

Hybanthus concolor

Green Violet

Violaceae



Hybanthus concolor by J. S. Dodds, 2018

***Hybanthus concolor* Rare Plant Profile**

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
State Forest Fire Service & Forestry
Office of Natural Lands Management
New Jersey Natural Heritage Program

501 E. State St.
PO Box 420
Trenton, NJ 08625-0420

Prepared by:
Elizabeth A. Johnson
eajohnson31@gmail.com

July, 2022

For:
New Jersey Department of Environmental Protection
Office of Natural Lands Management
New Jersey Natural Heritage Program
natlands@dep.nj.gov

This report should be cited as follows: Johnson, Elizabeth A. 2022. *Hybanthus concolor* Rare Plant Profile. New Jersey Department of Environmental Protection, State Parks, Forests & Historic Sites, State Forest Fire Service & Forestry, Office of Natural Lands Management, New Jersey Natural Heritage Program, Trenton, NJ. 14 pp.

Life History

Hybanthus concolor (Green Violet) is a perennial wildflower in the Violet family. It is the only species in the genus *Hybanthus* in eastern North America (Mid-Atlantic Herbaria 2022) and is very different in general appearance from members of the Violet family in the *Viola* genus (Straubaugh and Core 1978). The plant grows erect, 0.5–1 m in height, with somewhat pubescent stems. (Note: Eames [1930] described a mostly glabrous form of Green Violet that he proposed as a subspecies f. *subglabrum*.) The nodding greenish-white flowers are solitary or occur in small clusters of two or three in leaf axils along the stem. There are five petals and sepals, the lowest petal is slightly longer and strongly notched with a swollen nectar sac at the base (Straubaugh and Core 1978). Leaves are alternate, oval or broadly elliptical, pointed at both ends, 7–16 cm in length and 3 cm wide (Clemants and Gracie 2006; Gleason and Cronquist 1963; Mid-Atlantic Herbaria 2022; Straubaugh and Core 1978).

Flowering can occur from April to June, depending on location (Mid-Atlantic Herbaria 2022; MissouriPlants.com 2022; Weakley 2015), with seeds produced from June through early October (Smith 2018; Weakley 2015). (Note: seeds produced later in the season would be from cleistogamous flowers, seeds produced earlier in the season would result from pollination of chasmogamous flowers—see Pollinator Dynamics below.) In New Jersey, flowering usually takes place in May (Breden et al. 2006). Although *Viola* species regularly hybridize (Gracie 2012), it is not known whether *Hybanthus* does as well.



Left: *Hybanthus* plants, courtesy of R. W. Smith, Lady Bird Johnson Wildflower Center. Center: Leaf closeup, courtesy of Katy Chayka. Right: Seed capsule, courtesy of John Hilty.



Illustration by Britton and Brown 1913, courtesy USDA NRCS 2022a.

Pollinator Dynamics

Hybanthus concolor as well as other *Viola* spp. typically have two types of flowers. Early in the season chasmogamous flowers are produced that open to attract various insect pollinators. Pollinators of *Viola* species include honey bees (*Apis mellifera*), bumble bees (*Bombus* spp.), sweat bees (Halictidae), mason bees (*Osmia* spp.) and mining bees (*Andrena* spp.) (Discover Life 2022; Hilty 2020; Robertson 1929) with occasional visits by some butterflies, flies, and wasps (Eastman 1992; Gracie 2012). It is not known how often these insects visit the inconspicuous flowers of the Green Violet; however, Robertson (1929) observed *Oxystoglossa confusa* (Robertson) = *Augochlorella aurata* (Smith) visiting a Green Violet bloom and Hilty (2020) references *Lasioglossum laevissimum* as visiting Green Violet.

Later in the season, cleistogamous flowers may be produced that never open and instead are self-pollinating. (It has been noted that cleistogamous flowers are not produced in all populations, for example, rarely in Missouri [Missouriplants.com]). In most *Viola* species, these self-pollinating flowers are hidden at the base of the plant but in others, including the Green Violet, the late

season flowers are found at the top of the stalk (Gracie 2012). According to Gracie (2012), this “back-up” seed production system can be useful if there is insufficient insect pollination early in the season. It also produces plants that are identical to the adult plant, which may make them perfectly adapted to specific microclimates (Eastman 1992). While preserving locally adapted genes, however, over time self-pollination may lead to a decline in genetic diversity.

