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A Social History of North American Slipper Orchids Part 5, Conclusion [1]

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CYPRIPEDIUM POLLINATION

Prior to describing Lady's Slipper pollination, I would direct the reader to a newly published two-volume text entitled, *The Pollination Biology of North American Orchids: North of Florida and Mexico*, by Dr. Charles Argue. It is the standard on the subject and covers the subject exhaustively and describes a good deal more about the species than the title suggests. The present article contains highlights on the topic.

Orchids have evolved two means of pollination, cross-breeding and self-pollination. The former is considered superior as it increases genetic variability and therefore the ability of a species to adapt (Argue 2011). Our *Cypripedium* species are, with one exception, cross-breeders. The exception, *Cypripedium passerinum*, is self-pollinating in nearly all of its range; however, at least one population has been discovered that does cross-breed (Catling and Bennett 2007). Self pollination is advantageous to a colonizing species, especially in the absence of pollinators (Catling 1991).

The mechanism of pollination in *Cypripedium* species is determined by the saccate lip. This modified petal acts as a trap to the pollinator; once the potential pollinator enters it has only one escape route. The first question is what attracts pollinators to the flower?

Many theories have been proposed: pollinators, exploring the lip, accidentally fall into the sac; pollinators enter to collect oil from the hairs inside the lip; pollinators are attracted by a small amount of nectar in the lip. However, none of these theories have been proven. The consensus view is that Slipper orchids are non-rewarding and deceive pollinators with their false nectar guides and/or the flower scent (Argue 2011).

1. Part 4 appeared in the 8(3) July. September 2011 volume of this publication.

Flower scent production is fascinating. German investigators studied the composition of fragrances of European orchids for decades, and more recently such studies of North American orchids also provided insights into pollinator attraction. Generally, the compounds that our *Cypripedium* species produce are artificial pheromones and are chemically complex. Compounds differ between the species, and when multiple populations of one taxon are studied, the compounds were found to vary also; however, the intraspecific difference was not as great as the interspecific variation (Barkman 1997, Bergström 1992). Studies of the European *Cypripedium calceolus* suggests that since pheromones are used by bees to mark nest sites, flowers of slipper orchids mimic nest sites of their pollinators (Nillson 1979).

Once the pollinator is trapped inside the pouch, it cannot climb up the slippery side walls of the lip, but there are hairs at the bottom of the pouch and up the "back" of the pouch. This line of hairs is parallel to lines of darker color (nectar guides) towards the base of the lip. Each species has translucent areas near the base that draw pollinators towards their freedom, akin to the light at the end of the tunnel. As pollinators make their way towards either of the two exit paths available, one on either side of the base of the flower, it first must squeeze past the stigmatic surface, where it would deposit any pollen it might be carrying on its thorax. Then the pollinator comes into contact with the anther where pollen is deposited on the dorsal surface of its thorax before the pollinator finally reaches freedom (Argue 2011, Catling 1991). Obviously the size of the entrance and exit holes determine which potential pollinator(s) will be successful for a given species.

Historically, our slipper orchids were thought to be pollinated only by bees; however, recent studies prove otherwise (Ferguson 1999, Vogt 1990). There are scattered reports in the literature of butterflies and skippers being found in pouches of a variety of species – mostly dead. These are not pollinators; they may have been attracted by visual cues or aromas, but once inside the pouch and cannot exit, they perish. The primary determinant as to whether an insect can successfully pollinate a slipper orchid is its dorso-ventral width. If this measurement is too small it can escape through the exit hole without dislodging pollen; if too great, the insect will not be able to exit at all (Vogt 1990).

Cypripedium acaule

Although flowers of this species are self-compatible, cross-breeding is the primary means of reproduction. Bumblebee queens, *Bombus* Latrielle, are the chief pollinators; however, at least ten different species of bees have been collected with pollen attached (Argue 2011).

Cypripedium arietinum

Anyone who has examined these flowers might wonder how any bee could force their way into the entrance hole of 1-2mm, much less an exit hole of 1mm. As in most of our slipper orchids, plants are self-compatible, but self-pollination is absent (Catling 1983). Cross-pollination is infrequent and reproduction is primarily vegetative (Stoutamire 1967). The only identified pollinator is a small sweat-bee, *Lasioglossum coeruleum* (Stoutamire 1967).

Cypripedium californicum

The only pollinator so far documented of this species is a small carpenter bee, *Ceratina acantha*. Additional visitors, bees and flies, have been seen around and in its flowers, but none were carrying pollen (Argue 2011).

Cypripedium candidum

Although self-compatible, pollen from other flowers on the same stem or clone will pollinate its flowers; this species does not self-pollinate. At least a dozen species of bees have been documented as pollinators (Bender 1985, Argue 2011). The widespread hybridization of this species with *Cypripedium parviflorum* var. *pubescens* and *C. parviflorum* var. *makasin* demonstrates a lack of pollinator specificity.

Cypripedium fasciculatum

This species is self-compatible but self-pollination does not occur, and its pollinator is unusual for slipper orchids. The first fully documented pollinator was reported to be a tiny diaprid wasp in the genus *Cinetus* (Ferguson 1999). These wasps are parasites on the larvae of fungus gnats, which are, in turn, attracted to the musky odor produced by the flowers.

Cypripedium guttatum

Studies in Yunnan province, China identified several sweat bees *(Lasioglossum* spp.*)* to be pollinators. (Bänzinger 2005.) Bees, bumblebees, small wasps have also been reported as pollinators in Asia (Vakhrameeva 2008). All of these pollinators are present in North America (Argue 2011).

Cypripedium kentuckiense

The pollination biology of this species is unknown; however, as in other slipper orchid species, various insects and one moth have been found in the lips (Argue 2011).

Cypripedium montanum

No thorough studies have been reported on the breeding system of this species; however, a few reported sightings of possible pollinators refer to small to medium size bees (Argue 2011).

Cypripedium parviflorum

This species has four varieties (see the earlier discussion) that have only recently been fully differentiated. Given that earlier literature reporting pollinators did not have the benefit of this taxonomic structure, it is difficult, if not impossible, to establish which variety is being reported in most of the pollination literature, even though all varieties produce volatiles and the compounds seem to differ amongst the varieties. Although this species is self -compatible, cross-pollination is the rule in nature (Case 1993, 1994).

The list below shows the variety of pollinators observed for the species as a whole. All are small to medium size bees with the exception of *Eristalis* sp., hover flies: halictid bees (small sweat bees), *Ceratina sp*. (small carpenter bees), *Lasioglossum sp*. (small sweat bees), *Agapostemon sp.* (small sweat bees), *Osmia sp*. (mason bees), *Apis sp.* (honey bees), *Adrena sp.* (mining bees), and *Eristalis sp.* (hover flies).

Cypripedium passerinum

Sparrow egg Lady's-slipper is the northernmost occurring slipper orchid in our range — in areas that were for the most part covered by glaciers ten thousand years ago (Catling 1983). This indicates that *Cypripedium passerinum* is a colonizing species and self-fertilization is advantageous in a colonizing species because new colonies can originate with the success of a single seedling (Argue 2011). In this species the anthers develop next to the stigma, which differs from others of our slipper orchids; this unique anatomic arrangement allows self-pollination.

Recent finds of possibly cross-breeding morphotypes of this species in non-glaciated regions support the theory that the species was originally cross-

breeding, but evolved a self-pollinating strategy as it enlarged its range with the retreat of the surrounding glaciers (Catling and Bennett 2007).

Cypripedium reginae

This species is also self-compatible, but self-fertilization in the absence of a pollinator does not occur (Catling 1983). Since many plants produce more than one flower, pollen from one flower can pollinate others on the same stem.

Pollination studies of this species resulted in a surprising finding. Until recently the only reported pollinators of *C. reginae* have been medium sized bees, including two species of leaf-cutter bees. However, studies in Vermont showed that Syrphid flies were the most important pollinators In addition the researcher found a Scarab beetle carrying pollen from Showy Lady's-slipper (Vogt 1990).

Cypripedium yatabeatum

There are no studies on the pollination of this species (Argue 2011).

