

## Learning about coevolution using aphids

### Background

Pea aphids are well-suited for exploring coevolution in the classroom. Pea aphids grow quickly and are large enough to be counted with a magnifying glass or without any equipment. They can be easily kept in a tank or plastic cup on bean plants for days at a time, and can be found outside on garden plants (specifically alfalfa, clover, and beans) across Georgia. And they can be attracted to a garden or a few potted plants in the spring. Additionally, aphids have a number of natural enemies such as ladybugs, parasitic wasps, and fungi.



ladybug

fungus-killed aphid

‘mummy’ (wasp-killed aphid)

parasitic wasp

Coevolution occurs between organisms that depend on each other for survival, not just between hosts and parasites. Humans are home to millions of species of bacteria that have been shown to aid with digestion, immune function and protection against harmful bacteria, developmental regulation, and vitamin production. Aphids have symbiotic bacteria too, and some of these bacteria affect aphid survival by protecting them against parasites.

### Classroom Exercise 1: Monitoring Natural Communities

Snap pea plants can be planted in a garden or several pots of dirt in early spring (late March or early April), which should attract wild pea aphids within a few weeks. If wild aphids are not attracted to your plants, we can send you some local pea aphids that can be released onto the plants. (We need about 3 weeks of notice). Students can count the numbers of aphids on the plants over several weeks, along with counts of natural enemies such as ladybugs and evidence of enemies such as aphid mummies. Additionally, ladybugs can be easily ordered online from garden supply websites (gardeners often use them to control aphid populations) and released on to your plants. Students can then determine how the number of predators relates to the number of aphids to show how predators can impose a selective pressure on aphids in the wild.

### Classroom Exercise 2: Protection Against Wasps Conferred by Symbiotic Bacteria

Two groups of aphids (one with protective symbionts (green) and one without symbionts (red)) can be kept in a tank with their plants. A tightly sealed fish tank with a few inches of dirt and 15 plants would work well. When parasitic wasps are introduced to the tank, the numbers

of each color of aphid can be counted over several days to show how the protective bacteria increase the relative number of their aphid hosts. After several days, there should be relatively more green aphids than red because the secondary symbionts protected their hosts from the wasps.