Seed Dispersal

Hybanthus seeds are relatively large (~5 mm diameter) (Britton and Brown 1913; Gleason and Cronquist 1963; Mid-Atlantic herbaria 2022) with 6 to 9 seeds contained in three-seamed seed capsules. When the pods split open, the seeds are released explosively. Beattie and Lyons (1975) observed that in seven *Viola* species, seeds released in this manner were propelled an average of 2.1 to 5 m away from the parent plant.

Ants are also important dispersers of *Hybanthus* seeds. Each seed has an attached elaiosome, a gelatinous structure containing fats and proteins that ants use as food for their larvae. Ants collect these elaiosomes to bring back to their nest, discarding and thereby dispersing the seeds after consuming the elaiosomes (WIDNR 2022).

Many *Viola* species are clonal, reproducing vegetatively. According to Hilty (2020) Green Violets, with their thick fibrous root systems, may spread clonally as well.

Habitat

The Green Violet is found predominantly in rich, often calcareous, mesic deciduous woodlands and thickets, on shady undisturbed sites (Ballard 2020; Straubaugh and Core 1978). Smith (2018) describes the habitat of Minnesota populations as mesic forests in deep stream valleys or ravines of Sugar Maple (*Acer saccharum*) and American Basswood (*Tilia americana*) on silty loams. The species has also been reported in drier glades or forest microsites with an alkaline or occasionally basic substrate (Ballard 2020; Weakley 2015). In Indiana, *Hybanthus* is associated with Beech/Maple or Beech/Oak woodlands with a closed canopy (Mid-Atlantic herbaria 2022). In Virginia, plants have been found growing to 762 m (2500 ft) (Britton and Brown 1913). There is little to no information found about mycorrhizal associations or other specific habitat requirements.

A significant population of Green Violets was discovered in Wisconsin in May 2021 in a southern mesic forest of Sugar Maple, American Basswood, and Red Oak (*Quercus rubra*) with associated spring ephemerals such as *Trillium* spp., Spring Beauty (*Claytonia virginica*), and Dutchman’s Breeches (*Dicentra cucullaria*). The site is a steep slope that has been protected from extensive logging and grazing, with no encroaching invasive plant species. Until this discovery, the species had been considered extirpated from the state (WIDNR 2021).

In New Jersey, Green Violet populations occur in open woods on diabase hillsides and in rich friable soil on shale bluffs along the Delaware River, most with steep south-facing slopes. The

overstory may contain White Ash (*Fraxinus americana*), oak (*Quercus* spp.), Tulip Poplar (*Liriodendron tulipifera*), hickory (*Carya* spp.), along with Eastern Redbud (*Cercis canadensis*) and Flowering Dogwood (*Cornus florida*). Populations are also found on ledges and mid-to-upper slopes of limestone ridges in the northwestern part of the state, with Sugar Maple, Chinkapin Oak (*Quercus muhlenbergii*), and elm (*Ulmus* spp.) in the overstory (NJNHP 2022).

Wetland Indicator Status

Hybanthus concolor is a facultative upland species, meaning that it usually occurs in nonwetlands but may occur in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2022b)