MYCORRHIZAL RELATIONSHIPS

Our understanding of the relationship between orchids and fungi has grown and evolved a great deal since Bernard first advanced the theory that there was a mutually beneficial relationship between the two at the turn of the twentieth century. After nearly forty more years of research, investigators declared that the relationship was not mutually beneficial at all, and that "the symbiotic relationship is one of parasite and host, with the orchid deriving no benefits from the fungus in its roots." The fungus was thus declared a parasite (Curtis 1939). We have come a long way since then.

Our knowledge of orchids and fungi has grown. At the time Curtis' article was written, it was accepted that fungi were plants. It is now acknowledged that fungi form a separate kingdom from both plants and animals, although, interestingly, genetic studies show that fungi are more closely related to animals than plants. While our earlier concepts of fungal taxonomy and classification were based on morphology (the gross structure), the advent and continued sophistication of molecular analysis in the last two decades has led to a massive revision of our understanding, classification and taxonomy of the kingdom. In addition to these changes in understanding of fungi, the details of the interaction between fungi and orchids have grown exponentially also.

Electron microscopy allowed scientists to visualize the interaction of fungal hyphae, the long, thin, underground branching parts of the fungus, with the roots of orchids. This tool enabled researchers to determine that fungal hyphae invaded orchid seeds and cells and that the orchid cells digested them, making orchids the parasite in the equation. The next advances took more time.

The first mention I remember of specific orchid mycorrhizal fungi was the term *Rhizoctonias*, which I interpreted to mean a genus of fungi similar to the concept of genus I was used to in flowering plants. However this is not the case.

Rhizoctonia was always acknowledged to be a 'form genus.' This is a common concept in fungi and other disciplines — utilized to group organisms that look alike and which cannot be further separated because of a lack of distinguishing characteristics. In the case of fungi, hyphae tend to look alike, and in the absence of reproductive structures, beyond some basic level, they cannot be further identified. Mycology, then, has dealt with two systems of taxonomy, one for "real" species based on reproductive structures, and another of "form" species and genera that are merely convenient ways of grouping non-reproductive mycelia. Therefore DNA technology has permitted the resolution of long-recognized problems by linking form species with their reproductive forms. *Rhizoctonia* is a form genus and its "species", such as the facultative plant pathogen and orchid mycorrhizal associate *Rhizoctonia solani*, have always been acknowledged to be artificial groupings of diverse species (Sheviak, C., pers. comm.). So although diversity of fungi species in orchid mycorrhizal fungi had been noted earlier (Curtis 1939), molecular research proved that what we used to call *Rhizoctonias* were actually many different species, not necessarily closely related.

In the 1970s much research was done into the relationship of orchids and fungi in the laboratory. Mycorrhizal fungi were placed in artificial nutrients, allowed to grow to sufficient mass to separate out and identify the fungal species. These studies proved that not all fungal species in the mycorrhizal mass actually played a part in orchid development. Two additional breakthroughs came to light with these experiments. First that there was no single orchid-fungus relationship; not only were multiple fungal species involved, but orchid species differed in how they formed relationships. Some orchids formed relationships with multiple fungal species; some were more restrictive, partnering with only one fungus.

Another major breakthrough in the 1970s related to the flow of carbon between plant and fungus. Investigators were able to show that although in other plant families with mycorrhizal relationships, the carbon flow goes from plant to fungus, in orchids the flow goes from fungus to plant.

Further studies of mycorrhizal fungi provided new insights into their life histories, and through the technology of molecular DNA analysis, there have been substantial revisions in fungal taxonomy, as noted above.

Recently mycorrhizal study has returned to field studies, continuing in the manner reported by Curtis (Curtis 1939). This is an especially difficult task given the wide distribution of orchid populations and the inability to sample every population of an orchid species, especially small populations and rare species. Many studies on non slipper orchids have been reported in the last fifteen years (McCormick, et al 2004, McCormick, et al 2006, Rasmussen, 1995, Cameron 2006, Shefferson 2008), but only recently have our slipper orchids been studied in the field (Shefferson 2005, 2008, Whitridge 2004).

The latest and broadest of these studies (Shefferson, et al 2007) reported that in fifteen *Cypripedium* species studied, the overwhelming majority associated with fungi within the fungal family *Tulasnellaceae*. Parenthetically this is the same family of fungi associated with the non-photosynthetic orchid genera *Hexalectris* and *Corallorhiza*. Given that plants of these two genera depend on their mycorrhizal fungi totally for their carbon, it seems reasonable that fungi from the same family would supply the nutrition for a group of orchids that must survive long periods of dormancy. Another finding was that where different orchid species grew closely together geographically, they associated with different sets of fungi. This study also showed that our slipper orchids are not consistent in their number of fungal associates. *Cypripedium californicum* and *C. acaule*, the oldest of our slipper orchids phylogenetically, associate with a number of fungal species, whereas *C. arietinum, C. candidum, C. fasciculatum, C. guttatum, C. montanum*, *C. parviflorum* and *C. reginae* associate with few fungal species.

There is still much to learn about orchid mycorrhizal relationships – much of which pertains to the fungi. Some estimates of potential number of fungal species on Earth range up to 1.5 million species. Less than ten percent have been identified, and little is known about fungal life histories. So look forward to new knowledge in this emerging field.

POPULAR NAMES

The obvious need for and use of a universal system of naming plants and animals for scientific purposes has proved invaluable for a century and a half. But in everyday use people have continued to use colloquial terms for the plants growing in their region, and slipper orchids are no exception.

For scientific names, the rules are set by international convention, with the genus name capitalized and the species epithet lower case. There are no inter-

national rules concerning popular names; a literature review reveals wide variation. Some authors capitalize the first name, but not the second; some capitalize both and some neither. Recent books have a preference for lower case for all popular names. This has always been a sticking point for this author. I consider it demeaning – I prefer Uncle Bob to uncle bob. I have chosen the following conventions for the names listed below. Popular names here will have both names capitalized. Another personal issue is the designation, common name; this connotes vulgar. The term used here is popular name, implying appealing to the general public or aimed at non-specialists. Beyond these points there arose other difficulties.

How to deal with the term Lady's Slipper? Some authors refer to Lady's Slipper (referring to "Our Lady," or Mary), a historical holdover from Europe, while others refer to Ladies' Slipper (referring to all females). I have opted to keep both spellings in this listing.

There is considerable variation as to hyphenation (Lady's-Slipper vs. Lady's Slipper). Where both appeared, I have shown only one.

In researching popular names in the literature a pattern became apparent. In the early twentieth century, many popular names for a given widespread species were reported; the number decreased as time progressed. My theory is that prior to the middle of the twentieth century there were few widely distributed articles or books referring to our slipper orchids. Consequently, discrete names were used in isolated regions of primarily the northeastern quadrant of the country. All these names were not used throughout; rather many were in use in distinct geographic localities. For instance in some sections of Pennsylvania, kids used to put sand in the bottom of slippers and then place them in streams and lakes. They resembled ducks and therefore all slipper orchids from those areas were referred to as ducks. As more articles and books were disseminated, names became more homogenized. In most contemporary books and articles, only one or two popular names are given.

A word about popular names used for the Lady's Slipper in Europe. Of course there is only one species in Europe, but the name used in various countries all reflect the church domination of education until modern times. That influence still persists. Here is a small sampling.

France –*Sabot de la Vierge* (Clog of the Virgin). In Quebec this term was used for all Lady's Slippers. *Soulier de Notre Dame* (Shoe of Our Lady).

Germany – *Marienschuh* (Mary's Shoe), *Frauenschuh* (Womens Shoe), *Pantoffel* (Slipper), *Papstschuh* (Pope's Shoe).

Italy – *Scarpa della Madonna* (Shoe of the Madonna).

Some sources for North American slipper orchids are (Correll 1950, Gibson 1904, Luer 1975, Niles 1902, 1904).

Cypripedium acaule

Rose-veined Moccasin, Stemless Lady Slipper, Two-leaved Slipper, Pink Moccasin, Hare's Lip Squirrel Shoes, Noah's Ark, Whip-poor-will Shoe. Moccasin, Hare's Lip, Squirrel Shoes, Pink Lady's Slipper, Pink Moccasin-flower, Dwarf Umbil, Valerian, Purple Slipper, Brown Lady's Slipper, Old Goose, Camel's foot, Nerve-root, Moccasin Orchid.

