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Contents

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Assisting the Conservation of *Tolumnia bahamensis*

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Along the Atlantic Coast of Florida lies one of North America's most threatened and rare plant communities. Jonathan Dickenson State Park harbors such a community within its protected borders. It is known as the Florida coastal pine scrub and is home to many scrub species. Its overstory is dominated by *Pinus clausa* (sand pine) and many understory scrub species such as *Quercus myrtifolia*, *Q. chapmanii*, *Q. geminata*, *Serenoa repens*, and *Ceratiola ericoides* (Florida rosemary). These plant communities occur on extremely well-drained sites containing nutrient deprived, sandy quartz soils. The least productive of these scrub soils may support a "rosemary scrub" community, which is characterized by a shrub layer of *Ceratiola ericoides* with a widely scattered sand pine overstory (http://www.sfrc.ufl.edu/extension/florida_forestry_information/forest_resources/scrub.html; accessed 15 September 2008). Historically, these plant communities have been subjected to burning by using periodic and intense fires (Myers, 1985).

It is on and around the *Ceratiola ericoides* that the endangered orchid *Tolumnia bahamensis* (Nash ex Britton & Millspaugh) Braem occurs (Luer, 1972; Figure 1 on page 9). This species is limited in distribution in the United States to only a few small populations within protected areas along the Palm Beach and Martin County line (Brown, 2002). Though *Pinus clausa* need not be present as an overstory canopy for this orchid, it does however, seem that Florida rosemary is deemed a very suitable cohabitant for *Tolumnia bahamensis* (Luer, 1972). Perhaps this preference might be due to a not yet revealed relationship between one or more of these scrubby shrub species, the orchid, and a mycorrhizal associate. Currently, there is active seedling recruitment of *Tolumnia bahamensis* in the area. This might suggest that a suitable fungal associate is present. However, studies are needed to determine whether fungal associate(s) occur, their identity, specificity, and role in the orchid's lifecycle. It might also be suggested that the orchid could benefit indirectly from the known allelopathic effects that *Ceratiola ericoides* has on any other potential plant competitors (http://www.archboldstation.org/ABS/plantspp/cererisppacc.htm; accessed 15 September 2008).

Tolumnia bahamensis seems to prefer to germinate and produce seedlings as a terrestrial plant (http://bellsouthpwp.net/c/u/culpsb/Tolumnia/Tolumnia.html; accessed 15 September 2008). With limited competition for resources in the understory, the orchid seems to find more suitable areas to thrive within the rosemary scrub. These newly developing seedlings are thus protected by the often scorching sun on hot, summer days. "In many cases these orchids will

grow under the bright understory and not in full sun. Though it tends to be hot, the humidity near the soils of the understory also seems to hold enough moisture for the emerging plants to survive on" [Ron Determann, Atlanta Botanical Garden (ABG), personal communication]. Nestled among the reindeer lichens, sandy oak, rosemary, and pine detritus, the young orchids remain close to the shady ground where the air is consistently cooler and humid (Luer, 1972; Figures 2 and 3 on page 9). As the plants mature, they seem to grow across the scrubby debris, toward the base or branch of one of the scrub species such as *Ceratiola ericoides*. Eventually the orchid plant attaches some aerial roots to its host and grows more like a traditional epiphyte.

Although *T. bahamensis* is recognized as one of Florida's critically imperiled native plants (http://www.regionalconservation.org/ircs/RSFNPH/RSFNPHdefault.asp; accessed 15 September 2008), it is thought to have arrived from the Bahamas. Eight Mile Rock, on the western tip of Grand Bahama Island is reported as the Type Locality for the species (Luer, 1972). Eight Mile Rock, Grand Bahama is approximately 80 miles southeast of the Florida population. Although no information was immediately available for any currently extant populations within the Bahamas, it certainly is possible that it continues to exist somewhere in a similar scrub habitat on Grand Bahama Island. It is also not known (to me) how the coastal environment in Florida may differ from that on Grand Bahama Island. Based on the information available however, one of the orchids' primary companion species in Florida, *Ceratiola ericoides*, is endemic to the Southeastern United States (http://jhered.oxfordjournals.org/cgi/content/abstract/esn043v1; accessed 15 September 2008).

According to G.J. Braem "*Tolumnia bahamensis* differs from the *Tolumnia variegata* complex in that *T. bahamensis* is a tetraploid with 84 chromosomes" (http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242101978; accessed 15 September 2008). Perhaps this suggests that this species could be conspecific with *Tolumnia sylvestris*, which also has 84 chromosomes and is also reported to grow in the Bahamas, Cuba, and other Antillean Islands (Llamacho and Larramendi, 2005). One major difference between the two species is that of habitat preference. Llamacho and Larramendi (2005) report that "Cuba's *T. sylvestris* occurs at higher altitudes from 200 m to 1,974 m in the southeast region of the country," and occupies habitat that is somewhat different from the Florida and Bahamas' populations of *Tolumnia bahamensis*" (http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242101978; accessed 15 September 2008). More work is needed to determine whether or not *T. bahamensis* and *T. sylvestris* might perhaps be conspecific.

