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THE NATIVE ORCHID CONFERENCE JOURNAL

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LIMITED EVIDENCE FOR A DISTINCTIVE DISTRIBUTION OF *CORALLORHIZA TRIFIDA* F. *VERNA* IN MICHIGAN AND ONTARIO COMPARED TO F. *TRIFIDA*

By Paul M. Catling and Brenda Kostiuk, brenda.kostiuk@gmail.com

We suggested recently that f. *verna* is a good example of a white-lipped color variant for which the distribution is incompletely known. Here we provide some current information on the topic. This was done: (1) because we wanted to be able to say a little more about it in an updated book about the orchids of Ontario; and (2) the new iNaturalist platform (https://www.inaturalist.org) provides a relatively new, robust, and convenient basis for understanding of geographic variation. This resource is growing rapidly with the number of observations recorded roughly doubling each year (https://en.wikipedia.org/wiki/iNaturalist).

The two “kinds," f. *verna* with a white, unspotted lip, and f. *trifida* with one or more spots on the lip (Figure 1), are generally considered to be southern and northern respectively. Horner (2014: 11) writes: "In the Lower 48 one generally encounters bright green plants with a pure white lip. Plants with a purple spotted lip and column having petals and sepals tinged with brown are encountered further north in Alaska and Canada." Later, Horner (2017: 10) observed that the difficulty of making generalizations about the ranges of the forms was illustrated by the occurrence of the northern f. *trifida* at the extreme southern end of the range of the species in northeastern North America, 80 miles north of Milwaukee, Wisconsin. Coleman (2016: 14, Fig. 8) noted that "at the western limits of its range, in New Mexico and California, *C. trifida* has pure green stems, sepals, and petals." See additional information on southwestern occurrences in a forthcoming volume.

We describe distributions of these two taxa in Michigan and Ontario. We consider plants with any spots on the lip to be referable to f. *trifida*, and plants with an unspotted lip to represent f. *verna*. A spotted lip is often accompanied by spots on the petals, and occasionally also on the sepals and column. Spots on the perianth are invariably confined to the basal half of the perianth segments. Plants generally either have spots on all flowers, or are without spots on all flowers.

A brief history of f. *verna*

For a very useful compilation of information on this species, see Horner (2014, 2017) easily accessed in the archives of this journal which includes additional photos of the color forms (Horner 2014: 11, Figure 5 and Horner 2017: 9, 10, Figures 2 & 3).

The remarkable pioneer botanist, Thomas Nuttall (Graustein 1967) described *Corallorhiza verna* in 1823. He was brilliant, and the fact that his name, (*verna*) fell away into oblivion, is distressing, but that is only one reason for thinking about this taxon. Nuttall described the lip as immaculate. The great orchidologist John Lindley (1840: 533) thought that there was no difference between the North American *C. verna* and the European *C. innata*.

Fernald (1946: 196) made *verna* a variety, noting that it had a more southern distribution in North America, and was "transitional" to var. *trifida,* the latter with a spotted lip, and occurring further north (extending south to northern Ontario). The var. *verna* was maintained by Fernald (1950) in Gray's Manual, but he changed the concept to include, within var. *verna*, plants with "very few basal reddish dots" (Fernald 1950: 483). To the extent that intermediates exist, they may be these plants with few basal dots on the lip and are possibly referable to *C. ericetorum* Drejer (Fernald 1923: 93). The two very influential North American orchid monographs that followed (Correll 1950; Luer 1975), only briefly mentioned var. *verna* without any additional details on its distribution.

Figure 1**a**, *Corallorhiza trifida* **f. *trifida***, near Grand Marais, Michigan, June 2017, iNat. photo 31044486 (modified), by Ron Routledge, CC BY-NC 4.0. **b**, *Corallorhiza trifida* **f. *verna***, Harbor Island, Drummond Island Tp., Michigan, 2 June 2022, iNat. photo 205056717 (modified), by Jesse Lincoln, CC BY-NC 4.0. Another photo of the two forms is in Horner (2014: 11, Fig. 5)

Later, more geographically limited studies provided more information. Case (1987: 226) reported *verna* to be more common in the western Great Lakes region. He also reported that "many intermediate forms occur. Yellow-green plants with a few tiny madder-purple spots near the base of the lip are frequent along the northern Lake Superior shoreline." Whiting and Catling (1986: 96) reported var. *verna* extending north in Ontario to Thunder Bay and Cochrane districts. Coleman (1995: 57) reported only var. *verna* from California and suggested that the use of varietal rank should be continued because of the geographic isolation. Reddoch and Reddoch (1997) found var. *trifida* and var. *verna* "about equally abundant" in the Ottawa District, and they suggested that assigning the rank of form would be premature until morphological variation was studied throughout the range. Heshka (2007) reported unspotted lips in *C. trifida* as far north as Churchill, Manitoba.

Freudenstein's monograph of the genus *Corallorhiza* published in 1997 had an important influence on recognition of colour variants. He explained (Freudenstein 1997: 6) that the colour variants in *Corallorhiza* "are not recognized as taxonomic entities in this treatment because of the sporadic nature of the variation." Many do seem to occur very rarely within populations anywhere within the range of the species, … but this may not be true of all of them. Freudenstein (1997: 32) indicated that no infra-specific taxa are maintained in *C. trifida* because: (1) varietal characters may be influenced by environment, explaining environmental correlations, and a similar geographic pattern exists in Europe; (2) labellum colour is considered not to be a reliable diagnostic character in the genus; and (3) intermediates between the two varieties are frequent. He also noted that studies are made difficult by the poor preservation of morphological characters in dried specimens. There is more written than we have summarized here, and it is a good explanation. It was not a surprise when Magrath and Freudenstein (2002: 636) suggested that the floral forms of *C. trifida* "do not appear to warrant taxonomic recognition."

Sometimes questions linger on. For example: (1) if the two forms are under environmental control, why are they sometimes reported growing very near to each other (Reddoch & Reddoch 1997: 52) in the same environment, and sometimes seen close together (pers. obs.)? (2) flower colour is used to help distinguish many orchid taxa (e.g., *Platanthera blephariglottis* var. *conspicua* and *P. ciliaris*). It may or may not be useful, but it may not have been well tested in *C. trifida* due to the poor preservation of characters noted above; (3) hybridization and hybrid zones, i.e., the occurrence of intermediates, do not necessarily preclude recognition of two taxa, especially if there is discontinuity.

Perhaps some of these questions caused Brown (2006: 284) to recognize *verna* as a form. The majority of recent authors of books including North American native orchids (e.g., Chapman (1997: 99); Risen and Risen (2010: 42); Harms & Leighton (2011: 108); Voss & Reznicek (2012: 183); Smith (2012: 60); and Ames *et al.* (2016: 77), follow the suggestions of the influential monographs (as may be expected). They do not accept f. *verna*, but do allude to white lips (of *C. trifida*) that sometimes have purple spots.

Occurrence of the two taxa in Ontario

There were 240 iNat. observations for Ontario, 122 of which could not be assigned to form because they illustrated capsules rather than flowers, or because the view was not adequate. Thirty-nine were referred to f. *trifida* and 79 to f. *verna*. The period of these observations is 1980 to 2022 with most between 2019 and 2022.

Both forms are widespread in Ontario (Figure 2) suggesting a broad area of overlap. The southern-most observations are of f. *verna* and the northernmost are of f. *trifida*, this being consistent with some previous notions of different distributions but, in fact, substantially different distributions are not supported. Form *verna* appears to be widespread in Ontario, and to be the more common form at the present time. Form *verna* is also more prevalent than would be expected along the Lake Superior shore, based on expectation from work on that shoreline that has documented arctic-alpine flora (Given and Soper 1981).

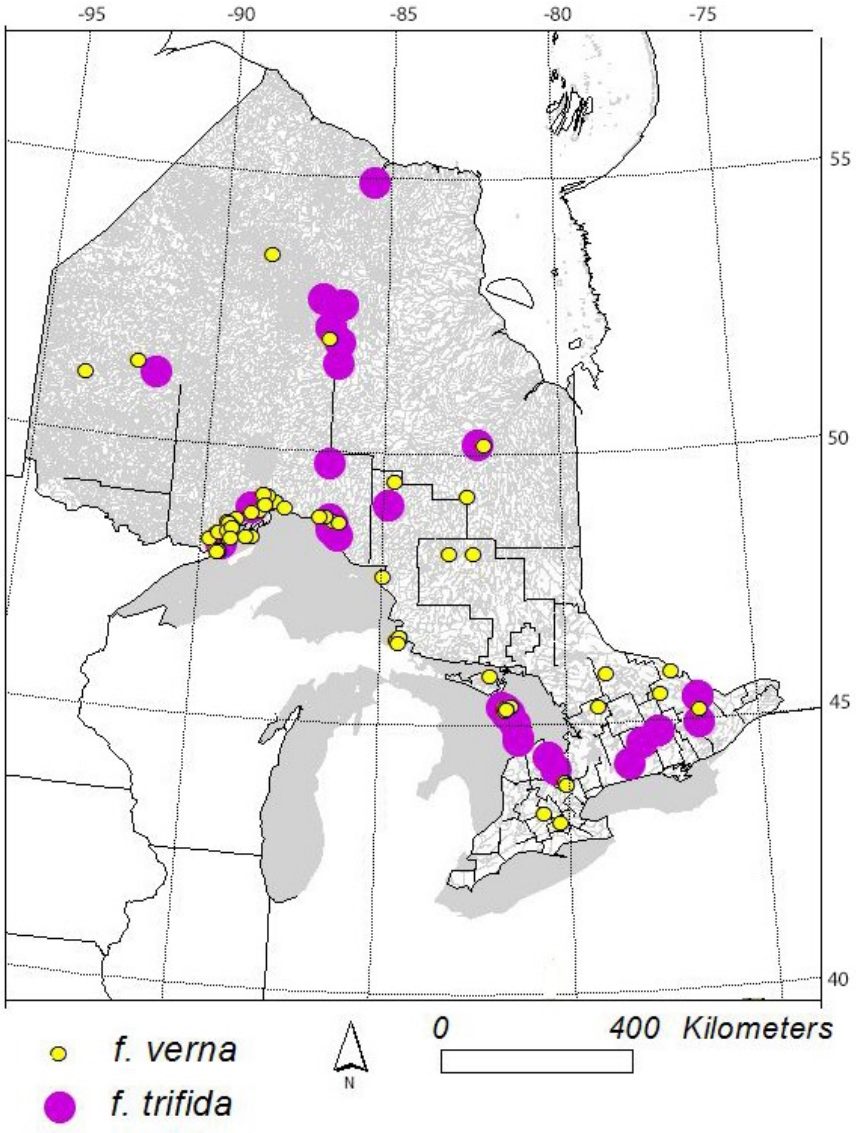

Figure 2. Distribution of the spotted lip (f. *trifida*), and unspotted lip (f. *verna*) colour forms of Early Coralroot (*Corallorhiza trifida*) in Ontario. The map is based on 240 iNat. observations, 122 of which could not be used. The map includes 39 referred to f. *trifida,* and 79 referred to f. *verna*.

