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This article is part of a series on biological control and IPM written by UAV-IQ (www.uaviq.com).

In our previous articles we have written about the enemies of my enemies, commonly referred to as “beneficials” or “biological control agents”. There are currently hundreds of biological control agents commercially available, which fall within five categories: 1) Predators, 2) Parasitoids, 3) Pathogens, 4) Weed Feeders and 5) Competitors. In this article we are going to focus on the first two - predators and parasitoids.

PREDATORS, NATURAL ENEMIES EATING THEIR PREY

Predatory beneficials can be insects, predatory mites (both of which fall within the “macroorganisms” category) or entomopathogenic nematodes. Middle school biology students often find them to be cool because watching them prey on their victims can be like watching a low budget horror movie. For example, predatory mites can suck their prey dry, ladybugs eat their prey completely, while entomopathogenic nematodes penetrate the prey’s body and feeds from its contents while releasing a bacteria that quickly kills it. In all cases, to be considered “beneficials”, species eat targeted pests and can be either generalists or specialists - meaning they attack a wide or narrow range of prey. With some exceptions, predatory beneficials generally have at least a few types of targeted prey.

This is particularly useful when dealing with multiple pests simultaneously, but the potential downside is that they can also kill beneficial insects. Predators often can eat more than they actually need, so when pest outbreaks are detected late and a strong response is required, predators are often the preferred choice as they can consume the pest in a shorter period of time than parasitoids could. However, they are usually less successful at establishing sustainable populations as they often require more prey to support their populations than parasitoids.

For this reason, the implementation of conservation biological control can be of great help

to sustain predator populations for a longer period of time. Some predators are more or less predatory at different stages of their life cycle, such as the green lacewing (Chrysopidae) whose larvae are predatory but the adults most often are not. Some predators, the rove beetle being one of them, have parasitoid life stages.

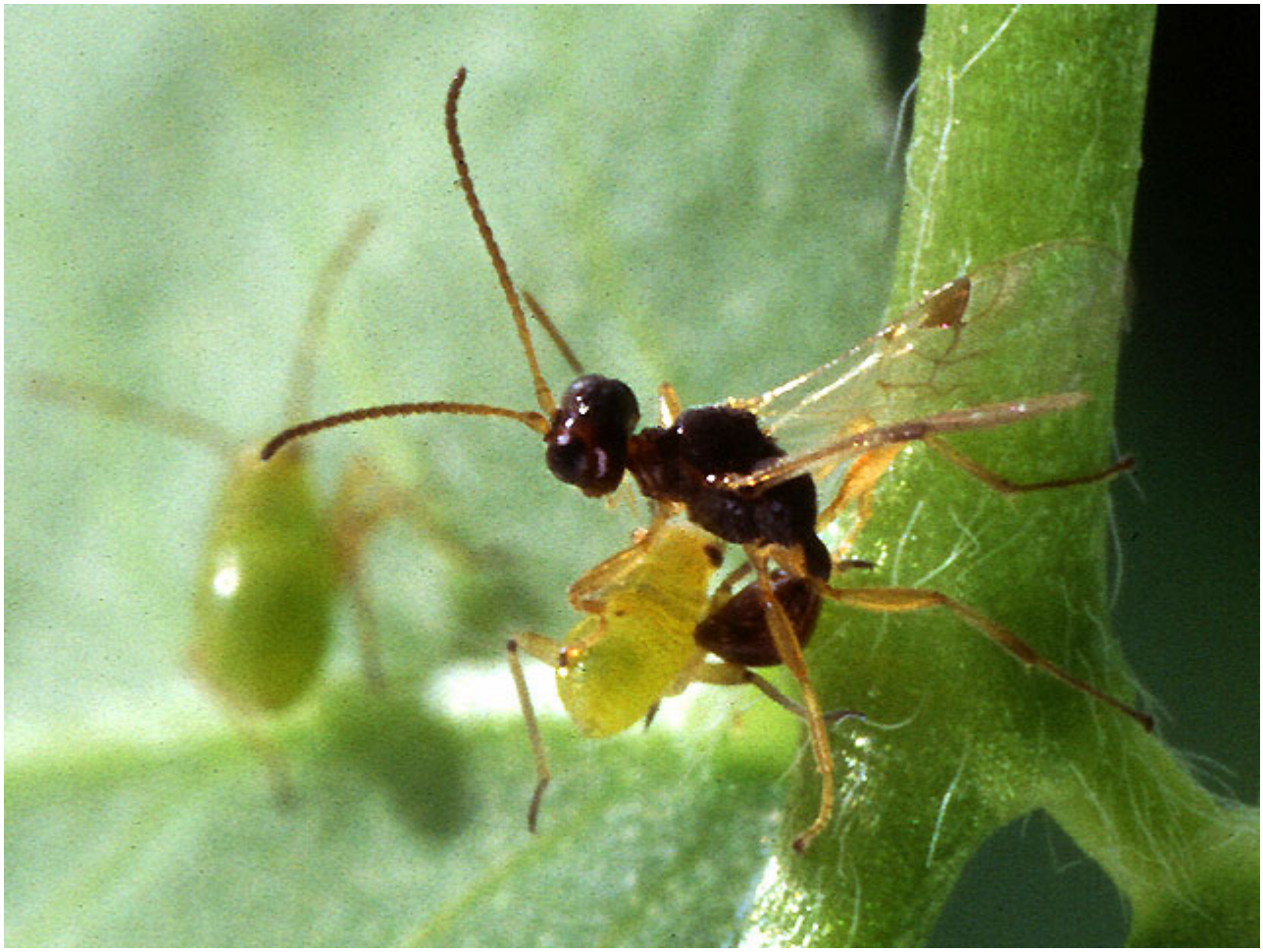
Green lacewing (Chrysopidae) larvae feeding on aphids (Source)

