Rare orchids mimic fungus to attract flies

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Cypripedium fargesii Image credit: srgc.org.uk

(PhysOrg.com) -- In a recent study published in the *Proceedings of the National Academy of Sciences*, Zong-Xin Ren from the Chinese Academy of Sciences and Peter Bernhardt from Saint Louis University discuss the lady's slipper orchid (*Cypripedium fargesii*) and its ability to mimic the Cladosporium fungus in order to attract the flat-footed fly for pollination.

This particular orchid is an extremely rare and endangered flower that is found only in the southwestern mountains of China. Ren spent four summers climbing Yaoshan Mountain at 3,000 meters above sea level where a hundred or so of these flowers are found.

When it comes to general flower pollination, the flowers usually offer something to the insects in order to attract them, be it food, water, or

specific chemicals. However, the lady's slipper orchid has nothing to offer potential visiting insects.

While most flowers are usually pollinated by bees, Ren found the only insect to visit these orchids were the flat-footed fly. The flat-footed fly feeds on fungus and, like the orchid, is extremely rare.

In order to attract the fly, the orchid mimics this fungus with the spots on its leaves and the odor it releases. The scent, similar to the smell of the fungus the flat-footed flies feed on, attracts the flies and the spotted leaves visually make it look as though it is infected with the particular fungus.

When the fly enters the flower, it has to follow a specific path to get out, passing the pollinators which deposit clumps of pollen onto to the fly who then carries it to the next flower he visits. Ren also discovered that the flowers go one step further in that the center of the flowers are hairs (trichomes) that have evolved to look like the fungal spores.

When the team analyzed the flies, they found fungal spores on the mouth, head, feet and pads, as well as the pollen from the flowers on their backs. Ren is planning further research to discover why the fungus carried by the flies does not infect the orchid. He also wants to know if the relationship between the flies and the orchid play any contributing factor to them both holding a rare status.

More information: Flowers of Cypripedium fargesii (Orchidaceae) fool flat-footed flies (Platypezidae) by faking fungus-infected foliage, *PNAS*, Published online before print April 18, 2011, doi: 10.1073/pnas.1103384108

Abstract
Charles Darwin was fascinated by the orchid–pollinator interactions, but

he did not realize that many orchid species are pollinated by deceit. Cypripedium, a model lineage of nonrewarding orchid flowers, is pollinated primarily by bees. Here we present both an example of floral mimesis of fungus-infected foliage in orchids and an example of flat-footed flies (Agathomyia sp.; Platypezidae) as pollen vectors for angiosperms. Cypripedium fargesii is a nectarless, terrestrial, endangered orchid from southwestern China that requires cross-pollination to produce the maximum number of viable embryos. All insects caught entering or leaving the labellum sac were Agathomyia sp. carrying conidia of Cladosporium sp. on their mouthparts and legs, suggesting mycophagy. Blackish hairy spots on the upper surface of foliage may imitate black mold spots, serving as short-term visual lures. Some odor molecules also associated with Cladosporium cultures were isolated in the floral scent. Mimesis of fungus-infected foliage probably represents an overlooked but important option in angiosperm diversification, because there are three to five more Cypripedium spp. in southwestern China with the same mode of floral presentation and black-spotted hairy leaves.