Occurrence of the two taxa in Michigan

There were 96 iNat. observations for Michigan, 34 of which could not be used because they represented capsules rather than flowers, or because the view was not adequate. 19 were referred to f. *trifida* and 43 to f. *verna*. The period of these observations is 2011 to 2022 with most between 2020 and 2022.

As in Ontario, both forms are widespread, but f. *verna* is again much more frequent (Figure 3). One or the other form seems to predominate in local areas. As in Ontario, f. *verna* is more frequently present than expected along the Lake Superior shore.

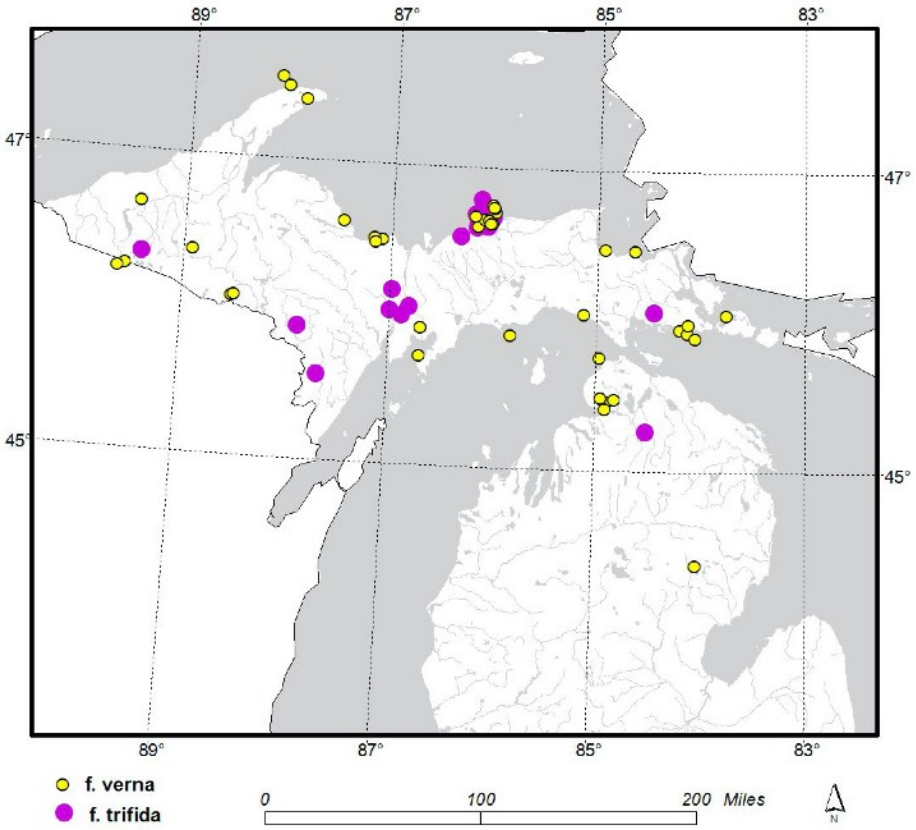

Figure 3. Distribution of the spotted lip (f. *trifida*), and unspotted lip (f. *verna*) colour forms of Early Coralroot (*Corallorhiza trifida*) in Michigan. The map is based on 96 iNat. observations, 34 of which could not be used. The map includes 19 referred to f. *trifida,* and 43 referred to f. *verna*.

Conclusions

The lack of a substantial difference in geographic distribution reported here makes recognition at the level of *forma* seem most appropriate. It does not mean that these forms are not of interest and should not be recognized at all. Understanding species means understanding the variation within species, and these two forms are interesting variants that remain to be explained.

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MICHIGAN'S UPPER PENINSULA

NATIVE ORCHID CONFERENCE SYMPOSIUM, JULY 2023

By Rick Burian, bur.rick@att.net

The 2023 Native Orchid Conference symposium was held in the Upper Peninsula region of the state of Michigan. The first two days used the campus of Northern Michigan University in Marquette for lectures, our annual meeting and social gatherings. On the third day participants traveled east to Sault Ste. Marie, stopping along the way at sites to observe orchids. Days four and five were based in Sault Ste. Marie at the campus of Lake Superior State University where we primarily took field trips to the west and south of the city.

https://www2.dnr.state.mi.us/publications/pdfs/harbor_guide/UP_Map.htm

The Upper Peninsula of Michigan—also known as Upper Michigan or colloquially the UP—is the northern and more elevated of the two major landmasses that make up the U.S. state of Michigan; it is separated from the Lower Peninsula by the Straits of Mackinac. It is bounded primarily by Lake Superior to the north, separated from the Canadian province of Ontario at the east end by the St. Marys River, and flanked by Lake Huron and Lake Michigan along much of its south. Although the peninsula extends as a geographic feature into the state of Wisconsin, the state boundary follows the Montreal and Menominee rivers and a line connecting them.

(https://liveinmichigan.org/attractions/michigan-upper)

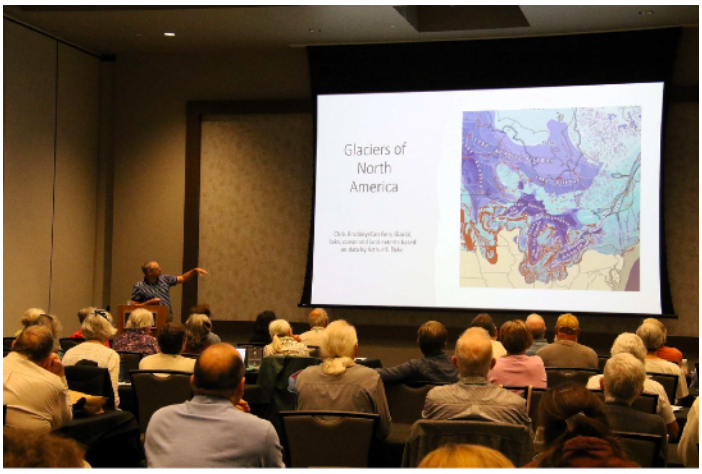
Our symposium was held in the beautiful Northern Center, a 25,000 square foot event space that was renovated in 2019. The ballroom can accommodate 1,000 guests. We had authors James Paquette (who also presented) and Erica Hannickle selling and signing books. Smithsonian Environmental Research Center/North American Orchid Conservation Center also had a display with *Orchid-gami* available for attendees.


Credit: Northern Center at Northern Michigan University Facebook page

Socializing at the reception on our first evening of the conference.

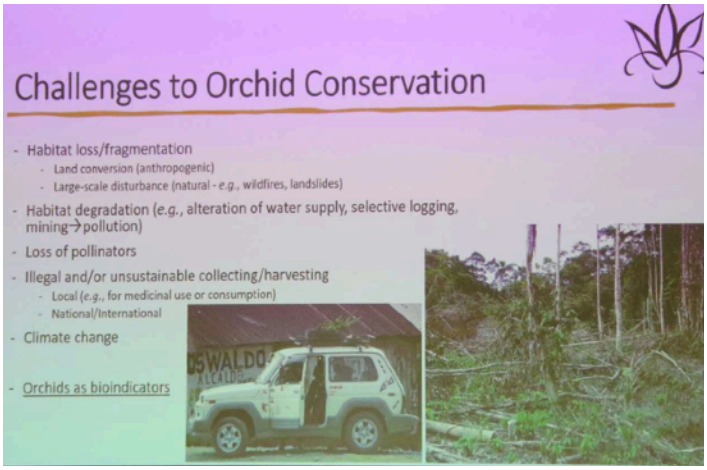
We had over 100 registrants at the symposium.
Registration fees covered the evening reception as well as three breakfasts and two lunches.

Our first talk was an introduction to the geology of northern Michigan by Ian Gannon (left).
Our second presentation was by Brad Slaughter (right) who discussed plant communities of the peninsula.

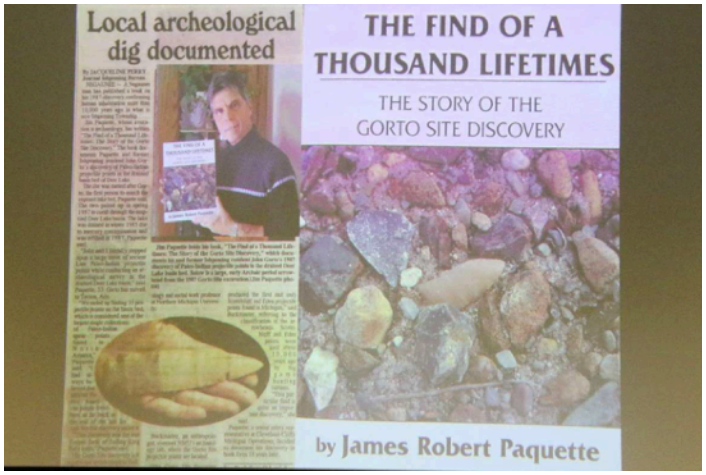


The annual membership meeting is a requirement of our bylaws. Updates from committees, a "state of the union" message and elections for officers and directors are held. Bob chaired the meeting, Dick gave the treasurer's report and Doug reported on the Case grants.

Ron Kaufmann, American Orchid Society conservation committee chair (left) and Jay Balchan AOS president (center) reported on efforts of the AOS in conservation. Collaboration between the NOC and AOS and other groups is important to get things accomplished.



Local resident James Paquette spoke about discovering Native American archaeological tools in the UP.



Hope Brooks from the Smithsonian Environmental Research Center (SERC) talked about her work on the small whorled pogonia, *Isotria medeoloides*.

