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A Social History of North American Slipper Orchids Part 3

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CYPRIPEDIUM REGINAE WALTER, FL. CAROL. :222(1788)

Linnaeus referred to this species as *Cypripedium calceolus* var. γ (gamma) in *Species Plantarum,* noting that Jacob Cornut had published it earlier as *Calceolus marianus canadensus* (Cornut 1635) and that Robert Morison referred to it as *Heleborine flore majore purpureo* in Plantarum Historia Universalis Oxoniensis (1699) (Linnaeus 1753).

The species epithet, *reginae,* is Latin for queen; however we do not know if he referred to Queen Charlotte, wife of George III, or to the fact that the plant had queenly stature. Perhaps Correll was correct in suggesting that Walter was "designating this, one of our most beautiful native orchids, as worthy of being the slipper of a "fairy queen (Correll 1950)."

The Showy Lady's Slipper is the first North American slipper orchid to be published with its presently accepted name. The description was published in *Flora Caroliniana* (1788), the first comprehensive regional flora of North American plants. Its author, Thomas Walter (1740-1789), came to America as a young man, bought a plantation along the Santee River in Berkely County, SC, and began botanizing. Using Linnaeus' 1753 edition of *Species Plantarum* as his guide, Walter claimed that his book covered plants within a fifty-mile radius of his coastal plain home.

Two species of *Cypripedium* are described in *Flora Caroliniana — C. calceolus* and *C. reginae*. Unfortunately the narrative for *C. reginae* is brief and ambiguous:

> "*radicibus fibrosis, foliis ovato-lanceolatis caulinis, caule multifloro, flore albo magno."*

This roughly translates as:

> "fibrous roots, ovate-lanceolate leaves on the stem, multiple-flowered stem, large white flower."

This is typical of all 1,000 descriptions in this book.

Given that Walter claimed that all the plants he described came from within a fifty-mile radius of his coastal plain plantation in a state that has never recorded this orchid, the question arose, how could he possibly describe this orchid? Inquiries to the University of South Carolina herbarium confirmed that this species has never been reported from the state. The mystery deepened. If there were a voucher specimen available, the issue could be resolved. Further investigation showed that there is a collection of botanical specimens in the herbarium of the British Museum known as the Walter Herbarium, a collection attributed to Thomas Walter, and that it contains a specimen that has been verified as *C. reginae.* This still does not explain how Walter might have found the specimen.

The search led me to Dr. D.B. Ward of the University of Florida, who has studied Thomas Walter for years, and heads up the Thomas Walter Typification Project (Ward 2006). The early date of Walter's publication has given many of his names priority over those of later authors, and Dr. Ward has tried to track down type specimens for those species. In a recent publication (Ward 2007) the author concluded that the collective specimens known as the "Walter Herbarium" housed in the Natural History Museum in London are not Thomas Walter's at all; they belong to John Fraser.

John Fraser (1750-1811), a Scottish botanist, led a most extraordinary life. First coming to Newfoundland to cure tuberculosis, he went on to botanize in the Appalachian and Allegheny Mountains on seven occasions. He botanized intensively and brought enormous quantities of material back to London. We know his name as they apply to many plants named for him, such as Fraser fir, Fraser sedge, Fraser magnolia, Fraser evening primrose, and many others. He met with Walter in 1787 after his first collecting trip into the Piedmont and the southern Appalachians. As Fraser was heading back to England, Walter entrusted him with the manuscript of *Flora Caroliniana* to take to London for publication.

The accepted story, until recently, has been that Fraser took the herbarium specimens that he claimed were Walter's, along with the manuscript, back to England. He delivered the manuscript to be published. The specimen collection remained in Fraser's family until the Linnaean society obtained it; subsequently it was purchased by the British Museum in 1863, "in a state of neglect, having suffered damage and loss."

When Dr. Ward examined the herbarium sheets in the "Walter Herbarium," he found that the specimens were actually those of John Fraser after discovering that a number of specimens had different handwriting (Ward 2007), although some did have notes in Walter's handwriting. On herbarium sheet 39-B in the Walter/Fraser Herbarium in the British Museum, marked *Cypripedium reginae* - the handwriting is actually Fraser's. It has been noted "type," and signed by

Oakes Ames. However, since Ames never published this typification, the determination is not legal. Additionally, without evidence that a given specimen was used by Walter in his writing, the specimen cannot rationally be cited as a holotype. Dr. Ward has concluded that it was possible that Walter saw this Fraser specimen and used it in his Flora. The specimen has now been designated as lectotype (Ward 2007a).

What a long and convoluted history this name proved to have! Obviously, Fraser collected the plant in his travels outside South Carolina and perhaps he showed it to Walter, and Walter added it to his book; or perhaps Fraser himself added it to Walter's manuscript. We will never know for certain.

Another interesting aspect to this species is that it has a sister species in Asia, *Cypripedium flavum* P.F.Hunt & Summerh. The two are similar in morphology and in their habitat requirements, and, although somewhat different in color, they are difficult to distinguish from dried specimens. Another of our other slipper orchids, *Cyp. arietinum*, is also part of a species pair (Sing-Chi 1983).

CYPRIPEDIUM ACAULE AITON, HORT. KEW. 3:303(1789)

Acaule is Latin meaning stemless. The stem of this orchid lies underground; what we see aboveground is two leaves and a very long upright peduncle supporting the flower and its bract. Interestingly Linnaeus did not include this orchid in *Species Plantarum* in spite of its having been published a half century earlier by Plukenet (see below). (See 2010 drawing on page 44.)

William Aiton (1731-1793) was asked by Princess Augusta to develop her personal garden at Kew House, after training to be a gardener in his native Scotland and working in London. Representing the princess and given a healthy budget, he was able to gather an impressive collection of plants from all over the globe. This private garden was to become the world famous Royal Botanic Gardens, Kew. Aiton's publication, *Hortus Kewensis*, is a catalog of the plants grown at Kew and was a result of thirty years work at the gardens. In it Aiton reports that the "Two-leaved Lady's Slipper" was introduced to Kew in 1786 by William Hamilton. Aiton bases his designation on the description by Leonard Plukenet as *Helleborine Calceolus dicta mariana, foliis binis e redice ex adverso prodeuntibus, flore purpureo*, in Volume III (pub. 1700) of the first edition of *Historia Plantarum* (Ray 1686-1704).

CYPRIPEDIUM PARVIFLORUM SALISB., TRANS. LINN. SOC. LONDON 1:77 (1791)

The term *parviflorum* is Latin for small-flowered. So precise are Salisbury's description and drawings that even though a type specimen does not exist, the description and drawings are deemed to satisfy the requirements. Salisbury based his description on a plant collected in Virginia (Sheviak 1994).

Richard Markham (1761-1829) was twenty-four years old when "a very old maiden lady" gave him the income from a large sum for life if he changed his name to Salisbury. Such arrangements were not rare in eighteenth century England. It was an opportunity too good for a poor young botanist to turn down, so he became Richard Salisbury (abbreviated as Salisb.). As a horticulturalist and botanist interested in the natural order of plants, Salisbury was meticulous in his observations, as his description of *Cypripedium parviflorum* shows. In publishing this name he cites the description and polynomial given by Leonard Plukenet in Vol.III (London 1700) of *Historia Plantarum* and to a plant collected in Virginia by H. Marshall.

Salisbury clearly distinguishes between the European *Cypripedium calceolus* and the North American *Cypripedium parviflorum* and illustrates the differences in his text and diagram perceptively.

There are so many twists and turns in the history of naming the North American yellow lady's slippers that it could fill an article of its own. I would point readers to the discussion in Phillip Cribb's monograph, The Genus Cypripedium (Cribb 1997), for a comprehensive discussion. The bewildering array of synonyms attest to the difficulty botanists encountered in distinguishing between the forms of yellow lady's slippers found across North America.

At least one author recognized all our yellow lady's slippers to be the same as the European – *C. calceolus* – and he recognized no varieties (Michaux 1828). Correll considered all our plants to be a variety of the circumboreal species, *C. calceolus* (Correll 1950), while Luer considered our plants to encompass three varieties (var. *pubescens,* var*. parviflorum* and var. *planipetalum)* of the circumboreal species (Luer 1975). Watson believed our plants to be different from the European one and that our plants represented two species, *C. parviflorum* and *C. pubescens* (Watson 1889). Watson also noted that the two species he described seem to merge. It was O.W. Knight who suggested that the two yellow lady's slipper taxa overlapped so much in their dimensions, that rather than considering them separate species, they should be considered as two varieties of one species (Knight 1906).

Contemporary investigators conclude that North American and Eurasian plants differ enough to be considered separate taxa (Atwood 1985; Sheviak 1992). In addition a distinct subset of yellow lady's slippers have been split off into a separate species, *Cypripedium kentuckiense* (Reed 1981). Enzyme studies (Case 1998) substantiate species recognition for *Cypripedium kentuckiense,* as do morphological analyses (Weldy 1996).

The rationale for choosing Salisbury's name of *Cypripedium parviflorum,* applied in 1791, for the North American plants formerly considered *C. calceolus,* was that it described a north American plant (collected in Virginia) and came with an excellent diagram and detailed description of a plant clearly different

from the European species. In fact Salisbury's characterization is a perfect portrayal of the small-flowered yellow lady's slipper of southern woodlands (Sheviak 1994). A difficulty arises in that no type specimen is available, but the diagram and excellent description make it clear that his name deserves priority for our plants.

Accepting *Cyp. parviflorum* for our plants still left the wide variation of forms, sizes and habitats to be addressed. Currently two, three or four varieties are recognized. Proposals for recognizing three varieties, var. *parviflorum,* var. *pubescens* and var. *makasin* has been widely accepted (Sheviak 1992, 1993, 1994, 1995, 2002). This concept is reflected in the Flora of North America (Sheviak 2002). Although Cribb does not recognize *C. parviflorum* var. *makasin* (Cribb 1997), enzyme studies conclude that the three varieties are distinct from one another; however they do not warrant species status (Case 1993).

