

Beneficial Organisms

Natural Enemies of Insects

In the following discussions, some of the major groups of natural enemies that suppress arthropod pests in forage and rangeland crops are described, including their importance, biology, and how they may be used for IPM in forage and rangeland crops. Natural enemies, which are living organisms that suppress pest population densities, can act through natural actions or through specific management practices. The use of natural enemies in biological control was described earlier in the “Integrated Pest Management” section. The sections following natural enemies include two other groups of beneficial species: the pollinators and the weed biological control agents.

When walking through an alfalfa field, or across a prairie, it is easy to see some of the natural enemies, such as a lady beetle or praying mantis. Others, such as damsel bugs or small spiders, are less easily observed. Even others are nearly impossible to see, like the tiny wasp parasitoid that kills eggs of potato leafhopper. At a length of $\sim 1/100$ in., the wasp appears like a speck of dust to the unaided eye. Yet, this parasitoid plays an important role in suppressing leafhopper populations; much more so than the easily observed praying mantis, for example. When it comes to natural enemies, size does not matter; rather, it is the ecological connection between the natural enemy and its prey that is important.

Because of the extreme diversity in these natural enemies, only a few of the many groups of arthropods that serve as natural enemies of insect pests are covered in detail. Table 1 is a list of the common arthropod groups of natural enemies found in forage and rangeland crops. In addition to those descriptions in this part of the handbook, some of the natural enemies are described elsewhere be-

cause in addition to preying upon insect pests, they are pests themselves.

Especially in rangelands, but also in forage grasses and legumes, natural enemies are an important part of the native community. Although biological control implies direct management of natural enemies, and thus may be a component of IPM in some forage and rangeland crops, more typically producers rely on the natural occurrence of predators, parasites, and pathogens to suppress arthropod pests. Some of the naturally occurring species exist in North America because of deliberate importation of species, such as the examples of wasps brought from Europe for alfalfa weevil control (see “Wasp Parasitoids”). Recognition of the role of these naturally occurring species in regulating pest populations is key to IPM.

Separating the natural enemies from the pests is critical and forms one of the basic guidelines for this handbook. Unfortunately, for some groups, there is no easy way to separate the “good insects” from the “bad insects”. An example is within the order Hemiptera, which includes the plant bugs, stink bugs, and the true bug predators. Careful review of all appropriate descriptions should enable one to identify the common pests versus the common predators.

Selected References: 22, 34, 81, 82, 123, 144

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Fly Parasitoids

The large group of flies known as the family Tachinidae (Diptera) is, next to the wasp parasitoids, probably the most effective group of parasitic insects. These flies are thick-bodied $1/16$ – $3/4$ in. (2–20 mm) long, with stout bristles near the tips of their abdomens. Many are similar in appearance to house flies but can be distinguished by their bristles (Fig. 1). Some resemble wasps or bees. They are good fliers and feed on nectar, pollen, or honeydew produced by aphids. There are more than 8,000 species within Tachinidae worldwide, with more than 1,300 species in North America. Tachinid flies parasitize a variety of insects, but caterpillars are their main hosts (including cutworms, armyworms, loopers, and borers). Other insects parasitized by these flies are beetles, true bugs (including stink bugs, shield bugs, plant bugs, and squash bugs), sawflies, and grasshoppers. Some species within Tachinidae are fairly host-specific, whereas others attack a wide range of hosts, but the mode of action is the same for all: Larvae (maggots) enter the body of a host, feed on the host's fat body and internal organs, kill the host,