The second day of presentations started with talks from Ida Hartvig and Melissa McCormick from SERC who spoke on species and hybrids in the fringed orchid complex.

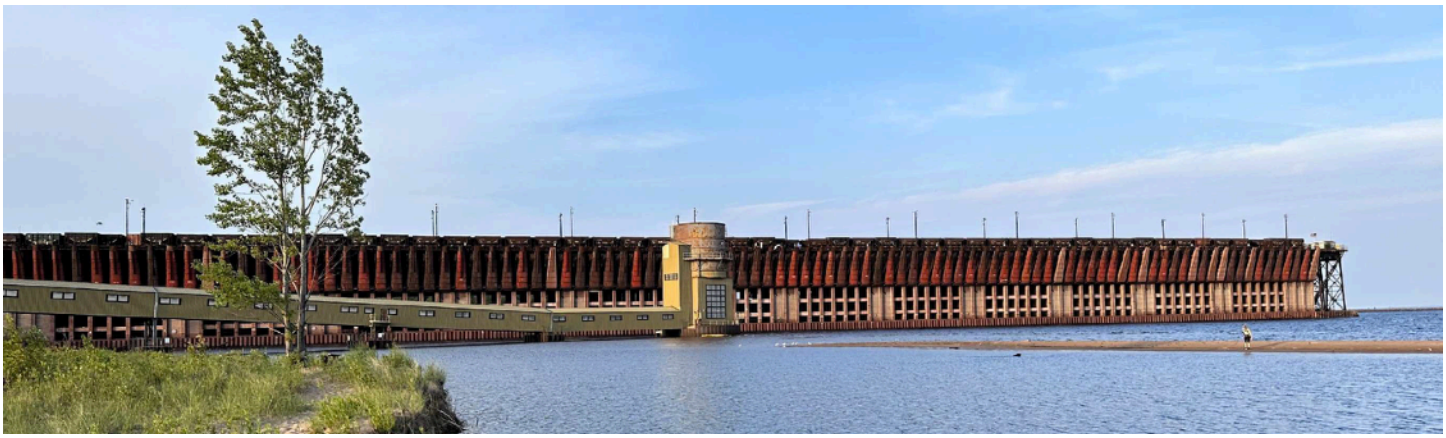
Ken Cameron discussed the impact of climate change on orchids of the Midwest and potential conservation strategies

Kevin Allen, a Case grant recipient, discussed seed germination in the genus *Platanthera*.

Larry Zettler told us about bringing the enigmatic ghost orchid of the Florida swamps to the Chelsea flower show in England.

Socializing during breaks.

Field trip planning.
A giant thank you to Bob Sprague and Amy Levengood for their tireless efforts to organize the conference.
And special recognition to Steve Baker for coordinating the field trips and providing local guides.
Sincere appreciation to trip coordinators: Rob Routledge and Adrienne Bozic and to the guides:
Quinn Sommer, Sara Kelso, Sarah Reding, Brad Von Blon, Jeff Sommer,
Erica Viau, Maddie O'Donnell and Elise Desjarlais.



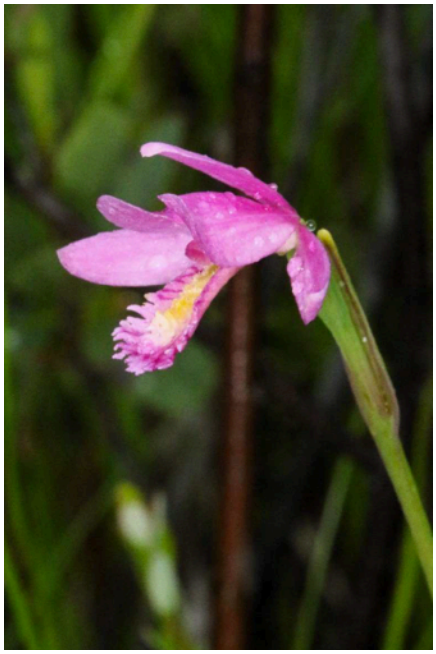
While staying in Marquette, some of us visited the Presque Isle dock. The dock, also known as the Upper Harbor ore dock, was built in 1912 and is still in use today. Each year approximately 9.5 to 10 million tons of ore are shipped from this dock; most of the pellets go to Algoma Steel in Sault Ste. Marie, Ontario, the largest integrated steel mill. These pellets, which are roughly 70% iron, will be combined with coke and limestone at the mill to make steel. Next to the ore docks is a nature walk where we found some orchids including *Liparis loeselii*, Fen Orchis or Loesel's twayblade.

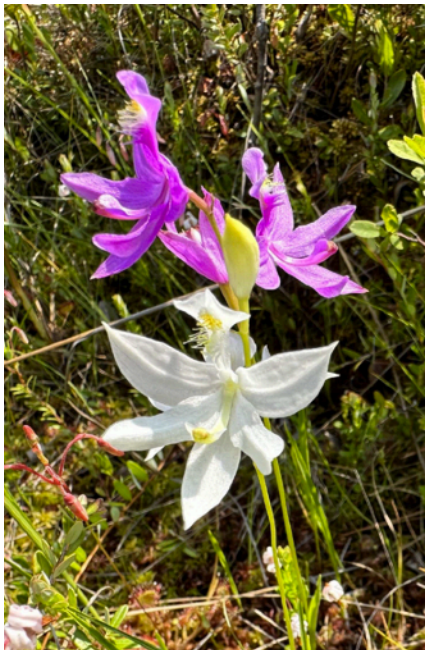
Just northwest of the city of Marquette are the Huron Mountains, remnants of eroded and glaciated taller ancient Precambrian formations. The tallest is Mt. Arvon which is the highest point in the state of Michigan at 1,979 feet (603 m) above sea level. Some of us climbed Sugarloaf Mountain which is just about 1,000 feet high for amazing views, even as the fog rolled in, of the lake, forested areas and other peaks in the range. At the summit is a stone obelisk erected long ago by Boy Scout Troop 1 to commemorate their assistant scoutmaster Bartlett King. King had helped to establish the local troop, which is one of the claimants of first Boy Scout Troop in the U.S. He later fought and died in World War I and his troop members constructed a memorial that his mother could see from her home on Marquette's Arch street.

Though not an official field trip site, many participants visited the Wetmore Pond which was near Sugarloaf Mountain. The beautiful pond and fen was reached by a 3/10th mile trail through hardwood forest. A rocky outcropping gave a wonderful view down onto the pond.

We did a little trail work near the edge of the pond to make it safer to enter the wetlands (bottom left). The fen was home to several orchid species…



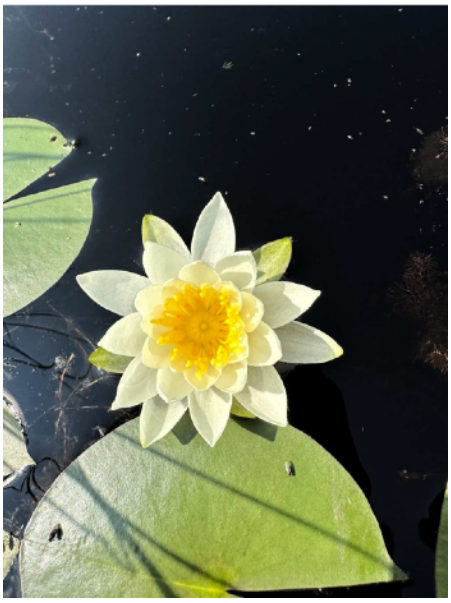


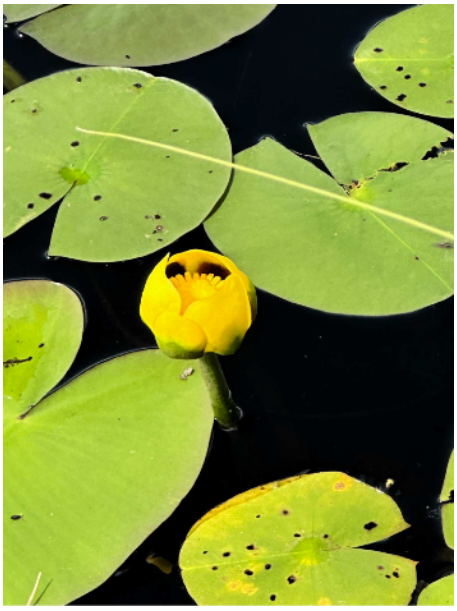


Arethusa bulbosa, dragon's mouth (top left); *Pogonia ophioglossoides*, rose pogonia (top right); and *Calopogon tuberosus,* grass pink (bottom right). The less common white form is striking and a treat to find.

…and other amazing plants.







Iris versicolor, Northern blue flag (top left); *Drosera intermedia*, spoon-leaved sundew (top right); *Nymphaea odorata,* American white waterlily (bottom left); *Utricularia cornuta*, horned bladderwort (bottom center); *Nuphar lutea* subsp. *variegata,* the variegated water-lily (bottom right).

Kirtland's warbler (*Setophaga kirtlandii*) is also known in Michigan by the common name jack pine bird, or the jack pine warbler. Nearly extinct just 50 years ago, populations have recovered due to conservation efforts. It requires large areas, greater than 160 acres (65 hectares), of dense young jack pine for its breeding habitat. This habitat was historically created by wildfire, but today is created through the harvest of mature jack pine, and planting of jack pine seedlings. The population of the species spends the spring and summer in their breeding range in the Great Lakes region of Canada (Ontario) and the United States (Wisconsin and Michigan, especially in the northeastern Lower Peninsula), and winters in the West Indies. A few of us got up extra early to visit a forest known for a few of these rare birds and we did hear them singing but they were hiding so couldn't be seen. Lucky glimpse of the warbler (top right, photo by Pauline Catling).

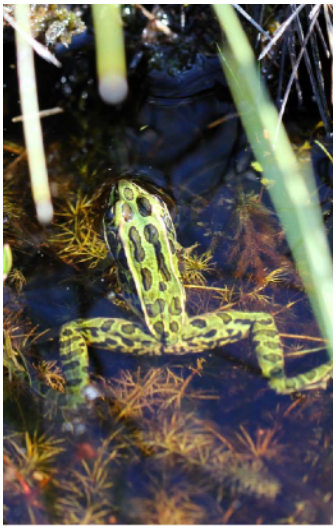
After our stay in Marquette everyone headed east on M28, skirting the southern shore of Lake Superior and passing through the town of Christmas (left). We then headed south to Shingleton, our first of several stops on our way to Sault Ste. Marie where we spent the next three nights. About half of the group stopped at a hidden patterned fen in the Lake Superior state forest. Lots of mosquitoes greeted us as soon as we parked our cars.