Very recently (Sheviak 2010) has proposed a fourth variety, *C. parviflorum* var. *exiliens*, and this fourth variety is accepted by World Checklist of Monocotyledons (World Checklist of Monocotyledons, 2009)

An interesting aspect to taxon differentiation is floral fragrance. Humans, as a rule, have a poorly developed olfactory ability compared to pollinators, and this human has one of the least developed of our species. As a consequence it often baffles me that some people claim to discern species and/or varieties by smell. Investigators have proven that there is a floral fragrance difference between taxa of yellow lady's slippers. Unfortunately for us, the species they studied – *C. calceolus*, *C. calceolus* var. *pubescens* and *C. calceolus* var. *parviflorum* – do not correspond precisely to the taxa. However, this study proves that the three taxa they studied had "distinctly different fragrances and that floral fragrance analysis provides a useful taxonomic tool in *Cypripedium*" (Bergström 1992).

CYPRIPEDIUM PARVIFLORUM SALISB. VAR. *PARVIFLORUM*

Described by Salisbury, this small-flowered variety is restricted to the southeast and overlaps in size and range with *C. parviflorum* var. *pubescens.* These two varieties seem to intergrade where they overlap in range and are sometimes difficult to differentiate.

CYPRIPEDIUM PARVIFLORUM VAR. *PUBESCENS* (WILLD.) O.W. KNIGHT, RHODORA 8: 93 (1906)

Pubescens is Latin for finely hairy.

Ora Willis Knight (1874–1914), a native of Maine, was a chemist by training. He spent two years as an assistant in Natural History at the University of

Maine and then went on to employment as chemist and state assayer of Maine. An avid ornithologist, Knight wrote and contributed to several books on the birds of Maine and published a number of scientific articles on orchids.

As presently understood this highly variable variety has the widest range throughout North America, and plants of very different habit and size grow intermingled in colonies in the wild (Cribb 1997). It is referred to as the large-flowered yellow lady's slipper (Knight 1906).

Since the beginning date of modern binomial nomenclature in 1753, over twenty names have been applied to this taxon in whole or part (World Checklist of Monocotyledons 2009).

CYPRIPEDIUM PARVIFLORUM VAR. *MAKASIN* (FARW.) SHEVIAK, AMER. ORCHID SOC. BULL. 62: 403 (1993)

Farwell first used the term "Makasin" for this variety and explains that it is "the Algonquin name of these flowers" (Farwell 1918).

Oliver Atkins Farwell (1867–1944) spent his working life as a botanist for the large pharmaceutical concern Parke-Davis & Co., in Detroit and wrote many scientific articles on the botany of Michigan, especially its ferns. He was the first to use the term 'Makasin' describing small-flowered plants from Michigan.

Charles J. Sheviak began his devotion to natural history by studying bugs as a child in the Midwest. He soon found himself drawn to native prairies and orchids. With two degrees from University of Illinois – Urbana, he showed his singular devotion to difficult issues by tackling the issue of understanding the *Spiranthes cernua* complex. After achieving a Doctorate at Harvard, he has served as Curator of Botany at the New York State Museum. Dr. Sheviak's determination in deciphering the most complex problems in our orchids, such as understanding our lady's slippers, have taken him around the globe and given him an unequalled grasp of the subjects he has studied. Widely published and meticulous, he is recognized as the leading expert of our North American slipper orchids.

Recognizing differences between northern and southern small-flowered forms, Sheviak proposed that the northern plant, often found in fens in wet, calcareous habitats was not the plant described by Salisbury, that it deserved varietal status as *Cypripedium parviflorum* var. *makasin*, while the more southern, upland mesic woods variety keep the designation described by Salisbury (Sheviak 1993, 2002). Cribb recognizes all small-flowered plants as part of a variable var. *parviflorum* (Cribb 1997).

CYPRIPEDIUM PARVIFLORUM VAR. *EXILIENS* SHEVIAK NATIVE ORCHID CONF. J. 7(2): 5 (2010).

Sheviak has long recognized that the small-flowered form of *C. parviflorum* in northwestern Canada and Alaska were distinct, and recently recognized them as a fourth variety of the species. Similar to the eastern *Cyp. parviflorum* var. *makasin,* these are small-flowered plants; their scent is intensely sweet – similar to the eastern variety when flowers are young – but changes with age. They are typically found in mesic upland sites northward, but may inhabit wetter areas southward. Morphologically this variety exhibits "flowers with shorter lips, sepals and petals, the latter two of a pale ground color marked with small dark spots that vary from minute, regularly and remotely spaced to somewhat larger and confluent in streaks along the principal nerves." (Sheviak 2010).

(Species discussions will continue with the next installment)

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Technical Descriptions of Cypripedium Species

Three different cypripedium are described. Others will follow in subsequent editions.

Cypripedium montanum

Cypripedium passerinum

Cypripedium montanum ×*columbianum*

Cypripedium montanum Douglas *ex* Lindley

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Nomenclature: The origin of the species name is from the Latin *montanus* - "relating to mountains." The common name "mountain lady's-slipper," is a descriptive term of the habitat in which this orchid is found. It is thought that this species was first recorded by the 1805-1806 Lewis and Clark expedition through the Oregon Territory – mentioned as a Cypripedium with a "white flower striped with purple."

Range: The range of *Cypripedium montanum* Douglas ex Lindley, extends from Alaska in the north, through British Columbia, Washington and Oregon, to approximately the mid-point of California in the south. The eastern extent of its range includes south western Alberta, the Cypress Hills of south western Saskatchewan, Idaho, Montana and north western Wyoming.

Forms: Two forms of this species have been recorded: a white petalled form- forma *praetertinctum* Sheviak, and a crimson edge-lipped form – forma *welchii* P.M. Brown.

Description: The plants are commonly found as multiple stems – arising from underground rhizomes. The individual stems are 25-71 cm. high with 4-6 alter-

nately arranged leaves, usually two flowers per stem, but occasionally one or three. Plants growing in exposed, relatively sunny situations have the ascending leaves inserted along the basal portion of the stem and the flowers displayed well above the leaves. In shadier, especially sheltered sites, the spreading leaves may be more evenly scattered along the stem. The dorsal sepal is 8-16 mm wide and 33-60 mm long, and synsepal is 6-8 mm wide and 33-60 mm in length, greenish in color often heavily suffused with reddish brown or madder. The petals are spreading-deflexed, the same color as the sepals, spirally twisted, linear to linear-lanceolate, 36-77 mm in length. The lip is white, rarely suffused with magenta, 19-33 mm.

Blooming dates: Due to the extensive range from north to south, flowering may begin as early as February and continue into September.

Habitat: Habit includes mesic to dry (rarely wet) coniferous, deciduous, and broadleaf evergreen forests, openings, and thickets, around shrubs on open slopes at elevations from sea level to 2400 m.

Conservation status: Because a number of populations of this species occur in federally protected parks in the US and Canada and its occurrence in sparsely populated mountainous regions this species has been assigned a Global Status G4 – apparently secure.

In Alaska, Wyoming and Saskatchewan this species is considered very rare and is given a status of S1. In Alberta it is considered rare with an S2 rating "may be vulnerable to extirpation." In British Columbia, Oregon and Montana it is considered uncommon in some regions and widespread and abundant in others and is an S3S4. In California this species has been assigned a ranking of S4.2 with an uncertainty of the exact rarity of the species. In Idaho and Washington the species has not been ranked.

Threats: Threats as listed by NatureServe include: Habitat loss – including logging, harvesting of wild plants, park and campground maintenance, road construction, herbicide spraying and grazing. Fire suppression may be the largest threat to the many populations located in developed/developing areas.

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George F. Ledingham Herbarium, Regina Saskatchewan – personal visit - March 25, 2002

NatureServe website: http://www.natureserve.org

Figure 1; page 19.

Cypripedium passerinum Richardson

Lorne Heshka

Nomenclature: The origin of the species name is from the Latin *passerinus* – "relating to a sparrow." Two common names are used; "Sparrow's-egg lady's-slipper" from the resemblance of the spotted lip to the egg of a sparrow and "Franklin's lady's-slipper" relating to the discovery of this orchid during the Franklin expedition to the arctic in 1820.

Range: The range of *Cypripedium passerinum* Richardson, extends from Quebec across northern Canada and Alaska and south through the mountains into Montana.

Varieties: A variety – *Cypripedium passerinum* Richardson var. *minganense* Victorin – is localized, found only in Quebec on Ile Nue in the Mingan Islands of the St. Lawrence River. According to Donovan Correll this variety found growing on "cobbled beaches" differs from typical material in being a smaller plant.

No natural hybrids relating to this species have been recorded.

Description: The plants are most often found as multiple stems – commonly 10 to 25 growths, and occasionally to as many as 100. The individual stems are 12-40 cm high. With 3-4 large elliptical leaves and small flowers, the plants have the appearance of being rather leafy. Normally each stem will have a single flower, however in ideal conditions, double flowered stems may be common. The flowers have pale green sepals, with the dorsal sepal nearly covering the lip opening. The white, flat petals, 12 to 20 mm long, are spread along each side of the lip. The lip is white, 15-20 mm. in length, with purplish spots.

This is the only self-pollinating lady's-slipper in North America and has the unusual characteristic of an ovary that swells while the flower is still in bud. The mature seed capsule is disproportionally large in comparison to the flower size.

Blooming dates: Flowering begins mid-June and continues to mid-July in northern localities. It may be found in a wide range of habitats up to 2,200 meters, with the common factor being long cold winters and ample moisture. Habitats include coniferous forests, sphagnum bogs, stream and river banks, thickets, forest openings and tundra.

Conservation status: With significant populations in Yukon, Ontario, Manitoba and Alberta, this species has been assigned a distribution ranking of S4 in those provinces and is considered "secure with long-term concern." In British Columbia – it is considered uncommon in some regions and widespread and abundant in others and is an S3S4. Here it is described as "apparently secure." Less common and considered rare in Saskatchewan, it, has been given an S2 ranking and "may be vulnerable to extirpation." In Quebec and Montana the species is very rare, it is rated as S1 and "may be especially vulnerable to extirpation." For Alaska, Nunavut and the Northwest Territories, evaluations of the distribution rankings have not been completed.

