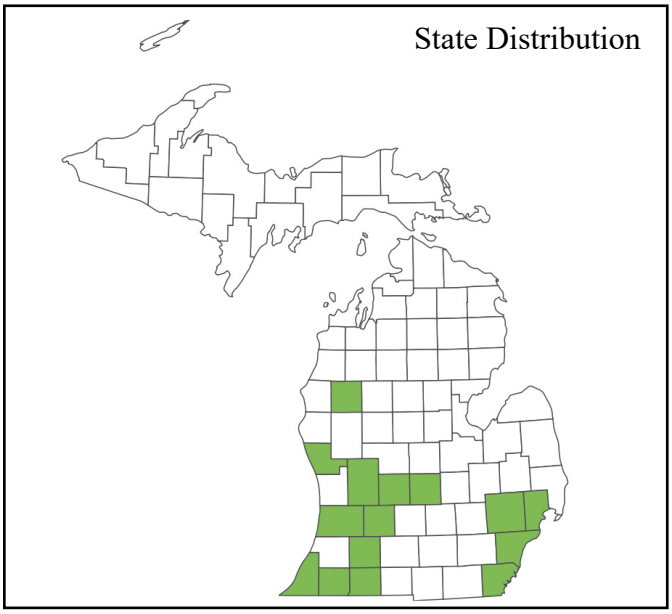
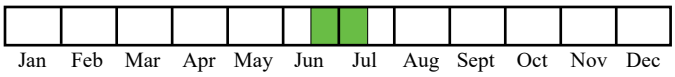
Boechera missouriensis (Greene) Al-Shehbaz — Missouri rock cress



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 that *Beochera* 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

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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 ranked as Poor, with the best estimated viability ranked as Fair, and this for only a single EO (MNFI 2024a).

Recognition: Missouri rock cress is a rosette-forming biennial herb with **creamy-white petals**. The fruits are **siliques**. The plant is **green (i.e., not glaucous)**. The **sepals are about half as long as the petals**. The flowers are borne on lax racemes. The **pedicels are at first ascending, then deflexed** in fruit. The **siliques are long, narrow, flat**, commonly curved, and more than 1 mm wide. The stem is 2–7.5 dm tall and has numerous (15–45) **auriculate-clasping**, appressed to ascending, linear-lanceolate to lanceolate to oblong cauline leaves. The lower cauline leaves have a few sharp teeth; the **upper cauline leaves are nearly entire**. The **persistent rosette leaves** are dentate to deeply pinnatifid. The plant is at least sparsely **pubescent near the base with simple hairs** (Gleason and Cronquist 1991, Yatskievych 2006, Al-Shehbaz and Windham 2010, Wilhelm and Rehricha 2017, Reznicek et al. 2024).

Missouri rock cress could be confused with several other Michigan species in the same genus but can be readily distinguished if the diagnostic parts are available. The cauline leaves of *Boechera canadensis* (sickle-pod) are not clasping at the

base. The pubescence of *Boechera grahamii* (rock cress) is stellate. *Boechera stricta* (drummond rock cress) has strongly appressed fruiting pedicels. *Boechera dentata* (rock cress) has pubescent, dentate upper cauline leaves. *Boechera laevigata* (smooth bank cress) is glabrous throughout, has non-persistent rosette leaves, fewer cauline leaves, a glaucous aspect, and sepals nearly as long as the petals (Wilhelm and Rehricha 2017, Reznicek et al. 2024).

Though *Boechera* is not closely related to *Arabis*, the genera are morphologically similar. *Arabis pycnocarpa* has fruits closely appressed to the stem. No other Michigan *Arabis* species are known, except for uncommon garden escapes. *Turritis glabra* (tower mustard) is also a segregate of a formerly more broadly defined *Arabis*. It is distinguished from Missouri rock cress by its closely appressed, round fruits (Reznicek et al. 2024).

Best survey time/phenology: Though flowers and various vegetative characters are useful, Missouri rock cress is 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 innoculated 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 *Boechera* 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: *Boechera* 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 *Boechera* 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 recongnize 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 (*Boechera dentata*)

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Photo by Patrick Alexander

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