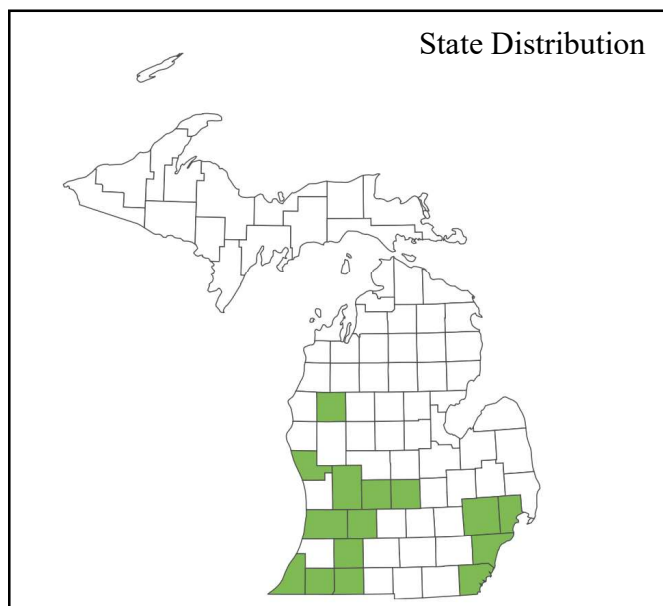




Photo by Patrick Alexander



Best Survey Period



Status: State Threatened

Global and state rank: G5 (Globally Secure) / S2 (State Imperiled)

Other common names: Green rock cress

Family Brassicaceae (mustard or cabbage family, also known as the Cruciferae)

Synonyms *Arabis missouriensis* Greene, *A. laevigata* var. *missouriensis* (Greene) H. E. Ahles, *Arabis viridis* Harger., *Borodinia missouriensis* (Greene) P.J. Alexander & William

Taxonomy The nomenclature of Missouri rock cress has shifted over recent decades. It was originally described as *Arabis missouriensis* in 1908. Since then, molecular phylogenetic work has demonstrated that Missouri rock cress and its near relatives are not closely related to *Arabis* (Al-Shehbaz 2003). Missouri rock cress was renamed *Boechera missouriensis* (Al-Shehbaz 2003) and is still recognized as such by Michigan Flora Online (Reznicek et al. 2024). It has recently become clear *Boechera* as originally circumscribed is non monophyletic. Alexander et al. (2013) make a compelling case that eastern North American

species of *Boechera* should be transferred to *Borodinia*. Most contemporary sources follow this and recognize Missouri rock cress as *Borodinia missouriensis*. *Borodinia*, *Boechera*, and their close relatives are within the tribe Boechereae, while the similar-appearing *Arabis* is in a separate tribe. Fortunately, the concept of the species has not broadened or narrowed (i.e., it has not been lumped with or split from anything); the name has merely changed.

Range: Missouri rock cress is apparently endemic to the United States, occurring in a disjunct fashion from Oklahoma east to Georgia, north to Maine, and west to Minnesota, and common only in Missouri, Arkansas, and Oklahoma (Kartesz 2015). It is ranked as No Status Rank (SNR/SU/SNA) in Arkansas, Connecticut, Minnesota, and Oklahoma; Secure (S5) in Missouri; Imperiled (S2) in Georgia, Massachusetts, Michigan, New York, Ohio, Vermont, and Wisconsin; Critically Imperiled (S1) in Iowa, Indiana, Maine, Maryland, Nebraska, New Hampshire, North Carolina, Pennsylvania, and South Carolina; and Presumed Extirpated (SX) in Kentucky (NatureServe 2024).

State distribution: Historically, the known



range of Missouri rock cress in Michigan was concentrated in the extreme southwestern portion of the state. Of 26 total element occurrences (EOs), 10 are from Berrien, Cass, Kalamazoo, and St. Joseph Counties, however, all but one of those is now ranked H (historical). Five EOs are from Macomb, Oakland, and Wayne Counties in the southeast, but all but one are also now ranked H. The area of Michigan with the greatest concentration of extant EOs is in Allegan and Barry Counties, where there are five known EOs, and they are all believed extant. Historically, Missouri rock cress was also known in the next two tiers of counties to the north (Muskegon, Kent, and Ionia/Clinton Counties), but the species is no longer known from these counties. Two disjunct EOs are believed extant further to the north in Lake County. Statewide, only nine of 26 EOs are believed extant. Of these, estimated viability tends to be poor, with the best estimated viability ranked as Fair, and this for only a single EO (MNFI 2024a).