In the spring of 2006, Jonathan Dickenson State Park officials requested assistance from the Atlanta Botanical Garden for the conservation of *T. bahamen-*

sis. The conservation strategy to date has involved *ex-situ* laboratory propagation for potential augmentation of the existing populations. The Garden and Florida State Park officials visited and hand-pollinated the flowers of *Tolumnia bahamensis* in the spring of 2006 (Figures 4 and 5 on page 10). In August of 2006, green capsules were collected and subsequently sent to our tissue culture laboratory for sowing *in-vitro* via asymbiotic methods. Seeds from the immature capsules were sown and germination occurred within 3 months on two different media formulations. The two formulations were: (1) *Phyto*Technology Laboratories media P668 used at half strength, and (2) Murashige and Skoog with vitamins (M519) reduced to one third strength, and with additional sucrose. Generally speaking, germination percentage was high and fairly uniform on both media formulations. It was noted however that germination was more rapid and abundant from some capsules in comparison to others, and seeds from some capsules did not germinate at all. After about three months of growth, the protocorms were beginning to produce their first 'fans' of leaves. These were transferred onto full strength P668 after adding 1 drop Dyna-Grow K-L-N rooting concentrate per liter (pH adjusted to 5.6). This media formulation, as suspected, rapidly yielded large seedlings. Some were even large enough to plant into our greenhouses before they were 1-year-old (Figure 6; page 11). This orchid is of particular ease to culture *in-vitro* and it was not surprising that this type of culture would quickly yield thousands of seedlings capable of surviving in the greenhouse environment. In fact, we have observed an estimated >95% survival of those which were planted out. It also should be noted that more recent trials indicate that a new media formulation, W1.5 (available from the Orchid Seedbank Project) with 50g/L B852 (banana powder) and 1 drop/L K-L-N, yielded more robust plants with superior root systems in less time when compared to both the ½ and full strength P668 from *Phyto*Technology Laboratories. Thousands of plants are currently at many different stages of growth. Some several hundred plants have already been planted out of the laboratory into the greenhouses (Figure 7; page 11), while thousands more continue to develop even stronger and faster after being transferred onto their final replate of the new (W1.5) media in the laboratory. After only 4 months out of flask, and only 1 year and 8 months from sowing the seed, several seedlings have flowered for the first time in the ABG greenhouses (Figure 8; page 11).

Tolumnia bahamensis is also easy to cultivate outside of sterile culture. Plants have been planted into a 1:1:1 mixture (by volume) of premium sphagnum moss, medium grade tree fern fiber, and medium grade charcoal. Many plants have been potted into 7.6 cm diameter plastic net pots to allow for rapid drying after each watering. Subsequently, because of the large number of plants being processed at a time we have adopted the use of webbed flats and planted the seedlings in a shallow layer of the mix. The plants are dusted with lime to keep the potting mix from acidifying. The city water in Atlanta, though excellent in quality, does not have a buffering capacity and without careful attention a mix

containing sphagnum moss will quickly acidify. This lime interface also serves to limit diseases such as damping off and other soft rots that might attack the newly planted seedlings. In my experience, the lime application is very effective, and with careful attention to watering frequency, a near 100% survival rate is relatively easy to achieve in the out-planted seedlings. Upon out-planting, the seedlings are first placed in our 'cool greenhouse' under Mee-Fog™ System to help acclimate and harden them off for about 5 days or so. The plants, then, are transferred to our 'intermediate house' where they get increased light, warmer temperature, and less fog. After a couple of weeks in this environment, they are finally moved into the 'warm house' with much brighter light, even warmer temperatures, and slightly drier ambient air. This environment seems to be perfect for the plants as they continue to push out new shoot growth and wiry shallow roots. As long as good light, moisture, and infrequent fertilization are supplied, the plants tend to thrive. We believe that one key to our success with this species in culture is the planting of the seedlings in a growing-mix that allows rapid drying-out after watering. In our experience, if the roots are kept too moist, the plants quickly succumb to rots of various types.

As more and more seedlings continue to 'out-grow' the laboratory, we continue to plan for another phase of the project. The Atlanta Botanical Garden continues discussion with the Florida Department of Parks and Recreation to refine the long term conservation strategies. We anticipate the augmentation of native populations to begin in the spring of 2009. With the execution of population augmentation, monitoring, and continued habitat protection and management, we hope to ensure that these beautiful and endangered orchids have a suitable and protected home for many years to come.

Literature Cited:

Brown, P.M. 2002. Wild Orchids of Florida with References to the Atlantic and Gulf Coastal Plains. University Press of Florida. Gainesville, Florida.

Llamacho, J.A. and J.A. Larramendi. 2005. The Orchids of Cuba. Escandon Impresores. Sevilla, Espana.

Luer, C.A. 1972. The Native Orchids of Florida. New York Botanical Garden. New York, New York.

Myers, R.L. 1985. Fire and the dynamic relationship between Florida sandhill and sand pine scrub vegetation. Journal of Torrey Botanical Club 112 (3): 241-252.