Cypripedium arietinum

Ram's Head Lady Slipper, Ram's Head, Steeple Cap, Ramhead Lady's Slipper, Ram's Head Orchid, Ram's Head Cypripedium, Chandler's Cypripedium.

Cypripedium californicum

California Lady's-Slipper.

Cypripedium candidum

Silver Slipper, Violet-veined White Slipper, White Lady Slipper, Small White Lady's-Slipper, White Frauenschuh, Moccasin Flower, Silver Slipper Orchid.

Cypripedium fasciculatum

Clustered Lady's Slipper, Brownie Lady's Slipper.

Cypripedium guttatum

This species and *C. yatabanum* are primarily Asian and Far Eastern in distribution; they are at the easternmost edge of their range in North America, as noted earlier in the article. I have included the popular names used in Japan for both.

Spotted Lady's Slipper — Kibana's lady's slipper (in Japan).

Cypripedium kentuckiense

Kentucky Lady's Slipper, Southern Lady's Slipper, Daulton's Lady's Slipper, Ivory Ladies'-Slipper, Purloined Slipper.

Cypripedium montanum

Large Lady's Slipper, Mountain Lady's Slipper, White Lady's Slipper, Moccasin flower.

Cypripedium parviflorum

As might be expected this species presents unique problems. Given that the concept of this species and its varieties has been modified so many times in the last few decades, it is virtually impossible to say to which presently recognized variety a given popular name applies. Consequently many of the older popular names might have been applied to one, two or three of the presently recognized varieties. The distinctions made here should be given some latitude.

Cypripedium parviflorum var. pubescens

Large Yellow Lady's-Slipper, Yellow Lady's Slipper, Yellow Moccasin, Yellow Moccasin Flower, Golden Slipper Orchid, Yellow Indian Shoe, Yellow Noah's Ark, Greater Yellow Lady's Slipper, Water Stealer, Noah's Ark, Whippoorwill-Shoe, Yellow Downy Lady's Slipper, Downy Lady's Slipper, American Valerian (Valerian has been used since Roman and Greek times to treat insomnia and nervous conditions), Monkey Flower, Umbil Root, Yellow Umbil.

(I find no reference as to the meaning of umbil other than related to the word umbilical, and can only surmise that the infolded opening to the pouch reminded someone of a belly button), Nerve Root, Male Nervine (Some used the root as a sedative, perhaps more effective for males?), Yellows, Yellow Indianshoe, Venus' Cap, Venus' Shoe, Yellow Slipper Orchid, Golden Slipper.

Cypripedium parviflorum* var. *parviflorum – In nearly all instances it is impossible to distinguish whether names applied to a smaller-flowered *C. parviflorum* were meant for this variety or *C. parviflorum* var. *makasin*.

Golden Slipper Orchid, Yellow Lady Slipper, Yellow Moccasin, Golden Slipper, Water Stealer, Noah's Ark, Whip-poor-will Shoe, Lesser Yellow Lady's Slipper, Small Yellow Lady's-Slipper.

Cypripedium parviflorum var. makasin

Small Yellow Lady's Slipper.

Cypripedium parviflorum var. exiliens

Western Yellow Lady's Slipper.

Cypripedium passerinum

Franklyn's (sic) Lady's-Slipper, Small White Northern Lady's-Slipper, Sparrow's Egg, Swallow's Egg Lady's-Slipper, Purple-Spot White-Slipper, Franklin's Lady's-Slipper (Captain John Franklin led the expedition in Canada during which this species was first discovered), Sparrow's Egg Lady's Slipper, Small White Lady's Slipper.

Cypripedium reginae

Queen Lady Slipper, Showy Slipper, White-wing Moccasin, Big Pink-and-White, Purple Blush, Large White Lady's-Slipper, Queen's Lady's-slipper, Showy Lady's-Slipper, White-Petalled Lady's Slipper, Queen Slipper-Orchid, Pink Lady's Slipper, Royal Lady's Slipper, Pink Moccasin-Flower, Female Nervine, Silver Slipper, Moccasin Flower, Queen of the Indian Moccasin-Flowers, Showy Moccasin Flower.

Cypripedium yatabeanum

Green Moccasin-Flower, Yellow Spotted Lady's-Slipper, Yatabes Cypripedium (Honoring Ruyokichi Yatabe, who collected the type specimen), Ezo Kumagai's Lily (in Japan; Ezo province is the primary location for this species).

ETHNOBOTANY

I have a miracle drug for your consideration. It has been used as an antispasmotic, aphrodisiac, hallucinogen, sedative, tonic, stimulant, diaphoretic, tranquilizer, analgesic, cure for headaches, menstrual cramps, nervous disorders, insomnia, as a remedy for all female problems, depression from sexual overindulgence, fever and a few other health issues (Lawler 1984, Moerman 1998). All these conditions are documented as having been treated with species of our Lady's Slippers. First a little background.

From earliest times plants were used as drugs and orchids were no exception. At the time North America was discovered and colonized, medicines were overwhelmingly plant based, so the pattern was set. Europeans used *Cypripedium calceolus* to help heal wounds and treat epilepsy for generations

(Lawler 1984). It was logical that newcomers to our continent would seek out plants and determine what use Native Americans made of them. They found a treasure trove.

Various native tribes, including Cherokee, Fox. Iroquois, Menominee, Micmac, Penobscot, Rappahannock, Ojibwa, and Chippewa used Lady's Slippers to treat an extraordinary range of conditions, sometimes contradictory, as you can see above (Moerman 1998). The most common use was in treating nervous conditions. Since Europeans had routinely used Valerian for similar conditions, Lady's Slippers became known as American Valerian.

Gradually non-native medical practitioners adopted the use of Lady's Slippers in their armamentarium and such use continued well into the 20th century as seen in this quote,

> "Collection, Prices and Uses -- Both rootstock and roots are used and these should be collected in autumn, freed from dirt and carefully dried in the shade. These beautiful plants are becoming rare in many localities. Sometimes such high priced drugs as golden seal and senega are found mixed with the Lady's-Slipper, but as these are more expensive than the Lady's-Slipper it is not likely that they are included with fraudulent intent and they can be readily distinguished. The prices paid to collectors of this root range from 32 to 35 cents a pound.
>
> "The principal use of Lady's-Slipper, which is official in the United States Pharmacopoeia, is as an antispasmodic and nerve tonic, and it has been used for the same purposes as valerian." (Harding 1908)

The US Pharmacopeia listed the active ingredient as Cypripedin (2,8 dimehoxy -7-1,4 phenanthraquinone) (Lawler 1984); the last date I could find it listed was in 1900. Its use continued to decline; however, I have copies of catalogs from herbal medicine suppliers as late as 1930 listing the roots for sale.

With the advent of modern drug development, the removal of Lady's Slipper plants from the woods to treat nervous disorders and other health problems should be a thing of the past. Despite a complete absence of scientific evidence that Cypripedin or Lady's Slippers are effective medicines, there are a number of groups and herbal medicine websites that still promote its use.

Before leaving this topic, mention should be made of the allergenic nature of some Cypripedium plants. Various species have been reported to cause moderate to severe contact dermatitis from handling leaves and stems (Jesup, 1893,

Reddoch 1984, MacCaulay 1987). Studies point to Cypripedin as the causative agent, although other quinone-like chemicals were also found in the glandular hairs covering the stems and leaves (Hausen 1984).

Of the North American Lady's Slippers, the species most likely to be linked to allergic contact dermatitis are *Cypripedium reginae, C. acaule and C. parviflorum*, with other species mentioned less often. Another finding is that there is wide variability between individuals as to their reaction to these plants. Some people are acutely sensitive to them and some not at all.

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BIBLIOGRAPHY

Argue, C.L. 2011. The Pollination Biology of North Americans Orchids; North of Florida and Mexico. Vol. 1. Springer Science+Business. New York.