Threats: Due to its occurrence in northern and mountainous sparsely populated regions, this species does not face the threats common to Cypripedium species of the south. As a consequence, *Cypripedium passerinum* has been assigned a Global Status of G4G5 and is considered "apparently secure."

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Figure 2; page 19; and front cover.

Cypripedium ×columbianum Sheviak
Columbia Lady's-slipper

Lorne Heshka

Nomenclature: *Cypripedium ×columbianum* Sheviak is the name assigned to the hybrid of *Cypripedium parviflorum* and *Cypripedium montanum.* Due to its occurrence in northern and mountainous sparsely populated regions, this hybrid does not face the threats common to Cypripedium species of the south. As a consequence, *Cypripedium ×columbianum* has been assigned a Global Status of G4G5 and is considered "apparently secure." The common name is Columbia Lady's-slipper.

Range: Much of the range of *Cypripedium montanum* overlaps the range of *Cypripedium parviflorum* var. *pubescens* as well as the range of *Cypripedium parviflorum* var. *makasin.* Generally *Cypripedium parviflorum* blooms somewhat earlier than *Cypripedium montanum,* however early blooming plants of one species will often coincide with late blooming plants of the other species. Where overlap takes place, there is a distinct possibility of hybridization occurring. From examination of range maps of the two parent species, it would appear that this hybrid may occur in Alberta, British Columbia, Washington, Idaho and Montana.

Blooming season*: Cypripedium* ×*columbianum* blooms about the same time as *Cypripedium montanum,* in mid to late June.

Habitat: This hybrid is normally found in locations where habitat is suitable for both parents. Roadside ditches in the foothills of mountainous regions often meet these requirements. A typical example of such a location is the Baker Creek rest area along the Yellowhead Highway in British Columbia, west of Jasper National Park. At this particular location it is visually difficult to determine if there are any "pure" *Cypripedium montanum* in this population.

Description: In general, these hybrids exhibit vegetative and floral morphology and color intermediate between those of their parents, or combinations of their parental characteristics. In particular, lips are commonly creamy, ivory, or yellow; often lips are yellow when the flower first opens and fade to white over the period of bloom. Consequently, different flowers on the same plant frequently exhibit a range of lip colors. Lip color sometimes varies from year to year in individual plants.

Threats: Prime threats to this hybrid include road reconstruction where ditches are totally reworked and the spraying of roadsides with herbicides or brush killer for control of weeds and woody perennials.

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http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242101551

Figures 3 and 4; page 20.

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Platanthera huronensis in the North, and the Occurrence of *P. hyperborea* in North America

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The recognition and delimitation of *Platanthera huronensis* (Nutt.) Lindl. (Sheviak 1999) clarified a long-standing problem in the notorious *P. hyperborea* (L.) Lindl. complex. Simultaneously, it generated yet another. Unexpectedly, the plant that had long been known in North America as *P. hyperborea* proved to be a distinct and unrecognized species, described in the same paper as *P. aquilonis* Sheviak. Nominate *P. hyperborea* from Iceland differed from both *P. aquilonis* and *P. huronensis* but combined some characteristics of each species. The relationship and status of *P. hyperborea* and *P. huronensis* and the distribution of the former, including its possible occurrence in North America, remained to be determined (Sheviak 1999, 2002).

The three species are delimited by a combination of reproductive mode and ploidy level. Various morphological features are associated with reproduction and together with others permit determination. *Platanthera aquilonis* is a facultatively autogamous diploid; the other two species are tetraploid, with *P. huronensis* allogamous, and *P. hyperborea* evidently variably autogamous. *Platanthera huronensis* has the appearance of a hybrid of *P. dilatata* (Pursh) Lindl. and *P. aquilonis*, being of a whitish green color and with the lip variably acuminate-dilated. It has commonly been confused with putative hybrids of these two species, being referred to the supposed hybrid *P.* ×*media* (Rydb.) Luer, a name nonetheless synonymous with *P. huronensis*. As a tetraploid, the species is likely of hybrid origin and may well be an allotetraploid derived from these proposed parents, as indicated by strong morphological and population evidence (Catling & Catling 1997, Sheviak 1999) and molecular data (Wallace 2003). As such, its genetics would provide ample opportunity for the generation of variation that could include a distinct autogamous lineage such as *P. hyperborea*. The status of these two somewhat similar species is thus in question.

The details of autogamy and the salient features of these species have been presented earlier (Catling & Catling 1997; Sheviak 1999, 2001; Sears 2008)

and in summary form in *Flora North America* (Sheviak, 2002). My intention here is to present additional, newer evidence indicating that *P. hyperborea* occurs in Arctic and Subarctic North America and to discuss its characteristics and population structure and the evidence that *P. hyperborea* and *P. huronensis* may be appropriately maintained as distinct at the species level.

POLLINATION MECHANICS

The column of *Platanthera huronensis* is typical of species in the *Limnorchis* group, with anther sacs separated by a narrow but clearly evident connective and oriented mostly vertically, diverging slightly toward the rostellum lobes (Figure 1; page 21). Pollinia are coherent, with pollen massulae loosely but effectively bound together and contained within closed anther sacs. Viscidia are large and oblong. In contrast, the column of *P. aquilonis* exhibits modifications that facilitate autogamy: The anther is low, the anther sacs often approaching the horizontal, wide-spreading from approximate distal apices (Figure 2; page 21). The pollinia commonly fall out of the gaping anther sacs and onto the stigma (Gray 1862a, 1862b; Catling 1983; Catling and Catling 1991; Sheviak 1999). Additionally, the only loosely bound massulae may be dispersed across the stigma by water droplets (Sheviak 2001). Viscidia are small and orbicular, but sometimes lacking; in some plants, at least, they may be present in some years but absent in others.

The comparatively large flowers of *Platanthera huronensis* with intense fragrance, moderate length spurs and oblong viscidia suggest partial specialization for pollination by bees, although smaller Lepidoptera also serve as vectors. Catling and Catling (1989) documented 5 species of bees, 3 noctuid moths, and 2 butterflies as pollinators in a Colorado population. In *P. aquilonis*, the shorter spurs and small orbicular viscidia suggest pollination by bees, but again, a variety of smaller insects could serve. In this species, however, the modifications to the anther sacs and pollinaria that promote autopollination dominate and serve to insure pollination of at least some flowers in the absence of insect vectors. This trend toward autogamy is reinforced by the lack of fragrance in much of the species' range, an occasional lack of viscidia in individual plants, and, in an extreme example, a central New York population wholly lacking spurs [*Wiegand s.n.*].

Complicating this picture are occasional plants of *P. huronensis* that display some tendency to autopollinate. Reddoch and Reddoch (1997, pers. com.) reported autopollination in the species by the same rotation as in *P. aquilonis*. I have observed such behavior as an exceptional condition in a few plants in Colorado [*Sheviak, Sheviak & Pyrzynski 6281*] (Figure 3; page 21) and Montana [*Sheviak 7055*], but I have not seen it elsewhere. However, in northern New York I have observed a few plants in which pollinaria in one or a few flowers may hang free of the anther sacs [*e.g., Sheviak 6272*]. The geometry of

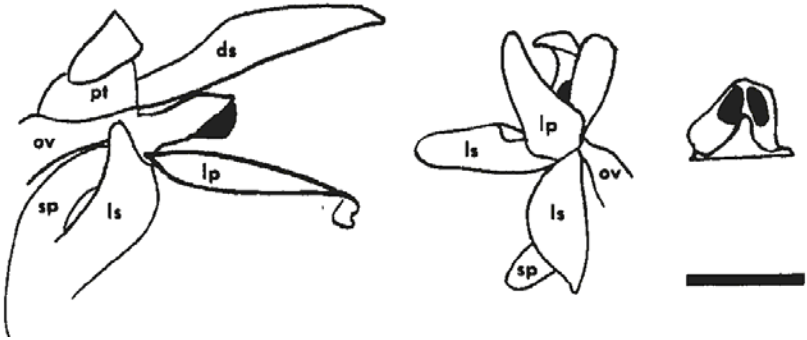

Figure 4. Holotype of *Orchis hyperborea* L. Free-hand drawings of pressed flowers. ds: dorsal sepal; ls: lateral sepal; pt: petal; lp: lip; sp: spur; ov: ovary. Anther sacs in solid black. Scale bar = 2 mm.

the column of these plants, however, with the stigma recessed behind an overhanging anther, does not permit the pollinia to fall directly onto the stigma as illustrated by Reddoch and Reddoch, and I myself have not found effectively autopollinating plants in the East. It appears, however, that autopollination is a tendency expressed to varying degrees in some plants of the species. As suggested above, this would be expected in an allopolyploid derived in part from *P. aquilonis*. This evident variability of *P. huronensis* has bearing on the identity and status of *P. hyperborea*.

CHARACTERISTICS OF *PLATANTHERA HYPERBOREA*

Orchis hyperborea L. was described from Iceland, a disjunct outlier of this essentially North American complex. Study of the type of *Orchis hyperborea* L. [LINN 1054.42], shows it to be representative of many smaller Icelandic plants: 81 mm tall, with 3 or 4 leaves and a fifth reduced to a bract, longest leaf 54 x 7 mm, with dense inflorescence 28 x 14 mm; lip 3.8 x ca. 1.2 mm, essentially lanceolate, neither markedly dilated nor rhombic, all appear to have fully descended and none are connected apically with the dorsal sepal; spur 3.0 x 0.6 mm, clavate, strongly obtuse, only somewhat porrect; column rather high, the anther sacs clearly separated by the connective, projecting prominently upward and forward (Figure 4; page 16). No intact pollinia nor viscidia could be located.

