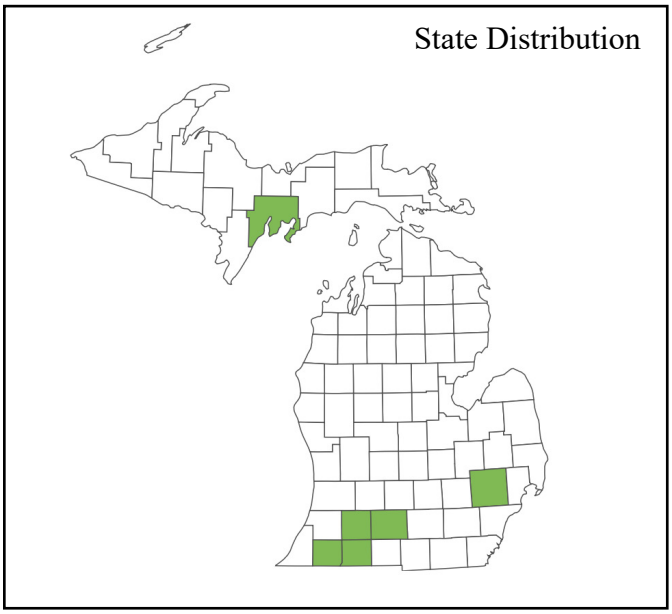
Viola pedatifida G. Don — Prairie birdfoot violet



Best Survey Period

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
				■	■						

Status: State Endangered

Global and state rank: G5 (Globally Secure) / S1 (State Critically Imperiled)

Other common names: larkspur violet, prairie violet, crow-foot violet, purple prairie-violet

Synonyms: *Viola palmata* L. var. *pedatifida* (G. Don) Cronqu., *Viola delphinifolia* Nutt.

Family: Violaceae

Section: *Nosphinium*

Subsection: *Borealiamericanae*

Taxonomy: The genus *Viola* is one of the largest genera within the angiosperms (Marcussen et. al 2022). There are an estimated 56 native violet species and 113 accepted hybrids in the United States and Canada alone (Ballard et al. 2023). The genus *Viola* is also broken into five sections and nine subsections. Prairie birdfoot violet has been placed in section *Nosphinium* (the Acaulescent Blue Violet lineage) and subsection *Borealiamericanae* (Marcussen et. al. 2022, Ballard et al. 2023). Within *Borealiamericanae*, it is placed within the unranked taxonomic group Pedatifida, together with *V. brittoniana* (coast violet) and *V. pectinata* (pectinate-leaved violet), two species of the far-eastern portion of North America (Ballard et al. 2023). In Michigan, 26 species of *Viola* have been documented, including one State Endangered, two State Threatened, and one State Extirpated species (Reznicek et al. 2011, MNFI 2024a).

Prairie birdfoot violet is known to form hybrids with several species, and there are at least three hybrids that could potentially be found in Michigan. These hybrids are formed with other stemless violets, namely *V. sagittata* (narrow-leaved violet), *V. nephrophylla* (northern bog violet), and *V. sororia* (common blue violet) (Brainerd 1913, Marcussen et al. 2022, Ballard et al. 2023). The hybrid with common blue violet is called *V.* ×*bernardii* and the hybrid with *V. nephrophylla* is known as *V.* ×*wilmattiae* (Little and McKinney 2015, Marcussen et al. 2022, Ballard et al. 2023).

Total range: Prairie birdfoot violet is a characteristic species of the Great Plains and black soil prairies of the Midwest. The species occurs as far north as the Canadian territories of Ontario, Manitoba, Saskatchewan, and Alberta. From there, its range extends west to Montana,

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Wyoming, Colorado, and Arizona; south to New Mexico, Oklahoma, and Arkansas; and east to Ohio, Michigan, Tennessee, and Virginia. Prairie birdfoot violet is most common in the Midwest and rare on the fringes of its range. Across its range, prairie birdfoot violet is listed as Apparently Secure (S4) in Manitoba and Iowa; Vulnerable (S3) in Saskatchewan, Alberta, and New Mexico; Imperiled (S2) in Indiana, Arkansas, and Colorado; and Critically Imperiled (S1) in Ontario, Michigan, Ohio, Wyoming, and Montana (NatureServe 2024).