A patterned fen or string bog is a shrub- and herb-dominated peatland mosaic characterized by a series of peat ridges (strings) and hollows (flarks) oriented parallel to the slope of the landform and perpendicular to the flow of groundwater. The strings vary in height, width, and spacing, but are generally less than one meter tall, resulting in a faint wave-like pattern that may be discernable only from aerial photographs. The flarks are saturated to inundated open lawns of sphagnum mosses, sedges, and rushes, while the strings are dominated by sedges, shrubs, and scattered, stunted trees. Patterned fens occur in the eastern Upper Peninsula.

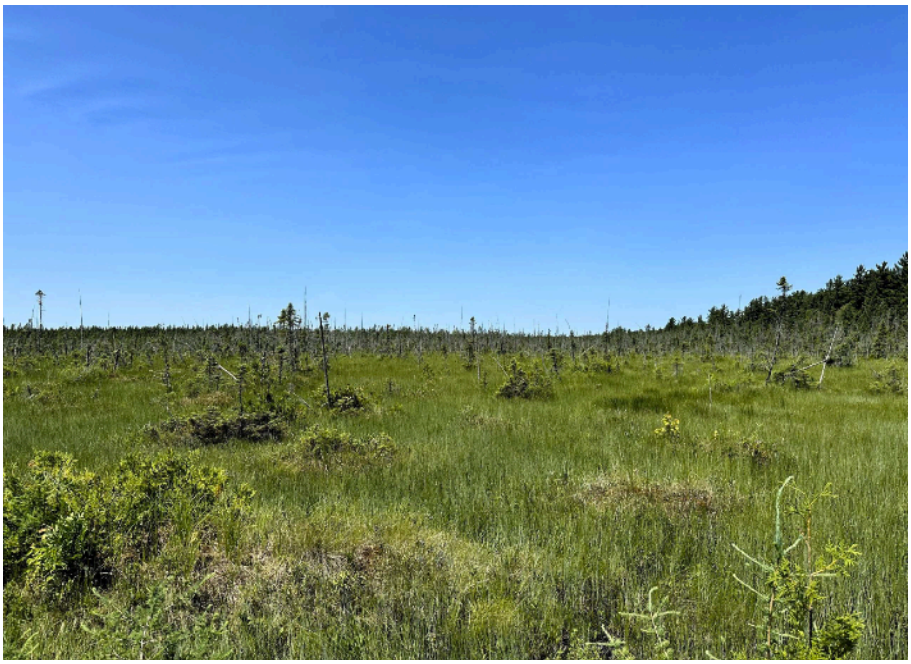
(https://mnfi.anr.msu.edu/communities/description/10669/patterned-fen)

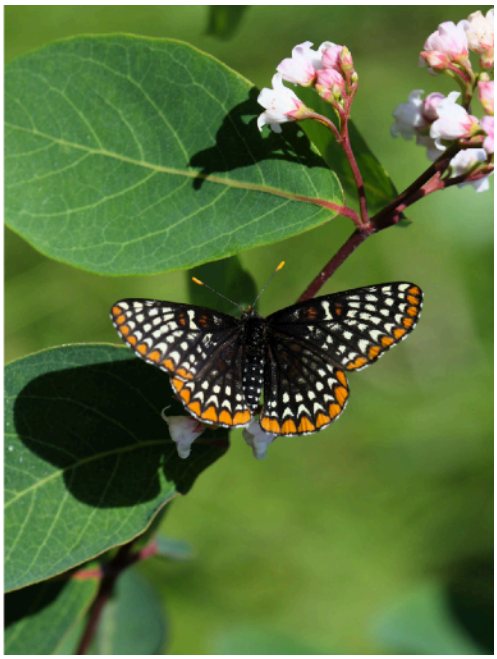




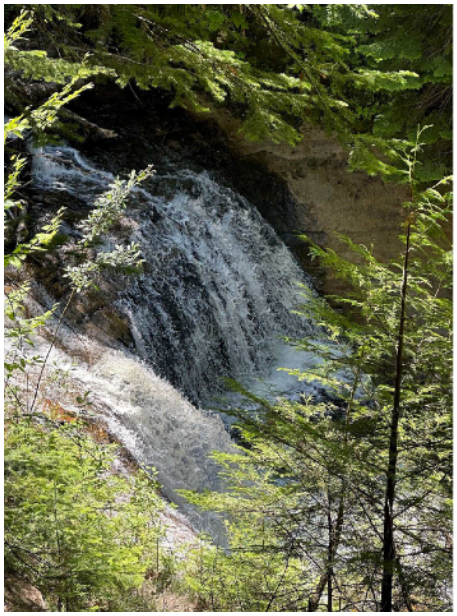
Platanthera lacera, ragged fringed orchid (top left); *Triantha glutinosa,* sticky bog asphodel (top center); the less common white form of *Pogonia ophioglossoides*, rose pogonia (top right); Bill and Dorothe Kress taking photos in the fen (bottom left); *Thamnophis sirtalis sirtalis*, Eastern garter snake (bottom center); *Lithobates pipiens*, Northern leopard frog (bottom right).





The other half of the participants stopped along an old train track where the draw was *Cypripedium reginae*, the showy lady's slipper orchid (top right and bottom left). Also found there was the Baltimore checkerspot, *Euphydryas phaeton* (bottom right). It is the state insect of Maryland and has seen significant decline in its population so is now considered rare and threatened.

Both groups then headed north up to the lake near Grand Marais where we had three stops for orchids. A peek at Sable falls (center), a 75 foot cascade over Munising and Jacobsville sandstone formations in the easternmost portion of the Pictured Rocks National Lakeshore. Dune plants included *Tanacetum bipinnatum* ssp. *huronense*, Lake Huron tansy (left) and *Lathyrus japonicus*, beach pea (right).



A view of the lake shore to the west of Log Slide and the Au Sable lighthouse is in the distance (left). The steep slope held a wooden chute where loggers would slide the cut trees down to the lake where they were floated to mills in Grand Marais. The enormous Grand Sable Dunes (right) were left by glacial action and are located at the eastern end of the park. Five square miles of Grand Sable Dunes are perched atop the 300-foot high Grand Sable Banks. A portion of the Grand Sable Dunes is set aside as a Research Natural Area.





Neottia convallarioides, broad leaved twayblade, (top left) was found in the very sandy soil of the cliffs often growing among *Toxicodendron radicans*, poison ivy. Other orchids growing in the area were *Dactylorhiza viridis,* frog orchid (top center); *Neottia cordata,* heart leaved twayblade (top right); *Platanthera hookeri,* Hooker's bog orchid (bottom left)…

...*Platanthera aquilonis*, north wind bog orchid (top left) and *Platanthera macrophylla,* large round leaved orchid (bottom center). The basis for giving this taxon species rank was elaborated by NOC members Joyce and Allan Reddoch in 1993.





Other orchids growing at Pictured Rocks National Lakeshore were *Corallorhiza maculata*, spotted coralroot (top left); *Spiranthes lacera,* slender ladies' tresses (top center); *Corallorhiza striata,* striped coraloot (top right); and *Goodyera tesselata,* checkered rattlesnake plantain (bottom left). *Limenitis arthemis* ssp. *arthemis,* the white admiral (bottom right) is a forest butterfly found throughout the eastern United States, southern Canada and west into the Rocky Mountains.




Grand Sable Lake (top left) lies inland of the dunes. Continuing east we got a beautiful view of Lake Superior from the town of Grand Marais (top right). The Tahquamenon Falls are a series of waterfalls on the Tahquamenon River, shortly before it empties into Lake Superior, in the northeastern Upper Peninsula of Michigan. They are the largest waterfalls in Michigan, and one of the largest in the eastern half of North America. The Tahquamenon River drains the watershed of an area of more than 790 square miles. From its source, it meanders 94 miles before emptying into Whitefish Bay. The water is noticeably brown in color from the tannins leached from the cedar, spruce and hemlock swamps which the river drains, leading to the nickname "Root Beer Falls". The extremely soft water churned by the action of the falls causes the large amounts of foam, which has been the trademark of the Tahquamenon since the days of the voyager. The falls are divided into the Upper and Lower Falls. The Upper Falls (bottom right) consist of a single drop of approximately 48 feet (15 m), where the river is more than 200 feet (60 m) across. The falls take their name from the river, which appears to come from Tahquamenon Island in Whitefish Bay, near the mouth of the river; the first written record of the name identifies the island as "Outakouaminan" in a 1671 French map (wikipedia).

Sault Ste. Marie is the second largest city on the UP with a population of around 16,000. Sault is pronounced as "soo." It is home to Lake Superior State University which began in 1946, originally as a branch of Michigan College of Mining & Technology (left). It was known as Lake Superior State College until 1987, when the institution was granted university status. The area that makes up the campus served as Fort Brady from 1894 to 1944. The institution was created to address the needs of returning World War II veterans and to provide educational opportunities to the people of the Eastern Upper Peninsula. The 115-acre (0.47 km2) campus includes several buildings which are listed in the National Register of Historic Places. The Walker Cisler center was our venue for our morning meeting (right).

Time to socialize over breakfast, catch up on the previous day's trip and to coordinate the field trips for the next two days. This was our only gathering as a group in Sault Ste. Marie.