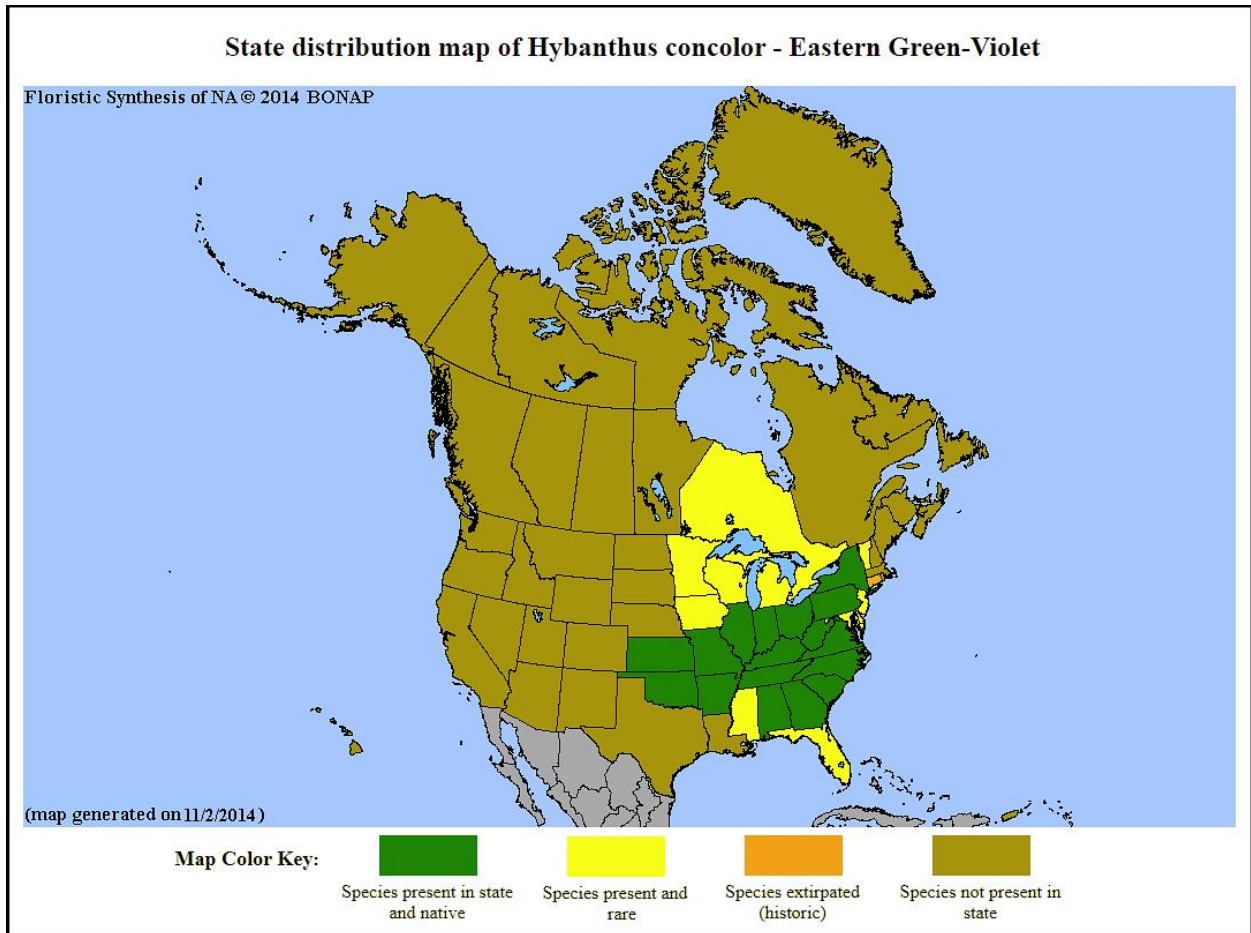
HYCO6

Coefficient of Conservatism (Walz et al., 2018)

CoC = 8. Criteria for a value of 6 to 8: Native with a narrow range of ecological tolerances and typically associated with a stable community (Faber-Langendoen 2018).

Distribution and Range

The global range of *Hybanthus concolor* is restricted to North America (POWO 2022), where it ranges from Vermont to southeastern Minnesota and north into Canada, south to northwestern Florida and west to eastern Oklahoma (Ballard 2020). The map in Figure 1 depicts the extent of the Green Violet in the United States and Canada.



*Figure 1. Distribution of *H. concolor* in North America, adapted from BONAP (Kartesz 2015).*

The USDA PLANTS Database (2022b) shows records of the Green Violet in five New Jersey counties: Camden, Hunterdon, Mercer, Sussex, and Warren (Figure 2). The data include historic observations and do not reflect the current distribution of the species. A single specimen from Atlantic County is reported from the Chrysler Herbarium at Rutgers University (Mayer, date not shown).