Best survey time/phenology: Though flowers and various vegetative characters are useful, Missouri rock cress is probably best identified while in fruit. Michigan data are so sparse that it is difficult to define the phenology. Existing records indicate that it flowers in May and June and fruits in June and July (MNFI 2024a). Of 21 known Michigan herbarium specimens, collection dates vary from May 20 to July 25, with 18 of 21 falling between May 30 and July 13 (Brad Ruhfel, University of Michigan, personal communication). The best survey season is conservatively from the third week of June through the second week of July.

Habitat: Reported habitat varies by author and region. In New England, Missouri rock cress is a species of open to forested rocky, alkaline habitats (Haines 2011). In Michigan and northern Indiana, Missouri rock cress is known from dry, sandy, open to semi-open uplands including savannas, fields, borrow pits, railroad rights-of-way, powerlines, oak-pine barrens, and black oak woods (Hanes and Hanes 1947, Wilhelm and Rehricha 2017, MNFI 2024a, Reznicek et al. 2024). It has even been reported from swamps, but those two records are



old and vague (MNFI 2024a), and presumably the specimens came from upland inclusions within the swamps.

Associated species documented in Michigan include *Andropogon gerardii* (big blue-stem), *Arctostaphylos uva-ursi* (bearberry), *Avenella flexuosa* (needle grass), *Carex muehlenbergii* (sedge), *C. pensylvanica* (sedge), *Comandra umbellata* (star toadflax), *Comptonia peregrina* (sweet fern), *Danthonia spicata* (poverty grass), *Elymus repens* (quack grass), *Euphorbia corollata* (flowering spurge), *Fragaria vesca* (woodland strawberry), *Galium pilosum* (hairy bedstraw), *Hypericum perforatum* (common St. John's-wort), *H. prolificum* (shrubby St. John's-wort), *Pinus banksiana* (jack pine), *Poa pratensis* (Kentucky bluegrass), *Potentilla simplex* (old-field cinquefoil), *Rosa carolina* (pasture rose), *Rubus flagellaris* (northern dewberry), *Sassafras albidum* (sassafras), *Tragopogon pratensis* (common goat's beard), *Quercus alba* (white oak), *Q. velutina* (black oak), *Schizachyrium scoparium* (little bluestem), and *Verbascum thapsus* (mullein). This list is based on relatively few data, as most EOs contain little



habitat data (MNFI 2024a).

Biology: Unlike most members of the Brassicaceae, Missouri rock cress appears to be mycorrhizal, as it successfully formed mycorrhizae when inoculated under greenhouse conditions (DeMars and Boerner 1996). The tribe Boechereae contains both sexual diploids and apomictic triploids. Missouri rock cress is a sexual diploid (Al-Shehbaz and Windham 2010).

Conservation/management: Missouri rock cress mostly occurs in open to semi-open habitats. It is likely threatened by mesophication and canopy closure (Nowacki and Abrams 2008), and it would likely benefit from prescribed fire, canopy thinning, or both. It has been reported in association with a few non-native plants in Michigan: Kentucky bluegrass, common St.-John's wort, and quackgrass. It can also be expected to be encroached upon by more invasive non-natives, such as *Celastrus orbiculatus* (Oriental bittersweet), *Centaurea stoebe* (spotted knapweed), *Elaeagnus umbellata* (autumn-olive), and *Lonicera* spp. (bush honeysuckles). Multiple EOs occur within utility or transportation rights-of-way and could potentially be threatened by right-of-way maintenance activities such as herbicide application.

Comments: Eastern North American *Boecheera* species appear to form a monophyletic group with *Borodinia macrophylla*, a species of eastern Asia. Thus, a broadly defined *Borodinia* is another example of the eastern Asian / eastern North American floristic disjunction, together with genera such as *Jeffersonia*, *Podophyllum*, and *Panax* (Wen 1999, Alexander et al. 2013).

Research needs: *Boecheera* is becoming a model genus, with much research focused on hybridization, apomixis, polyploidy, infraspecific adaptation, genetic diversity, and phylogeography (Alexander et al. 2013). However, there has been little research on Missouri-rock cress specifically. Not much is known about the natural history and autecology of Missouri-rock cress, though Dodds



(2023) provided trenchant speculation based on what is known about its close relatives. Basic information on its pollination, mating system, ontogeny, physiology, and response to management would help to inform its conservation.

It is now clear that *Boecheera* as previously circumscribed (Al-Shehbaz 2003) is not monophyletic and that eastern North American species form a group distinct from western North American species (Kiefer et al. 2009, Alexander et al. 2013). However, relationships within and among the other genera of Boechereae need further research. This includes *Borodinia*, in which many authors now recognize Missouri rock cress (Alexander et al. 2013). In Michigan, monitoring of extant populations, surveys for historical populations, and surveys for new populations are needed.

Related abstracts: Oak-pine barrens, rock cress (*Boecheera dentata*)

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