Barkman, T.J., Beaman, J.H., Gage, D.A. 1997. Floral fragrance variation in *Cypripedium*: implications for evolutionary and ecological studies. Phytochemistry 44:875-882.

Bender, J.D. 1985. The reproductive biology of *Cypripedium candidum* Muhl. Ex Willd. (Orchidaceae). Ohio J. Sci. 85:12.

Bergström, G., Birgerssom, G., Groth, I., and Nilsson, L.A. 1992. Floral fragrance disparity between three taxa of Lady's Slipper *Cypripedium calceolus* (Orchidaceae) Phytochemistry 31:2315-2319.

Cameron, D.D., Leake, J.R. and Read, D.J. 2006. Mutualistic mycorrhiza in orchids: evidence from plant-fungus carbon and nitrogen transfers in the green-leaved terrestrial orchid *Goodyera repens*. New Phytol. 171:405–416.

Case, M.A 1993. High Levels of Allozyme Variation within *Cypripedium calceolus* (Orchidaceae) and Low Levels of Divergence among its Varieties. Systematic Botany 18:663—677.

_____ 1994. Extensive variation in the levels of genetic diversity and degree of relatedness among five species of *Cypripedium* (Orchidaceae). American Journal of Botany, 81:175–184.

Catling, P.M. 1983. Autogamy in Eastern Canadian Orchidaceae: A Review of Current Knowledge and some new Observations. Naturaliste Canad. 110:37-54.

Catling, P.M. and Bennett, B.A. 2007. Discovery of a Possibly Relict Outbreeding Morphotype of Sparrow's-egg Lady's-slipper Orchid, *Cypripedium passerinum,* in Southwestern Yukon. The Canadian Field–Naturalist 121:295-298.

Catling, P.M. and Catling, V.R..1991. A Synopsis of Breeding Systems and Pollination in North American Orchids. Lindleyana 6(4):187-210.

Correll, D.S. 1950. Native Orchids of North America North of Mexico. Stanford University Press, Stanford, CA.

Curtis, J.T. 1939. The Relation of Specificity of Orchid Mycorrhizal Fungi to the Problem of Symbiosis. Am. Journal of Botany 26(6):390-399.

Ferguson C.S. and Donham, K. 1999. Pollinator of clustered lady's slipper orchid, *Cypripedium fasciculatum* (Orchidaceae) in Oregon. N Am Native Orchid J 5:180-183.

Gibson, W.H. 1905. Our Native Orchids. Doubleday, Page and Company. NY.

Harding, A.R. 1908. Ginseng and Other Medicinal Plants. A.R. Harding Pub. Columbus, OH.

Hausen, B.M. 1984. Toxic and Allergenic Orchids. In Orchid Biology Reviews and Perspectives III, pp. 261-283. Cornell University Press, Ithaca, NY.

Jesup, H.G. 1893. Is *Cypripedium Spectabile* Poisonous to the Touch?. Botanical Gazette 18-4:142-143.

Lawler, L.J. 1984. Ethnobotany of the Orchidaceae, In Orchid Biology: Reviews and Perspectives III. J. Arditti (ed.) pp 27-151. Cornell University Press. Ithaca, NY.

Lloyd, J.U. 1911. History of the Vegetable Drugs of the Pharmacopeia of the United States. Bull. Lloyd Library 18, Pharmacy Series No. 4. Cincinnati, OH.

Luer, C.A.1975. The Native Orchids of the United States and Canada excluding Florida. NY Botanical Garden. NY.

MacCaulay, J.C. 1987. Orchid Allergy. Contact Dermatitis 17: 112-113.

McCormick, M.K., Whigham, D.F. and O'Neill, J. 2004. Mycorrhizal diversity in photosynthetic terrestrial orchids. New Phytol. 163:425–438.

McCormick, M.K., Whigham, D.F., Sloan, D.O'Malley, K.and Hodkinson, B. 2006. Orchid-fungus fidelity: a marriage meant to last? Ecology 87:903–911.

Moerman, D.E. 1998. Native American Ethnobotany. Timber Press. Portland, OR.

Niles, G.G. 1902. Origin of Plant Names. The Plant World. 5(8):141-144.

_____ 1904. Bog-Trotting for Orchids. G.P. Putnam's Sons. NY.

Nillson, L.A. 1979 Anthecological studies on the Lady's-slipper, *Cypripedium calceolus* (Orchidaceae). Bot. Notiser 132:873-881.

Rasmussen, H.N. 1995. Terrestrial orchids: from seed to mycotrophic plant.

Cambridge Univ. Press, Cambridge, UK.

Reddoch, A.H., and Reddoch, J.M. 1984 Warning: Lady's slippers can be hazardous to your health. Plant Press 2(1):10.

Shefferson, R.P., Kull, T., and Tali, Kadri. 2008. Mycorrhizal interactions of orchids colonizing Estonian tailings hills. Am. J. Bot. 95:156-164.

Shefferson, R.P., Taylor, D.L. et al. 2007. The evolutionary history of mycorrhizal specificity among lady's slipper orchids. Evolution 61(6):1380-1390.

Stoutamire, W.P. 1967. Flower biology of the lady's-slippers. Michigan Bot. 6:159-175.

Stoutamire, W.P. 1971. Pollination in temperate American orchids. In: Proceedings of the 6th World Orchid Conference. Coorrigan MJ (ed) pp. 233-243. Halstead Press. Sydney, Australia.

Vakhrameeva, M.G., Tatarenko, I.V., Varlygina, T.I., Torosyan, G.K., and Zagulski, M.N. 2008. Orchids of Russia and adjacent countries (within the borders of the former USSR). Ruggell A.R.G. Gantner, Liechtenstein.

Whitridge, H., and Southworth, D. 2004. Mycorrhizal symbionts of the terrestrial orchid *Cypripedium fasciculatum*. Selbyana 25:254–260.

Vogt, C.A. (1990). Pollination in *Cypripedium reginae*. Lindleyana 5:145-150.

Whitridge, H., and Southworth, D. 2005. Mycorrhizal Symbionts of the Terrestrial Orchid *Cypripedium fasciculatum*. Selbyana 26-1:328-334.

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List of topics included in this series[1],

A Social History of North American Slipper Orchids

By Hal Horwitz

Introduction – Describing the goals of the series and how it would differ from standard texts.

Historical Background – An overview of the myths and nomenclature of the slipper orchid in Europe up to the discovery and colonization of North America.

The New World and Evolution of Scientific Classification – How botanical exploration in the New World expanded the knowledge of slipper orchids.

Scientific Names – the Whys and Wherefores – How Linnaeus dealt with our species in *Species Plantarum* and how slipper orchids almost became a family separate from the rest of orchids.

A Review of our Species – A discussion of who discovered and under what circumstances our slipper orchids were first reported, and the history of the accepted scientific names of each species.

Pollination of our Slipper Orchids – What we know and what we don't know about the pollination biology of the species.

Mycorrhizal Relationships in Our Cypripedium Species – An overview of the evolution of knowledge of the complex relationship between orchid and fungus, how difficult the search for understanding has been and the progress made so far.

Popular Names – A historical look at the variety of popular names applied to our slipper orchids and, where possible, an explanation of the relevance of the names.

Ethnobotany – How native Americans and herbalists used slipper orchids to treat disorders and how, unfortunately, some still do.

1. Volume 7(4):1-11; 8(1):1-7; 8(2):1-8; and 8(3):1-10, 19-20..

Distribution of the Infrataxa of Calypso Revealed by Flickr® Online

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Of 1,215 photos of North American *Calypso bulbosa* on the Flickr website, there were 200 unique locations. The infrataxa portrayed in the photographs taken at these locations were identified and mapped. The map revealed eastern and western patterns that were already known but previously without a clear basis. The work confirmed the eastern extension of var. *occidentalis*, mostly of the Coastal Mountains, into the Rocky Mountains of western Montana, and it also suggested contact in this region with var. *americana* as well revealing the presence of the hybrid, *Calypso* nothovar. *kostiukiae*. Another photo of the latter was taken in southwestern British Columbia in Stein Valley in the Lilloet Range in Nlaka'pamux Heritage Park, basically the east slope of the Coastal Mountains. This is apparently another general region where the putative parents may be in contact. The hybrid concept is supported by its geographical restriction to a small area of probable contact of the putative parents. Flickr is of particular interest as an information source because of: (1) the high level of accessibility; (2) the proof value of a good photo, which may be more valuable and informative than a recollection; and (3) the fact that it is an independent source that can augment and help to evaluate data from other sources.