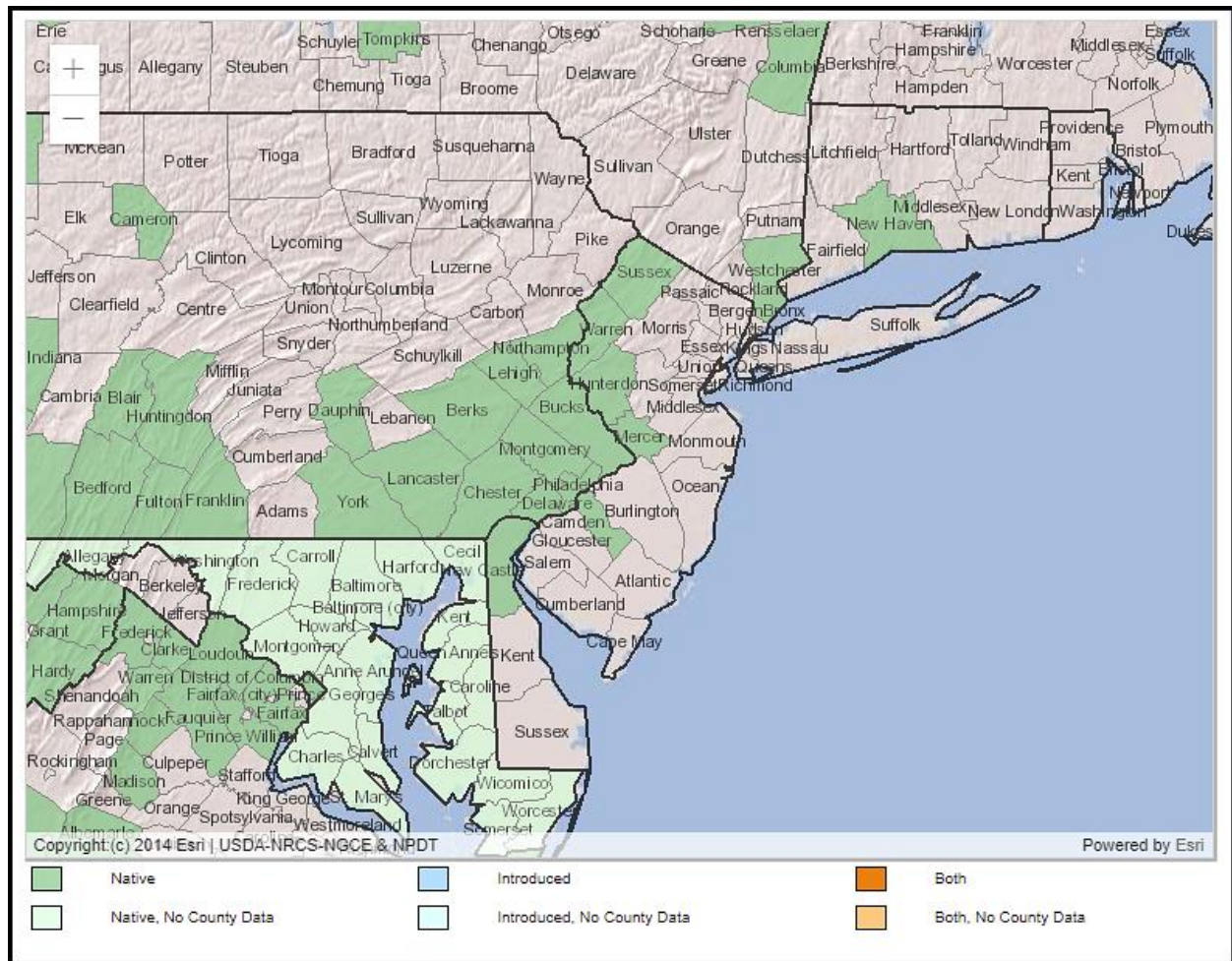


Figure 2. County records of *H. concolor* in New Jersey and vicinity (USDA NRCS 2022b).

Conservation Status

Hybanthus concolor is considered globally secure. The G5 rank means the plant has an extensive range, abundant occurrences, and little cause for concern due to declines or threats (NatureServe 2021). The map in Figure 3 illustrates a synthesis of data from Natural Heritage Programs regarding their state's conservation rank and status.

Populations at the periphery of the species' range are considered critically imperiled, imperiled, or vulnerable depending on the location (e.g., Canada, Minnesota, Michigan, Wisconsin, Iowa, Florida, New Jersey, Delaware, and Maryland) (Ballard 2020; Kartesz 2015). Both Connecticut and Wisconsin populations have been considered likely extirpated (Kartesz 2015; WIDNR 2015); however, in May 2021 a new population was discovered in the southwest savanna ecological landscape in Wisconsin.