I have not had the opportunity to study the species in the field in Iceland, and have relied on an extensive set of herbarium specimens and European publications to characterize the species (Sheviak 1999). Only a few specimens with apparently well-preserved color were seen; in these the flowers appear predominantly whitish green, but sometimes with a more creamy lip. Published descriptions (Williams, Williams, and Arlott, 1978; Moore, 1980; Davies,

Davies, and Huxley, 1983) report Icelandic plants to bear flowers yellowish or pale green and fragrant, and photographs (Harmsen, 1943; Baumann, 1988) show plants with yellowish or whitish green flowers. Plants vary greatly in stature, general habit, and floral morphology. With a range in height of 60 – 330 mm, plants vary from reduced with two basal leaves to tall with several leaves scattered along the stem. Inflorescences are somewhat lax to more typically dense, even in small plants. Lips are typically short, 3.5 – 4.5 mm, occasionally as much as 6.0 mm in larger plants, broad, and obtuse, sometimes similar in shape to those of *Platanthera aquilonis*, but often exhibiting a rounded basal dilation comparable to that of *P. huronensis*. Spurs are cylindrical to slenderly or occasionally markedly clavate, about equaling the lip, and sometimes strongly porrect and then with their apices below the middle of the lip. They often approximate the condition in *P. huronensis*, but when strongly clavate and porrect they resemble those of *P. aquilonis*. Viscidia in the specimens studied are uniformly oblong, sometimes very narrowly so and then narrower than is usual in *P. huronensis* and similar to those of *P. dilatata*. Icelandic columns are also more nearly comparable to those of *P. huronensis,* with the anther elevated above the stigma, the rostellum lobes only gradually diverging, than they are to the typical condition in *P. aquilonis*.

The reproductive mode of nominate Icelandic *Platanthera hyperborea* is uncertain. The early report of Darwin (1869) is actually based on Asa Gray's study of *P. aquilonis*. Hagerup (1952) reported that in *P. hyperborea* the massulae already are uniformly in contact with the stigma when the buds open. However, he specifically mentioned only Greenland in the discussion of this species. Nonetheless, study of Icelandic specimens has shown that in at least some [*e.g.*, *Smith 2408*] the pollinia are very loosely organized, with massulae often trailing down onto the stigma, as in *P. aquilonis*. In a few specimens, however, pollinaria are lacking, these evidently having been removed by pollinators. This is inconsistent with the precocious autopollination mechanism reported by Hagerup and also suggests the presence of different pollination mechanics in different Icelandic plants.

The variation in lip and spur characters and possibly reproductive mode that is evident in Icelandic material might reflect the occurrence in Iceland of more than one taxon, and *Platanthera hyperborea* var. *major* Lange has been proposed for the larger plants. These plants often bear long, prominently dilated lips similar to those of *P. huronensis*, and it is a few such plants that have been found without pollinaria.

Icelandic plants therefore exhibit a combination of characteristics of *Platanthera huronensis* and *P. aquilonis* and perhaps some unique features as well.

CHARACTERISTICS OF PLANTS IN THE AMERICAN NORTH

For many years I had been aware of certain specimens from the North that appeared somewhat intermediate between what we now know as *P. huronensis* and *P. aquilonis*. [*e.g.*, *Schofield & Crumm 6575, 7030*]. It was only when delimiting these two species, however, that I came to view the specimens as anomalous. Although in the herbarium they suggested *P. aquilonis* in general aspect and clearly autopollinated in the same manner, viscidia were oblong and anthers were comparatively high with a pronounced connective separating only moderately diverging anther sacs. I tentatively interpreted the plants as comprising a northern facultatively autogamous race or races of *P. huronensis*. The status of such a race and its relationship to *P. hyperborea* has been a focus of subsequent study.

Field work with facultatively autogamous populations in three areas of the North has shed some light on the matter. Although they represent a very limited sample, they nonetheless span the continent: Seward Peninsula, Alaska; northern Manitoba; southern Labrador. The Alaskan plants were located at a few sites within ten kilometers of Nome, all growing in tundra. Despite reconnaissance spanning some hundreds of kilometers of the region and intensive searches of countless areas of seemingly suitable habitat, no other populations were found. They appear to be highly localized, as the only previously known site in the region is at a hot spring in the interior of the peninsula, a site we were unable to reach due to weather. In Manitoba, populations are extensive around Churchill, growing in tundra and the boreal forest ecotone. They were also located at three widely separated sites along a transect through the boreal forest to the western shore of Lake Winnipeg. The Labrador population was also found in boreal forest, on a rather hasty, late season survey from Labrador City to Sheshatsheits. The Alaska and Manitoba plants were very similar morphologically; those from Labrador were markedly different. This situation has bearing on the above questions.

The extensive populations around Churchill provide by far the largest sample and also the greatest diversity. Accordingly, they constitute a baseline for discussion: 65-230 mm tall, with 2 leaves plus 1 bract to 3 leaves and 1-4 bracts, longest leaf 33 x 6-95 x 11 mm; inflorescence lax to dense, 19 x 12-70 x 15 mm; lip 4.0 mm x 1.2 mm - 5.0 [- 5.5] x 1.6 [- 2.1] mm, lanceolate, acuminate, or rarely with a marked basal dilation, linear lanceolate, or linear oblong, usually whitish green, sometimes pure white, white marked with green, or rarely pale yellow; spur ca. [3.0 -] 4.0 [-5.0] mm., clavate to slender, slightly to usually strongly porrect; column rather high, subulate, acute to obtuse, anther sacs separated by a distinct connective and diverging at ca. 38-59°; viscidia oblong, pollinaria often rotating out of anther sacs and onto stigma, pollinia sectile,

(Continued on page 27)

Figures to accompany *Cypripedium Descriptions* by Lorne Heshka, page 9

Figure 1. *Cypripedium montanum* by Lorne Heshka

Figure 2. *Cypripedium passerinum* by Lorne Heshka

Figures 3 & 4. *Cypripedium* ×*columbianum* Sheviak Columbia Lady's-slipper by Lorne Heshka

Figures to accompany "*Platanthera huronensis* in the North, and the Occurrence of *P. hyperborea* in North America" by Charles Sheviak, page 14

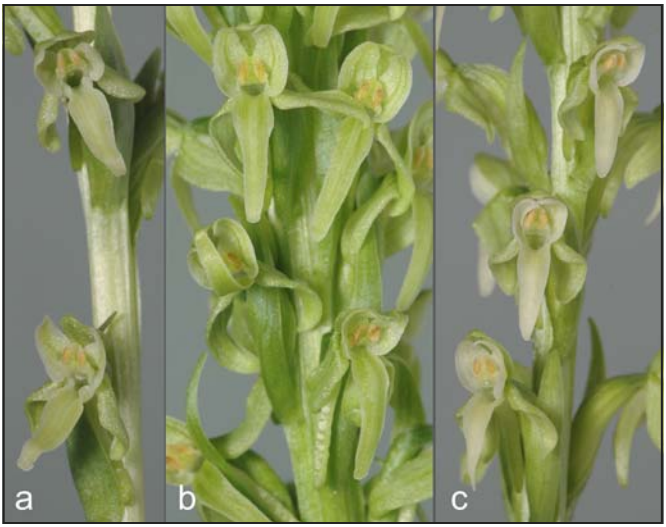

Figure 1. Variability in *Platanthera huronensis*, but note prominent connective separating vertically-oriented anther sacs and pollinia retained within them. a: Idaho: Lemhi County. *Sheviak 7052b*; b: Alaska: Popof Island. *Sheviak & Sheviak 6463b*; c: Montana: Sweet Grass County. *Sheviak 7057c*

Figure 2. *Platanthera aquilonis.* Note wide-spreading anther sacs with approximate apices and autopollination with pollinia rotated onto stigma. Manitoba: vicinity of Thompson. *Sheviak & Sheviak 6979a*

Figure 3. *Platanthera huronensis* showing autopollination with pollinia rotating out of the anther sacs. Colorado: Gilpin County. *Sheviak, Sheviak, & Pyrzynski 6281b*

Figure 5. *Platanthera hyperborea.* Typical plant of common form in tundra. Manitoba: vicinity of Churchill. *Sheviak, Sheviak, Heshka & Heshka 6954a*

Figure 6. *Platanthera hyperborea.* Population-level variation in floral morphology and color. Note anther sacs diverging from distinctly separated apices and autopollination via rotation of pollinia forward and down onto stigma. Note also dilated lip in insert "e". Manitoba: vicinity of Churchill. a: *Sheviak, Sheviak, Heshka & Heshka 6948b*; b: *Sheviak, Sheviak, Heshka & Heshka 6961b*; c: *Sheviak, Sheviak, Heshka & Heshka 6955b*; d: *Sheviak, Sheviak, Heshka & Heshka 6964b*; e: (small insert in d) *Sheviak, Sheviak, Heshka & Heshka 6963a*

Figure 7. Typical differences in flower size illustrated with side-by-side inflorescences. left: *Platanthera hyperborea.* Manitoba: Vicinity of Churchill. *Sheviak, Sheviak, Heshka & Heshka 6964a;* right: *Platanthera huronensis.* Montana: Gallatin County. *Sheviak 7055a*

Figure 8. *Platanthera hyperborea*. Alaska: Vicinity of Nome. left: Typical plant in tundra. Sheviak & Sheviak 6388; right: inflorescence showing autopollination with pollinia rotating free of anther sacs. Sheviak & Sheviak 6388a

Figure 9. *Platanthera hyperborea*. left: Manitoba: Vicinity of Churchill. Sheviak, Sheviak, Heshka & Heshka 6961b; right: Alaska: Vicinity of Nome. Sheviak & Sheviak 6388c

Figure 10. *Platanthera huronensis.* Although not evident in these flowers, this plant and other members of the population commonly autopollinate in the manner of *P. aquilonis* and *P. hyperborea*. Labrador: Vicinity of Pinus River. *Sheviak 6355c*

Figures to accompany "Description and Conservation Status of *Cypripedium kentuckiense"* by Kevin Allen, page 37

Figure 1. Photo by Paul Chance. Flowering colony of *C. kentuckiense* in Kisatchie National Forest in Natchitoches Parish, Louisiana. Note the stalk at far left that contains two flowers.

Figure 2. Photo by Kevin Allen. Specimens of *C. kentuckiense* currently in cultivation that were rescued from lignite mining in Desoto Parish, Louisiana, in the 1970s.