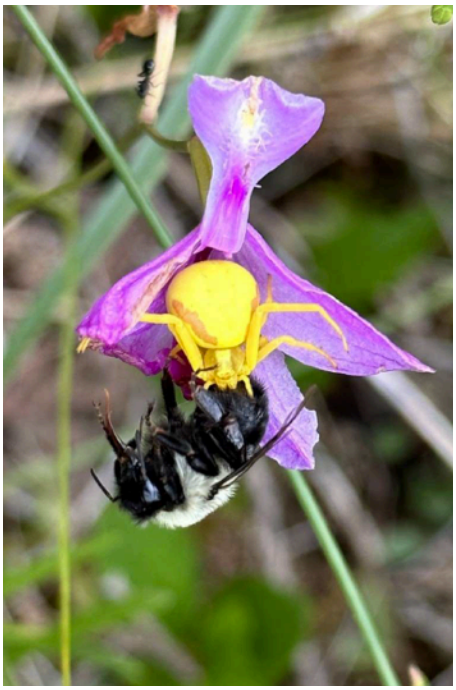
My group headed west of Sault Ste. Marie to a site along the lake where we found *Platanthera orbiculata,* round leaved orchid (top right and bottom left) and *Monotropa uniflora*, ghost plant or Indian pipe (bottom right). This plant is achlorophyllous and is mycoheterotrophic; that is, it utilizes fungi to obtain energy and nutrients.

Part of group 1 along the shore (above) and a stop at the Point Iroquois lighthouse on Whitefish Bay (below). The point marks the division line between Whitefish Bay and the western end of the St. Marys River, the connection between Lake Superior and other Great Lakes. Point Iroquois includes a larger geographic area than the light station site. It was named for the Iroquois warriors massacred there by the Ojibwe in 1662. The original lighthouse was built in 1856 but was replaced in 1870. The present Cape Cod style white brick lighthouse was built and ran continuously for 93 years, guiding ships in and out of the Soo Locks. It has a 65-foot (20 m) tower height, and a focal plane that is variously reported as 68 or 72 feet (21 or 22 m). In 1905, a two-floor extension was added to the 1871 building, providing living space for another assistant keeper, bringing the staff to three lighthouse keepers. At peak operation, the station was manned by a Head Keeper and two Assistant Keepers. The children of the keepers and local fisherman were enough to populate a local school on the grounds for a period. The station was deactivated in 1962 yet the light quarters and light were completely renovated in 1993 and the buildings are on the National Register of Historic Places (wikipedia).

Summerby Swamp is a large alkaline wetland complex exhibiting a very intact Northern Fen community. It contains numerous plants commonly found in alkaline wetlands as well as protected species. It is at 630 feet (192 meters) above sea level, about 8 miles north of the southern border of the UP above Lake Michigan. *Goodyera repens,* dwarf rattlesnake plantain (left); *Goodyera oblongifolia,* giant rattlesnake plantain (center); *Platanthera obtusata*, blunt leaved bog orchid (bottom right); *Lithobates sylvatica*, wood frog (top right) is found in deciduous, coniferous, and mixed forests, marshes, meadows and swamps. It spends most of its time on the ground in woody areas except for during mating season when it is found in breeding pools.

Epipactis helleborine, broad-leaved helleborine (top left) is an introduced species (possibly as a cure for gout) with origins in Europe, Asia and North Africa. It has become invasive in parts of North America and is now known as the weed orchid. The unusual hypochromic plant (top right) does not photosynthesize and doesn't produce nectar so probably won't get pollinated. *Cirsium palustre*, European swamp thistle, is an invasive species that can reach over six feet in height, especially in shaded woods, as demonstrated by Duane. Other orchids found in the area were *Spiranthes romanzoffiana*, hooded ladies' tresses (bottom center) and *Malaxis unifolia,* green adder's mouth (bottom right).

Part of Summerby consists of marl ponds. Marl is an earthy material rich in carbonate minerals, clays, and silt. It is a common sediment in post-glacial lakes, such as the marl ponds of the northeastern United States. *Pinguicula vulgaris*, common butterwort (bottom right), a carnivorous plant, was abundant along the edges of this wetland. *Calopogon tuberosus,* grass pink orchid (top right and bottom left) also liked the fen and some *Misumena vatia*, goldenrod crab spiders, used their usual m.o. of hiding in flowers to ambush unsuspecting insects. These critters change colors from white to yellow and back again, in order to camouflage on different flowers. They especially like to hide on *Solidago*, goldenrod, hence their name.



Ryerse Lake occupies a shallow depression in an area of gentle morainic and kamic topography; sandy soils with scattered limestone and dolomite boulders. The elevation of the lake is 850 feet (259 meters) above sea level. The area surrounding the lake is sphagnum moss bog up to the forest edges. Boots are required gear. It is easy to sink up to your knees in the wet bog around the edges of the pond. *Sarracenia purpurea*, purple or northern pitcher plant (bottom right), is a common resident of the bog, as well as *Utricularia cornuta*, horned bladderwort (top left).

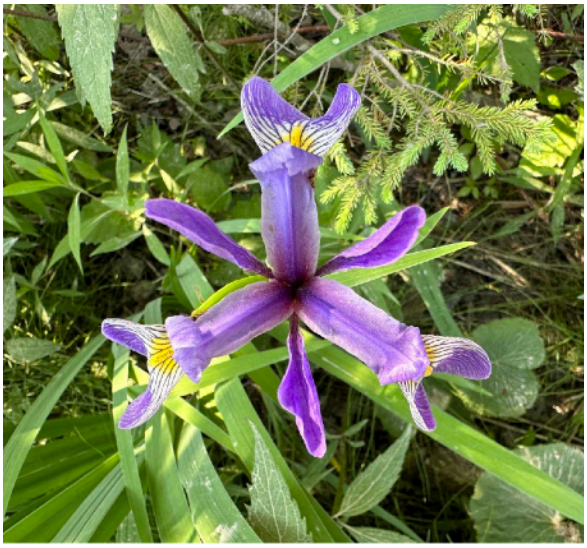





The orchids that we found at Ryerse Lake included *Pogonia ophioglossoides,* rose pogonia (top left); *Platanthera clavellata,* club spur orchid (top center); *Platanthera huronensis,* Lake Huron bog green orchid (bottom left); *Platanthera dilatata,* tall white bog orchid (bottom center); and *Arethusa bulbosa*, dragon's mouth (bottom right). Brad Von Blon, one of our field trip guides (top right).



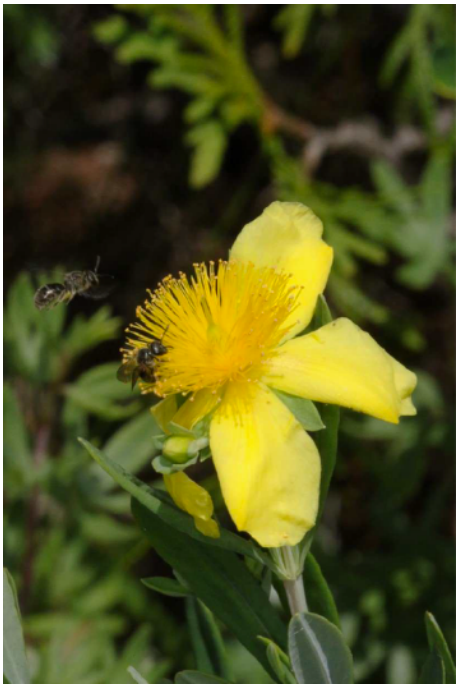




Our second day of field trips out of Sault Ste. Marie took us about an hour south to cross the Mackinac bridge and leave the Upper Peninsula. Our first stop was Cheboygan State Park, a public recreation area covering 1,250 acres (510 hectares or 2 square miles) on the shores of Lake Huron in Cheboygan County. The highlight there was *Platanthera psycodes*, lesser purple fringed bog orchid (top center and right) which came in an array of beautiful purple and bright to pale pink colored flowers. Also growing in the area were *Verbena hastata*, blue vervain (top left); *Mimulus ringens,* Allegheny monkey flower (bottom left); and *Iris versicolor*, northern blue flag (bottom right).

Little Traverse Conservancy's Wendy O'Neil Memorial Nature Preserve near Cheboygan covers 204 acres of forest, bogs and lake. The land was purchased in 1999 in memory of Wendy O'Neil, a passionate northern Michigan conservationist. To access the bog and lake one must hike through the forest on a narrow boardwalk (bottom right). *Asclepias incarnata*, the swamp or rose milkweed or white Indian hemp (bottom left) grew along the edge of the lake. The flower color varies from darker shades of purple through soft, pinkish purple, and a white flowering form exists. The featured orchid here is *Platanthera blephariglottis,* white fringed bog orchid (top left and right).

Back on the Upper Peninsula we headed east along the shore of Lake Huron to Bush Bay. This area is one of the most spectacular limestone bedrock shorelines in Michigan. The Port Dolomite quarry is across the bay. A lakeside trail called the Narnia trail is where we stopped to look for orchids. Here we found and photographed *Platanthera unalascensis*, Alaska orchid (below).





Our last stop was at a Nature Conservancy preserve further east along the lake near Dudley and Stevenson bays. Carl A. Gerstacker Nature Preserve protects a large expanse of contiguous forest on and near the Lake Huron shoreline to support migratory birds on their journey north and south, as well as safeguard other rare plants and animal species. The highlight of this site was a large population of *Platanthera huronensis*, Lake Huron bog green orchid (top center). We also saw *Hypericum kalmianum*, Kalm's St. Johnswort (top left); *Drosera rotundifolia,* round-leaved sundew (bottom left); and *Hemaris diffinis,* snowberry clearwing on *Apocynum androsaemifolium*, spreading dogbane (bottom right).