State distribution: Prairie birdfoot violet has been documented from 16 occurrences in five counties. Prairie birdfoot violet is mostly restricted to the southernmost counties where remnant prairies may still be found. One disjunct occurrence is known from Delta County in Michigan's Upper Peninsula, where it occurs on a limestone glade on the Garden Peninsula (MNFI 2024b). There were a few plants found in Washtenaw County that were mapped as a similar species, *V. palmata* (wood violet), that may represent a hybrid between wood violet and prairie birdfoot violet (Reznicek et al. 2011).

Prairie birdfoot violet could be considered nearly extirpated from the state of Michigan, and it could soon disappear from the landscape. There are only four Element Occurrences (EOs) that are not considered Historic (H), Failed to Find (F), or Extirpated (X). The most secure occurrence is the Delta County occurrence (rank BC [good to fair estimated viability]), and the other three are in Kalamazoo and Cass Counties (all D-ranked [poor estimated viability]). One of these occurrences in Kalamazoo County, however, has not been revisited since 1981.

Recognition: Prairie birdfoot violet is a short perennial forb of prairies and savannas. The plant can reach 4–20 cm in height and is **acaulescent** (stemless) and **without stolons**. Rosettes form from a short, erect rhizome, and roots are fibrous. **Leaves are ternate** (with three leaflets), and leaf morphology changes through the season. Early **spring leaves are less divided than summer leaves** (Russell 1956). **Summer leaves are deeply**


Photo by Nate Martineau

divided into three main lobes, which are then divided further into several sections; all segments are nearly divided to the base. Flowers are 1.5–2.5 cm wide and typical of the violet family; they are spurred, 5-merous, and bilaterally symmetrical. Fruits are glabrous capsules that split into three sections, each containing several seeds (Judd et al. 2008, Reznicek et al. 2011). A distinctive feature of violet flowers is the stamens, which bear yellow appendages atop white anthers arising from short, inconspicuous filaments. The stamens are arranged closely together but not quite fused (i.e., connivent) around the pistil (Judd et al. 2008).

Prairie birdfoot violet is most like *V. pedata* (birdfoot violet) but can be distinguished based on floral and rhizome traits. The **lateral and spurred petals of prairie birdfoot violet are bearded and stamens do not extend outside the constricted throat of the corolla**. The petals of birdfoot violet, however, are glabrous and the stamens conspicuously extend outside

the throat of the corolla. These flowers are the typical, chasmogamous flowers (those that open). Additionally, prairie birdfoot violet produces **cleistogamous flowers** (self-fertilized flowers that do not open) in the summer while birdfoot violet does not produce any. The **rhizome of prairie birdfoot violet measures 5 mm or less**. Lastly, birdfoot violet is far more common in the Michigan landscape than prairie birdfoot violet (Reznicek et al. 2011).

Best survey time/phenology: From first week of May to fourth week of June (MNFI 2024c). The ideal survey time is when the plant is flowering in early-to-late May (MNFI 2024b) as one of the key characteristics differentiating prairie birdfoot violet from birdfoot violet is the flower. However, the species could also be detected in summer based on its distinctive leaves together with a narrow rhizome, cleistogamous flowers, or both (Reznicek et al. 2011).

Habitat: The historical range of prairie birdfoot violet barely enters southwestern Michigan, where it is slightly disjunct from the nearest occurrences in Indiana and Ohio (Kartesz 2024). The species has also been documented in Oakland County, but that record dates to 1955 and is ranked Historical (MNFI 2024b). In southern Michigan, prairie birdfoot violet is known from remnant mesic prairies, and historically from bur oak plains, with virtually all records associated with remnants along roads and railroad tracks (MNFI 2024b). Prairie birdfoot violet should also be sought in related communities, such as mesic sand prairie, oak openings, and dry-mesic prairie (Cohen et al. 2024). The Delta County record is slightly disjunct from the nearest populations in Wisconsin. This record is associated with thin soil within a limestone bedrock glade (MNFI 2024b). Prairie birdfoot violet is also to be sought in related communities such as alvar (Cohen et al. 2024).