INTRODUCTION

"Flickr," an image hosting website created by Ludicorp in 2004 and acquired by Yahoo! in 2005, includes over 51 million registered members. Photos can be accessed from Flickr without registering an account (http://en.wikipedia.org/wiki/Flickr). Many of the photos have information regarding where the photo was taken (obtained by clicking on the photo) and many actually include a map. The photos that are available for a particular plant have widespread sources and are sometimes numerous. This source of information was explored in connection with the recently described hybrid, *Calypso bulbosa* nothovar. *kostiukiae.* (Catling 2012) and because information on the infrataxa of *Calypso* is frequently lacking in regional floras. The results are of

(Continued on page 21)

Figures to accompany "Distribution of the Infataxa of *Calypso bulbosa* Revealed by Flickr Online" by Paul M. Catling and Brenda Kostiuk, page 16.

Figure 1. Calypso orchids. a, *Calypso bulbosa* var. *americana*, Jasper, Alberta; b, *Calypso bulbosa* nothovar. *kostiukiae*, Waterton, Alberta; c, *Calypso bulbosa* var. *occidentalis*, Medford, Oregon. All photos by Hal Horwitz.

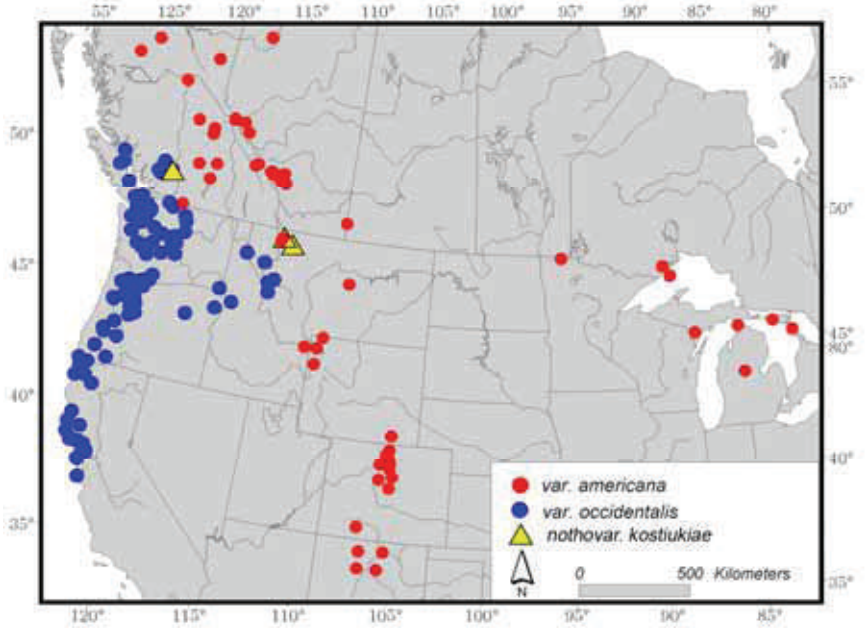

Figure 2. Map of the North American distribution of three infrataxa of *Calypso bulbosa* revealed by photos in Flickr online.

Figures to accompany "Searching for a Ghost Orchid in South Florida" by Haleigh Ray, page 27. Also see front cover. All photos by author.

Figure 1. The habitat, 2. *Prosthechea cochleata* growing nearby, and 3. initial work on scale that affects many of the native orchids in the area.

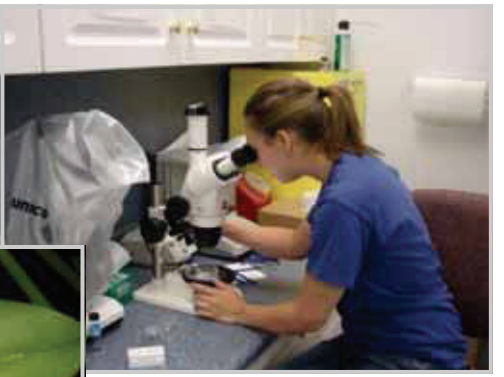

Figure 4. Scale on orchid leaves.

Figures to accompany "*Goodyera pubescens*… Being Pollinated!" by Jean M. Stefanik, page 29. Photos by author.

Habitat showing tessellation, plant in bloom, and bee pollinating *Goodyera pubescens.* Also see back cover.

Figures to accompany "New County Records for *Spiranthes vernalis* in Southern Illinois" by Christopher David Benda, page 31.

Figure 1. Flower spike of *Spiranthes vernalis* showing single row of spiraling flowers.

Figure 2. Close-up of flower.

(Continued from page 16)
interest with regard to support for the hybrid and with respect to what a single online source can reveal about a group of popular native plants.

METHODS

The name "*Calypso bulbosa"* was searched for in the Flickr website (http://www.flickr.com/). The plants in photographs were identified to infrataxa of *Calypso bulbosa* using the following characteristics arranged into three choices (see also Figure 1; page 17).

> 1. Lip with central yellow spot and a few small pink spots, the latter only in the central area near the yellow spot, the outer lip apron pure white or rose and unmarked … **Eastern Calypso** (*Calypso bulbosa* (L.) Oakes var. *americana* (R. Brown) Luer) (Figure 1a)
>
> 2. Lip with central yellow or white spot and small pink spots scattered over the entire area of the lip apron … **Kostiuk's Hybrid Calypso** (*Calypso bulbosa* nothovar. *kostiukiae.* P.M. Catling) (Figure 1b)
>
> 3. Lip with central white spot, two pinkish to brownish blotches, or a single large blotch below it and magenta or brownish, sometimes pinkish spots elsewhere and around the edge of the lip apron … **Western Calypso** (*Calypso bulbosa* (L.) Oakes var. *occidentalis* (Holzinger) B. Boivin) (Figure 1c)

The locations were found using Google Maps and the latitude and longitude in decimal degrees was recorded in an excel database along with the corresponding infrataxon identification. The locations of all records and the locations of all infrataxa were then plotted using Arcview GIS. The locations are believed in all cases to be within 20 km of the exact place where the photo was taken. They are thus covered by the corresponding dots on the broad scale base map (Figure 2; page 17).

RESULTS

Searching for "*Calypso bulbosa*" results in 1,215 photos (http://www.flickr.com/search/?q=Calypso+bulbosa&f=hp#page=45). Approximately half of these photos have no location information. Of those that do have information, there are often several from the same location by the same photographer or by different photographers. Clearly some locations such as Flowerpot Island (Bruce Peninsula, Lake Huron, Ontario) and Washington Park (Fidalgo Island, Portland, Oregon) are popular places for photographing *Calypso*. However, there were 200 unique locations and these suggest a distinctive pattern (Figure 2; page 17).

The var. *occidentalis* is largely confined to the region of the coast ranges but extends eastward into the Rocky Mountains in the region of eastern Washington, northeastern Oregon, northern Utah and northwestern Montana (Figure 2). In northwestern Montana there are photographs of var. *occidentalis* from Hamilton, the Coeur d'Alene Mountains, and the vicinities of Missoula and Upper Rattlesnake. The var. *americana* on the other hand is confined to areas east of the Coast Mountains where it has a widespread distribution, the westernmost point found being the Similkameen River in Manning Park, southwestern British Columbia. The eastward extension of var. *occidentalis* comes close to the range of var. *americana*. Specifically the var. *americana* is shown to extend well into this area of probable contact based on the photos from Manning Park (Figure 2; page 17).

From a part of this general region of close contact in northwestern Montana there are photos of the hybrid between var. *americana* and var. *occidentalis*, *i.e.*, *Calypso* × *kostiukiae*, from Glacier National Park. Other photos from the park indicate the presence of var. *americana*. The photos of nothovar. *kostiukiae* are from different sources, and along with the photos in books (Catling 2012), they suggest that the Kostiuk's Hybrid Calypso may be abundant in parts of Glacier Park. Another photo of Kostiuk's Hybrid Calypso was taken in southwestern British Columbia in Stein Valley in the Lilloet Range in Nlaka'pamux Heritage Park, on the east slope of the Coastal Mountains. This is apparently another region where the putative parents are at least in close contact, and the local presence of var. *occidentalis* is established with photos.