Orchid species observed during the symposium (according to Steve Baker):

Arethusa bulbosa	Dragon's-mouth
Calopogon tuberosus	Common Grass Pink
Corallorhiza maculata	Spotted Coralroot
Corallorhiza striata	Striped Coralroot
Corallorhiza trifida	Early or Northern Coralroot (not in flower)
Cypripedium acaule	Pink Lady's-slipper
Cypripedium arietinum	Ram's Head Lady's-slipper (not in flower)
Cypripedium parviflorum var. *pubescens*	Large Yellow Lady's-slipper (not in flower)
Cypripedium reginae	Showy Lady's-slipper
Dactylorhiza viridis (*Coeloglossum viride*)	Frog Orchid
Epipactis helleborine	Helleborine (not in flower)
Goodyera oblongifolia	Giant Rattlesnake Orchid (not in flower)
Goodyera pubescens	Downy Rattlesnake Orchid (not in flower)
Goodyera repens	Lesser Rattlesnake Orchid (not in flower)
Goodyera tesselata	Checkered Rattlesnake Orchid (not in flower)
Liparis loeselii	Fen Orchis, Loesel's Twayblade
Malaxis brachypoda	White Adder's-mouth
Malaxis unifolia	Green Adder's-mouth
Neottia convallarioides	Broad-leaved Twayblade
Neottia cordata	Heart-leaved Twayblade
Platanthera aquilonis	Northern Bog Orchid
Platanthera blephariglottis	Northern White-fringed Orchid
Platanthera clavellata	Club-spurred Orchid
Platanthera dilatata	Tall White Bog Orchid
Platanthera hookeri	Hooker's Orchid
Platanthera huronensis	Green bog Orchid
Platanthera lacera	Ragged-fringed Orchid
Platanthera macrophylla	Goldie's Pad-leaved Orchid
Platanthera obtusata	Blunt-leaved Orchid
Platanthera orbiculata	Pad-leaved Orchid
Platanthera psycodes	Small Purple-fringed Orchid
Platanthera unalascensis	Alaskan Piperia
Pogonia ophioglossoides	Rose Pogonia
Spiranthes lacera	Northern Slender Ladies'-tresses
Spiranthes romanzoffiana	Hooded Ladies'-tresses

HOW SOME NORTH AMERICAN TEMPERATE ZONE ORCHIDS SURVIVE WINTER

By Katharine B. Gregg, gregg@wvwc.edu

Like most tropical orchids, North American temperate zone orchids are perennials, often living for decades. Except for two genera that produce winter-green leaves (*Aplectrum* and *Tipularia*), all are summer-green plants that die back in the fall. With one exception that will be revealed later, they survive winter underground and emerge again each spring from perennating buds that were produced in late summer or fall of the previous year. A variety of specialized overwintering structures protect and sustain the perennating buds, and some actually produce them. These may be fibrous fleshy roots, tuberoids (thickened structures with both root and stem tissue), or more slender roots with a vertical, underground stem. They can also be horizontal underground stems called rhizomes, tubers (thickened underground stems), or corms (compact, swollen underground stems). Fibrous roots (all the same size as opposed to taproot systems), tuberoids, and rhizomes are most common (Romero-González *et al*. 2002). These structures often harbor mycorrhizal fungi that supply nutrients when plants are not aerial (Rasmussen 1995). A less common overwintering structure in the temperate zone is a green, thickened, above-ground stem called a pseudobulb that is adapted for storage and photosynthesis, as well as water and nutrient transport. Pseudobulbs are extremely common in tropical epiphytic orchids but are rare in northern regions. Both Luer (1975) and Romero-González *et al*. (2002) state that pseudobulbs are aerial and corms are subterranean, although these definitions are not always followed in some of their species descriptions. Luer (1975) further describes corms as pearly white. Here we will consider pseudobulbs to be green and aerial, while corms are pearly white, underground structures. Although seeds, which are dispersed in the fall, do survive winter to sprout in the spring (Rasmussen 1995), here they will not be considered over-wintering structures, that is, those that enable perennials to persist year after year.

Romero-González *et al.* (2002) listed some 129 species in 27 genera of temperate zone summer-green orchids in North America; 18 species in five genera have corms and only one genus, Liparis, with two species has pseudobulbs. Species of the two winter-green orchid genera, *Tipularia* and *Aplectrum*, have corms as underground storage organs. Their leaves emerge in the fall and persist through spring, with blooms appearing after leaves disappear. Thus, for these species, the corms serve as "oversummering" structures. Our temperate zone orchids probably display the full gamut of overwintering structures. In this article I will describe the structures of five species and two genera with which I am familiar. My experience with native orchids has been largely in West Virginia, and all but one of my photographs have been taken within this state. Thus, I expect that the timing of some of the life history events described here may differ somewhat in other locales; however, I would also expect that the basic story for each species or genus would be similar.

Cleistesiopsis bifaria, formerly *Cleistes bifaria*, is commonly called the spreading pogonia. It occurs primarily in the Appalachian Mountains, from northern Alabama and Georgia, northwest into middle Tennessee and Kentucky, as far north as northcentral West Virginia, and east into South Carolina, North Carolina, and Virginia (Kartesz 2015). Plants are typically found in open meadows, forest edges, and open woods. Vegetative plants

can have one, two, or three bluish-green leaves, and flowering stems typically have one leaf and one floral bract. Flowers sport three erect or reflexed, green to maroon sepals (Fig. 1a). Two pink petals fold around a pale pink to white labellum with maroon veining and often a yellow, false pollen spot near the apex that fools pollinators in search of pollen (Gregg 1991). Starch-filled, succulent roots emerge at right angles to an underground vertical short rhizome (Gregg 1989; Fig.1b). The next spring's shoot bud, i. e., the perennating bud, is often a stunning rose color and about 1 cm high; it is borne at the base of the current year's stem and sits just below the soil level (Gregg 2011; Fig. 1c). In addition to serving as overwintering structures, the roots of this genus, as well as closely related *Isotria* and *Pogonia*, can produce root shoots (Dressler 1981) that can arise at some distance from the original plant. If the root in between the two shoots is damaged, you get two plants for the price of one.

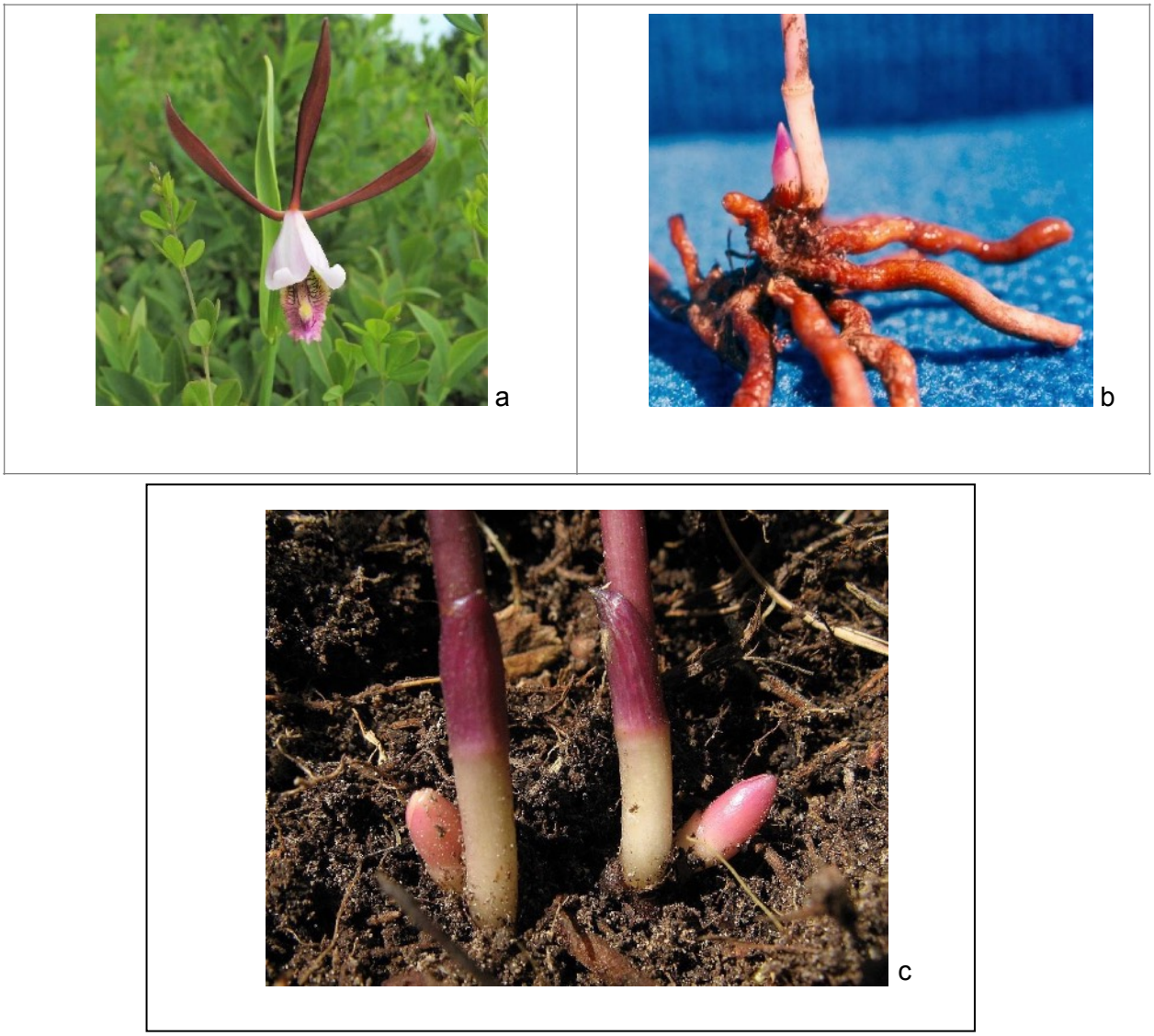


Figure 1. *Cleistesiopsis bifaria*. In b, the perennating bud sits to the left of the current year's flowering stem. The short vertical rhizome from which the roots arise is obscured (see Fig. 2b for a clearer view of a similar rhizome). c, Perennating buds in mid-September, just beneath the soil, of two flowering stems connected by an underground, horizontal rhizome.

Neottia smallii, the kidney-leaved twayblade (formerly in the genus *Listera*) is narrowly distributed in the Appalachian Mountains. It inhabits mountains from north Georgia through central Pennsylvania, and into northern New Jersey (Kartesz 2015) and can live at altitudes to 4,000 feet (Correll 1950). In West Virginia, it is found growing in sphagnum moss beneath species of *Rhododendron*, under a canopy of hemlock. Plants may also be found in humus of shady coniferous forests, and in sphagnous bogs (Correll 1950, MacGrath & Coleman 1993+). Plants are generally small and slender, up to 34 cm in height, with two green kidney-shaped leaves opposite each other about mid-way up the flowering stem, which bears greenish-pinkish-brown flowers with a two-lobed labellum (Fig. 2a). Like *Cleistesiopsis*, this plant overwinters as succulent roots arising at right angles from a vertical underground rhizome (Fig. 2b). By late summer, the plant produces a perennating bud approximately 1 cm high (Fig. 2b). In closely related *N. ovata*, fibrous, somewhat succulent roots extend from a short rhizome (Zhou and Jin 2018) and may live up to 10 years (Rasmussen 1995).

