

The Pink Lady Slipper is Endangered by Human Activities

Lady slipper orchids are sensitive to loss of habitat from human activities and increasing overshadowing as forests mature.

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Pink lady slippers (*Cypripedium acaule*) are orchids that live in the forests of the eastern United States and Canada. Each mature plant has at most two leaves and may produce a single flower. The flower is pink (rarely white), stands about one foot (33 cm) above the leaves, and is deliciously scented.

There is one petal that forms a star-like backdrop for two other petals that form the "slipper." These slipper petals are about 1.5 inches (3.75 cm) long, fused along their bottoms, and tightly pressed together along the opening.

Lady slipper orchids are found in woodlands with filtered sunlight. A lady slipper plant can live a hundred years or more, but may become invisible for extended periods of time if conditions are unfavorable. In these situations, the plant stops producing leaves for several to many years, but can resume producing above-ground foliage from the root stock if the environment becomes favorable again. As humans cut down woodlands and allow old woodlands to mature, these plants are slowly but surely becoming eradicated.

Why Are They Disappearing?

Rarely abundant, the pink lady slipper is the most common of the four lady slippers in New England. In many areas locations in which this species can be found are becoming uncommon. Deer and insect eat the flowers and leaves, but the primary reasons this plant is declining in Connecticut are:

- habitat loss,
- collecting by people who "must" have this flower in their gardens,
- collection for medicinal purposes, and
- aging of the forests.

Growing in semi-shady woodlands under oaks, maples, pines, and various other plants, they require a layer of somewhat moist, acidic leaf mulch on the surface of the soil, a mycorrhizal fungus of the genus *Rhizoctonia*, some sunlight through the day, and to be left alone. Human activities usually destroy them.

Almost 99% of all transplanted lady slippers that are dug up and tenderly cared for in home gardens die after only a few seasons. If the roots are broken or the soil becomes compacted, the plant dies. *Rhizoctonia* fungi provide nutrients for embryos and possibly adult plants.

Although lady slippers can sometimes be purchased from nursery-grown stock, the specimens are extremely pricey, and many nursery-purchased lady slippers are doomed to die because they are wild dug and have damaged roots.

Lady slippers cannot tolerate more than three hours of direct sun nor less than one hour of filtered sunlight each day. In many woodlands most of these orchids die back as the forest forms a closed canopy and the lady slippers languish from a lack of light, but they often rapidly recover given appropriate light requirements. A few still survive here and there in more open areas, but in New England, thickets of mountain laurel often seal the doom of many of these showy plants.

Richard Primak has shown that when lady slipper plants bloom and set seed over several years, they forgo blooming for one to four years. If reproduction also occurs in the same year as injury from browsing or fire, leaves produced the following year will be up to thirty percent smaller than leaves produced the year it bloomed and some plants will not produce leaves for a year or more after blooming – apparently obtaining nutrients from their fungal symbionts.

Managing the Forest

Although common in Massachusetts, the best hope for survival of this species in Connecticut is to leave the plants where they grow naturally and manage the forests for their health. When the canopy where lady slippers were once found is opened, so many lady slipper plants rapidly appear that it seems they might simply have been dormant, feeding off their fungal associates during their years of invisibility.

Thus, it is possible this long-lived plant is capable of waiting years or even decades when the forest canopy closes to return to resplendent glory once the canopy becomes thinned. As seed-mediated reproduction is highly unpredictable for lady slippers, dormancy may previously have been this species' greatest hope for continuation into the future.

Lady slipper Reproduction

Vegetative reproduction appears to be limited to producing a few buds on a healthy root-stock. This produces a few plants growing closely together.

Although many kinds of insects enter lady slipper flowers, these plants depend entirely on bumblebees for pollination. Unlike most flowers, lady slippers do not provide nectar or pollen for the insects to eat. When a bumblebee is attracted to the flower, it forces itself through the slit on the upper surface and enters the large inner chamber. This chamber is equipped with hairs that provide tiny drops of sweet exudate, but not enough to feed the bee.

The bee soon decides to leave the flower. There is one exit clearly marked at the base of the flower and the bee makes its way there. As the path narrows, the stigma of the female organ presses against the bee's back to collect any pollen that may be there. The bee can only leave the flower by pushing hard against the anthers which deposit their load of sticky pollen in exactly the spot the next lady slipper's stigma will press.

Because of the problems with exiting the flower and the lack of nutrients provided, many bees give up on lady slippers after only one or two attempts. Thus, less than ten percent of the flowers are pollinated. A pollinated flower produces tens of thousands of tiny seeds that have no nutrient reserves. These seeds can not germinate without first becoming infected by one of about six species of parasitic fungi in the genus *Rhizoctonia*.

Primak has shown that hand fertilization of the flowers can result in rapid expansion of colonies if light conditions and soil pH are favorable.

Fungal Relationships

Rhizoctonia are endosymbiotic fungi that aid nutrient absorption for most flowering plants. Shefferson et al. found that once the seeds of lady slippers become infected with the fungus, the plant embryo digests the fungus to obtain enough nutrients to grow. Lady slippers do not produce photosynthetic leaves for a minimum of three years after germination, obtaining all their nutrition from the fungus.

As the fungus does not at first obtain any benefit from its association with the lady slipper, the early-on relationship appears to be mycotrophic: which means the lady slipper is a parasite on the fungus. Later, when the lady slipper produces leaves, the fungus obtains carbohydrates and phytonutrients from the lady slipper.

Once the lady slipper has produced leaves, its dependency on the fungus is reduced, but not ended. If the plant is severely stressed during a growing season, it may stop producing leaves for a year or two and resume its dependency on the fungal cells for nutrition, producing leaves again once it obtains enough nutrients from the fungus. Resumption of mycotrophism may be a mechanism to stay alive under adverse conditions and may be the reason the root stock of a lady slipper plant can remain alive for decades when necessary.

References

Richard P. Shefferson, et al. 2007 "The Evolutionary History of Mycorrhizal Specificity Among Lady's Slipper Orchids" *Evolution* 61-6: 1380–1390

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