DISCUSSION

The distribution of the infrataxa of *Calypso bulbosa* in North America has been featured only by Luer (1975) and later by Sheviak and Catling (2002). Their indicated distributions are generally supported by the data presented here. The basis for the maps produced by these authors was personal observations and personal communications, examination of specimens in herbaria, as well as some literature references, but no details were given. Literature was of limited value because authors of regional floras generally did not separate the varieties, although in an unusual departure, they were treated as subspecies with extensive discussion by Calder and Taylor (1968).

The eastward extension of range of var. *occidentalis* was indicated by both Luer (1975) and by Sheviak and Catling (2002) and is supported here. Based on the data presented, the hybrid is supported as such as a result of being confined to the relatively small region of probable contact of the putative parents.

Although very illuminating, Flickr is only a single source of information on this subject. It is incomplete and influenced by the distribution of members and the higher frequency and greater abundance of both varieties of *Calypso bulbosa* in western North America than in eastern North America. For example var. *americana* is found in southern Manitoba (Ames *et al.* 2005) and var. *occidentalis* extends up the Pacific coast to the Alaska panhandle (Hultén 1968, but not into central Alaska where var. *americana* occurs). Neither of these areas of occurrence are indicated in Figure 2. Much additional information on the occurrence of these infrataxa may be obtained from personal observations, books and herbarium specimens.

Despite limitations, Flickr did provide new and useful perspectives on distribution and in the case of *Calypso bulbosa*, it represents the first extensive study based on an analysis of data from an indicated source. This source of information is of particular interest because of (1) high level of accessibility; (2) the proof value of a good picture, which may be more valuable and informative than a recollection; and (3) the fact that it is an independent source that can augment existing information and help to evaluate information from other sources, such as literature and specimens.

ACKNOWLEDGEMENTS

Hal Horwitz provided excellent photos of *Calypso* for Figure 1, page 17. Chuck Sheviak provided useful comments on the manuscript.

LITERATURE CITED

Ames, D., P.B. Acheson, L. Heshka, B. Joyce, J. Neufeld, R. Reeves, E. Reimer and I Ward. 2005. Orchids of Manitoba, a field guide. Native Orchid Conservation Inc. 158 pp. http://www.nativeorchid.org.

Calder, J. A. and R. L. Taylor. 1968. Flora of the Queen Charlotte Islands, part 1, systematics of the vascular plants. Research Branch, Canada Department of Agriculture monograph no. 4, part 1. 659 pp.

Catling, P. M. 2012. A new infraspecific *Calypso* hybrid. Native Orchid Conference Journal 9(1): 1-6.

Hultén, E. 1968. Flora of Alaska and neighbouring territories, a manual of the vascular plants. Stanford University Press, Stanford, California. 1008 pp.

Luer, C.A. 1975. The native orchids of the United States and Canada , excluding Florida. New York Botanical Garden. 361 pp.

Sheviak, C.J. and P.M. Catling. 2002. 51. *Calypso.* Pp. 622-623 *in* Flora of North America Editorial Committee, Flora of North America North of Mexico, volume 26. Oxford University Press, New York, New York.

Preliminary Report on Chlorine Dioxide for Treating Orchid Seeds

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Here's a quote from "North American Native Terrestrial Orchids, Propagation and Production" (1996) by William K. Steele:

> "Attention should be focused on the point that the effectiveness of bleaching in NaOCl in breaking dormancy was an accidental discovery made doing bleaching for surface sterilization. It seems highly likely that a deliberate search might find chemical agents more effective for removing germination-inhibiting substances from the embryo sac while being less destructive to embryo tissues."

This is a preliminary report of a "deliberate search" for a better bleaching agent.

Chlorine dioxide (ClO_2) is widely used in bleaching wood pulp, and it is well known to be far gentler on cellulose fibers than NaOCl. It has an oxidation-reduction potential of about 590 mv, as opposed to 750 mv for NaOCl. Not only is chlorine dioxide a superior bleaching agent, it is also widely used as a sterilizing agent. It is generated as needed by adding a solution of a weak acid, such as citric, to a solution of sodium chlorite ($NaClO_2$). Both are stable crystalline solids, and readily available in kit form, or from PhytoTech Labs. Chlorine dioxide could be everything that we are looking for.

I made up 1% solutions of these solids in rain water. The citric acid keeps indefinitely, but sodium chlorite solutions decomposes with time and must be made up fresh. By mixing equal portions, an approximately 0.5% solution of chlorine dioxide is produced.

An Idea Concerning Germination-Inhibiting Substances

Higher plants produce a wide variety of condensed phenolic substances such as lignins, tannins and flavones that serve many purposes, such as ultraviolet pro-

tection, preservation, stiffening etc. These materials are almost always brown in color, and I am suggesting that they may well be the candidate materials in seed inhibition. They are readily removed from plant tissue by the very bleaching agents under discussion.

The role of phenolic compounds in land plants is covered in detail by Gillian A. Cooper-Driver in "Plants Invade the Land", Columbia University Press, 2001.

EXPERIMENTS

I have done a lot of "dabbling" with this idea, and will not lead you through all of the false starts, but will detail, as best as I can, a couple of experiments that went very well.

Experiment 1: 19Jan10. Used Steele medium T-849 with added 0.2 g casein hydrolysate and 0.2 g. myo-inositol in a 1 liter batch. Pasteurized by boiling 1 hour in a water bath, making up 22 flasks in recovered jelly jars.

Cypripedium reginae seed had been collected in September 2009 from a site near Moxie Falls, Maine, which had been previously hand pollinated. The mother plants had dried away, and the seed capsules were ready to burst. Seed from 2 pods were recovered and dried.

During flasking on 1Feb10, a "pinch" of seed was bleached for 8 minutes in a vial with 10 drops of 1% NaOCl and 10 drops of 1% citric acid, as an activator. After 8 minutes, the excess water was removed by a plastic pipette, and a small amount of sterile water was added, and the seed was plated onto two jars of T-849. They were stored at room temperature in darkness for 6 weeks, and a nice growth of protocorms formed. They have been in subdued light since then, and a great abundance of small plants is forming.

Experiment 2: Exactly as Exp. #1, but using Malmgren M-551 instead of Steele T-849, and with the same amendments. This medium has carbon black. I set two jars, as in Exp. #1 with Moxie Falls *Cyp. reginae* seed on 1Feb10. An abundant growth is noted, with about 70 small plants growing in the two jars. They are outperforming those set on Steele T-849, and are ready for replate.

RECENT RESULTS

I gathered excellent seed at the Moxie Falls site in 2011, and set 17 mother flasks on December 7, 2011. Bleaching was for 8 minutes with 10 drops of 2%

$NaOCl_2$, 10 drops of 2% citric acid. The entire contents of the sterilizing vial was dumped onto the surface of amended Malmgren M-551 medium. The flasks were set in a dark container for 10 weeks before setting them in subdued light.

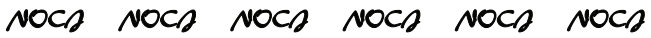
All flasks were sterile, and roots are starting to emerge.

NEXT, AND BEYOND —

I have tried to dry seed orchids onto media, and sterilize them with short wavelength UV radiation. It was successful in killing the bacteria, but not the fungi. Molds took over. It's still a great idea: just dust the seed onto the media, treat it for molds, bacteria, etc, and close the jar. So far, the molds have the upper hand.

There are 4 other methods of pulping and bleaching wood, that is, removing the lignin component, that come quickly to mind. They are all candidates for new methods of orchid seed preparation. More good news, let's hope, in the future.

Please, give chlorine dioxide a try, and let me know what you find.