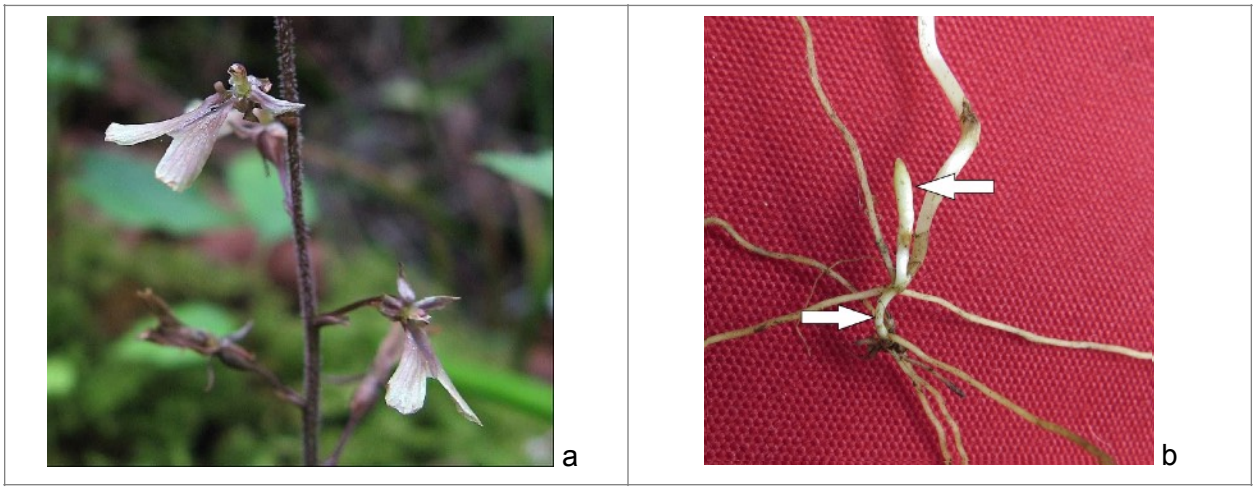


Figure 2. *Neottia smallii*. Left-pointing arrow in b indicates perennating bud in mid-August; Right-pointing arrow, vertical rhizome.

Malaxis unifolia is called the green adder's mouth. It is widely distributed, occurring throughout middle and eastern North America, central and southern Mexico, northern Central America, Cuba, and Jamaica (Luer 1975). Habitats are extremely variable, from conifer swamps and dry, upland pine forests in Minnesota (Smith 2012), to moist forests in the southeastern United States or fully exposed in high altitude northern habitats (Luer 1975) to mixed forests over lava in Mexico, to clay soils, bogs, meadows, thickets, and grassy seeps elsewhere (Correll 1950). In West Virginia, it occurs along roadsides and in annually mowed open areas and meadows. The species occurs in a wide range of altitudes, from sea level in coastal areas, up to 2,000 feet in New England, 5,000 feet in the Appalachian Mountains and Jamaica, and up to 8,500 feet in Mexico (Correll 1950).

Green adder's mouth is a slender plant with inconspicuous inflorescences of tiny, green, tightly packed flowers (Fig. 3a) but may reach up to 55 cm in height (Correll 1950). The species is named for the single ovate leaf borne mid-way up flowering stems. Plants overwinter as pearly-white underground corms about 1.3 cm high

(Fig. 3b), that develop from the base of the aerial stem as fall approaches, soon after which the previous year's corm senesces and disappears. A few fibrous roots emerge just below the corms (Fig. 3b). The perennating bud is located at the base of the current year's corm and is hidden underneath a papery sheath (Fig. 3c,d).

Interestingly, Luer (1975, plate 84, photo 5) shows an individual of *Hammarabya* (*Malaxis*) *paludosa* (L.) Kuntz with a green pseudobulb. In the text, Luer remarks that "budding plantlets may sprout from the tips of detached leaves."

Figure 3. *Malaxis unifolia*. In b, is shown the underground portion of the plant in late June. The current year's developing corm is on the left, and the previous year's corm, on the right. Eight fibrous roots emanate from the base of this older corm. In a living plant, the older corm would senesce and disappear over the winter. In c, in mid-August, the current year's corm is on the far-left, with lower portion of the cut-off flowering stem pointing left. Its papery sheath is visible to its right. Farther right are the two halves of the sectioned previous year's corm. In your mind, roll the young corm up and to the right into its sheath, put the two halves of the older corm together, and roll everything together to see how the perennating bud becomes tucked between the two corms in the intact plant. In d, the tiny perennating bud is about 3 mm high by mid-August in West Virginia.

Liparis liliifolia, common name the large, or purple, twayblade, is fairly common throughout the northeastern United States north through Pennsylvania and west through Minnesota, Iowa, Missouri, and Arkansas; plants occur but are rare in New England and in northern areas of South Carolina, Georgia, and Alabama, with a few sites in southeast Oklahoma, Ontario, and Quebec (Environment Canada 2016, Kartesz 2015). Habitats, usually over slightly acidic, loamy soils, range from rich, mesic forests to floodplains to roadside banks, young successional forests, clearings in older forests, red cedar stands, oak forests, and pine plantations; however, plants typically prefer light shade and tend to disappear quickly when canopies close (Mattrick 2004, McClain 1968). In New England, disappearance of a population of some 30-70 plants took place in less than 10 years (Mattrick 2004). In West Virginia, a population of some 122 plants disappeared from a fairly open forest over a period of only 8 years (Gregg, unpublished).

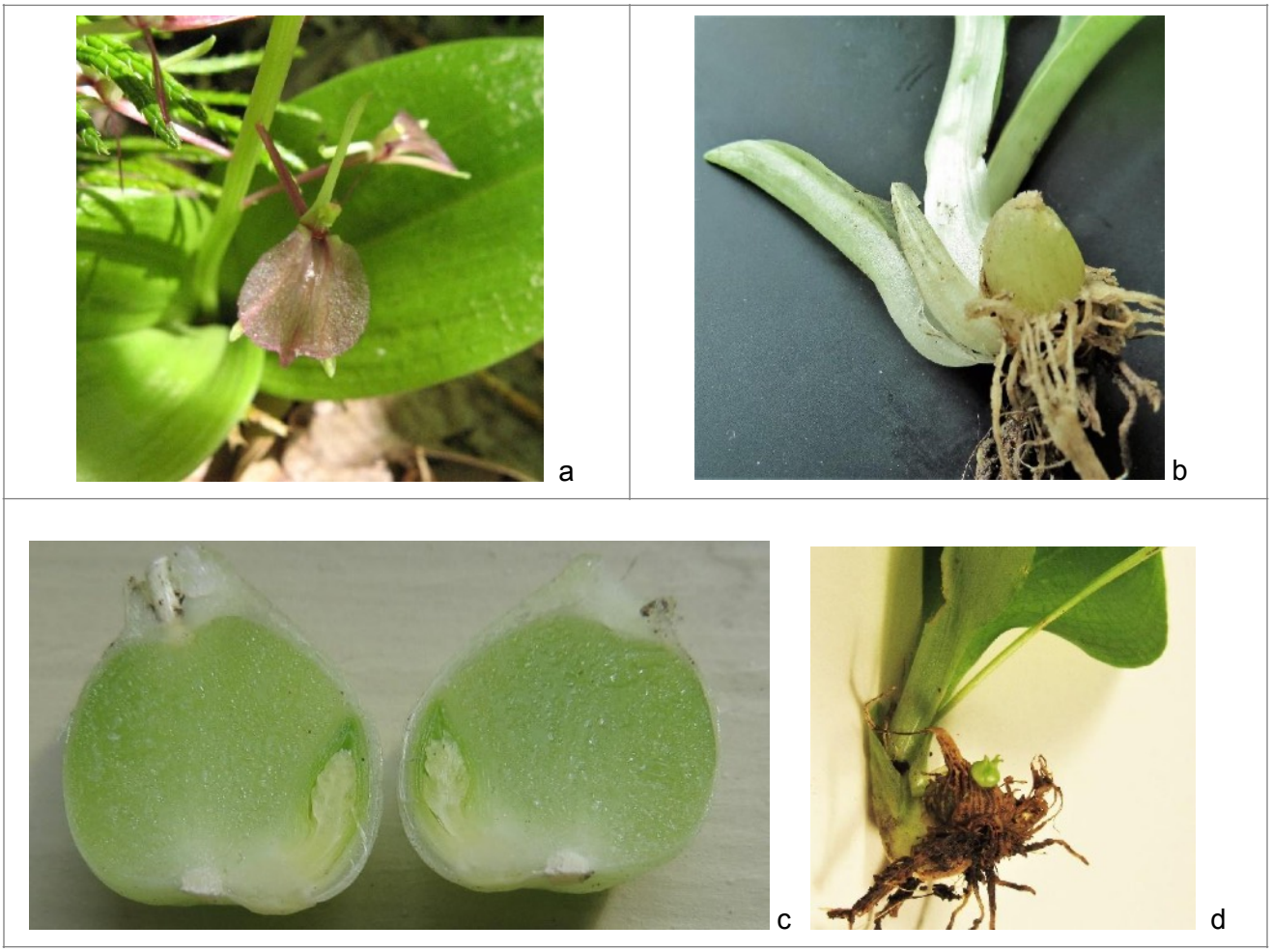


Figure 4. *Liparis liliifolia*. In b, in early September, the green pseudobulb from the previous year is to the right of the current year's leaves on the left. The current year's pseudobulb is hidden within the leaf sheaths of the fruiting stem (not visible) which arose at the base of the right-hand leaf. In c, are both halves of the current year's growing pseudobulb, showing the perennating bud with tiny leaf and flower buds already present by early September in West Virginia. d, Offset bud produced by older pseudobulb.

Mauve-colored flowers (Fig. 4a) are borne in an open arrangement along a stalk approximately 25 cm tall. Flowering plants produce two basal, elliptic to ovate, succulent, dark green leaves. Very young non-flowering plants may have only one leaf. Two pseudobulbs (Fig. 4b), are typically present, one from the previous year, with roots emanating from its base, and a newer one that produces the current year's plant from which, when reproductive, a flowering stalk arises. In Fig. 4c, you can see inside a sliced pseudobulb that there is already a new perennating bud, about 0.5 cm high, showing multiple baby leaves and tiny flower buds. The older pseudobulb and its roots die in autumn, leaving the new one to overwinter, with new roots appearing in spring (Whigham and O'Neill 1991). Occasionally, pseudobulbs produce tiny offsets that may dislodge and establish a new plant (Fig. 4d, Whigham and O'Neill 1991).

