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Marlin E. Rice  
*Iowa State University*, merice@iastate.edu

Gary Munkvold  
*Iowa State University*, munkvold@iastate.edu

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BIOLOGY AND MANAGEMENT OF THE CORN FLEA BEETLE IN IOWA FIELD CORN: THOUGHTS FOR 2001

Marlin E. Rice
Professor of Entomology
and
Gary Munkvold
Associate Professor of Plant Pathology
Iowa State University

The Corn Flea Beetle

Corn flea beetle populations this past spring were unusually large throughout central and southern Iowa. It was not uncommon to find 5–10 beetles chewing on seedling corn that had just emerged from the soil. This insect can physically damage seedling corn by chewing long lesions in the leaves that may cause injured leaves to turn brown and die. Also, the insect can transmit Stewart’s disease, also called Stewart’s wilt. This article discusses what is known about the biology of the insect, its relationship to the disease, and management options.

Beetle Description

Corn flea beetles are very small, only 1/16 inch (1.8 mm) long, or about the size of a pinhead. They are shiny black and have enlarged hind legs that enable them to jump rapidly when disturbed. Full-grown larvae are 1/6 inch (4.5–5 mm) long. Color photographs of the corn flea beetle and its injury to corn may be found on the web at http://www.ipm.iastate.edu/ipm/icm/2000/5-1-2000/fleabeetle2000.html

Life History

Corn flea beetles overwinter as adults at the base of grasses near cornfields (Gray 1998). They emerge during the spring and feed on secondary hosts if corn is not available. After mating, females lay their eggs in the soil near corn plants. The eggs hatch in about six days and larvae complete their development in about 14 days (Gray 1998). Later the adults emerge from the soil to feed and mate for the remainder of the summer. It is not uncommon to see corn flea beetles or their feeding scars (although harder to find on large plants) during midsummer.

Pest Status

Corn flea beetles prefer to feed on corn but they will feed on other host plants including orchard grass, crabgrass, fall panicum, redtop, witch grass, Kentucky bluegrass, Sudan grass, yellow foxtail, giant foxtail, barley, and wheat. Foxtail, oats, and wheat can sustain corn flea beetles in early spring until corn emerges from the soil. Sweet corn varieties and sensitive inbred lines planted in seed production fields are more susceptible than commercial corn hybrids to flea beetle injury and Stewart’s disease (Gray 1998).

Beetle Injury to Corn

Corn flea beetles injure corn by feeding on the outer layers of the leaf. This injury rarely results in economic loss (Gray 1998), but during years when beetle populations are large, corn plants are still young (VC to V1 stages), and dry soil conditions exist in the field, then leaf feeding by the beetles may kill the plants.
Feeding injury consists of small to very long scars that run parallel to the leaf veins. Feeding scars typically do not perforate the leaf. Beetles also transmit the bacterium *Erwinia stewartii* that causes Stewart’s disease.

**Stewart’s Disease Symptoms**

There are two phases to the symptoms of Stewart’s disease – the wilt phase and the leaf blight phase. In either case the symptoms initially appear as leaf lesions originating from flea beetle feeding scars. Lesions begin as pale-green to yellow, sometimes water-soaked streaks extending along leaf veins. The wilt phase generally occurs in seedlings but can occur in older plants of very susceptible sweet corn. Inbreds and sweet corn hybrids are most likely to be affected, but in 2000, the wilt phase occurred in dent corn hybrids in many locations in the southern half of the state. The wilt phase is associated with systemic (whole-plant) infection, but plants can have systemic infection without displaying the wilt symptoms. As the bacterium spreads rapidly within the plant, entire leaves wither and die, and the plants are stunted, or the entire plant may wilt and die. The plants may produce dwarfed, bleached tassels that eventually shrivel and die. Plants showing wilt symptoms often display leaf blight symptoms as well. As the bacterium spreads into the stalk tissue, it causes a browning and necrosis of the vascular bundles. Yellow masses of bacteria may ooze from the vascular bundles of systemically infected stalks when the stalks are cut and squeezed. This can be followed by a general browning and water-soaking of the stalk tissue. Sometimes open cavities will form in this tissue. Stalk rot fungi may invade the weakened plants, resulting in further damage later in the season.

The leaf blight phase can occur any time during the season but is more common after pollination. As the initial lesions expand, their margins become irregular or wavy. Lesions may extend the entire length of the leaf. They range in width from 1/16 to 1/2 inch. As the disease progresses, these leaf streaks die and turn brown. Entire leaves may be blighted as lesions coalesce. In severe cases, yield can reduced and the diseased plants become more susceptible to stalk and root rots. Flea beetle populations fluctuate throughout the season, but usually they build up in the late season, resulting in the leaf blight phase. That pattern was different in 2000, when the populations seemed to decrease during the mid-season and the leaf blighting was not as widespread as expected, considering the high numbers of beetles in the spring.