Searching For a Ghost in South Florida

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Standing in the dark in the waist high water, I could notice the smell of sulfur and there were mosquitoes flying around me. My net was propped up against a floating log near the tree I was under, although it kept falling into the water. None of this mattered to me since I finally got to see one of the rarest flowers in North America—the ghost orchid, *Dendrophylax lindenii*.

Growing up in a small town in Illinois, I never thought of entomology as a career path until I got to college. My first year of school I entered as a pre-pharmacy major, but then enrolled in a general insect course which shifted my goals. One year later I began working in the Orchid Recovery Program at Illinois College and started to realize that this type of work was much more appealing to me. The following summer, I was able to combine these two interests at an internship at the Florida Panther National Wildlife Refuge, surveying native orchids for armored scale insects in Collier County.

While in South Florida there were a number of other difficulties, the kind I was not used to handling in central Illinois. I was not adapted to slowing down for alligators to cross the road, hearing them angrily hiss at you, or how to react when almost stepping on a rattlesnake. Putting these aside, the internship was both interesting and informative. I was also able to get an idea of what type of work some graduate students would be doing by working at Division of Plant Industry in Gainesville for a couple of days, learning how to place the scales onto slides and identify them with the help of Dr. Ian Stocks, a professional entomologist.

Another exciting part of this internship for me was all of the different types of orchids, many of which I was able to see in bloom. One in particular that I had been hoping to see was the ghost orchid. We would be working in multiple

areas of both Florida Panther National Wildlife Refuge and Fakahatchee Strand State Preserve, so I was certain we would see one. The first couple days working out in the refuge we saw a few ghost orchids, but so far none that were in bloom. Later in the month we visited Fakahatchee Strand, and after watching the movie *Adaptation*, I was even more sure there would be ghost orchids there. We walked around with the park biologist, Mike Owen, tripping over logs and vines for hours and swatting away what seemed like thousands of mosquitoes, yet still did not see a single ghost orchid.

A few days later we visited a site just outside of Naples specifically to look for ghost orchids. It turned out to be the only place where we would be walking though standing water, and I was glad when it finally stopped about waist deep. I was directed to go through a small area of trees, and when I reached the other side I saw one that had small white flowers attached to it. As I approached the tree I couldn't help but be excited to finally see the ghost orchid. It was a very delicate looking flower and was actually much smaller than I had imagined. All Figures are on page 18.

Luckily none of the ghost orchids that we saw were infested with scale, but some of the other types of orchids were, including *Prosthechea cochleata*. It was shocking to see what kind of damage such a small insect could cause, and made me want to learn more about them.

Despite the alligators, snakes, and swarms of mosquitoes, being in South Florida to work on this type of project turned out to be very useful to the rest of my educational plans. Now I'm getting ready to move back to the area to research armored scale damage on orchids at the University of Florida as a graduate student next fall. I look forward to seeing more orchids during my career and discovering ways to assist in their conservation for future generations to enjoy.

I kindly thank the Naples Orchid Society for funding this research. I also express gratitude to the following individuals: Lawrence Zettler, Larry Richardson, Mike Owen, Ian Stocks, John McCormick, and Andrew Stice.

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Goodyera pubescens… Being Pollinated!

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Last summer (2011) while attending the North American Native Orchid Conference, I spent some time with some *Goodyera pubescens* plants along the side of a road in Pennsylvania. They looked like other plants I had seen before, but I noticed something different this time (Figures page 19).

A singular bee was busily (ignoring me for the most part) visiting flower after flower, from plant to plant in the cluster of a dozen or so which were blooming. A bit of online research has since revealed that bee is probably *Augochlorella striata*, first documented pollinating Goodyeras by Homoya in 1993 in Indiana.

I spent over an hour watching, photographing (figure on back cover), and the persistent little bee was not the least bit intimidated at my lens being inches away. Sometimes it went almost halfway into the flower, other times seemed to just walk the outer edges of the petals with its head (and presumably proboscis) only probing the flower.

A closer look in one of the photos reveals pollen on the leg of the bee in some photos, although I admit I didn't keep track of when it appeared or was deposited. I really only was aware of it when looking closely at the photos. Some have it while others do not.

Goodyera pubescens is often called the "downy rattlesnake plantain" because of its soft downy hairs on the inflorescence, and is easily identified by its brightly tessellated leaves with distinct glistening white lines on a deep green leaf, arranged in a basal rosette on the ground. *Goodyera pubescens*, like other in the genus, reproduces vegetatively using rhizomes and roots spreading from a mature plant as well as sexually by producing flowers periodically.

According to Charles Sheviak regarding ranges of the North American Goodyeras, *Goodyera pubescens* ranges from southernmost Quebec (barely beyond the US border) to northernmost Georgia In addition to the West Coast, *G. oblongifolia* is widespread throughout much of the West, occurring throughout

the Rockies, for instance. It also occurs across the Upper Great Lakes region, and at various disjunct sites eastward, including an extensive distribution in eastern Quebec, of which the occurrences in Maine and New Brunswick are merely part. *Goodyera repens* is indeed an "eastern species" in that it occurs in the Eastern US, but merely at its southeastern range limit. It is a circumboreal species that is transcontinental in the North and widespread in the montane West. *Goodyera tessellata* is indeed eastern. Sheviak has further noted that Jacquelyn Kallunki's (1976) work indicated the evident allotetraploid origin of the species and explained its variation as a result of this and triploid back-crosses.

Keenan did a study in the 1970s and determined the evergreen leaves lasted 4 -7 years before dying back and being replaced. I've observed a 10-30% flowering rate annually. Most plants remain vegetative for years before blooming according to a long term study by the Reddochs in Ontario, who determined that higher blooming rates followed a warm dry period of time in May, and only on mature plants.

New County Records for *Spiranthes vernalis* in Southern Illinois

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Finding a rare orchid species is an exciting passion shared by both botanists and amateurs alike. Even common orchids can elicit an emotional response, especially when they are found growing wild in their natural habitat.

Only known from a few counties in Illinois, *Spiranthes vernalis* is one of the rarest orchid species in the Great Plains Region of North America. It is listed as state endangered in Illinois and is reported as rare in adjacent states like Indiana and Iowa. This is merely a range limitation however, and not indicative of true rarity, as this is the most common *Spiranthes* species found in the southeastern United States.

Spiranthes species are universally recognizable but keying out to species can often be quite difficult. For example, some *Spiranthes* flowers never open but are cleistogamous and self-fertilized in the bud. Luckily, *Spiranthes vernalis* splits out early in the dichotomous keys and can be easily identified by the following characteristics. It flowers earlier than other species, in late spring or early summer. The inflorescence is copiously hairy with dense pointed pubescence. Although variable, the flowers are most often produced in a single row of spiraling flowers (Figure 1 and 2; page 20).

Twice in the summer of 2011, I encountered this rare orchid occurring naturally in two disjunct areas, both private prairie creations in southern Illinois. True prairie communities did not historically occur this far south in Illinois, though is it well known that our forests were once a complex matrix of woodlands, glades, and barrens, intertwined with herbaceous species typical of the prairies in the north. However, the habitat for *Spiranthes vernalis* is highly variable as it will grow anywhere it is exposed to full sunlight, even cultivated lawns, which is essentially where I located both occurrences of the species in southern Illinois.

The first location where I encountered *Spiranthes vernalis* in 2011 was at the property of Robert and Rhonda Rothrock in rural Pomona in Jackson County, Illinois. The owners have a 5-acre prairie garden that replaces a former fescue field which historically was a woodland community. Their prairie is quite diverse, with over 500 species of native plants, some collected as seeds from remnant prairie patches throughout southern Illinois and southeastern Missouri. However, many of the native species present there came in on their own and such is the case with *Spiranthes vernalis* in June 2011. In a few separate places within their prairie, small colonies of *Spiranthes vernalis* were present — the most in one patch being 15 individuals. Mr. Rothrock told me about how several other *Spiranthes* species also seem to thrive within the mowed trails he has established throughout the prairie, and I told him this is consistent with the disturbance prone habitats in which *Spiranthes* is known to occur. This is highly atypical as most orchid species rely on mycorrhizal associations that make them highly vulnerable to disturbance, and for this reason translocations usually fail.