Figure 3. Photo by Kevin Allen. Flask of *C. kentuckiense* seedlings being grown as part of a class research project at Captain Shreve High School in Shreveport, Louisiana.

(Continued from page 18)
massulae sometimes loosely streaming onto the stigma. Flowers are intensely sweet scented, clove-like (Figures 5, 6, 7; pages 22-23)

Southward through the boreal forest, plants average larger, ranging 150 – 350 mm, commonly toward the upper limit of the range in the collected specimens. They may also bear more numerous, larger leaves or bracts. In other respects, the plants do not differ from the common plants of Churchill populations. Inflorescences are 30-78 mm, entirely comparable to those of much smaller tundra specimens. Flowers in the sampled populations are uniformly whitish green, with the lip sometimes quite pale, but in general quite uniform and without the marked color variation seen around Churchill. Otherwise, flowers appear identical to those of the more northern plants, with lance-acuminate lips and porrect clavate to cylindrical spurs. Columns are similarly proportioned and autopollinate in the same manner. Flowers at all three sites were scentless, but this might have been due to the timing of the sampling.

The small population around Nome exhibits much less variation. Despite the severe environment, plants tend to be significantly more robust than Churchill plants, ranging over 300 mm tall and sometimes markedly stouter and leafier than even the more southern plants from the Manitoba boreal forest (Figure 8; page 24). Leaves 3-6, only gradually reduced to bracts, longest leaf 115 x 16 mm. The flowers, too, differ to some extent. Lips are whitish green, sometimes slightly yellowish, and in a few very robust plants, rather bluish. Lips are 5.5-6.8 mm, lance-acuminate but sometimes more obtuse and less attenuated than in the Manitoba plants, with a slightly rounded basal dilation. Despite the rather larger flowers and longer lips, spurs average shorter, 2.5-4.0 mm, subsaccate or obtuse-clavate to cylindrical, porrect or the shorter only thrusting backward and somewhat downward. Viscidia are oblong. The column functions similarly to that of the Manitoba plants, and the flowers are abundantly autopollinating. However, the connective varies to markedly broader, with the anther sacs rather widely spaced, nearly parallel to somewhat diverging, sometimes at 10° or less, but up to 35°. In one very robust plant, the columns varied greatly, with the anther sacs sometimes parallel, but in some flowers diverging at up to 58° or even nearly horizontal as in *P. aquilonis*, yet with a broad connective separation and hence unlike that in *P. aquilonis*. Flowers are intensely fragrant, the scent sweet, spicy, and pungent. Although in the field the Nome plants thus sometimes appear somewhat different from the Manitoba plants, the distinctive features have not been maintained for me in cultivation. In pot culture indoors, the flowers assumed the typical whitish-green color and smaller size, with more attenuated lips without notable basal dilation, proportionally longer, more slender spurs, and more triangular anthers without a substantially broader connective. The evident differences between the Alaska and Manitoba plants may thus be environmentally induced (Figure 9; page 25).

The Labrador plants comprised a single small colony, so the sample is particularly limited. Located late in the season, the plants were mostly in fruit, but a few fresh flowers remained on some plants. A few plants collected live bloomed repeatedly in cultivation. Plants are tall, 300–440 mm (taller in cultivation) with 3-4 leaves, the longest 125 x 15 mm, and a few bracts. Flowers are yellowish green in aspect due to a pale dull yellowish, very broad, rhombic lip 5.5 x 3.2 mm; spur clavate, porrect, 5 mm (Figure 10; page 25). The column again functions similarly, abundantly autopollinating with sectile pollinia; anther sacs diverge at ca. 60° from a moderate connective; viscidia are oblong.

DISCUSSION

All populations studied were determined to be composed of tetraploids from cytological analysis of representative specimens. Assuming these to be allotetraploids, certain genetic complexities are to be expected. Tetraploidy restricts recombination and hence serves to preserve initial expression of parental characteristics in hybrid lineages. In contrast, variation may result largely from differing percentages of parental chromosomes, leading to a multi-character variation pattern quite different from that of the hybrid swarms typical of diploids. Although inbreeding resulting from self pollination typically reduces variability, it may also provide opportunities for the generation of such chromosomal segregates and then support their perpetuation. These are potential features of the populations under study here.

If *P. aquilonis* is indeed an ancestor of *P. huronensis*, autogamy would be a predictable consequence of selection in the North, where the presence and activity of pollinators are likely to be unreliable. One question, then, is whether these autogamous plants represent a single, monophyletic race, or have been repeatedly selected. If the latter, has their evident facultative allogamy yielded a single interbreeding population? This question is of fundamental importance to the relationship of these American plants with *P. hyperborea*; do all these plants comprise a single species? *Platanthera hyperborea*, as a disjunct outlier of this American group, would reasonably have spread to Iceland from North America, most likely via southern Greenland, where similar plants also occur. Hypothetically, however, a progenitor might have arrived in Iceland and evolved into the present *P. hyperborea*, distinct from American plants. Finally, if these plants comprise a northern autogamous race, and if it is referable to *P. hyperborea*, at what level is it distinct from allogamous *P. huronensis*? What status is to be accorded *P. huronensis*, given that *P. hyperborea* has priority?

Due to the large size of the Churchill population and its variability, it provides the most information. Churchill plants span the range in height seen in Icelandic specimens and exceed their evident range in floral form. Additionally, the range in color from whitish green to white and pale yellow is consistent with published photographs and descriptions of Icelandic plants. The variabil-

ity of these plants is decidedly greater than that encountered elsewhere. In particular, flowers may be pure white; these plants were always found with more common green-flowered plants, but the predominance of one or the other varied. At one site with both, additional plants with flowers variably white with green infusions were also found. Pure white flowers usually were comparable to green flowers in most features, and the columns were identical. Nevertheless, in a few, the lips were markedly dilated at the base (Figure 6e; page 23), and leaves of white-flowered plants were often narrower than average. These characteristics suggest linkage of genes of *P. dilatata*, as might be expected in an inbred allotetraploid. Only a few plants with concolor pale yellow flowers were found, these limited to two sites. They appeared morphologically identical to the common green-flowered plants with which they grew. The pale yellow color might be due to a generalized expression of the gene for yellowish lip color in *P. aquilonis*. Plants occurring further south through the boreal forest are comparable to the largest Churchill plants, but much less variable, being uniformly whitish green and with little variation in floral morphology. The observed lack of fragrance in these more southern plants cannot be assessed from the limited sample, but if representative, it would suggest a greater reliance on autogamy.

Clearly, the holotype of *Orchis hyperborea* is accommodated within the range of variation at Churchill and the broader boreal forest population. In general, then, the Manitoba plants compare favorably with Icelandic material and hence may be appropriately referred to *P. hyperborea*. Indeed, Icelandic plants can be viewed as a subset of these more variable American plants, as would be expected if the Icelandic population was derived from North America.

Platanthera huronensis in the strict sense is variable in general morphology. In particular, two extreme forms stand out. One is the classical form with whitish, slenderly lance-acuminate lip and slender spur three-quarters to equaling the lip in length. The anther is elevated, with the anther sacs diverging gradually, and the stigmatic surface is nearly horizontal and recessed behind the rostellum. This is the form found throughout the eastern portion of the range of the species; it also occurs in the West, ranging from the easternmost Aleutians southeast to at least Wyoming. Another prominent form in the West is marked by a shorter, more clavate spur and often a somewhat broader lip with a more rounded-dilated base and sometimes more yellow-green color. The column is slightly more compact, with somewhat lower anther with more widely spreading anther sacs; the stigma is presented forward and is less recessed, permitting these plants in rare cases to effectively autopollinate. Throughout the West, plants are particularly variable, and populations of varying morphology obscure discrete differentiation of forms. To what extent this variability might be merely phenotypic is unknown, but spur lengths have been maintained in cultivation. Wallace (2003) found strong molecular evidence for multiple origins for *P. huronensis*, followed by widespread gene flow and the incorporation of

the various lineages into a single functional species. Certainly this could explain this variation. As she noted, however, the perceived differences in DNA sequence data, like the morphological data, could have arisen through selection from a common hybrid gene pool. Allotetraploids are particularly difficult to interpret; DNA sequence data, although very suggestive, is not necessarily more definitive in this venue than is morphology. Nonetheless, the evidence for multiple origins of *P. huronensis* does suggest that the Nome population may have arisen independently from more eastern *P. hyperborea* or secondarily acquired genes from another source. The differences noted in some of the Nome plants, including lip color and shape, spur length, and, perhaps most significantly, connective width and anther sac orientation, suggest *P. convallariifolia* of the Aleutians. This might indicate ancient introgression from this now geographically widely separated species. Alternatively, some of the features suggest the cordilleran *P. huronensis* discussed above, and that form has been found rarely to autopollinate. The loss of the distinctive features in cultivation, however, makes their significance uncertain. They may be merely a local phenotypic expression. The Nome plants may be merely a local population varying uniquely but otherwise comparable to the broader Manitoba population in much the same way that the Churchill population varies in color and lip shape. Key to interpretation of the status of the population will be study of other populations across Alaska and Yukon.

Whereas the Nome and Manitoba populations are readily accommodated within a well-delimited concept of *P. hyperborea*, those from Labrador are unambiguously different. In general habit in the field they suggest *P. huronensis*, but the broadly rhombic, pale yellowish lip and effective autopollination immediately distinguish them from a typical expression of that species. Clearly, they are not part of *P. hyperborea* as it occurs in Manitoba, but represent another autogamous lineage. Whether this resulted through selection of *P. aquilonis* autopollination capability from a allopolyploid *P. huronensis* genome, as suggested by the lip shape and color, or resulted from a separate hybridization event, is unknown. Whatever the origin of the population, however, these plants speak to the repeated generation of autogamous populations in the North and the uncertainty of assessing the perceived patterns of variation.

The rare tendency of *P. huronensis* toward autopollination that I have seen in northern New York and in the West emphasizes the potential of the species to generate autogamous populations and lineages. Although the eastern occurrences that I have found were not really successful, pollination having been limited at best to rare individual flowers, the report of Reddoch & Reddoch and the limited effectiveness I found in Colorado and Montana demonstrate that autogamy is at least locally achieved. How then are the differences between *P. huronensis* and *P. hyperborea* to be interpreted? At what taxonomic level should they be recognized?