Malaxis paludosa – a Hidden Jewel of Wet Sphagnum Bogs

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Our native orchids come in many shapes, colors, and sizes. Some are large and showy, while others shun the limelight and are small and well-camouflaged. If the latter situation is combined with a preference for inaccessible places, our thoughts should immediately turn to one of the most elusive orchids in North America - *Malaxis paludosa* (bog adder's-mouth; Figure 1 on page 12). I have seen and photographed this tiny bog dweller in Alaska and Minnesota. This was made possible by the help of friends (e.g., Rob Freeman, Mark Larocque, and Mark Duffy) who either showed me the plants or provided directions.

The bog adder's-mouth was known to the great Swedish taxonomist Carl Linnaeus (1707-1778) who named it *Hammarbya paludosa* in reference to his summer home at Hammarby, Sweden. In the European literature *Hammarbya* is still preferred over *Malaxis*, which puts the bog adder's-mouth in a separate genus because of its unique ability to propagate asexually by production of bulbils on its leaf tips. In addition, it is sometimes called the only European epiphyte because of its tendency to root with its two pseudobulbs in sphagnum moss without reaching into a soil layer. These atypical characteristics set this orchid apart from other members of the genus *Malaxis*, although *Malaxis spicata* in south Florida is also said to be semi-epiphytic in some locations.

Plants of bog adder's-mouth are small with most plants just reaching 10 cm, and large plants not exceeding 15 to 20 cm. Plants are green and have 2 to 4 ovate-elliptic leaves at the base. It develops a flower spike with about 5 to 50 crowded, tiny yellow-green flowers that require a magnifying glass to appreciate their beauty as each flower is normally only 4 mm long (Figure 2; page 12). The number of flowering plants in a bog may reach thousands. Typically however, the ardent searcher is lucky to find 10 to 50 plants at any location. Flowering plants appear at the end of June and bloom well into July and the beginning of August throughout its range in the boreal regions of North America and northern Eurasia.

In North America, the plant prefers open sphagnum bogs (Figure 3; page 12) of south and central Alaska and Canada. It also occurs in swampy woods at the southern limit of its distribution in northern Minnesota. In Europe, moderately acidic bogs and soligenous mires are the favorite locations. Bog adder's-mouth is considered a rarity in most of its range although it is thought that this orchid is being grossly under-recorded, and that it may exist in countless bogs of the Far North. Perhaps, the plant is most common in the British Isles, which may harbor 25% to 50% of the known populations of this orchid. Within the United

States, bog adder's-mouth occurs only in Alaska and Minnesota and can be found in neighboring Canada in the proximity of the Great Lakes, e.g., Thunder Bay. The orchid was first described for North America from Minnesota in 1905 and was believed to only have a very few locations in the continental United States restricted to Clearwater, Hubbard, and Beltrami Counties in Minnesota. However, recent searches in 2005 and 2006 in these and Becker County revealed new sites, and increased the documented records to at least 17 populations in Minnesota, where it prefers rich conifer swamps with black spruce, white cedar, tamarack, and balsam fir.

This orchid is infamous for blending into the surrounding vegetation. The flowering stems rise above the moss level and can form tight clusters, but because of the greenish color and diminutive size of the plants, they are extremely hard to spot among the grasses, sedges, and heath plants that dominate the habitat. Accordingly, I have never seen this orchid in my native Germany, where it is called the "Sumpf-Weichstendel," and where it has suffered a dramatic decline over the last one hundred years.

For many years, I was hoping to see the bog adder's-mouth at least once in its natural habitat. This wish became true in 2005 when trips to Alaska and to the annual meeting of the Native Orchid Conference (NOC) in Winnipeg offered two opportunities to see the plant. The trip to Alaska covered the later half of June. My wife and I met our friends, Hal and Helen Horwitz, near Fort Richardson Army Base just outside Anchorage. A survey in the 1990s had revealed new locations of this orchid on the Army base, and after a long debate involving documentation of a valid car insurance policy, the guards granted us passage to pursue our orchid hunt. It took two bogs and a few hours of searching to find several blooming plants growing in a sphagnum bog not far off a dirt road. The species has been recorded from other sites in and around Anchorage, but some of these no longer exist – victims of the needs of a growing city. The second chance to see the orchid came just two weeks later on my way to the NOC annual meeting with Chuck Wilson and Rob Freeman, who was our guide. He showed us a bog in northern Minnesota where the orchid had been seen in previous years. In contrast to Alaska, this location was a conifer swamp that harbored many types of orchids, including *Cypripedium reginae* (showy lady's-slipper), *Cypripedium parviflorum* (yellow lady's-slipper), *Malaxis unifolia* (green adder's mouth), *Goodyera repens* (lesser rattlesnake orchid), *Platanthera orbiculata* (large round-leaved orchid), and *Corallorhiza striata* (striped coralroot), among others. A search quickly yielded the elusive bog adder's-mouth in an area where it had been seen previously. As usual, the plants were tiny and, indeed, very difficult to see. The population was larger than the one in Alaska, and we located from 20 to 40 plants blooming in one spot, with a few others not far away.

It was gratifying to see and photograph this orchid. Although not large or showy, the tiny plants have their beauty and you feel greatly rewarded at finding them. Just take mosquito repellent, and do not forget the magnifying glass that you will need to appreciate the flowers.