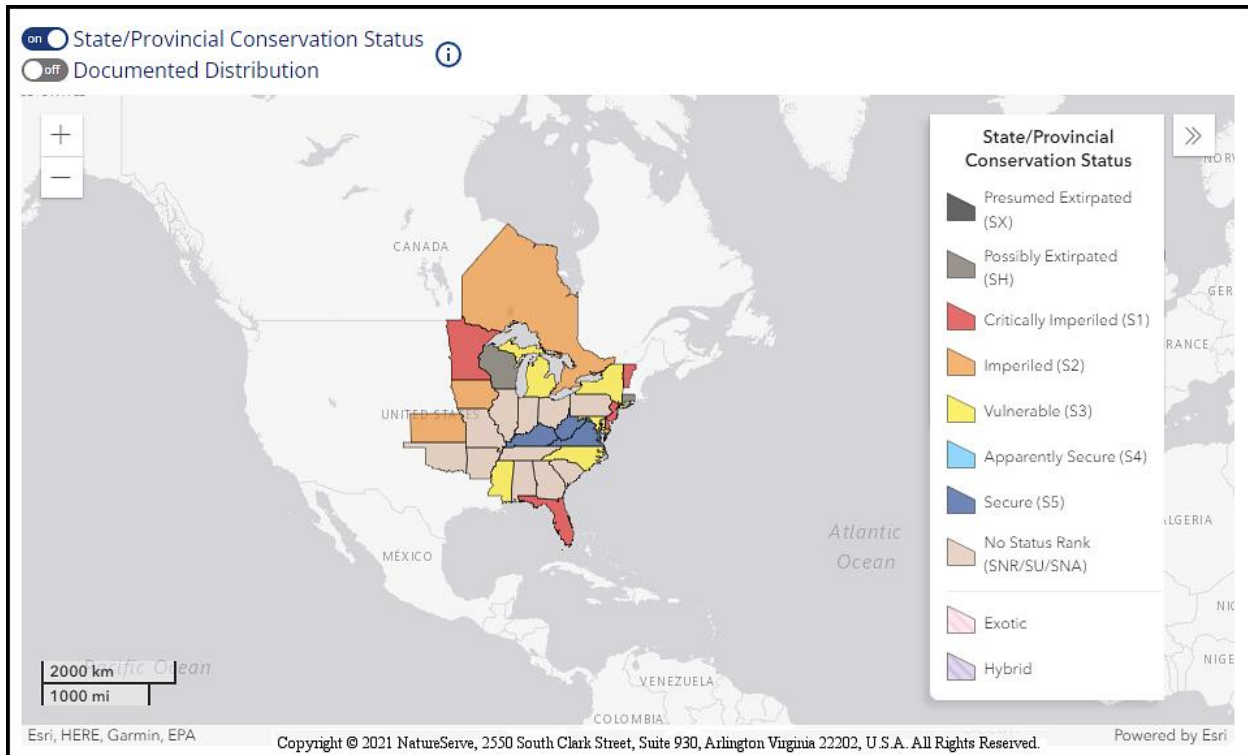


Figure 3: Conservation Status of *H. concolor* in North America (Natureserve 2021).

New Jersey is one of the four states where the Green Violet is critically imperiled (S1) (NJNHP 2022). The rank signifies five or fewer occurrences in the state. A species with an S1 rank is typically either restricted to specialized habitats, geographically limited to a small area of the state, or significantly reduced in number from its previous status. *Hybanthus concolor* is also listed as an endangered species (E) in New Jersey, meaning that without intervention it has a high likelihood of extinction in the state. Although the presence of endangered flora may restrict development in certain communities such as wetlands or coastal habitats, being listed does not currently provide broad statewide protection for the plants. Additional regional status codes assigned to the arrow-grass signify that the species is eligible for some safeguards under the jurisdictions of the Highlands Preservation Area (HL) and in the New Jersey Pinelands (LP) (NJNHP 2010).

Hybanthus is currently known from three counties in New Jersey; Hunterdon, Mercer, and Warren. There are seven documented occurrences, six of which are presently considered to be extant. The seventh occurrence was described as “failed to find” in 1974 (NJNHP 2022). Historically, the Green Violet may have been more widespread in the state (Breden et al. 2006).

