Owl Clover Leads a Complex Life

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Lewis and Clark discovered and collected specimens of Owl Clover (also called Owl's Clover) at Traveler's Rest, near Lolo, Montana, in early July 1806 as they returned eastward. During summer Owl Clover would have been seen by the explorers throughout the Bitterroot and Missoula Valley grasslands. It was just one of many plants the Corps of Discovery gathered on their way back to St Louis. Although Lewis and Clark passed through this area on their way westward, they wouldn't have seen Owl Clover in September 1905, because, as an annual, it would have been present only as dormant seeds in the soil seed bank.

There are two species of Owl Clover common in west-central Montana: one with inflorescences composed of petals and bracts, both colored a bright yellow, and a second one composed of pink-purple colored bracts, and yellow flower petals tinged with purple. The flowers and bracts collectively form narrow, showy plume-like spikes. The "bracts" are really small, modified leaves, not flower petals. The bract's bright color, combined with the actual flowers, form a large visual target for pollinating insects and birds. For annuals, it is important that a seed crop be formed each year.

During spring, the presence of moisture triggers germination of Owl Clover's seed; usually a portion of an annual's seed supply remains dormant in the soil as a fail-safe mechanism. However, in years when precipitation is very abundant, Owl Clover may exhibit a mass flowering, producing a carpet of purple color.
Owl Clover is a member of the Snapdragon Family, which includes other well known plants such as snapdragon, speedwell, beard-tongue, foxglove, monkey

flower, and the well known, Indian paintbrush. The “brush” is a compact spike composed of red colored petals and bracts.

The Owl Clover collected by Lewis and Clark is named *Orthocarpus tenuifolius*, and is the pinkish-purple one. The yellow one is *Orthocarpus luteus*. “*Orthocarpus*” comes from Greek meaning, “straight fruit.” The species name, “*tenuifolius*”, refers to the narrow, elongated leaves; “*luteus*” is Latin for yellow. No one knows exactly why it’s called Owl Clover, although some believe the name may refer to the eyelike spots on the petals of some *Orthocarpus* species. Other botanists believe the rounded flower tops resemble an owl’s head, with the projecting flowers being the owl’s ears. It grows in habitats that are warm and dry during the summer, such as in grasslands or open ponderosa pine forests. Collections in the University of Montana Herbarium reveal Owl Clover locations spanning elevations from 3000 to over 6000 feet, but typically in sunlit, open meadows and grasslands.

There’s a lot more to Owl Clover than meets the eye. Plant ecologists have discovered that this plant, along with many other members of the Snapdragon Family, is a “root hemiparasite.” The term “semi-parastic” is also used. Owl Clover is fully capable of living independently, photosynthesizing its own food with chlorophyll and sunlight (called autotrophy, or “self-feeder”). However, if the first roots emerging from a germinating Owl Clover seed find themselves near the roots of a neighboring plant of a different species, such as prairie lupine, it will initiate structural connections called haustoria. These are modified roots capable of causing infection in the host plant.

The haustoria invade, literally grow into, the inner tissues of the host lupine’s roots. The Owl Clover haustoria are triggered into formation when the lupine itself exudes chemicals from its roots; that is, the lupine chemically signals its presence to the Owl Clover. The haustoria connections are all completed and in place within a few hours! With functional haustoria in place, Owl Clover’s growth is accelerated. The Owl Clover gains water, minerals and energy from the host plant. Being an annual, Owl Clover has a relatively small root system, so getting extra food really helps its growth rate. This host-parasite relationship is called heterotrophy, the opposite of autotrophy. Being semi-parasitic, Owl Clover may engage in both at the same time!

Owl Clover, when functioning as a parasite, also takes in toxic chemicals the host plant produces; lupines have alkaloids (remember, plants like lupines are poisonous to livestock). These toxic chemicals are distributed into the Owl Clover's stem and leaf tissues. The consequences? The presence of the poisonous alkaloids, botanists have learned, reduces the level of feeding (herbivory) by butterfly and moth larvae that favor Owl Clover leaves for their growth and development. Larvae feeding is hindered by the presence of the poisons, and the Owl Clover retains more of its leaf tissue for photosynthesis, an obvious benefit. Butterfly and moth larvae need alternative leaves to eat, but that's impossible since mature butterflies and moths lay their eggs on developing Owl Clover plants not knowing if the leaves are toxic or not. Larvae, it's assumed, survive better, and develop to maturity by feeding on Owl Clovers that are not parasitizing a lupine or other toxic host plant.

There's one remaining piece of this interesting relationship to be told: studies suggest that Owl Clover's flower nectar is not contaminated by the toxic alkaloids. Perhaps the alkaloids are detoxified by some means before reaching the nectar glands. Why is this important? Visiting pollinators, such as hummingbirds or bumble bees, can harvest the Owl Clover's nectar reward without suffering ill effects. Thus pollination is accomplished as they feed, assuring a new Owl Clover seed crop. One interpretation: this complex, biochemically mediated hemiparasitic habit of Owl Clover has evolved to gain supplementary energy from the host, while reducing leaf tissue loss through larvae herbivory, and, finally, without experiencing reduction in reproductive efficiency and seed production. Indian paintbrush has evolved the same capabilities.

Many of western Montana's grassland and woodland plants live lives far more complicated than many of us imagine as we hike past them. We appreciate their presence, but are often unaware of the processes involved in their basic survival. Competition for necessary resources is fierce among plants living in the same habitat. In our local efforts to maintain and/or restore native grasslands currently over-run with weeds, we need to keep in mind the complex, but invisible, chemical interactions that go on between and among our native plants living side by side. Weeds, like knapweed, are successful partly because they did not co-evolve ecological and chemical relationships with our native plants, and thus do not, or cannot, participate in a balanced co-existence with the natives.