Location, Location, Location

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Most native orchid enthusiasts are familiar with *Calopogon tuberosus* var. *tuberosus*, the common grasspink (Figures 1 and 2; page 13). This is a well-known North American native orchid, but many might consider it ordinary. *Calopogon tuberosus* is a fascinating plant. *Calopogon tuberosus* has an unusual distribution from Florida to Newfoundland, and west to eastern portions of Texas. Throughout the distribution the species inhabits a variety of ecosystems including fens, bogs, prairies, and roadsides. In the South Carolina Piedmont area, *C. tuberosus* can be found in cataract bogs (Figure 3; page 13). These unusual communities are found near the edge of streams that flow nearly horizontally over granite rock outcroppings (Porcher and Rayner, 2001). Additionally, *C. tuberosus* can grow and flower in very dry conditions or while partially submerged. Given that *C. tuberosus* has a widespread distribution and occupies diverse habitats, there exists morphological and genetic variation (Goldman et al., 2004a; Goldman et al., 2004b; Trapnell et al., 2004). However, all plants form storage organs called corms, and flowers are usually similar in size.

Variation among populations may be influenced by adaptation to local environmental conditions such as photoperiod, soil nutrients, and temperature. This variation is referred to as ecotypic differentiation. An ecotype is a genotype or population within a species adapted to local environmental conditions (Hufford and Mazer, 2003). Why be concerned with ecotypes? As orchid conservationists, bolstering declining populations and reintroducing plants to former habitat are extremely important. *In vitro* symbiotic or asymbiotic seed germination are used to propagate plants for reintroduction, but preserving the genetic advantages that locally adapted populations have evolved (i.e. using local seed) is vital to maintain healthy plant populations and ecosystems (Hufford and Mazer, 2003; McKay et al., 2005). Distinguishing ecotypes is not a simple task, and often requires years of research. However, studying the germination

ecology of widespread populations of a species can be used to differentiate ecotypes. For orchid seed germination, *in vitro* techniques can be utilized to study the environmental conditions required for seed germination.

Little information exists on the germination ecology of widespread populations of a single orchid species. Due to its wide distribution and adaptability, *C. tuberosus* is a model species to explore ecotypic differentiation and germination ecology using asymbiotic *in vitro* techniques. *In vitro* techniques, in other words, can be utilized to study the ecology of plants. Ecotypic differentiation is currently being explored in several populations throughout the United States including upper peninsular Michigan, South Carolina (3 locations), north central Florida, and south Florida (see Kauth et al., 2008).

The populations are latitudinally widespread, and differences in photoperiod may influence seed germination. The affects of photoperiod on seed germination were studied using a short day (8/16 hr light/dark), neutral day (12/12 hr), and long day (16/8 hr) photoperiod. One germination media, P723 (*Phyto*Technology Laboratories, Shawnee Mission, KS), was used based on previous success with *C. tuberosus* seed germination (Kauth et al., 2006). After 8 weeks culture, percent germination was very low in all South Carolina populations with a maximum of 3.5% germination. Michigan seeds also exhibited low germination (12.5% maximum germination) with no difference among photoperiod treatments. However, Michigan seeds germinated and developed more quickly than the other populations regardless of photoperiod. After six weeks in culture, seeds from Michigan developed leaves, roots, and corms. Both Florida populations exhibited higher germination with short days promoting maximum germination. However, development was delayed in south Florida seeds while north central Florida seeds germinated and developed quickly.

Because germination percentages were low, an embryo viability test using tetrazolium was conducted. When living embryos are exposed to tetrazolium, they become stained red or pink. Before staining the embryos, the seed coat (testa) was degraded in a 5% calcium hypochlorite solution to facilitate tetrazolium staining. Viability differed greatly among the populations. The maximum viabilities after 3 hr calcium hypochlorite treatment were as follows: 50% (Michigan), 25% (South Carolina 1), 38% (South Carolina 2), 42% (South Carolina 3), 67% (north central Florida), and 85% (south Florida). Viabilities were higher than germination percentages reported in the photoperiod screen.

A media screen was conducted since P723 may not have been an ideal germination medium. Six germination media were used: BM-1 Terrestrial Medium, Malmgren Modified Terrestrial Orchid Medium, Knudson C, P723, Vacin and Went (all obtained from *Phyto*Technology Laboratories), and half-strength Murashige and Skoog (Sigma-Aldrich, St. Louis, MO). After eight weeks in culture, few differences in germination were observed among media for both

Figures to accompany 'Assisting the Conservation of *Tolumnia bahamensis*' by Matt Richards (page 1). Photos by Carol Denhof.

1. Florida coastal pine scrub community in Jonathan Dickenson State Park.
2. Young plants of *Tolumnia bahamensis* growing nestled among scrub vegetation.
3. Inflorescences of *Tolumnia bahamensis*.

Figures to accompany 'Assisting the Conservation of *Tolumnia bahamensis*' by Matt Richards (page 1). Photos by Carol Denhof.

