

Orchid Research at The Ridges Sanctuary

Current collaborative research at the Ridges focuses on understanding which fungi native orchids require for successful germination and long-term survival, with particular emphasis on the Showy Lady's Slipper (*Cypripedium reginae*) and The Rams Head Orchid (*Cypripedium arietinum*). Researchers collect small soil samples from orchid habitats and analyze the fungi living within them while simultaneously studying fungi found inside/around orchid roots. These data help identify which fungal partners may be necessary for restoration projects. Because scientists still do not know the precise fungal requirements of every orchid species, most restoration efforts currently use asymbiotic germination, allowing orchid seeds to germinate under sterile laboratory conditions without fungi before seedlings are transplanted into shade houses for growth and eventual restoration. Continued research aims to identify the fungi needed for independent germination, so future restoration efforts can better mimic natural ecological processes and improve long-term survival of native orchid populations.

Why is Identifying Orchid Fungal Relationships So Difficult?

Despite more than a century of orchid research and advancements in laboratory technologies, identifying orchid fungal partners remains a challenge in plant ecology. Better understanding these complex underground relationships is essential for successful orchid conservation and habitat restoration at places like The Ridges and continues to be a main focus at the sanctuary. Some challenges include:

- Identifying native orchid populations can be very difficult due to orchid dormancy underground which can last for years
- Multiple closely related fungal species can be utilized by the same orchid species, and an orchid's fungal partners can change during the plant's life cycle
- Distinguishing true symbiotic fungi from other unrelated fungi on or in roots
- Some identified fungal groups have still not been scientifically described as individual species
- Fungal abundance, not simply presence, can strongly influence orchid germination, flowering, dormancy, and survival

FLOWERS AND FUNGI

EXPLORING FUNGAL SYMBIOSES AT THE RIDGES SANCTUARY

Showy Lady's Slipper



THE
RIDGES

Ram's Head Orchid



What are Plant–Fungal Symbioses and Why Do They Matter?

Did you know that the mushrooms we see above ground are only the visible fruiting bodies of fungi, not the entire organism?

Many plants live in close partnership with underground fungal networks through relationships known as mycorrhizal symbioses. **Mycorrhiza** meaning "fungus" and "root", describes a mutualistic relationship in which fungi colonize plant roots. **Symbiosis** describes the mutualistic partnership between plants and fungi where both organisms benefit. The plant supplies the fungus with sugars produced through photosynthesis, while the fungus extends a vast network of microscopic threads called hyphae into the soil, increasing the plant's ability to absorb water and essential nutrients such as phosphorus and nitrogen. **These networks improve plant health, increase drought resistance, enhance soil structure, and connect plants into complex ecological communities.**



Most Plants Depend on Fungi

Plant–fungal partnerships are not rare or unusual, they are one of the most widespread biological relationships on Earth. Most terrestrial plants form mycorrhizal associations during their lives, helping them to survive even in nutrient-poor soils (like in the Ridges wetland swales). Among flowering plants, orchids represent one of the most complex examples of fungal dependence. And because orchids make up roughly 10% of all flowering plant species, understanding their fungal relationships has the potential to give researchers valuable information and insights into plant-fungal symbioses.

Orchid Fun Facts:

- Orchids require fungi to germinate
- Orchid seeds or 'dust seeds' contain no nutrient reserves
- A single orchid can produce tens of thousands of seeds, but very few successfully germinate because the correct fungus must already be present in the soil



Grass Pink Orchid

Not All Plant–Fungal Relationships are the Same

Although many plants form mycorrhizal partnerships, not every species depends on fungi in the same way. Some plants, including many trees and wildflowers, maintain mutualistic relationships throughout their lives, exchanging sugars for nutrients and water. Orchids begin life as completely dependent on fungi but gradually transition toward photosynthesis as they mature, although many species continue to benefit from fungal partners throughout adulthood. Other plants rely on fungi even more heavily. Some species native to the Ridges such as Ghost Pipe and some coralroot orchids are myco-heterotrophs, meaning they no longer photosynthesize and instead obtain nearly all of their nutrients indirectly through fungi connected to nearby trees. While other natives, such as *Pyrola*, occupy an intermediate strategy known as mixotrophy, combining photosynthesis with nutrients received from fungal partners.

Mutualism → Mixotrophy → Mycoheterotrophy



White Cedar



Pink-Flowered Pyrola



Ghost Pipe