The plants in the Adirondacks that exhibit sectile pollinia rotating free of the anther sacs and those that rarely autopollinate there in my experience tend to show some other characteristics of *P. aquilonis*, especially a shorter, more rhombic lip with a more yellowish color [*e.g., Sheviak 6272*]. This suggests either recombination expressing genes of that species, or secondary hybridization. In contrast, the plants illustrated in Reddoch and Reddoch (1997) and in their photos (pers.com.) show plants otherwise typical of *P. huronensis*. Similarly, sparsely autopollinating western plants were otherwise not noticeably different from entirely allogamous members of the same population. Together with the distinctive Labrador plants, a diversity of origins is apparent. None of these plants, however, approach the characteristics of *P. hyperborea* as represented by the plants around Churchill, in the Manitoba boreal forest, and at Nome. Additionally, the diversity of forms in the Churchill area and to a lesser extent evidently also on Iceland is not seen in *P. huronensis*. Although probably the result of inbreeding, they emphasize the difference between *P. hyperborea* and *P. huronensis*. This suggests that the derivation of truly autogamous lineages is not readily achieved and yields diverse products; hence *P. hyperborea s.s.* likely has not been repeatedly generated.

Platanthera hyperborea appears to have a broad range in North America. In addition to its occurrence in the tundra, it ranges widely in the boreal forest, as comparable material has been collected in southern Yukon [*Bennett & Seccombe-Hett 04-0791*; *B.A.Bennett s.n.*; *B. Gallagher s.n.*; *Brunner s.n.*; *Kennedy s.n.*], at the southern tip of James Bay [*G.M. Bartram & H. Andrews s.n.*], and in Newfoundland [*Dean s.n.*]. My own limited field work traced *P. hyperborea* from the southern edge of the tundra in Manitoba nearly through the boreal forest to the edge of the mixed forest and aspen parkland. At the southern margin of its range, it therefore may occur sympatrically with *P. huronensis*. Indeed, both species were found on Long Point, on the western shore of Lake Winnipeg [*Sheviak, Sheviak, Heshka, & Heshka 6942*; *Sheviak & Sheviak 7020*]. At this site they occurred, too, with *P. aquilonis* [*Sheviak, Sheviak, Heshka, & Heshka 6941*], yet no hybridization of any sort was evident. The uniformly smaller sized flowers, unique variation pattern, and broad, probably transcontinental range indicate that *P. hyperborea* is more than merely a race of *P. huronensis* comparable to the locally generated autogamous individuals and populations. The sympatric occurrence of *P. hyperborea* with *P. huronensis* in the boreal forest, and specifically on Long Point without evident hybridization, further indicates that *P. hyperborea s.s.* is a discrete entity that should be maintained as a species barring additional evidence to the contrary.

Much remains to be done to document the species' limits, both geographic and taxonomic. In particular, my initial emphasis on pollination mechanics in determining *P. aquilonis* may have resulted in misidentifying some specimens of *P. hyperborea*. Some of the anomalous character expression reported by Sears (2008) from British Columbia may have been due to the variable assignment of

specimens of *P. hyperborea* to either *P. aquilonis* or *P. huronensis* in his analysis. I have collected *P. aquilonis* around Churchill [*Sheviak, Sheviak, Heshka, & Heshka 6949*; *Sheviak & Heshka 7025*] and in the Brooks Range, northern Alaska [*Sheviak & Sheviak 5474*], thereby verifying its occurrence at its reported northern range limit (Sheviak 2002). Additionally, the northern range limit of *P. dilatata* is in question, because any specimen reported to bear white flowers is customarily assigned to that species. Determination of the ranges of all of these species must hence be reassessed. The necessary in-depth herbarium work, however, is beyond the scope of this summary paper. Such work, both taxonomic and floristic, must await a subsequent investigator.

KEY TO THE SPECIES

1: Flowers allogamous, not autopollinating, the pollinia retained within the anther sacs (occasional flowers and rare individuals or populations excepted), the anther high, with anther sacs clearly separated distally by a distinct connective, slightly to moderately diverging toward the rostellum lobes; viscidia oblong to linear oblong; flowers whitish green, lip 5-12 x 2-4 mm, lanceolate to lance-acuminate, often with a marked rounded basal dilation, spur 4-12 mm…… *P. huronensis*

1: Flowers autogamous, commonly autopollinating with sectile pollinia rotating out of the anther sacs onto the stigma or fragmenting and pollen trailing down onto the stigma, the anther variously high to low, connective various, the anther sacs slightly diverging to nearly horizontal; viscidia linear oblong, oblong, or orbicular (sometimes absent); flowers green, whitish green, yellowish, or white, lip rhombic-lanceolate to acuminate or with a rounded basal dilation…….…….....2.

2: Anther sacs distally separated by a distinct connective, moderately diverging toward the rostellum lobes, the anther subulate. Viscidia oblong to linear oblong. Flowers green, whitish green, white, or pale yellow, lip 4-5.5 (-6.8) x (1.5-) 2-2.5 mm, lanceolate to basally dilated, spur (2.5-) 4-6 mm……..… *P. hyperborea*

2: Anther sacs distally approximate (the connective attenuated), diverging toward the rostellum lobes to nearly horizontal, the anther subulate to obtuse. Viscidia orbicular (sometimes absent). Flowers green with dull yellowish lip, the lip 2.5-6 x 1-1.5 mm, rhombic lanceolate, with straight sides and not acuminate, spur 2-5 mm..……. *P. aquilonis*

REFERENCED SPECIMENS

Platanthera hyperborea:

ICELAND: Gullbringusýsla: Vifilstadhavatn. Abundant in mossy swale along small stream. Jul 1943. S.J. Smith 2408 [NYS]. ALASKA: Bendeleben Quad.: Serpentine Hot Springs, 65°51'N. 164°43'W. At bath house along Hot Springs Creek near air strip. Site 41. 27 Jul 1970. *S. Walker s.n.* [ALA]; Bendeleben Quad.: Serpentine Hot Springs. serpentine creek bottom, wet ground near bath house. 65°52'N. 164°41'W. 4 Jul 1971. *A. Springer (Site s-15)* [ALA]; Bendeleben Quad.: Serpentine Hot Springs. 65°52'N. 164°26'W, 150 m.s.m. 24 Jun 1987. *T. Kelso 87-174* [ALA]; Seward Peninsula. Serpentine Hot Springs. In open disturbed areas of willow shrub thicket around hot springs area and cabin along creek at 400 ft elevation. 4 Aug 1973. *C.H. Racine 440*. [ALA]; Seward Peninsula: Nome-Teller Road, ca. 2.2 miles WNW of Perkinsville. T11S R34W, Sec 4, SW ¼. Low tundra bordering marshy pond margin. 2 Jul 2001. *C.J. Sheviak & J.K. Sheviak 6388* [NYS]; Along Anvil Creek at Teller Road. Banks above creek and adjacent moist tundra. 4 Jul 2001. *C.J. Sheviak & J.K. Sheviak 6395* [NYS]. YUKON: Crow River Hotsprings, elev 960 m. 60.20021863N – 125.79145870W. Common throughout hotspring meadows. 16 Jul 04. B.A. Bennett & P. Seccombe-Hett 04-0791 [NY]; Beaver River, elevation 350 m, 60° 01', 124° 41'. 17 Aug 1997. *B.A.Bennett s.n*. [BABY]; Hotspring Creek, elevation 1219m, 63° 04', 135° 41. 7 Aug 1987. *B. Gallagher s.n.* [BABY]; Jackfish Lake, 66° 49', 133° 49', pond with large graminoid fen. 4 Jul 1999. *G. Brunner s.n.* [BABY]; Coal River, elevation 650 m, 60° 08', 127° 25', wetland-larix/betula/salix. 6 Jul 1983. *C.E. Kennedy s.n.* [BABY]; East of Copper Haul Rd., elevation 730 m, 60° 43', 135° 09'. Marl concretions. 9 Jul 1996. *C.E. Kennedy s.n.* [BABY]; MANITOBA: Long Point, northwest shore of Lake Winnipeg. Long Point Road, 0.25 miles from end at lake. Roadside limestone gravel and edge of spruce forest. 12 Jul 2003. *C.J. Sheviak, J.K. Sheviak, L. Heshka & J. Heshka 6942* [NYS]; South of Ponton, along Hargrave River immediately west of rt. 6. Alder thickets and open spruce forest on river bank. 13 Jul 2003. *C.J. Sheviak, J.K. Sheviak, L. Heshka & J. Heshka 6944* [NYS]; Vicinity of Churchill, Lat. 58° 46'N., Long 94° 10'W. near Landing Lake. In swampy area, spruce-larch forest. 12 Jul 1956. *W.B. Schofield & H.A. Crum 6575* [DS/CAS]; Vicinity of Churchill, Lat. 58° 46'N., Long 94°10'W. About 4 miles East. Wet mossy area near lake. 28 Jul 1956. *W.B. Schofield & H.A. Crum 7030* [DS/CAS]; Vicinity of Churchill. Dene Village site. Wet mossy open taiga, Picea/Larix. 15 Jul 2003. *C.J. Sheviak, J.K. Sheviak, L. Heshka & J. Heshka 6948* [NYS]; Vicinity of Churchill. East of Dene Village site, vicinity of Metal Dump, along railroad spur. Open wet sedge meadow and Picea/Larix border. 16 Jul 2003. *C.J. Sheviak, J.K. Sheviak, L. Heshka & J. Heshka 6954, 6955* [NYS]; Vicinity of Churchill. Goose Creek Road, ca. 0.5 km SW of CNRR mainline crossing. Wet Eleocharis flat. 17 Jul 2003. *C.J. Sheviak & L. Heshka 6959, 6960* [NYS]; Vicinity of Chur-

chill. Along Twin Lakes Road, south of open muskeg. Open mossy spruce/fir forest and roadside bank. 17 Jul 2003. *C.J. Sheviak, J.K. Sheviak, L. Heshka & J. Heshka 6961, 6962, 6963* [NYS]; Vicinity of Churchill. Along Twin Lakes Road, extensive muskeg. Open muskeg. 17 Jul 2003. *C.J. Sheviak, J.K. Sheviak, L. Heshka & J. Heshka 6964* [NYS]; Vicinity of Thompson. Along rt 280, within 1 mile of junction with rt 391. Roadside ditch bank in low spruce forest. 20 Jul 2003. *C.J. Sheviak & J.K. Sheviak 6980* [NYS]; ONTARIO: Moosonee, Front Street ditch. 8 Jul 1960. *G.M. Bartram & H. Andrews s.n.* [GH]. NEWFOUNDLAND AND LABRADOR: Newfoundland: without locality and date. *J.K. Dean, s.n.* [NYS].