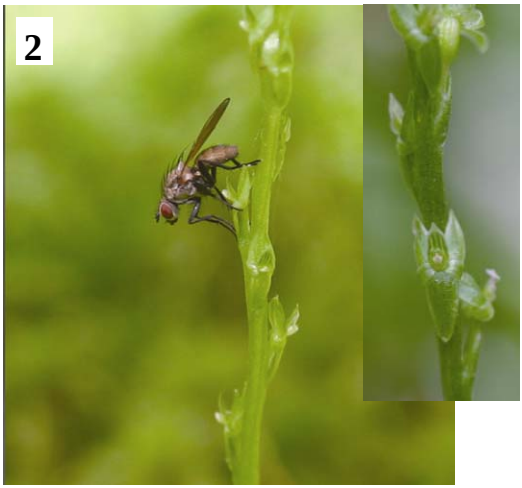
4. Flowering plants of *Tolumnia bahamensis.*
5. Florida State Park officials and Atlanta Botanical Garden staff hand-pollinating the flowers to obtain viable seeds for subsequent use in *in vitro* germination.

Figures to accompany 'Assisting the Conservation of *Tolumnia bahamensis*' by Matt Richards (page 1). Photos by Matt Richards.

6. *In vitro* cultured seedlings of *Tolumnia bahamensis*.
7. Outplanted plants of *Tolumnia bahamensis* growing in the Atlanta Botanical Garden greenhouses.
8. An *in vitro* grown, flowering plant of *Tolumnia bahamensis* among several other outplanted plants.

Figures to accompany '*Malaxis paludosa* – a Hidden Jewel of Wet Sphagnum Bogs' by Stefan Ambs (page 5). Photos by Stefan Ambs.

1. Flowering spike of *Malaxis paludosa.*
2. A putative pollinator for *Malaxis paludosa*. Inset shows close-up of a flower.
3. Plants of *Malaxis paludosa* growing in an open sphagnum bog.



Figures to accompany 'Location, Location, Location' by Philip Kauth (page 7). Photos by Philip Kauth.

1. *Calopogon tuberosus* var. *tuberosus* from north central Florida.
2. *Calopogon tuberosus* var. *tuberosus* from northern Michigan.
3. Cataract bog habitat in the Piedmont region of South Carolina. Note the micro-island to the right where the stream flows– this is a cataract bog.

Figures to accompany '*Isotria medeoloides*' by Shirley Curtis (page 19). Photos by Shirley Curtis.

1. A double flowered plant of *Isotria medeoloides*.
2. Close-up of flowers of *Isotria medeoloides*.
3. Two double flowered plants of *Isotria medeoloides.*
4. Image showing habitat of *Isotria medeoloides* in Maine, USA.


3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Figures to accompany 'The library of the Swiss Orchid Foundation at the Herbarium Jany Renz' by h.c. Samuel Sprunger (page 22).

1. *Cattleya labiata*.
2. *Ansellia congoensis*.

Florida populations. As observed in the photoperiod screen, Michigan seeds germinated and developed quickly regardless of media. Interestingly, South Carolina seed germination was much lower on P723 compared to all other media tested. Seed germination from cataract bog populations was highest on Vacin and Went and Knudson C medium, which contain higher concentrations of magnesium and calcium than other media. This *in vitro* "preference" for magnesium and calcium rich media may reflect these populations adaptation to cataract bog soils, which are also rich in magnesium and calcium. However, germination percentages in two South Carolina populations were lower than 7%. Soil analysis may help to clarify the role of soil nutrients on seed germination as well as aiding to develop germination media based on soil nutrient availability at each site. However, embryo viabilities were still greater than germination, and methods to increase germination were explored.

Previous reports indicate that chilling seeds increases germination (van Waes and Debergh, 1986; Chu and Mudge, 1994; Miyoshi and Mii, 1998); therefore, a time-course cold-chill experiment was conducted using seed from Michigan, two South Carolina locations, north central Florida, and south Florida. Seeds were placed on germination media and stored in complete darkness at 11°C for 0, 2, 4, 6, or 8 weeks. After the chill treatment, seed cultures were placed under light at 23°C for the remainder of 10 weeks. Chilling proved to be the ideal treatment to increase germination, because over 80% germination was observed for several populations. Germination was greater than reported embryo viabilities in Michigan and South Carolina populations, while germination peaked at embryo viability percentages in both Florida populations. Interestingly, Michigan seed germination was lower than all other populations. Michigan seeds may require a longer cold treatment to stimulate higher germination percentages since Michigan winters are considerably longer than South Carolina and Florida winters.

While tetrazolium results can be misleading due to embryo dormancy, pretreatment in calcium hypochlorite longer than 3 hr may be required to degrade the potential thicker testas of Michigan and South Carolina seeds. Thicker testas may be responsible for impeding maximum tetrazolium staining resulting in observed lower embryo viabilities. Further experiments are underway to examine the testa thickness of these populations.

With seed germination experiments complete, seedling development was examined. *Calopogon tuberosus* is a corm forming species, which is evident *in vitro*. However, a clear difference in seedling corm development and biomass allocation *in vitro* among populations is apparent. A time-course *in vitro* seedling study was conducted over 20 weeks. Within 6 weeks corms formed on Michigan seedlings, while corm formation was delayed on southern populations. Corms formed on South Carolina seedlings after 10 weeks, 14 weeks on north central Florida seedlings, and 18 weeks on south Florida seedlings.

