TWO RECORDS OF ACHLOROPHYLLOUS
CYPRIPEDIUM ACAULE FROM WISCONSIN

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The pink lady’s slipper orchid (Cypripedium acaule Aiton.) is one of the more common orchid species in the Great Lakes region, occurring in habitats ranging from dry sandy upland woods under mixed oaks, pines, or aspens to lowland bogs amidst sphagnum moss and beneath cedar, spruce, or tamarack (Voss, 1972; Luer 1975; Case, 1987). The plant also ranges over much of eastern North America (Case, 1987; Cribb, 1997). Variants of the plant have been recorded throughout its range, including plants with two flowers per inflorescence and a white flowered variant (Cribb, 1997). The white flowered variant of the pink lady’s slipper (f. albiflora Rand & Redfield) is a rare find and typically occurs in the northeastern part of the plant’s range (Luer, 1975). This variant is not a true albino or achlorophyllous plant because it contains chlorophyll and derives most of its energy through photosynthesis. Achlorophyllous plants are thought to lack chlorophyll and other pigments that are associated with photosynthesis (Cummings & Welschmeyer, 1998). However, Cummings and Welschmeyer (1998) found in their study of ten apparent achlorophyllous plant species, representing four families (Lennoaceae, Monotropaceae, Orchidaceae, and Orobanchaceae), that chlorophyll and other chlorophyll-related pigments were present although, at dramatically reduced levels. Although no previous record of a seemingly achlorophyllous pink lady’s slipper is known (Fred Case, personal communication, 20 October 2005), the purpose of this article is to announce the discovery of two separate occurrences of apparent achlorophyllous variants of pink lady’s slipper in Wisconsin.

Achlorophyllous orchids demonstrate an apparent absence of chlorophyll. Rather than harnessing their energy via photosynthesis, these plants are theorized to be mycotrophic which means that they parasitize mycorrhizal fungi for nutrients and carbon compounds (Furman & Trappe, 1971). The parasitized fungi, in turn, gain their nutrients and compounds from external sources such as photosynthesizing green plants or from the soil or decomposing organic matter and therefore act as a bridge between a source of nutrients and the apparent achlorophyllous plant (Furman & Trappe, 1971). A non-orchid example of this relationship is shown in a study conducted by Bjorkman (1960) on Monotropa hypopitys. Bjorkman (1960) demonstrated that Monotropa shared mycorrhizal fungi with nearby trees and that nutrient materials passed from the trees, through
the fungi and into the Monotropa. Bjorkman (1960) also found that mycorhizal development was stimulated toward growth by a substance produced by Monotropa, thereby showing that the fungi also benefit from the relationship with Monotropa. A systematic study on the mycotrophic nature of seemingly achlorophyllous pink lady’s slippers has not been conducted and therefore it can only be theorized that they have a similar method of survival to that of other achlorophyllous plants such as Monotropa hypopitys.

The pink lady’s slipper orchid is not the only apparent achlorophyllous species in the orchid family. An uncommon, seemingly achlorophyllous variant of hellborine orchid (Epipactus helleborine) is also known (Case, 1987). This variant of hellborine orchid has been found in Illinois and Quebec and could be the result of a relationship with symbiotic fungi that allows the plant to survive without producing the amount of chlorophyll typically necessary to sustain life (Case, 1987). In the genus Corallorhiza, the apparent lack of chlorophyll is common due to a close relationship with symbiotic fungi (Luer, 1975; Case, 1987). This relationship allows the plant to flower only in favorable years and remain dormant in others (Luer, 1975). The occurrence of seemingly achlorophyllous variants in other genera of orchids demonstrates the strong relationship that these plants have with symbiotic fungi. This relationship is present in the pink lady’s slipper as well. According to Cribb (1997), C. J. Sheviak presented a photograph showing pink lady’s slipper in a fairy ring, which suggests that mycorrhizal fungi within the fairy ring are in symbiosis with the orchid.
Figure 2. Apparent achlorophyllous variant of pink lady's slipper orchid. The plant's leaves are reduced in size and seemingly achlorophyllous. Photographed by Matt Bushman in a Price County, Wisconsin conifer swamp on the 22nd of June, 2005.
The two Wisconsin occurrences of the apparent achlorophyllous variant of pink lady’s slipper were found in separate locations and in different years. The first reported occurrence was from central Wisconsin in Waushara County during the summer of 1975 when two seemingly achlorophyllous plants where found and photographed by Guy David, then a student at UW-Stevens Point. The plants occurred in a red pine (Pinus resinosa L.) plantation with numerous other normal chlorophyllous plants of pink lady’s slipper (Guy David, personal communication, 25 October 2005). The two apparent achlorophyllous plants as well as the other chlorophyllous plants at the site were flowering (Guy David, personal communication, 25 October 2005). The leaves and stems of the plants were seemingly achlorophyllous while the labellum was a typical pink color and the sepals light brown in color (Figure 1). These plants were monitored for two summers and in the following summer (1976) the apparent achlorophyllous plants were notably reduced in size and non-flowering. This may have been a reflection of a drought that occurred throughout the growing season (Guy David, personal communication, 25 October 2005).

The second occurrence of the seemingly achlorophyllous variant of pink lady’s slipper was found in northwestern Wisconsin in Price County within the Chequamegon-Nicolet National Forest on the 22nd of June 2005. This plant occurred as a single sterile individual with two apparent achlorophyllous leaves (Figure 2). Other chlorophyllous pink lady’s slipper plants were found within the area. The leaves appeared to be reduced in size in comparison with a typical chlorophyllous plant and had a number of holes possibly from herbivory. The plant occurred at the base of a northern white cedar (Thuja occidentalis L.) at the bottom of a slight topographic rise along the margin of a low conifer swamp dominated by white cedar and black ash (Fraxinus nigra Marshall). The top of the rise was an upland area dominated by white pine (Pinus strobus L.).

Note added in proof: For further reading on recent studies of achlorophyllous orchids see Julou et al. (2005).

LITERATURE CITED