Threats

Several threats have been identified for the watersheds where extant populations of New Jersey's *Hybanthus concolor* populations occur. Depending on watershed, these top threats include construction and maintenance of roadways and other corridors (e.g., railroads, rights-of-ways), habitat succession, mining or quarrying, and recreational activities or other types of habitat

disturbance (Breden et al. 2006; NJNHP 2022). For extant populations of Green Violet in these Watershed Management Areas, the greatest threats appear to be invasive species, deer herbivory, the effects of recreational activities, and forest management that opens the canopy. The results of each of these threats can destroy populations directly or degrade habitat conditions such that populations decline over time.

The impacts of non-native invasive plant species on *Hybanthus* populations are well-documented. Of note in Minnesota and other upper Midwestern populations are buckthorn (*Rhamnus* spp.), Japanese Honeysuckle (*Lonicera japonica*), and Garlic Mustard (*Alliaria petiolata*) (Smith 2018; WIDNR 2021). At New Jersey sites, numerous non-native invasive plants have been identified as problematic, including Multiflora Rose (*Rosa multiflora*), Wineberry (*Rubus phoenocolasius*), Japanese Stilt Grass (*Microstigeum vimineum*), Japanese Honeysuckle, Tree-of-heaven (*Ailanthus altissima*), Nodding Mouse-ear Chickweed (*Cerastium nutans*), Mother-of-the-Evening/Dame's Rocket (*Hesperis matronalis*), and Garlic Mustard. At New Jersey's northwestern calcareous sites, Common Buckthorn (*Rhamnus cathartica*) is pervasive. Invasive insects are also considered a major threat, for example, with the non-native Emerald Ash Borer (EAB – *Agrilus planipennis*) causing widespread ash (*Fraxinus* spp.) die-off that is opening the canopy and substantially altering those forests.

Deer herbivory is a significant concern at all known New Jersey populations (NJNHP 2022), with heavy browsing directly affecting plants. The general literature does not address herbivory in much detail, although Hilty (2020) mentions White-tailed Deer (*Odocoileus virginianus*) as an herbivore of Green Violet, along with upland game birds and White-footed Mice (*Peromyscus leucopus*) as potential seed predators.

Trampling and other impacts from heavy recreational trail use and maintenance (e.g., mowing) have been identified as a major concern at several New Jersey populations (NJNHP 2022). Logging was identified as a threat at two New Jersey occurrences, the removal of the canopy cover resulting in the rapid encroachment of invasive plant species into the populations (NJNHP 2022). Extensive logging, as well as grazing, have also been noted as threats to Green Violet populations in the upper Midwest (Smith 2018).

While the long-term effects of climate change on this species are unknown, in Minnesota there is concern about increasing exposure to more frequent flood events due to climate change that may harm the remaining *Hybanthus* populations in low lying areas in that state (Smith 2018). Other potential effects of climate change on this species have not been discussed in the literature.

Management Summary and Recommendations

Hybanthus is typically found in moist, shady habitat conditions under a relatively closed canopy with a deep friable soil to support the plants' shallow root system (Smith 2018). Therefore, it is important to maintain forest cover and avoid trampling and other soil disturbances in proximity to the plants. Protecting forest cover will also reduce soil erosion on steeper slopes where this plant is often found (Smith 2018). Care should be taken during invasive weed control, forest management, vehicular access, roadside or trail maintenance, and other woodland activities

where plants are present (NJNHP 2022; Smith 2018). WIDNR (2021) recommends avoiding known plant locations for any necessary management activity or, if unavoidable, conducting management when soils are dry later in the season or during the winter when the ground is frozen. Given the recent discovery of a new population in Wisconsin, surveys for Green Violet should be conducted prior to any proposed site management in potential habitat in New Jersey and other locations where the plant is imperiled. Also, it would be beneficial to revisit New Jersey sites that have not been surveyed in recent years.

In 2019 at one New Jersey Green Violet occurrence, Friends of Hopewell Valley Open Space (FOHVOS) land managers established five small deer exclosures around Green Violet plants and implemented an invasive species removal program focused on Garlic Mustard and chickweed. In just one year, these management actions resulted in a significant increase in *Hybanthus* plant numbers as well as in fruit/seed set (Michael Van Clef, personal communication; NJNHP 2022). The rapid improvement in site condition and population numbers after deer and invasive species management reinforces the importance of addressing deer herbivory and invasive species encroachment. Where feasible at other sites where deer herbivory has been identified as a significant threat to Green Violet the establishment of fencing exclosures to prevent deer access may be warranted. At locations where there is high public recreational use adjacent to Green Violet populations, trail rerouting or fencing to prevent trampling of the plants should be considered.