Michigan seedlings also allocated more biomass to corms compared to all other populations. Additionally, Michigan seedlings initiated shoot senescence sooner than all other populations. This is likely a response to growing season. In northern Michigan the growing season is very short, thus *C. tuberosus* seeds are genetically programmed to germinate quickly and form corms in order to survive the long winter. South Florida seeds germinate, grow, and form corms slowly due to a longer growing season.

How does all this information relate to orchid conservation? Because plants become locally adapted to particular environments, using locally adapted plant material is crucial to conservation projects. Would *C. tuberosus* from south Florida survive the cold winters of northern Michigan? Would plants from cataract bogs grow along roadsides in north central Florida? While seeds may germinate in distant habitats, the long term consequences of using non-local material on population genetics often outweigh the benefits (Hufford and Mazer, 2003; McKay et al., 2005). In addition, seeds from the same species may require different germination conditions. I assumed that seeds from all populations would germinate on P723 based on my prior experience; however, this was a poor assumption. In order to better understand the seed physiology of any plant species, using seed from multiple populations is necessary. Reintroduction success depends on habitats and climates, and attempts to introduce plants from one ecosystem to another may harm not only the plant population but the entire ecosystem. Our goal should be to not only save orchids, but orchid habitat. These experiments provide strong evidence for ecotypic differentiation; however, additional *in vitro* and *in situ* experiments are currently in progress to support the case of *C. tuberosus* ecotypes.

NOTE: This article is a summary of the presentation "Do *Calopogon tuberosus* Ecotypes Exist" at NOC 2008 in Morgantown, WV.

Literature Cited:

Chu, C.C. and K.W. Mudge. 1994. Effects of pre-chilling and liquid suspension culture on seed germination of the yellow lady's slipper orchid (*Cypripedium calculus* var. *pubescent*). Lindleyana 9: 153-159.

Goldman, D.H., C. van den Berg, and M.P. Griffith. 2004a. Morphometric circumscription of species and infraspecific taxa in *Calopogon* R. Br. (Orchidaceae). Plant Systematics and Evolution 247: 37-60.

Goldman, D.H., R.K. Jansen, C. van den Berg, I.J. Leitch, M.F. Fay, and M.W. Chase. 2004b. Molecular and cytological examination of *Calopogon* (Orchidaceae, Epidendroideae): circumscription, phylogeny, polyploidy, and possible hybrid speciation. American Journal of Botany 91: 707-723.

Hufford, K.M. and S.J. Mazer. 2003. Plant ecotypes: genetic differentiation in the age of ecological restoration. Trends in Ecology and Evolution 18: 147-155.

Kauth, P.J., W.A. Vendrame, and M.E. Kane. 2006. *In vitro* seed culture and seedlings development of *Calopogon tuberosus*. Plant Cell, Tissue and Organ Culture 85: 91-102.

Kauth, P.J., M.E. Kane, W.A. Vendrame, and C. Reinhardt-Adams. 2008. Asymbiotic germination response to photoperiod and nutritional media in six populations of *Calopogon tuberosus* var. *tuberosus* (Orchidaceae): evidence for ecotypic differentiation. Annals of Botany 102: 783-793

McKay, J.K., C.E. Christian, S.H. Harrison, and K.J. Rice. 2005. How local is local?—A review of practical and conceptual issues in genetics of restoration. Restoration Ecology 13: 432-440.

Miyoshi, K. and M. Mii. 1998. Stimulatory effects of sodium and calcium hypochlorite, pre-chilling and cytokinins on the germination of *Cypripedium macranthos* seed *in vitro*. Physiologia Plantarum 102: 481-486.

Porcher R.D. and D.A. Rayner. 2001. A guide to the wildflowers of South Carolina. University of South Carolina Press, Colombia, South Carolina.

Trapnell, D.W., J.L. Hamrick, and D.E. Giannasi. 2004. Genetic variation and species boundaries in *Calopogon* (Orchidaceae). Systematic Botany 29: 308-315.

van Waes, J.M. and P.C. Debergh. 1986. *In vitro* germination of some Western European orchids. Physiologia Plantarum 67: 253-261.

Isotria medeoloides

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Isotria medeoloides (Pursh) Rafinesque (small whorled pogonia), a member of the orchid family (Orchidaceae), was first described by Frederick Pursh in 1814 as *Arethusa medeoloides*. In 1838, Rafinesque placed this orchid in its own genus and recognized it as *Isotria medeoloides*; however, it also became known as *Pogonia affinis* Austin ex A. Gray and later as *Isotria affinis* (Austin) Rydberg. Its nomenclature was clarified by M.L. Fernald in 1947, making the latter names synonyms of *Isotria medeoloides* (Pursh) Rafinesque.

Distribution:
Isotria medeoloides occurs along the Appalachian belt from Ontario through New England, south to Tennessee, Georgia, and South Carolina, and west to Michigan and Missouri. The three primary population centers are upland eastern New England, the Blue Ridge Mountains, and the coastal plain/piedmont provinces of Virginia. There are probably 125-135 sites in New England with 80% of the plants found in Maine and New Hampshire. *Isotria medeoloides*

was listed as endangered on September 10, 1982 (47 FR 39827-39831), but has been reduced from endangered to threatened in the 1992 recovery plan.