You may wonder whether plants of *Liparis* truly overwinter underground, since they have pseudobulbs, which by definition, are aerial structures. From my experience, I'd say that they overwinter just above-ground and covered by leaf litter (Fig. 5).

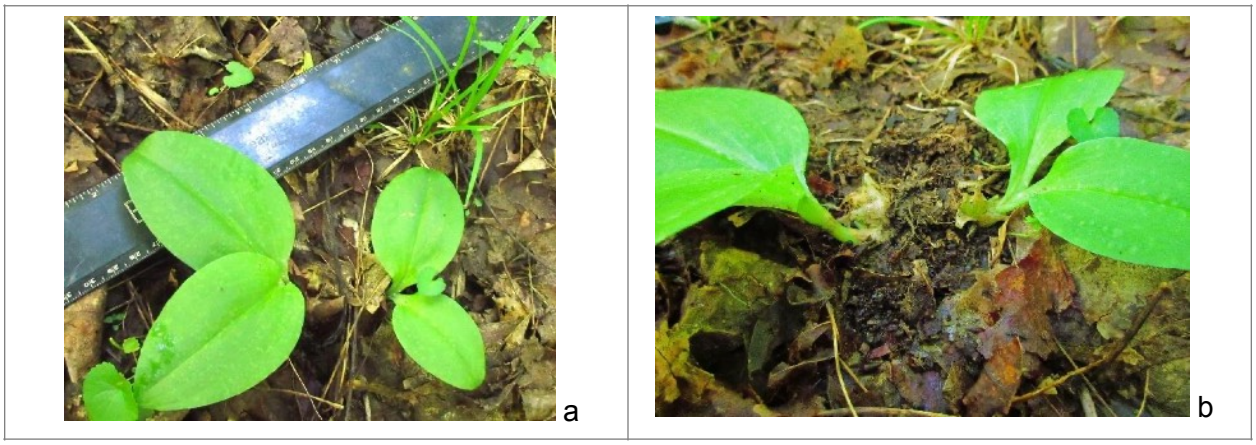


Figure 5. *Liparis liliifolia*. a, two plants growing on forest floor, pseudobulbs covered with leaf litter. b, Pseudobulbs visible after leaf litter has been brushed away.

Spiranthes lacera var. *gracilis,* common name, slender ladies' tresses, has a broad distribution throughout the eastern half of the United States and a bit into Ontario and Nova Scotia; habitats are variable, from open woods to mowed meadows, fields, and prairies, to roadsides and lawns (Romero-González *et al*. 2002). Stem leaves are absent at flowering time, plants are glabrous, and flowers are borne in tight spirals. Petals and sepals are white, and there is a distinctive green to greenish-yellow splotch in the center of the labellum (Fig. 6a). As a genus, lady's tresses have thickened roots that serve as storage reserves as well as overwintering structures. Some have sprawling roots, while others, like *S. lacera* var. *gracilis*, have fascicled, or clustered roots (Fig. 6b). This variety of *S. lacera* flowers in West Virginia in late summer to early fall. At that time, new perennating buds are already present but quite small (Fig. 6b).

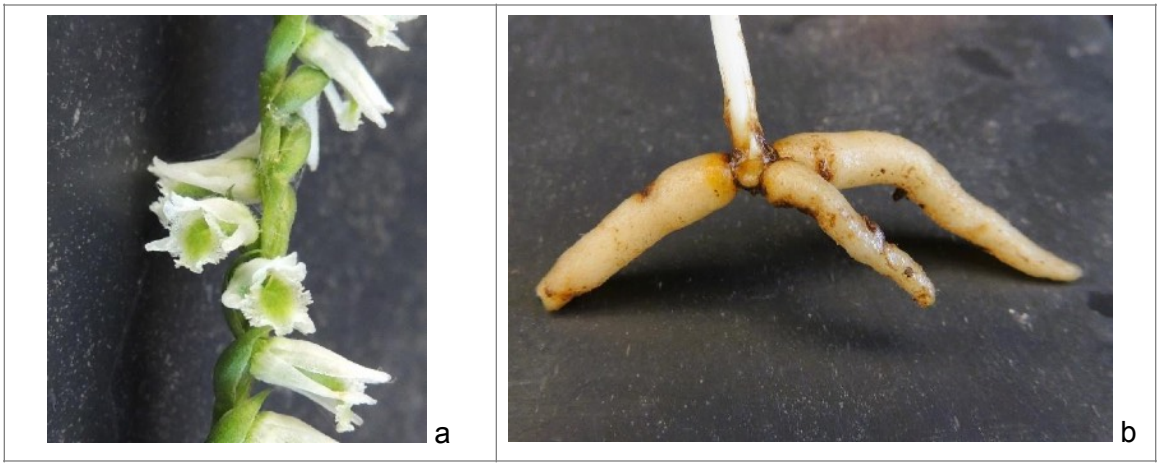


Figure 6. *Spiranthes lacera* var. *gracilis*. In b, in early September, a 1.5-mm tall pearly-white perennating bud for the next season's growth appears at the stem base, just above three thick, fascicled roots. There was a second tiny bud on the opposite side of this stem, indicating that plants are capable of clonal reproduction.

Numerous species of *Platanthera* are found in North America. Their flowers come in a number of colors: green, greenish-white, white, orange to yellow, and pink to purple (Fig. 7a) and live in many different habitats. Orchids in this genus overwinter with thick, fleshy, clustered stem-root combinations that are often enlarged into a single tuberoid (Fig. 7b), as shown here for *P. lacera*. New growths arise from the tuberoid (Fig.7b) and emerge in the spring. According to Dressler (1981), the tuberoids of the tribe Orchideae, to which *Platanthera* belongs, are unusual because they are mainly root tissue but with a section of stem that produces the apical bud; an axillary bud then forms the next season's tuberoid.

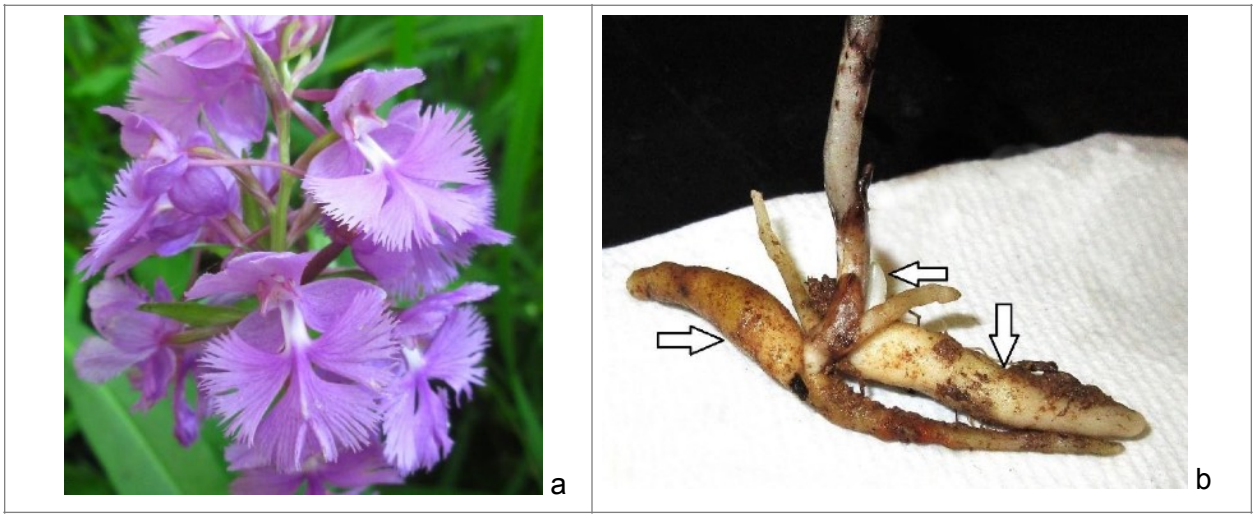


Figure 7. *Platanthera grandiflora*. In b, in early July, the perennating bud for the next year (left-pointing arrow) is just to the right of this year's flowering stem. The down-pointing arrow indicates the new tuberoid being produced in the current year, while the right-pointing arrow indicates the previous year's tuberoid.

According to Coleman (2019), there are 12 species and 4 hybrids of lady's slippers, genus *Cypripedium,* native to the United States and Canada, one of which is *C. parviflorum* (Fig. 8a). Coleman's article and others (e.g., Hanko 2022) have described their varied appearances and habitats. Lady's slippers have long, succulent fibrous roots arising from thick rhizomes from which new growths appear each spring (Fig. 8b, c, d). The rhizomes can branch, and in some species, e. g., *C. reginae*, produce multiple flowering stems. Kull (1999) illustrated a section of a zigzag branching rhizome of European *C. calceolus* from 1972-1993 that produced 6 shoots in 1993. Thus, besides being overwintering, the rhizomes can serve as a means of asexual reproduction when rhizomes are damaged, or age and die.

Figure 8. *Cypripedium*. a, *C. parviflorum* (photo taken in Manitoba). b, *C. reginae*, in late July, showing perennating bud at arrow and fleshy, fibrous roots that emanate from an obscured rhizome. The three stems are connected by rhizomes and belong to the same individual. c, *C. reginae* in late July, showing perennating bud (arrow) arising from the rhizome below the soil, along with numerous succulent fibrous roots. d, *C. calceolus*, showing rhizome, current flowering stem, and new perennating bud (https://floracanaria.com/dibujos/orquideas/Cypripedium_calceolus.html).

As you can see from these examples, overwintering structures in North American orchids vary quite a bit but are basically modified roots and stems. Why a particular structure is employed by a particular species is a question I haven't seen asked or answered in the orchid literature. It would certainly be worth investigating. Further, with the exception of *Malaxis* and *Liparis* that belong to the same tribe (Malaxideae), the species and genera described here belong to different tribes and are distributed among four of the five orchid subfamilies. Whether a particular type of overwintering structure is more associated within certain tribes or subfamilies than others would be an additional direction of inquiry. Looking at overwintering structures of orchids in other temperate regions besides North America, as well as in arctic and subarctic regions, might also be illuminating.

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