Synonyms

The accepted botanical name of the species is *Hybanthus concolor* (T. F. Forster) Sprengel. Orthographic variants, synonyms, and common names are listed below (ITIS 2021; POWO 2022; USDA NRCS 2022b).

Botanical Synonyms

Calceolaria concolor (T. F. Forst.) Kuntze
Cubelium concolor (T. F. Forst.) Raf.
Cubelium concolor f. *subglabrum* Eames
Ionidium concolor (T. F. Forst.) Benth. & Hook.f. ex S.Watson
Ionidium sprengelianum Schult.
Solea concolor (T. F. Forst.) Ging.
Viola concolor T. F. Forst.
Viola sprengeliana Steud.
Viola stricta Muhl. ex Pursh

Common Names

Green Violet
Eastern Green-violet
Nodding Violet

References

Ballard, H. 2020. Violets (Violaceae) of the Great Plains and Eastern North America. Website accessed May 5, 2022 at <https://people.ohio.edu/ballardh/vgpena/>

- Beattie, A. J. and N. Lyons. 1975. Seed dispersal in *Viola* (Violaceae): adaptations and strategies. *American Journal of Botany* 62(7): 714–722.
- Breden, T. F., J. M. Hartman, M. Anzelone and J. F. Kelly. 2006. *Endangered Plant Species Populations in New Jersey: Health and Threats*. New Jersey Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program, Trenton, NJ.
- Britton, N. L. and A. Brown. 1913. *An Illustrated Flora of the Northern United States and Canada in three volumes: Volume II (Amaranth to Polypremum)*. Second Edition. Reissued (unabridged and unaltered) in 1970 by Dover Publications, New York, NY. 735 pp.
- Chayka, K. 2017 photo of Eastern Green Violet leaf. Image courtesy of Minnesota Wildflowers, <https://www.minnesotawildflowers.info/flower/eastern-green-violet> licensed by <https://creativecommons.org/licenses/by-nc-nd/3.0/>.
- Discover Life. 2022. *Andrena violae*. Accessed July 20, 2022 at <https://www.discoverlife.org/20/q?search=Andrena+violae>
- Dodds, J. S. 2018 photo of *Hybanthus concolor* flowers. Used with permission.
- Eames, E. H. 1930. *Cubelium concolor*. *Rhodora* 32(379): 140–142.
- Eastman, J. 1992. *The book of forest and thicket*. Stackpole Books, Mechanicsburg, PA. 336 pp.
- Faber-Langendoen, D. 2018. *Northeast Regional Floristic Quality Assessment Tools for Wetland Assessments*. NatureServe, Arlington, VA. 52 pp.
- Gleason, H. A. and A. Cronquist. 1963. *Manual of Vascular Plants of northeastern United States and Adjacent Canada*. Willard Grant Press, Boston, MA. 810 pp.
- Hilty, J. Undated image of *Hybanthus concolor* seed capsule. Photo from Illinois Wildflowers at. Used with permission https://www.illinoiswildflowers.info/files/photo_use.html
- Hilty, J. 2020. Green Violet. Illinois Wildflowers. Accessed June 5, 2022 at https://www.illinoiswildflowers.info/woodland/plants/green_violet.htm
- ITIS (Integrated Taxonomic Information System). Retrieved November 13, 2021 from the on-line database at <http://www.itis.gov>
- Kartesz, J. T., The Biota of North America Program (BONAP). 2015. Taxonomic Data Center. (<http://www.bonap.net/tdc>). Chapel Hill, NC. [Maps generated from Kartesz, J. T. 2015. Floristic Synthesis of North America, Version 1.0. Biota of North America Program (BONAP) (in press)].

Mayer, G. C. Date not shown. Biodiversity occurrence data published by Rutgers University Chrysler Herbarium). Accessed through Mid-Atlantic Herbarium Consortium at <https://midatlanticherbaria.org/portal/index.php> January 21, 2022.

