

Biological Control of the Alfalfa Weevil in Iowa

The alfalfa weevil, one of Iowa's most destructive insect pests of alfalfa, has several natural enemies in Iowa. These enemies include stingless, parasitic wasps that kill both adults and larvae, and a fungal disease, which kills large numbers of both larvae and pupae. Natural enemies of the alfalfa weevil have saved East Coast alfalfa growers millions of dollars each year in reduced insecticide use and alfalfa damage. Iowa growers may obtain similar results as the weevil-killing parasites and the fungal disease become more widely established across the state.

Parasitic wasps were first released by Iowa State University entomologists from 1975 to 1977 in scattered areas across Iowa. By 1987, the wasps had been released in 60 Iowa counties at 160 sites through the cooperative efforts of the U.S. Department of Agriculture, Iowa Department of Agriculture and Land Stewardship, and ISU Extension. By 1991, these parasitic wasps had been recovered at approximately 130 sites in 48 Iowa counties.

The fungal disease was first reported infecting alfalfa weevil larvae in Iowa in 1982 by State Entomologist Carl Carlson. The disease has since been documented in 15 Iowa counties, but may be distributed throughout the state.



Figure 1. Larval parasite *Tetrastichus incertus* laying eggs on alfalfa weevil larva.

Using Biological Control

The alfalfa weevil (*Hypera postica*) is an insect pest of Central Asian origin. It was first discovered in the United States in Utah in 1948 and then in Maryland in 1951. Since then, the weevil has spread throughout the country and is now in all 48 contiguous states. The weevil flourished in the United States in the absence of its native natural enemies, which keep populations at low levels in Asia. Beginning in 1957, the USDA began to import and release parasitic wasps to reduce alfalfa weevil populations. The introduction of natural enemies to control the alfalfa weevil is an example of the environmentally sound method of pest control known as biological control.

Biological control of insect pests usually involves the introduction of beneficial insects known to be natural enemies of an introduced insect pest. Some beneficial insects are predators that feed on pests, such as the seven-spotted lady beetle that eats aphids.

Other beneficial insects are parasites, such as the tiny wasps that lay their eggs on or inside host insects like the alfalfa weevil. After hatching from the egg, the developing parasite feeds on the insect pest and eventually kills it. Many insect pests also are attacked by insect-specific diseases. Disease is usually spread from one insect to another causing sickness and/or death.

Biological control is an important feature of many insect pest management programs and is likely to become even more important on Iowa alfalfa. Through the use of ecologically sound pest management programs, we can avoid the use of insecticides and reduce risks to wildlife, water resources, and people. We also can reduce losses from pests, which results in more efficient and profitable agriculture.

Alfalfa Weevil

The alfalfa weevil is a brown, black-striped beetle that causes significant damage on alfalfa in Iowa. Alfalfa weevils have one generation per year. Typically, it lays eggs in alfalfa stems in the spring. When the eggs hatch in mid to late spring, the green alfalfa weevil larvae feed on alfalfa leaves. Larvae may feed for more than four weeks, depending on temperatures. Most injury to alfalfa comes from larval feeding, which may reduce yields at first cutting and delay regrowth. Mature larvae produce net-like cocoons and then transform into adults. The adults emerge from the cocoons to feed on alfalfa, mate, and lay eggs. Adults overwinter in hay, dead leaves in roadside ditches or in the field if there is enough alfalfa growth for protection from harsh winter weather.

Natural Enemies of the Alfalfa Weevil

Parasites

Alfalfa weevil parasites are surviving, reproducing, and spreading throughout Iowa. During May 1991, 15 to 41 percent of weevil larvae collected in central and south central Iowa were infected with parasites.



Figure 2. Alfalfa weevil adult.



Figure 3. Alfalfa weevil larva.

Additionally, up to 48 percent of alfalfa weevil adults were attacked by parasites. Even if complete alfalfa weevil control is not achieved, parasites may reduce the number of fields requiring insecticide treatments. More than a dozen parasite species are known to attack the alfalfa weevil. Five species have been recovered in Iowa and are causing significant mortality to alfalfa weevil populations.

Bathyplectes curculionis is the only one of the five important parasites that was not released in Iowa. This parasite was released in the eastern and western United States and has spread by itself throughout much of the country. These wasps go through

one to two generations per year. They are black and $\frac{1}{8}$ -inch long, with a long, egg-laying structure (ovipositor). Adult female wasps lay their eggs into young alfalfa weevil larvae, and the developing parasites kill the weevil as it completes its cocoon (figure 4).

Bathyplectes anurus is a $\frac{1}{8}$ -inch long, black wasp that has one generation per year. Adult female wasps lay their eggs into alfalfa weevil larvae and the developing parasite kills the weevil as it completes its cocoon.

Tetrastichus incertus is only $\frac{1}{16}$ -inch long and has three to four generations per year. The female wasp lays several eggs inside an alfalfa weevil larva after it has spun a cocoon. The dead larva becomes a mahogany brown color and the parasites overwinter in this "mummy," emerging as adult wasps the following spring (figure 1).

Microctonus colesi is a $\frac{1}{8}$ -inch long, black wasp with one generation per year. Parasite eggs are laid inside large alfalfa weevil larvae and the developing parasite remains there for almost a year. In the spring, the wasp larvae emerges, killing the adult alfalfa weevil.

Microctonus aethiopoides attacks adult alfalfa weevils. These wasps are about $\frac{1}{8}$ -inch long with black males and reddish brown females that produce two generations a year. In the spring, females lay eggs inside adult weevils that have overwintered or recently emerged. The parasite larva feeds inside the adult, kills the weevil, then spins a cocoon and pupates in the soil (figure 5).

Disease

The fungal disease *Zoophthora phytonomi* infects and kills alfalfa weevil larvae in Iowa. Under the proper weather conditions, outbreaks of this disease occur during high larval numbers. In 1991, the greatest larval mortality attributed to the fungus was reported to be between 75 and 92 percent in central and south central Iowa. The disease is most prevalent when there is an abundance of spring rainfall, reducing larval weevil populations and surviving populations of overwintering adults.

Studies have shown that outbreaks of this disease can be initiated by early harvest of first-cutting alfalfa. By cutting early, weevil larvae are concentrated within windrows of hay for several days where environmental conditions are ideal for the development and spread of the fungal disease. This fungus is specific to the alfalfa weevil; it will not infect other beneficial insects or vertebrates.

How You Can Help

1. Consider practices that encourage biological control. Recommended practices for alfalfa weevil management include scouting for alfalfa weevils at appropriate times, properly evaluating weevil numbers, and determining the need for treatment based on the growth of the alfalfa and weevil densities. These procedures minimize unnecessary and uneconomical insecticide treatments. Alfalfa near maturity should be cut rather than treated with an insecticide. Cutting early will replace the need for chemical treatment because weevil larvae are destroyed or starve because of lack of food.



Figure 4. Larval parasite *Bathyplectes curculionis* and its cocoon.



Figure 5. Adult parasite *Microctonus aethiopoides* attacking adult alfalfa weevil.



Figure 6. Alfalfa weevil larvae killed by fungal disease. (Dead larvae may be either brown or black.)

2. If an insecticide application is necessary, avoid spraying from May 1 to 10, a period that is most hazardous to parasitic wasps because of adult wasp activity.

3. Learn more about alfalfa weevil management by contacting your county extension agriculturalist and obtaining a copy of a publication on the pest.

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This publication is dedicated to Carl Carlson (1938-1992), state entomologist, Iowa Department of Agriculture and Land Stewardship.

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