Description:
Perennial herb. Stem stout, pale green dusted with whitish coating, hollow, and 6-35 cm tall. The leaves, usually five or six in a single whorl, are about 8 cm long, about 4 cm wide, pale green, and pointed toward the ground when the flowers first open and slowly rise to become horizontal (Figure 1; page 14). A single flower or pair of flowers arises (Figures 2, 3, and 4; page 14 and 15) from the leaf whorl in early June in New England. The three sepals are green and outwardly spreading. Two of the petals are pale yellow-green, about as long as the sepals, and pointed toward the tips. The labellum or lip is three-lobed, nearly white and about 15 mm in length, approximately the same length as the petals.

Plants emerge in May at the northern edge of the orchid's range, and in April farther south. Flowers can last from several days to two weeks (Homoya, 1977; Mehrhoff, 1983). Taller plants with a larger whorl diameter tend to flower more frequently than smaller plants (Mehrhoff, 1983), and may emerge somewhat earlier in the year (Brumback and Fyler, 1988). The fruit capsule matures in the fall. Seed production for this species is characterized as low to moderate, with about 9,600 seeds produced per plant (Mehrhoff, 1983), but seed production is generally efficient because of the orchid's capacity for self-fertilization (Vitt and Campbell, 1997). Dust-like orchid seeds often disperse by wind from the parent plant, but precise dispersal mechanisms are undescribed for this species. Although multiple stems can arise from a single root system, *Isotria medeoloides* is not known to reproduce vegetatively (Mehrhoff, 1983).

Ecological characteristics:
Small whorled pogonia typically occurs in mid-successional mixed woods with sparse shrub and herb layers and thick leaf litter. It often occurs near intermittent streamlets or where a hardpan impedes water percolation into the soil. Associated understory plants include *Medeola virginiana* (Indian cucumber-root), *Thelypteris novaboracensis* (New York fern), *Mitchella repens* (partridge berry), and *Goodyera pubescens* (downy rattlesnake plantain).

Isotria medeoloides plants may live for several years, remaining dormant for several years at a time (Mehrhoff, 1983; Vitt, 1991). Plants that remain dormant for more than three years have a small probability of re-emerging, however (Vitt, 1991). Evidence from field studies suggests that *Isotria medeoloides* responds favorably to increased exposure to light and that reproduction may be suppressed by a closing canopy. Management to thin the canopy above subpopulations of the orchid in New Hampshire has stimulated flowering, reduced the proportion of plants entering dormancy, and has fostered a higher density of stems (Brumback and Fyler, 1988).

With few specialized structures or scents to attract insect pollinators, plants are reported to be primarily self-pollinating (Mehrhoff, 1983). The species is morphologically similar to the more commonly occurring *Medeola virginiana*, hence the specific name *medeoloides* (i.e., looks like M*edeola*), but can be distinguished by its pale, fleshy stem, unlike the firm, wiry stem of the common species. I can't tell you how many of these wrong plants we have checked before and since seeing *Isotria medeoloides*.

Other notes:
In 1985 Phil Keenan showed my friend Sally Puth and me a site in Milton, NH and told us this was a great site for *Goodyera pubescens.* In August Sally and I went there to photograph the *Goodyera*. While eating our lunch, we looked down by our feet and saw we had almost stepped on a group of four plants of *Isotria medeoloides* in fruit. We had been looking for a long time, and couldn't believe we just found this beautiful group of 4 double plants in fruit!

In June 1986 we checked our site again, and located five single stemmed plants in a small group, growing from almost the same point in the ground. I even wondered if these were multiple stems arising from a single root system. Other people I've talked with have never seen a group like this. This was a very exciting find for us! In1987 there were four single stemmed plants; in 1988 there were three plants, two were double flowered, and one was single flowered; in 1989 there was a group of three double stemmed plants. We've tried to check this site most every year between 1985 and 2004, and have noticed the above mentioned group producing flowers every year. In 2005 we couldn't find any plants and have not seen them since. Either the plants have perished, or they are dormant. I hope they are just dormant! Because it is an easy site to access and check, we've looked all around this site but never found any other plants. In all the other areas we've even found plants they are very hard to locate. Although in 1986 we did find five more plants a few miles south of this site. These plants were much harder to locate even when we knew we were at the correct site. In 1994 we couldn't find any of the plants, and haven't seen any at this site since.

Another one of our favorite sites for this orchid is in North Berwick, Maine. Paul Martin Brown showed us this site in 1989. There were about 200 plants, not all were flowering, of course, and these were very difficult to find! I think a lot of people from our NOC group have visited this site. Some years we have only found 1 or 2 plants, some years none, but in 2008 we counted 67 plants.

In the time since we first discovered *Isotria medeoloides* in Milton, NH, many more sites have been discovered in New Hampshire. And we've personally observed these orchids at a minimum of six different sites throughout Maine and New Hampshire.

