts: Open dunes, wooded dune and swale complex, acute-leaved moonwort, dunewort, fascicled broom-rape, goblin fern, Lake Huron tansy, Pitcher's thistle, Pumpelly's brome grass, dune cutworm, Lake Huron locust, piping plover, red-legged spittlebug.

Selected references:

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- Morin, N.R., et al. 1993. Ophioglossaceae C. Agardh, Adder's-tongue Family, by W.H. Wagner, Jr., & F.S. Wagner. *In: Flora of North America. Volume 2. Pteridophytes and Gymnosperms.* Oxford University Press, New York. 475 pp.
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