In prairie communities, prairie birdfoot violet is associated with black cherry (*Prunus serotina*), smooth sumac (*Rhus glabra*), big bluestem (*Andropogon gerardii*), little bluestem

(*Schizachyrium scoparium*), cordgrass (*Spartina pectinata*), Indian grass (*Sorghastrum nutans*), prairie coreopsis (*Coreopsis palmata*), wild geranium (*Geranium maculatum*), pale-leaved sunflower (*Helianthus strumosus*), white false indigo (*Baptisia lactea*), false boneset (*Brickellia eupatorioides*), yellow coneflower (*Ratibida pinnata*), rosin weed (*Silphium integrifolium*), yellow-pimpernel (*Taenidia integerrima*), hoary vervain (*Verbena stricta*), round-headed bush-clover (*Lespedeza capitata*), wild raspberry species (*Rubus* spp.), wild strawberry (*Fragaria virginiana*), and golden alexanders (*Zizia aurea*). In limestone bedrock glade, it is associated with poverty grass (*Danthonia spicata*), common milkweed (*Asclepias syriaca*), prairie cinquefoil (*Drymocallis arguta*), wild bergamot (*Monarda fistulosa*), and Indian paintbrush (*Castilleja coccinea*).

Biology: All above-ground parts of prairie birdfoot violet provide benefits for various organisms. The flowers provide nectar for several bee species

and small butterflies (Hilty 2018). Seeds have caruncles, which are structures that provide food for ants and ultimately facilitate myrmecochory—the dispersal of seeds through ants (Cooperrider 1995, COMH 2017). Plants are a larval host for many butterfly species, including the rare regal fritillary (*Speyeria idalia*) (Kopper et al. 2000) which is considered extirpated in Michigan (MNFI 2024c) and Vulnerable to Critically Imperiled in much of the United States (NatureServe 2024). Leaves and stems of prairie birdfoot violet have been known to host several species of parasitic fungi in Wisconsin. These fungal species include *Synchytrium*, *Puccinia ellisiana*, *Phyllosticta violae,* and *Ascochyta violae*. One species, *Phyllosticta violae*, was observed to actively harm plants, causing leaf lobes to brown and die (Greene 1948).

Plants reproduce using two forms of sexual reproduction: cross-pollination and self-pollination. Chasmogamous flowers emerge in spring, which encourage visitation from pollinators and allows for outcrossing. Cleistogamous flowers form later in summer and are strictly self-pollinated (Zumwalde 2015). Although plants possess a rhizome, they are not known to reproduce clonally (COMH 2017).

Conservation/management: Prairie birdfoot violet is sharply declining due to habitat loss and other anthropogenic factors. A recent status assessment over 2013–2017 documented only one occurrence extant out of nine surveyed, though that survey did not incude the Delta County occurrence (MNFI 2024b, H. Ballard, Ohio University, personal communication). This species requires habitat protection and management to survive and thrive. Stopping encroachment from woody vegetation will prevent competition and succession. Two methods of controlling woody vegetation are mechanical brush removal and prescribed burns. In fact, burns conducted during fall or early spring appear to be beneficial to the species, both in terms of increased leaf production and improved reproductive success. Conversely, late spring burns can be harmful (Lovell et. al. 1983).

Current populations are under the constant threat of road and railroad right-of-way (ROW) maintenance. Maintenance activities include herbicide application, mowing, trenching, and bulldozing—all activities that have directly led to the degradation and extirpation of numerous element occurrences (EOs) (MNFI 2024b). Repeated disturbance can also cause encroachment from weedy and invasive species that can quickly outcompete native species.