**Disease Spread and Development**

The bacteria survive low winter temperatures in the digestive tract of dormant, adult corn flea beetles. The corn flea beetle is the primary mode in which the bacteria are able to overwinter, and the primary vector for disease spread. As the adult beetles emerge and feed in spring and early summer, bacteria are deposited in feeding wounds and enter the veins of corn leaves. Beetles feeding on infected tissue acquire the bacterium and further spread the disease throughout the season. An infested beetle carries the bacterium for the rest of its life.

The bacterium that causes Stewart’s disease can be detected in seeds from severely diseased, systemically infected plants. Transmission of the bacterium from seed to young seedlings has been demonstrated but it is extremely rare. Studies assessing the risk for seed transmission have concluded that the risk is almost nonexistent under commercial conditions. Only severely affected plants produce infected seed. Most of this seed is of poor quality and would be removed.
during routine seed conditioning. Even among infected seeds, the frequency of seed transmission is extremely low (0.02% or less).

**Temperature and Flea Beetle Survival**

Warm winter temperatures favor the survival of flea beetle vectors and increase the risk of Stewart's disease. A generally accepted method to assess the risk of disease is to add the mean monthly temperatures for December, January, and February. If the sum of the mean temperatures is 90°F or greater, the beetles survive in high numbers and the disease risk is high; if the sum is between 85 and 90, the risk is moderate to severe; 80 to 85, moderate to low; and a sum less than 80 represents a low risk. Recent observations suggest this system may be too conservative (the predicted risk is too low) for predicting Stewart's disease in Iowa seed production fields. Heavy snow cover acts as insulation favor the survival of the beetles, and other undefined factors probably influence beetle survival and disease development.

**Control of Stewart's Disease**

In sweet corn, planting resistant hybrids is the most effective means of control. Most dent corn hybrids have adequate partial resistance, but when flea beetle populations are very high, damage still occurs. Some commonly used dent corn inbreds are quite susceptible. There are no cultural practices that are known to reduce the disease. Foliar insecticides or systemic seed treatment insecticides can reduce the disease incidence. These practices can be economical in sweet corn and seed corn production, but rarely so in commercial hybrid corn production.

Data available on soil and foliar insecticides are mainly limited to older studies performed on sweet corn. Soil insecticides generally are not recommended for flea beetle control, because the population of flea beetles in a specific field is unpredictable. Foliar insecticides are commonly used, especially in seed corn production, but repeated applications may be necessary in order to adequately control Stewart's disease. Another option is the use of systemic insecticide seed treatment. Seed treatments have the advantages of lower application rates, greater convenience, and lower risk of pesticide exposure compared to granular or liquid applications made in the field. Currently, the only systemic insecticide available for seed treatment is imidacloprid, sold by Gustafson, Inc. as Gaucho, Gaucho Extra, or Prescribe. Another product, thiamethoxam (Adage) is in the testing stages with Syngenta (formerly Novartis) and probably will be available in the near future.

Imidacloprid has shown good control of flea beetle feeding and Stewart's disease in greenhouse and field trials. We conducted greenhouse trials in which treated and nontreated plants were subjected to flea beetle infestation for 2 to 4 weeks and then the flea beetle feeding injury and Stewart's disease were assessed. We found that the seed treatment significantly reduced flea beetle feeding and infection by the bacterium (Fig. 1). With imidacloprid treatment, the total numbers of feeding scars were reduced, and more importantly, the numbers of large feeding scars were reduced. The larger feeding scars represent a longer feeding duration, which is more likely to result in Stewart's disease transmission.

The protection from flea beetle feeding provided by imidacloprid is limited in duration. In the greenhouse experiment, plants were up to 6 weeks old. In field trials with sweet corn in Illinois, imidacloprid reduced the incidence of Stewart's disease by 50% to 85% but in some trials the incidence increased on treated plants when
flea beetles were active later in the season. Imidacloprid treatment of inbred seed is expected to be widespread in 2001, and some hybrid seed will be available with imidacloprid treatment, which also is effective against some species of soil insects.

**Thresholds for Managing Beetles**

Edwards et al. (1995) states that seed corn production fields with known inbreds that are susceptible to Stewart’s disease should be scouted closely for corn flea beetles. Prior to the V5 stage, control may be necessary if 10% of the plants show severe beetle feeding (leaves with white scars or leaves beginning to die) and approximately 2 to 3 or more beetles are found per plant.

In commercial field corn, treatment has been suggested that if 50% of plants shows severe feeding injury and 5 or more beetles per plant are observed feeding.

Early planting dates for inbreds or hybrids that are susceptible to Stewart’s disease should be avoided (Gray 1998).

**References Cited**