Platanthera huronensis:

ALASKA: Shumigan Islands: Popof Island. East of Sand Point. 55 20 55N, 160 28 33W. Hummocky Empetrum heath. 17 Jul 2001. *C.J. Sheviak & J.K. Sheviak 6463* [NYS]; MANITOBA: Long Point, northwest shore of Lake Winnipeg. 2.5 km east of rt. 6, north side of road. Moist, mossy/sedge opening in shrubby Thuja border of roadside ditch. 20 Jul 2005. *C.J. Sheviak & J.K. Sheviak 7020* [NYS]; NEWFOUNDLAND AND LABRADOR: Labrador: Northeast of Pinus River [Pena's River] on Trans Labrador Highway. Mesic Picea/Larix, rather open; mostly in depressions with Alnus and on roadside ditchbank. 24 Sep 2000. *C.J. Sheviak 6355* [NYS]; COLORADO: Gilpin County: Vicinity of East Portal of Moffatt Tunnel, base of Rollins Pass Road. 4 Jul 1999. *C.J. Sheviak, J.K. Sheviak & J.F. Pyrzynski 6281* [NYS]. NEW YORK: Hamilton County: 4.4 miles east of Long Lake (junct. rt 30) on rt. 28N. Roadside ditch. 9 Jun 1999. *C.J. Sheviak 6272* [NYS]. IDAHO: Lemhi County: Vicinity Lemhi, along Lemhi River. Willow thickets and grassy openings in light shade or partial sun. Moist to wet, heavy black alluvial soil. 23 Jun 2006. *C.J. Sheviak 7052* [NYS]; MONTANA: Gallatin County: Taylor Creek, between Gallatin River and Wapiti Creek, above The Blowout. Low grass/sedge/willow on stream bank in meadow. 24 Jun 2006. *C.J. Sheviak 7055* [NYS]; Sweet Grass County: Crazy Mountains. Big Timber Canyon. Just inside national forest boundary along Big Timber Creek. Moist, open stream bank with P. dilatata 7056. 25 Jun 2006 *C.J. Sheviak 7057* [NYS].

Platanthera aquilonis:

ALASKA: Brooks Range: Endicott Mountains. Vicinity of confluence of Nahtuk River with Alatna River. Mesic to wet clay banks on open, sparsely vegetated bars and edges of thickets along river and backwaters. 24 Jun 1994. *Sheviak & Sheviak 5474* [NYS]; MANITOBA: Vicinity of Churchill. Dene Village site. Wet mossy open taiga, Picea/Larix. 15 July 2003. *Sheviak, Sheviak, Heshka, & Heshka 6949* [NYS]; Churchill. Vicinity of Port. Low tundra and fill at base of railroad embankment. 18 Jul 2005. *Sheviak & Heshka 7025*

[NYS]; Long Point, NW shore of Lake Winnipeg. Long Point Road, 0.25 miles from end at lake. Roadside limestone gravel and edge of spruce forest. 12 Jul 2003. *Sheviak, Sheviak, Heshka, & Heshka 6941* [NYS]; Vicinity of Thompson. Along rt 280, within one mile of junction with rt 391. Roadside ditch bank in low spruce forest. 20 Jul 2003. *C.J. Sheviak & J.K. Sheviak 6979* [NYS]; NEW YORK: Tompkins County: McGowan's Woods. Jul 1903. *K.M. Wiegand s.n.* [CU/BH].

ACKNOWLEDGEMENTS

In this complex group, even the limited progress represented by this contribution could not have been possible without the support and cooperation of many others. In particular, Lorne and Joan Heshka, Winnipeg, generously shared their knowledge, time, enthusiasm, and lives and arranged two trips to Churchill. The Churchill Northern Studies Center and its staff facilitated my field work with laboratory space and a congenial environment. Robert Dirig & Anna Stalter (BH) generously relocated the Wiegand specimen based on my vague recollection of it. Bruce Bennett, Yukon Environment, NatureServe Yukon, Whitehorse, provided critical specimens from that area and helped broaden my understanding of the region's flora. Over the years, numerous herbaria provided specimens on loan or facilitated my visits; those specifically in support of this limited study include ALA, AMES, BABY, CAS, CU, F, GH, ICEL, LINN.

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Description and Conservation Status of *Cypripedium kentuckiense*

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DESCRIPTION

Cypripedium kentuckiense, the largest-flowered member of the genus (Brown, 1995), is a terrestrial herb with a short, stout rhizome (Cribb, 1997). Reed (1981) described the species as having finely pubescent stems reaching 6-7 dm tall and containing usually five alternating leaves that are broadly ovate and taper gradually from the middle to the slightly twisted apex. The leaves measure 14-16 cm long and 6-8 cm wide and are subglabrous with the exception of some pubescence along the underside of the veins. Usually one – but rarely two (Medley, 1986) (Figure 1; page 26) – terminal flowers adorn the stems. The flower, which can measure 15 cm across, contains a lip that is 5 cm long and 3.5 cm wide. The orifice takes up most of the top of the lip (Medley, 1986). The color of the lip ranges from creamy white to pale yellow, and the petals and sepals contain greenish stripes mottled with purple (Cribb, 1997) or maroon (Medley, 1986). The veins on the inner surface of the lip are also dotted and lined with maroon (Medley, 1986). The two spirally twisted petals are 7-9 cm long and 0.7 cm wide (Cribb, 1997). The dorsal sepal hangs over the lip rather than standing erect as in *C. parviflorum* var. *pubescens* (Medley, 1986).

NOMENCLATURE

Reed (1981) published the first complete description of *C. kentuckiense*, including a Latin diagnosis and specimen citation. An earlier description by Soukup (1977) identified the species as *C. daultonii* but did not contain a Latin diagnosis. Jim Daulton, for whom Soukup named the species, had discovered a population of the plant in northeastern Kentucky while on a fishing trip in 1951. Previously, Correll (1938) had chosen to lump all of the yellow-flowered North American species together under the umbrella of *C. calceolus* var. *pubescens* and did not believe the polymorphisms merited species status. Earlier still, Rafinesque (1828, 1833) meagerly described what was probably *C. kentuckiense* first as *C. luteum* var. *grandiflorum* and then as *C. furcatum* but did not cite any type specimens.

Brown (1998, 2002) proposed two forms: *C. kentuckiense* forma *pricei* and *C. kentuckiense* forma *summersii*. Both descriptions were of flowers lacking all

purplish or reddish pigmentation and were accompanied by photographs taken in Arkansas.

RANGE

This species is native primarily to the southeastern United States. Medley (1986) confirmed its occurrence in Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas. Cribb (1997) also included Missouri and Ohio in its range. In the past two decades, outlier populations have been discovered in two states not previously known to harbor the species, including Georgia in 1999 (M. Richards, pers. comm., January 31, 2011) and Virginia in 1995 (Weldy *et al.*, 1996).

BLOOMING SEASON

The blooming season of *C. kentuckiense* can vary from late March in central Louisiana (personal observation) to early June in the northeastern reaches of its range (Medley, 1986). The flowers can most frequently be seen in April and May, and they are in peak bloom for about 8 to 12 days (Medley, 1986).

HABITAT

Stream banks, alluvial terraces, and deep ravines in mesophytic, hardwood-dominated forests are the primary habitats of *C. kentuckiense* (Cribb, 1997). The usually slightly acidic soils are typically sandy or sandy with clay and can have little or high organic content (Medley, 1986). Plants are frequently situated in locations subject to periodic inundation from rising water (Medley, 1986). Dominant hardwoods often include *Fagus grandiflora* (American beech), *Ulmus rubra* (slippery elm), *Acer saccharum* (sugar maple), and, in more southerly locations, *Magnolia grandiflora* (Southern magnolia) (Cribb, 1997; Liggio and Liggio, 1999). Herbaceous companion plants often include *Polystichum acrostichoides* (Christmas fern), *Tipularia discolor* (cranefly orchid), *Mitchella repens* (partridgeberry), and various *Trillium* species (Liggio and Liggio, 1999).

RESEARCH AND CONSERVATION

Case *et al.* (1998) determined through genetic testing that *C. kentuckiense* is sufficiently different from *C. parviflorum* var. *pubescens* so as to be recognized as a distinct species. It is classified federally as a species of concern by the U.S. Fish and Wildlife Service (2011) and globally at the G3 level, or, very vulnerable to extinction throughout its range (NatureServe, 2010). Approximately 100-200 extant populations are known to exist (NatureServe, 2010). It is threatened by habitat destruction from such activities as timber harvesting and coal mining (Figure 2; page 26) as well as by plant collectors who harvest them for their personal gardens or commercial trade (Medley, 1986). Several

conservation efforts involving *in-vitro* seed propagation of the species are underway in Georgia, Louisiana, Texas, and Arkansas.

Matt Richards, the orchid conservation specialist at the Atlanta Botanical Garden (pers. comm., January 28, 2011), is coordinating a propagation and reintroduction project for the only known population of *C. kentuckiense* in Georgia, located in Laurens County. The project began in 2005 when seeds from the population were first germinated *in vitro*. After the seedlings were grown in the conservation nursery, the first plants were outplanted in 2008 to the site of the existing population and to an experimental site. As of October 2010, 47 out of 50 total seedlings outplanted to the site of the existing population have survived. Work with seed baits also resulted in the isolation of mycorrhizal fungi from protocorm tissue in 2008. The mycorrhizae have yet to be identified.