The second location I encountered *Spiranthes vernalis* in 2011 was on the property of Tony and Berna Gerard, in rural Vienna in Johnson County, Illinois. The owners have converted an agricultural field to a large grassland consisting almost entirely of *Andropogon gerardii* (big bluestem). Wilderness survival skills and the sacred rituals of indigenous cultures are taught on this property and this training area includes a sundial comprised of a circle of rocks in a small mowed part of the grassland. In this mowed area, a dozen individuals of *Spiranthes vernalis* were located in mid-July 2011.

Both locations in Jackson and Johnson County of Illinois are in close proximity to high quality natural areas, containing grade A assemblages of plants. However, *Spiranthes vernalis* has not been vouchered in either county, according to the Illinois Plant Information Network (ILPIN) database. Element of Occurrence records have been submitted to the Illinois Department of Natural Resources, Natural Heritage Division, and more efforts should be focused on locating this species in southern Illinois in the years to come. According to Mike Homoya's "Orchids of Indiana," this species has been found in new locations as recently as 1986 and may be spreading from adjacent states and not from historical populations. Searches focused on dry old field habitats in southern Illinois could yield additional occurrences of this rare Illinois orchid.

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Long Term Monitoring of *Cypripedium candidum* in the Chicago Wilderness Region

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Plants of Concern has monitored endangered, threatened and rare plants species in the Chicago Wilderness region for the last 11 years. Rare species monitored by Plants of Concern are as varied as golden sedge (*Carex aurea*) and butternut (*Juglans cinerea*). Among the monitored species is the small white lady's slipper orchid (*Cypripedium candidum*), a characteristic long lived perennial species of the tallgrass prairie (Bowles 1983). Plants of Concern monitors this species because it once was abundant with a broad range and is now threatened in Illinois (Herkert and Ebinger 2002) and other states (plants.usda.gov). Its recorded range extends from northern Alabama to southern Manitoba and east to Connecticut (for more details on range see Bowles 1983; Garness 2010). Typically growing in moist to wet prairies, fens or seeps and on calcareous soils. *C. candidum* has been severely impacted by reduced habitat availability, limited pollinator based reproduction, poaching and competition with invasive species. Woody species encroachment is very problematic as they tend to grow in more open areas with little to no tree or shrub canopy (Bowles 1983).

Understanding the birth, death, immigration and emigration rates of a population and all the factors that play into those variables (demographics) leads to an understanding of factors that influence long term and short term changes in a population (population dynamics). Monitoring the demographics of *Cypripedium candidum* is difficult for several reasons. *C. candidum* is a long lived perennial, and it can take up to fourteen years for a seed to mature into a reproductive plant (Bowles 1983). This plant vegetatively spreads through rhizomes and separation between clonal clusters can yield independent ramets, which makes it difficult to determine an individual plant without digging up the root networks, which isn't an option in the case of a threatened species. This species is able to go dormant for six years and dormancy isn't an uncommon process for this species especially in smaller plants (Shefferson 2006). These factors make it important that long term monitoring occurs to understand popula-

tion demographics and dynamics (Shefferson and Simms 1997) as the longer studies yield more complete understanding of population dynamics.

Currently, Plants of Concern collects data on 53 populations of *C. candidum*, which include species location, number of individuals in a population, estimates of area covered by a population, threats to populations, associated species (native, exotic and invasive) and signs of management activity. Additional, detailed demographic data have been collected in 8 of the 53 populations. These data include the number of flowering and non-flowering stems per discrete cluster, clusters width and the number of fruits per cluster. Permanent plots were created and plant "clusters" inside the plots were tagged and mapped. Each year clusters, treated as individual plants with multiple stems, are measured and previously untagged individuals found within are tagged and subsequently monitored. Plants of Concern aims to create demographic models to capture population responses to variables such as climate change and various management regimes. This type of model will help to guide future conservation efforts that seek to identify, establish and maintain viable populations.

The Plants of Concern dataset is unique not only in the length of the study but also the number of populations monitored. Volunteers with a plant science background living in the Chicago region that are interested in monitoring *C. candidum* demographics should visit our website (plantsofconcern.org) for current staff contact information. Feel free to send us an e-mail. Plants of Concern is coordinated by Susanne Masi at the Chicago Botanic Garden in Glencoe, Illinois.

Bowles, M. 1983. The tallgrass prairie orchids *Platanthera leucophaea* (Nutt.) Lindl and *Cypripedium candidum* Muhl. ex Willd.: Some aspects of their status, biology and ecology, and implications toward management. Natural Areas Journal 3(4):14-37.

Garness, K. 2010. *Cypripedium candidum*. The Native Orchid Conference Journal 7 (4):26-27.

Herkert, J.R. and Ebinger, J.E. 2002. Endangered and threatened species of Illinois: status and distribution, volume 1 – plants. Illinois Endangered Species Protection Board, Springfield Illinois. p33.

Shefferson, R.P. 2006. Survival costs of adult dormancy and the confound influence of size in lady's slipper orchids, genus *Cypripedium.* Oikos 115:253-262.

Shefferson, R.P. and Simms, E.L. 2007. Costs and benefits of fruiting to future reproduction in two dormancy-prone orchids. Journal of Ecology 95:867-875.

USDA, NRCS. 2012. The PLANTS Database (http://plants.usda.gov, 29 February 2012). National Plant Data Team, Greensboro, NC 27401-4901 USA.

2012 Native Orchid Conference: 19-23 May

After holding our initial conference in Greensboro in 2002, we're returning to North Carolina 10 years later. This state is rich with wildflowers and orchids. According to our Natural Heritage Program, there are 72 orchid taxa listed for the state. In our coastal and mountain areas there are species which are at the northern or southern limits of their ranges.

Our conference will follow our typical pattern of a day of talks followed by a day of field trips. The next day of talks will be followed by a travel day to allow for relocation to Brevard in the mountains after which we will have our last day of field trips. Along the coast we expect to see the following orchids in bloom: *Calopogon barbatus*, *Calopogon pallidus*, *Calopogon tuberosus*, *Cleistesiopsis (Cleistes) bifaria*, *Cleistesiopsis (Cleistes) divaricata*, *Pogonia ophioglossoides*, *Spiranthes praecox*, and *Spiranthes vernalis.* Additionally, there will be an opportunity to see plants of *Epidendrum conopseum*. This is the only epiphytic orchid in North America north of Florida, and North Carolina is the northern limit of its range. In our mountain field trips around Brevard, NC we could see the following orchids: *Cypripedium acaule*, *Cypripedium parviflorum*, *Galearis spectabilis*, *Goodyera pubescens* (plant), *Goodyera repens* (plant), *Isotria verticillata*, *Liparis liliifolia*, and *Platanthera orbiculata* (in bud).

One of the coastal areas we will visit is the Nature Conservancy's Green Swamp Preserve which is a spectacular botanical area. Research has identified up to 50 plant species per square meter making this one of the richest botanical areas in the world. The areas where we will hike are within sight of highways and have relatively easy access. You should bring good hiking boots, plenty of bug spray and drinking water. It can get extremely hot and muggy, and the ticks are plentiful. Most of the orchids will be found in the open savannahs which are fairly dry, grassy areas of open pine forest. Eleven orchid species along with 14 species of carnivorous plants have been located in the preserve. They begin blooming in early May and some flower as late as November. There are three prime blooming periods during the year; late May, mid-July, and August.

Finally, along with a rich display of other wild flowers, we should see many carnivorous plants: Venus Flytrap (*Dionaea muscipula*) that is endemic to this region, 2 Bladderworts species (*Pinguicula*), 3 Pitcher Plant species (*Sarracenia*), and 2 Sundew species (*Drosera*).

Registration will be limited to the first 150 people. All registration should be done by mail and needs to be received no later than **May 7th** in order to plan food. A form is provided in the Journal and on the web site. **There will not be any registration at the door**. Lunch will be served as part of the conference on Saturday and Monday.

Most importantly though, this conference is an opportunity for people interested in native orchids to get together, share information and gain knowledge. Hopefully, it will provide you with an opportunity to make or renew friendships and enjoy the company of others who have our shared interest. We hope to see you here in May!

Respectfully,
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