# Coral Root Orchids

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**Coral root orchids** come up every year at BLP. Look for thin, maroon or pale asparagus-like shoots 6-14" tall. Coral root is a wonderful example of the complexity of co-evolved systems. It is a *mycoparasite* (or *epiparasite*, or *hyperparasite)*. Myco- refers to mushrooms and fungi (mycology is the study of mushrooms). Parasites are organisms that steal their nourishment from other organisms. The coral root is **parasitizing** not just an organism, but a co-evolved relationship between two organisms. Most trees in the world have their roots attached to the roots (*mycelium*) of mushrooms. In the spring when sunlight and water are plentiful the tree produces excess carbohydrates and sugars through the process of photosynthesis. It sends these photosynthetic products down to its roots, and on into the roots (*mycelium*) of the fungus. Later in the year when things are tougher, and the tree is stressed, the fungus repays the favor by sending the tree water and mineral nutrients. It turns out that fungi are better at finding scarce commodities (water, phosphorus) in the soil than trees are. So, trees and fungi have this fancy, ancient, co-evolved cooperation (***mutualism***). We give this particular cooperative relationship a special name. We say the tree and the fungus are *mycorrhizal* partners, or that they share a mycorrhizal relationship. The coral root (do you remember where this started?) parasitizes the mycorrhizal relationship. It attaches itself to the fungus and feeds on the products of photosynthesis the tree produces. The coral root parasitizes the tree via a fungal bridge. Think of the fungus as a feeding tube connecting the *parasitic orchid* to its tree food source.

There is also a historic angle to this wonderfully complex *web of interactions*. In the old days (not very long ago) we were taught that coral root orchids are ***saprophytes***. The story was that saprophytes are flowering plants that eat dead leaves. In retrospect, that is a pretty bizarre concept, since eating dead leaves is what mushrooms are supposed to do, not what flowering plants are supposed to do. There are a number of flowering plants that lack chlorophyll, meaning that they are not green, and are not photosynthetic. Non-green plants must have some alternative form of nutrition. These *achlorohyllous* (= lacking chlorophyll = non-green) flowering plants were given the name "saprophytes" a couple of hundred years ago, and have been called saprophytes ever since. "Saprophytes" you may know include snow plant, ghost flower, sugar sticks, false pink asparagus, indian pipe and white groundcone (see the pictures in **Redwood Empire Wildflowers**, by Dorothy King Young, plates 112-120). In the 1970's some people in Scandinavia injected radioactively marked water into trees and followed it around with a Geiger Counter to see where it went. They found it turning up in indian pipe flowers on the nearby forest floor, meaning that the two were connected. A surprise, no? A "saprophyte" connected to a live tree? Further probing led to the discovery of the story outlined above, and the complete collapse of the concept of "saprophytes." This is great, because, among other things, it illustrates how science works. We start with observations, develop a theory to explain those observations, then teach our children the theory as the best explanation of how the world works. Later (in this case 200 years later!) new observations challenge the theory, resulting in new theory. The two take-home messages are: 1. Take everything with a grain of salt; and 2. Enjoy the coral root!

There are two species of coral root at BLP. Early in the spring (March-April) we see **striped coral root** (*Corallorhiza striata*). Later (April-May) the **spotted coral root** (*C. maculata*) comes up. The spotted coral root comes in two forms, spotted and unspotted! Striped coral root can be distinguished from spotted coral root by: 1. Presence or absence of stripes; 2. The lower lip of the flower is boat shaped in striped coral root, and has distinct "ears" in the spotted coral root. Striped is generally straw brown (and thus harder to see), spotted is generally pinkish or maroon, with a distinct, obvious white lower petal. Look closely at the flowers to determine which species you are looking at.

There is one more important nuance in this story. The coral root orchids are specific in their choice of fungal partners. Most coral roots associate with members of the milkcap family (Russulaceae, two local genera: *Russula* and *Lactarius*). Although our two coral root species both associate with members of the genus *Russula*, each attaches to a different **species** of *Russula*. Even more intriguing is the fact that within the spotted coral root species (*C. maculata*) the two forms (spotted and unspotted) associate exclusively with different fungal partners (different species of *Russula*). Botanists have long argued over whether the spotted and unspotted forms *of C. maculata* should be recognized as separate species. There seems to be a habitat distinction between the spotted and unspotted forms, with the spotted associated with conifers like Douglas fir and redwood, and the unspotted associated with oaks. The fact that they have separate fungal associates indicates that they are genetically distinct, and perhaps deserving of specific recognition. The kicker in this is that the evolution of relationships with fungal partners may even be driving the speciation of these orchids!!

Spotted Coral Root (notice the lower "lip" has "ears") This can be spotted or unspotted.

Striped Coral Root (notice the boat-shaped lower "lip")

Spotted Coral Root (unspotted variety)

Spotted Coral Root (unspotted variety) (You can really see the "ears" here.)