Literature cited:
Brackley, F.E. 1985. The orchids of New Hampshire. Rhodora 87: 1-117.
Brumback, W.E. and C.W. Fyler. 1988. Monitoring of *Isotria medeoloides* in New Hampshire. Wild Flower Notes 3: 32-40.
Homoya, M.A. 1977. The distribution and ecology of the genus *Isotria* in Illinois. M.S. thesis, Southern Illinois University, Carbondale, Illinois. 104p.
Mehrhoff, L.A. 1983. Pollination in the genus *Isotria*. American Journal of Botany 70: 1444-1453.
Vitt, P. 1991. Conservation of *Isotria medeoloides*: a Federally endangered terrestrial orchid. M.S. Thesis, University of Maine. Orono, Maine. 40p.
Vitt, P. and C.S. Campbell. 1997. Reproductive biology of *Isotria medeoloides* (Orchidaceae). Rhodora 99: 56-63.

The library of the Swiss Orchid Foundation at the Herbarium Jany Renz

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The Renz library is one of the finest and most complete orchid libraries, and is a cultural asset with worldwide accessibility. It is a comprehensive reference collection of orchid literature, which serves as excellent basis for research, conservation, and horticulture. The collection contains over 3,000 volumes, including an irreplaceable collection of rare and antique folio volumes considered to be among the best preserved copies in the world.

A complete reference of modern literature is a precious resource for the study of orchids, the largest family of flowering plants. The collection of around 5,000 scientific articles from many sources represents an extraordinary, comprehensive and versatile collection of literature on orchids. The complete library was incorporated into the online catalogue of the University Library of Basel and is now available at http://aleph.unibas.ch.

Some 90 select illustrated orchid books, containing over 7000 hand colored drawings (Figures 1 and 2; page 16), have been digitized during the last five

years and may be accessed online on the website of the Swiss Orchid Foundation (http://www.orchid.unibas.ch; see 'orchid books'). The rarity, originality, and quality of these hand colored drawings is an invaluable source of information and proves that scientific precision and artistic efforts are not mutually exclusive. Scientific illustration is irreplaceable for exact documentation, as neither computer science nor photography is able to present such a large amount of accurate and aesthetic information on a single sheet of paper. A large number of the hand colored drawings were used for first descriptions and are thus important for the interpretation of the scientific names of orchids.

In addition to the illustrations, over 52,000 photographs of orchids from around the world have been scanned and their identity and names checked. These are available through the website of the Swiss Orchid Foundation. Herbarium specimens, drawings or photographs of all orchids from Europe, Asia Minor, North Africa and North America are available online. Images of many other Asian, Australasian, African, Madagascan, and tropical American orchids are also available. This World Orchid Iconography is an important tool to obtain identifications and nomenclatorial information on orchids.

Furthermore, the Foundation's website provides free access to BibliOrchidea, a comprehensive literature database with more than 140,000 entries, covering over 80% of the orchid literature available worldwide. The database is continually expanded and kept up-to-date by the eminent orchid specialist Dr. Rudolph Jenny. Scientists, horticulturists, and conservationists, both professional and amateur, can find publications easily, either by searching for a specific title, author, or year of publication, or by browsing through a comprehensive list of keywords. First descriptions may be found by specifying the taxon (genus, species, subspecies, and variety). All results are accompanied by appropriate images from the Swiss Orchid Foundation database.

END NOTES

NOC, Inc. 2009 Annual Conference
13—16 June, University of Wisconsin, Green Bay, Wisconsin

Wisconsin will be the site for the 8th annual Native Orchid Conference to be held at the University of Wisconsin-Green Bay in coordination with the Coffin Center for Biodiversity. Meetings will be held in the Phoenix Room of the University Union building. Our field trips will provide an opportunity to visit some unique habitats in Wisconsin and Michigan to see as many as 15 species of native orchids in flower.

During the four day conference we will explore methods used to set aside native orchid habitat, followed by conservation and restoration programs used to preserve them. The field trips will include visits to the specific areas mentioned in presentations of the preceding day.

Presentations of Saturday will emphasize conservation, natural areas, and the newly dedicated 2,326 acre Carney Fen, a Michigan State Natural Area. Sunday's field trip will feature a visit to the Carney Fen. Talks presented on Monday will highlight stewardship, restoration, propagation, and the Ridges Sanctuary. Tuesday's field trips will feature the internationally recognized Ridges Sanctuary of Door County, Wisconsin. We believe that this integrated approach to coordinated presentations and field trips will enrich the overall conference experience.

Orchids expected to be in flower during this time period include *Amerorchis rotundifolia*, *Arethusa bulbosa*, *Cypripedium acaule*, *Cypripedium parviflorum* var. *makasin*, *Cypripedium parviflorum* var. *pubescens*, *Corallorhiza trifida*, *Corallorhiza striata*, *Cypripedium reginae*, *Liparis loeselii*, *Listera cordata*, *Malaxis unifolia*, *Platanthera hookeri*, *Platanthera huronensis*, *Platanthera obtusata*, *Spiranthes lucida*.

Also, we are excited to announce plans to publish the Proceedings of the 2009 NOC Annual Meeting. We are currently looking into the options of soft-cover bound publication, DVD, or both.

Native Orchid Conference annual meetings provide a great opportunity to network with other people interested in native orchid conservation. We hope that you will join us in June 2009!

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Web Site: http://groups.yahoo.com/group/nativeorchidconference/

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