Climate change may pose unique threats to the persistence of prairie birdfoot violet populations. The duration and magnitude of the seed stratification period (i.e., winter dormancy period) may be a factor that impacts conservation efforts. It has been demonstrated that a shorter stratification period negatively affects the genetic diversity and output of *Viola pedatifida* under artificial conditions (Diaz-Martin et. al. 2023). With climate change posing a continued threat, there is a risk of Michigan winters becoming warmer and shorter and negatively impacting extant populations.

Small population sizes in southern Michigan could lead to indbreeding depression, or to genetic swamping or outbreeding depression from hybridization with more common violet species. At least one population mapped as prairie birdfoot violet in southwestern Michigan is suspected of having some introgression with a more common species (N. Martineau, personal communication).

Comments: All species of violet are edible,

although not all are palatable (UOME 2021). It is not recommended that prairie birdfoot violet be collected for consumption due to its rarity. The genus name and specific epithet are both Latin. *Viola* directly translates to violet and *pedatifida* translates to "cleft foot," which is in reference to the shape of the leaf (KWAG 2024). Violets have a long history in Europe and were first mentioned in Ancient Greek texts (Marcussen et. al. 2022).

Research needs: It is imperative to resurvey extant prairie bird violet EOs and survey for suitable habitat. If restoration is to be pursued, performing the same seed extraction and germination experiment performed in Illinois (Johnson and Anderson 1986) could be beneficial to increasing numbers of native Michigan plants without collecting seed from vulnerable populations.

Related abstracts: Alvar, bur oak plains, limestone bedrock glade, mesic prairie, prairie coreopsis, regal fritillary

Selected references:

Ballard, H. E., J. T. Kartesz, M. Nishino. 2023. A taxonomic treatment of the violets (Violaceae) of the northeastern Unites States and adjacent Canada. Journal of the Torrey Botanical Society 150: 3-266.

Brainerd, E. 1913. Four hybrids of *Viola pedatifida*. Bulletin of the Torrey Botanical Club. 40: 249-260.

Cohen, J. G., M. A. Kost, B. S. Slaughter, D. A. Albert, J. M. Lincoln, A. P. Kortenhoven, C. M. Wilton, H. D. Enander, and K. M. Korroch. 2020. Michigan Natural Community Classification [web application]. Michigan Natural Features Inventory, Michigan State University Extension, Lansing, MI. <https://mnfi.anr.msu.edu/communities/classification>. Accessed 28 March 2024.

Consortium of Midwest Herbaria (COMH). 2017. *Viola pedatifida*. <https://midwestherbaria.org/portal/taxa/index.php?taxon=2456&clid=>. Accessed March 23 2024.

Cooperrider, T. S. 1995. The Dicotyledoneae of Ohio, Part 2: Linaceae through Campanulaceae. Ohio Sate University Press, Columbus, OH.

Gray, A. and M. L. Fernald. Gray's Manual of Botany. 8th ed. 1950. American Book Company, New York, NY.

Greene, H. C. 1948. Notes on Wisconsin Parasitic Fungi. X. The American Midland Naturalist 39: 444-456.

Hilty, J. 2018. Prairie Violet. <https://www.illinoiswildflowers.info/prairie/plantx/pr_violetx.htm>. Accessed March 21 2024.

Johnson, R. G. and R. C. Anderson. 1986. The seed bank of a tallgrass prairie in Illinois. The American Midland Naturalist 115: 123-130.