A similar reintroduction project involving Kisatchie National Forest, the Central Louisiana Orchid Society (CLOS), and Captain Shreve High School in Shreveport, Louisiana, is ongoing to augment native populations of *C. kentuckiense* on National Forest Service lands. Seeds were first sent to Spangle Creek Labs in Bovey, Minnesota, in 2004 for *in-vitro* germination. Members of CLOS grew the resulting seedlings and were able to outplant 160 plants from December 2007 to December 2008 at the site of an existing population in Kisatchie National Forest. The survival rate has yet to be determined. As a continuation of the project, students in the honors chemistry classes at Captain Shreve High School began experimental trials in 2010 to study the effects of various chemical variables on the *in-vitro* germination of the seeds. Seedlings produced from these trials (Figure 3; page 26) will continue to supply the project with plant material for additional outplantings. Coordinators of the project include Dr. James Barnett, Emeritus Scientist, USDA Forest Service, Southern Research Station; David Moore, Botanist, Kisatchie National Forest; and Kevin Allen, chemistry teacher, Captain Shreve High School.

A project modeled after the one in Louisiana began in East Texas in 2007 and involves the National Forest Service, the Houston Orchid Society, the Native Plant Society of Texas, and Stephen F. Austin State University (Loos and Philipps, 2010). One viable seedpod was collected from a population of *C. kentuckiense* in Sabine National Forest in 2007 and was sent to Spangle Creek Labs for *in-vitro* germination. Members of the participating organizations have grown the seedlings in preparation for the first outplantings, which are planned for spring 2011.

In Arkansas, Nevin Aspinwall (pers. comm., February 5, 2011) is working with the forest botanist at Ouachita National Forest to germinate seeds *in vitro* to reinforce a native population that has dwindled over the years from several hundred plants to approximately 50. Thus far, about 200 seedlings and young

plants have been outplanted to the site. In 2010 – one year after planting – the initial survival was observed to be about 50 percent.

Although the habitat of this magnificent orchid continues to dwindle, improved methods of *in-vitro* propagation and better knowledge of the germination requirements of this species have made conservation efforts more realistic over the last decade.

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2011 Native Orchid Conference

Saturday, July 30 - Tuesday, August 2, 2011

Mt. Cuba Center, located in northern Delaware, will be hosting the 2011 Native Orchid Conference. The July 30 and 31 lectures and presentations will be held at the Center. On August 1 and 2 we will go on field trips to observe native orchids in their natural and varied habitats within the region.

For more information, contact Phil Oyerly at:

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Annual Financial Statements

The Native Orchid Conference, Inc.

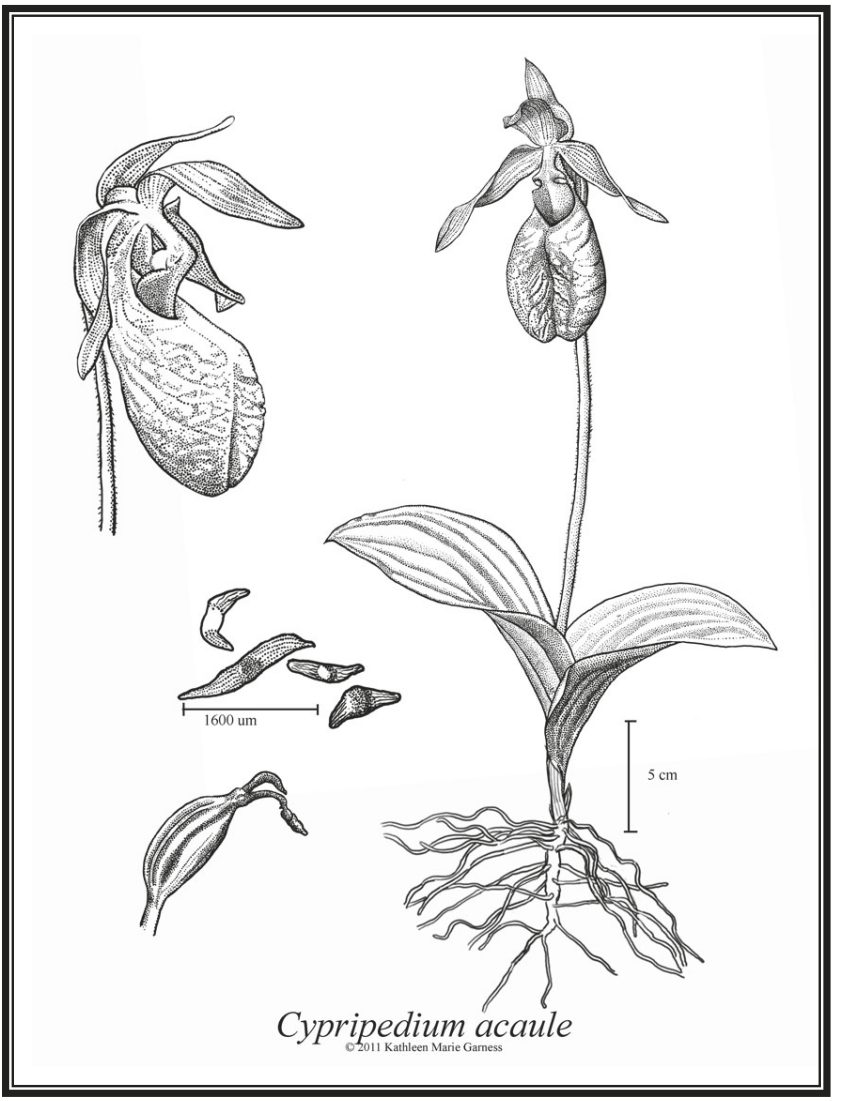
Account Balances 2008 to 2010 - As of 12/31/2010:6

As of 12/31/2010

Account	12/30/2008 Balance	12/31/2008 Balance	12/31/2009 Balance	12/31/2010 Balance
Bank Accounts				
Checking-Newbridge Bank	1,754.02	1,754.02	1,606.02	1,551.02
Checking-US Bank	15,513.96	15,508.96	15,935.78	17,736.55
TOTAL Bank Accounts	**17,267.98**	**17,262.98**	**17,541.80**	**19,287.57**
OVERALL TOTAL	**17,267.98**	**17,262.98**	**17,541.80**	**19,287.57**

Cash Flow 2008 to 2010:6
1/1/2008 through 12/31/2010

Category Description	1/1/2008-12/31/2008	1/1/2009-12/31/2009	1/1/2010-12/31/2010	OVERALL TOTAL
INFLOWS				
Conference Registration	10,443.75	9,740.00	6,506.25	26,690.00
Donations	260.00	75.00	65.00	400.00
Memberships	0.00	0.00	0.00	0.00
Memberships-New Family	120.00	210.00	190.00	520.00
Memberships-New-Back Issues	5.00	30.00	221.20	256.20
Memberships-New-Individual	875.00	2,080.00	410.00	3,365.00
Memberships-New-International	140.00	245.00	270.00	655.00
Memberships-New-Student	15.00	45.00	15.00	75.00
Memberships-Renewal-Family	1,200.00	955.00	1,080.00	3,235.00
Memberships-Renewal-Individual	2,450.00	955.00	2,415.00	5,820.00
Memberships-Renewal-International	840.00	490.00	480.00	1,810.00
Memberships-Renewal-Student	30.00	30.00	15.00	75.00
Merchant Fee Income	225.00	160.00	115.00	500.00
Other Inc	60.00	235.00	70.00	365.00
Publication Sales	0.00	0.00	1,685.50	1,685.50
Shipping & Handling	0.00	0.00	258.10	258.10
Shirt Sales	0.00	0.00	50.00	50.00
TOTAL INFLOWS	**16,663.75**	**15,250.00**	**13,846.05**	**45,759.80**
OUTFLOWS				
Bank Charge	10.00	0.00	0.00	10.00
Conference Expenses				
Hotel	272.16	0.00	0.00	272.16
Materials	0.00	1,181.71	45.22	1,226.93
Participant Meals	3,088.13	5,115.45	3,587.76	11,791.34
Postage	0.00	0.00	224.10	224.10
Printing	378.84	626.27	334.94	1,340.05
Room Rental	150.00	1,026.50	0.00	1,176.50
Shirts	0.00	793.28	0.00	793.28
Speakers	150.00	800.00	0.00	950.00
TOTAL Conference Expenses	4,039.13	9,543.21	4,192.02	17,774.36
Conservation Grant	150.00	0.00	0.00	150.00
Filing Fee	0.00	0.00	30.00	30.00
Insurance				
Directors & Officiers	750.00	750.00	750.00	2,250.00
General Liability	275.00	275.00	275.00	825.00
TOTAL Insurance	1,025.00	1,025.00	1,025.00	3,075.00
Merchant Fees	205.21	222.16	187.60	614.97
Office Supplies	343.66	215.86	252.11	811.63
PO Box Rental	106.00	110.00	112.00	328.00
Postage	1,368.73	545.69	959.40	2,873.82
Printing	3,850.45	3,271.26	3,518.32	10,640.03
Publication Expenses	0.00	0.00	1,559.83	1,559.83
Publicity	436.98	0.00	164.00	600.98
Safe Deposit Box Rental	48.00	38.00	100.00	186.00
Void	0.00	0.00	0.00	0.00
TOTAL OUTFLOWS	**11,583.16**	**14,971.18**	**12,100.28**	**38,654.62**
OVERALL TOTAL	**5,080.59**	**278.82**	**1,745.77**	**7,105.18**



Kathy Garness, creator, has this image on display at the Morton Arboretum (Chicago area) as part of a Guild of Natural Science Illustrators exhibit. She notes:

"*Cypripedium acaule* is feared extirpated in Illinois, another victim of human impact, through destruction of its beloved bogs and upland forests, and over-collection. Illinois Department of Natural Resources ecologists have been monitoring this state-endangered species for almost forty years but they have not seen it for at least the past twenty. Stephen Packard, director of Audubon Chicago Region, said that it was once abundant here."

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