Mid-Atlantic Herbaria. 2022. *Hybanthus concolor* (T. F. Forst.) Spreng. Species resource page. Accessed June 15, 2022 at <https://midatlanticherbaria.org/portal/taxa/index.php?taxon=87186&clid=4035#>

Missouriplants.com. 2022. *Cubelium concolor*. Website managed by members of the Missouri Native Plant Society. Accessed May 15, 2022 date at http://www.missouriplants.com/Cubelium_concolor_page.html

NatureServe. 2021. NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available at <https://explorer.natureserve.org/> (accessed November 13, 2021).

NJNHP (New Jersey Natural Heritage Program). 2010. Special Plants of NJ - Appendix I - Categories & Definitions. https://www.nj.gov/dep/parksandforests/natural/heritage/spplant_ap1.html#state Site updated March 22, 2010.

NJNHP (New Jersey Natural Heritage Program). 2022. List of Endangered Plant Species and Species of Special Concern, generated January 19, 2022 from the Biotics 5 Database. NatureServe, Arlington, VA.

POWO (Plants of the World Online). 2022. Facilitated by the Royal Botanic Gardens, Kew. Retrieved January 4, 2022 from <http://www.plantsoftheworldonline.org/>

Robertson, C. 1929. Flowers and Insects: Lists of Visitors of Four Hundred and Fifty-Three Flowers. The Science Press Printing Company, Lancaster, PA.

Smith, R. W. 2012 photo of *Hybanthus concolor*. Lady Bird Johnson Wildflower Center, Plant image gallery <https://www.wildflower.org/gallery/>.

Straubach, P. D. and E. L. Core. 1978. Flora of West Virginia. 2nd edition. Seneca Books, Inc. Morgantown, WV. 1079 pp.

U. S. Army Corps of Engineers. 2020. National Wetland Plant List, version 3.5. https://cwbi-app.sec.usace.army.mil/nwpl_static/v34/home/home.html U. S. Army Corps of Engineers Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH.

USDA, NRCS (U. S. Dept. of Agriculture, Natural Resources Conservation Service). 2022a. *Hybanthus concolor* illustration from Britton, N. L. and A. Brown, 1913, An illustrated flora of the northern United States, Canada and the British Possessions, 3 vols., Kentucky Native Plant Society, New York, Scanned by Omnitek Inc. Image courtesy of The PLANTS Database (<http://plants.usda.gov>). National Plant Data Team, Greensboro, NC.

USDA, NRCS (U. S. Dept. of Agriculture, Natural Resources Conservation Service). 2022b. PLANTS profile for *Hybanthus concolor* (Green Violet). The PLANTS Database, National Plant Data Team, Greensboro, NC. Accessed January 21, 2022 at <http://plants.usda.gov>

Van Clef, Michael. Personal Communication. July 19, 2022. Dr. Van Clef is the Stewardship Director, Friends of Hopewell Valley Open Space; Program Director, New Jersey Invasive Species Strike Team; Principal, Ecological Solutions, LLC.

Walz, K. S., L. Kelly, K. Anderson and J. L. Hafstad. 2018. Floristic Quality Assessment Index for Vascular Plants of New Jersey: Coefficient of Conservatism (CoC) Values for Species and Genera. New Jersey Department of Environmental Protection, New Jersey Forest Service, Office of Natural Lands Management, Trenton, NJ, 08625. Submitted to United States Environmental Protection Agency, Region 2, for State Wetlands Protection Development Grant, Section 104(B)(3); CFDA No. 66.461, CD97225809.

Weakley, A. S. 2015. Flora of the southern and mid-Atlantic states, working draft of May 2015. University of North Carolina Herbarium, North Carolina Botanical Garden, Chapel Hill, NC.

WIDNR (Wisconsin Department of Natural Resources). 2015. The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management. Chapter 20, Southwest Savanna Ecological Landscape. Wisconsin Department of Natural Resources, PUB-SS1131V 2015, Madison, WI.

_____. 2021. "DNR Ecologist finds holy grail of rare plants in state natural area." Published July 8, 2021 in Wisconsin State Farmer. <https://www.wisfarmer.com/story/news/2021/07/08/dnr-ecologist-finds-holy-grail-rare-plants-state-natural-area/7910491002/>

_____. 2022. Green Violet. *Hybanthus concolor*. <https://dnr.wi.gov/topic/EndangeredResources/Plants.asp?mode=detail&SpecCode=PDVIO02020> accessed April 25, 2022