Judd, S. J., C. S. Campbell, E. A. Kellogg, P. F. Stevens, and M. J. Donoghue. 2008. Plant Systematics: A Phylogenetic Approach, Third Edition. Sinauer Associates, Inc. Sunderland,

MA.
Kansas Wildflowers and Grasses (KWAG). 2024. Prairie Violet. <https://kswildflower.org/flower_details.php?flowerID=218>. Accessed March 23 2024.
Kartesz, J. T. 2024. The Biota of North America Program: North American Vascular Flora. <http://www.bonap.org/>. Accessed 28 March 2024.
Kilgore, S., K. Havens, A. Kramer, A. Lythgoe, L. MacKechnie, and M. De Vitis. 2022. Seed Collection, storage, and germination practices may affect *Viola* reintroduction outcomes. Native Plants 23: 40-54.
Kopper, B. J., R. E. Charlton, and D. C. Margolies. 2000. Oviposition site selection by the regal fritillary, *Speyeria idalia*, as affected by proximity of violet host plants. 13: 651-655.
Little, R. J. and L. E. McKinney. 2015. *Viola*. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico [Online]. 25+ vols. New York and Oxford. Flora of North America Editorial Committee. Vol. 6. <http://floranorthamerica.org/Viola>. Accessed 26 March 2024.
Lovell, D. L., R. A. Henderson, and E. A. Howell. 1983. The Response of Forb Species to Seasonal Timing of Prescribed Burns in Remnant Wisconsin Prairies. Pages 12–15 *in* Proceedings of the Eighth North American Prairie Conference. R. Brewer, Editor. Western Michigan University, Kalamazoo, MI.
Marcussen, T., H. E. Ballard, J. Danihelka, A. R. Flores, M. V. Nicola, and J. M. Watson. 2022. A revised phylogenetic classification for *Viola* (Violaceae). Plants 11: 1-135.
Michigan Natural Features Inventory (MNFI). 2024a. *Michigan's Rare Plants*. <https://mnfi.anr.msu.edu/species/plants>.
Michigan Natural Features Inventory (MNFI). 2024b. Michigan Natural Heritage Database, Lansing, MI.

Michigan Natural Features Inventory (MNFI). 2024c. *Viola pedatifida*. <https://mnfi.anr.msu.edu/species/description/15050/viola-pedatifida>. Accessed 23 February 2024.
Minnesota Wildflowers (WM), a field guide to the flora of Minnesota. 2024. *Viola pedatifida*. <https://www.minnesotawildflowers.info/flower/prairie-violet>. Accessed March 21 2024.
Missouri Botanical Garden (MBG). 2022. *Viola pedatifida*. <https://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?taxonid=287512&isprofile=0&>. Accessed March 21 2024.
NatureServe. 2024. NatureServe Network Biodiversity Location Data accessed through NatureServe Explorer Web. <https://explorer.natureserve.org/>. Accessed February 2 2024.
Reznicek, A. A., E. G. Voss, and B. S. Walters. 2011. Michigan Flora Online. University of Michigan. <https://michiganflora.net/>. Accessed 23 February 2024.
Russell, N. H. 1956. Hybridization between *Viola pedatifida* and its relatives. Castanea 21: 133-140.
Stevens, P. F. 2017. Angiosperm Phylogeny Website, Version 14. <www.mobot.org/mobot/research/apweb/>. Accessed March 21 2024.
University of Minnesota Extension (UOME). 2012. Wild edibles: Common blue violets.

<https://extension.umn.edu/news/wild-edibles-common-blue-violets>. Accessed March 23 2024.

Voss, E. G. 1985. Michigan Flora Part II: Dicots (Saururaceae-Cornaceae). Cranbrook Institute of Science Bulletin 59 and the University of Michigan Herbarium, Ann Arbor, MI.

Wilhelm, G. and L. Rericha. Flora of the Chicago Region: A Floristic and Ecological Synthesis. Indiana Academy of Science, Indianapolis, IN.

Zumwalde, B. A. 2015. A Systematic Revision of the *Viola pedatifida* Group and Evidence for the Recognition of Viola virginiana, a New Narrow Endemic of the Virginia Shale Barrens. Thesis, Ohio University, Athens, USA.

Abstract citation: Smith, D. E. and S. M. Warner. 2024. Special plant abstract for *Viola pedatifida* (prairie birdfoot violet). Michigan Natural Features Inventory. Lansing, MI.

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