PARASITOIDS, NATURAL ENEMIES USING THEIR PREYS ARE HOST FOR THEIR EGGS

The most common parasitoids are wasps and flies, which, much like the creature in the movie “Alien”, lay eggs on or within the body of their victims. When the eggs hatch, the host is killed (although usually without the loss of a mining colony on a distant planet’s moon). Since parasitoids don’t kill the prey instantaneously, their application can take longer to bear results than the use of predatory beneficials, however, they tend to have shorter life cycles resulting in faster population growth than most predators. Parasitoids tend to attack during specific stages of their prey’s life cycle, so different parasitoids can be applied at different times of the crop growth cycle to manage the same pest population.

Among the popular examples of parasitoids to control pest in commercial crops, we can name the parasitoid wasp *Encarsia formosa*, which is used to control whitefly larva, the *Trichogramma* parasites which are released to control harmful moths such as the European corn borer (*Ostrinia nubilalis*) or codling moth (*Cydia pomonella*). The parasitic wasp *Anagyrus pseudococci* is released in orchards to control different pest such as the citrus mealybug (*Planococcus citri*) on crops such as oranges and mandarins, the vine mealybugs (Planococcus ficus) in grapes but also the Gill's mealybug (*Ferrisia gilli)* in pistachio and almond orchards.

Parasitoids are usually slower to kill the targeted pest than predators: while the parasitoid grows, hosts can still cause some damage. However, one of the benefits of using parasitoids is that they tend to target specific prey, and once established, they might control the pest population for a longer period of time.



A parasitic wasp, laying eggs in a tarnished plant bug nymph (source)

HOW TO CHOOSE BETWEEN PREDATORS AND PARASITOIDS

Like all decisions made on a farm, the choice between using parasitoids or predators must weigh costs and benefits with both economic and scientific factors taken into consideration. Key questions are: 1) What level of pest population/crop damage is acceptable (referred to as the Threshold Level)? 2) Are you looking to prevent, suppress or eradicate (which is generally an ill-advised goal) the pest population? 3) How urgent is the problem?

Based upon answers to these questions (and most likely a couple more), an entomologist can help create a biological control plan specifically tailored to a grower's specific situation. It is also important to note that certain parasitoids are restricted from use in certain areas, so growers need to be sure to check local regulations before releasing them.

For both predators and parasitoids, conservation biological control techniques can be used to maintain their populations during the growing and off-seasons. Techniques include providing additional sources of food such as pollen of flowers, creating or maintaining habitats, and avoiding the use of broad-spectrum pesticides.

In subsequent articles, we will dive a bit deeper into these topics and eventually move into a discussion of application techniques and how to develop a sustainable biocontrol practice within your operation. As always, your feedback is important and please leave comments about what you'd like future articles to focus on.