

BIOLOGY AND MANAGEMENT OF Hessian Fly in Wheat

The Hessian fly, *Mayetiola destructor*, is a severe pest of winter wheat in the United States. This pest caused disastrous losses in Alabama wheat in the mid-1980s. In 1985, estimated losses were 21 bushels per infested acre. Since that time, later planting of wheat and the use of wheat varieties resistant to Hessian fly minimized economic losses to this pest.

In 2008 and coming years, entomologists expect the risk of economic losses from Hessian fly to be as high, or higher, than they were in the 1980s. Reasons for this include increased wheat acreage, supply shortages of Hessian fly-resistant wheat varieties, widespread occurrence of a strain of Hessian fly that overcomes resistance in most wheat varieties, increased conservation tillage, and disrupted crop rotation schemes as farmers plant the crop that offers the best promise for an economic return. A last and very important factor is that phorate and di-syston insecticides can no longer be used at planting to control Hessian flies. This publication discusses the biology of the Hessian fly and provides suggestions for managing this insect.

Historically, Hessian fly has caused the greatest problems in the southern two-thirds of Alabama. Outbreaks of this insect have occurred periodically in the United States since the mid 1800s.

The Hessian fly is believed to have been introduced into Long Island, New York, in straw bedding used by Hessian soldiers during the Revolutionary War. Hessian fly prefers to feed on wheat, but may also infest triticale, barley, and rye; Hessian fly does not attack oats or ryegrass.



Figure 1. Hessian fly adult

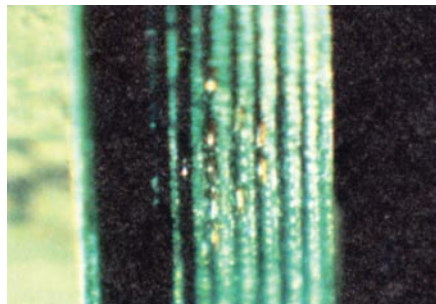


Figure 2. Hessian fly eggs



Figure 3. Maggot (larva) nestled behind leaf sheath

Description and Life Cycle

The Hessian fly (Figure 1) is a small mosquito-like fly, about 1/8-inch long. Adult females live 1 to 2 days and lay reddish-colored eggs (Figure 2) in grooves on the upper side of wheat leaves. Each adult female can lay 250 to 300 eggs.

The maggots (larvae) hatch from the eggs after 3 to 10 days. Hessian fly maggots cannot live in the open, so they crawl down to their preferred feeding site, at the base of a leaf sheath, between the sheath and the stem. In the fall, the maggots crawl down to the crown of the plant. As the wheat stem elongates, maggots are usually found just above a leaf node. Infestations of Hessian fly tend to be found further up the plant as the stem elongates, because females prefer to lay eggs on newly emerged leaves.

Newly hatched maggots are reddish brown and about 1/50-inch long. As they grow, they become white, then greenish white, and grow to be about 3/16-inch long (Figure 3). The maggots feed by scraping the stem, then sucking up the sap that oozes out of the wound. The maggots feed for 14 to 30 days.

The last stage of the maggot is spent inside the “flaxseed.” The flaxseed is a shiny, brown protective case about 1/8-inch long (Figure 4). It is built from the insect’s skin, and named for its resemblance to a seed from the flax plant.

If weather conditions are favorable (between 40 to 80°F), the Hessian flies will pupate (transform into adults) inside the flaxseed. Adults then emerge and start a new gener-



Figure 4. Flaxseeds at the base of a plant

ation. If it is too hot or cold, Hessian flies remain as maggots inside the flaxseed until the weather moderates. It is not uncommon to find Hessian fly maggots or flaxseeds stacked up one behind the other, particularly in heavy infestations (Figure 5).



Figure 5. In heavy infestations, many Hessian flies may be found behind a single leaf sheath.

There are 4 to 6 generations per year of this pest in the South. The entire life cycle requires about 35 days at 70°F, longer at cool temperatures. Generations tend to overlap. The pest overwinters as flaxseeds in wheat stubble. The first generation in September is generally on volunteer wheat or on wild grass hosts, the most important of which is little barley. Then there are often two more generations in the fall and early winter.

Maggots continue feeding as long as temperatures are above 40°F. In spring, adults emerge, become active when temperatures reach between 50 to 60°F, and start a new generation. There is usually one spring generation in northern Alabama, and there may be two spring generations in southern Alabama.

Damage

Feeding by Hessian fly maggots permanently stunts vegetative tillers and can kill seedlings (Figure 6). Severe stunting is probably caused by injection of toxic substances during feeding. Stunted vegetative tillers are dark green. Leaves on infested tillers are wider and shorter than normal. Infested tillers usually die after the Hessian fly pupates. Therefore, fall infestations affect yield by reducing the number of live tillers per unit area (Figure 7). Unusually large numbers of dead tillers at the base of the wheat plant may signal a Hessian fly problem.

If fall infested tillers do produce grain heads, these heads are small and the stems are stunted. Spring



Figure 6. Infested plants (top); healthy wheat (bottom).



Figure 7. A sparse stand is a sign of Hessian fly infestation.

infested plants have weakened stalks, which can lead to stem breakage and lodging. These plants also have poorly filled, smaller grain heads. Hessian fly reduces forage production of winter wheat, but does not greatly affect wheat forage quality.

Management of Hessian Fly

Decisions on Hessian fly need to be made before or at planting, and at the time fertilizer is applied in the spring. Hessian fly can be managed through a combination of cultural and chemical controls. Biological control agents are also present that help keep Hessian fly under control.

Planting Resistant Varieties of Wheat

The most reliable management strategy in the South is to plant varieties of wheat that are resistant to Hessian fly (Figure 8). Rye or oats may be a better choice for grazing as they are poor or nonhosts for Hessian fly.

Plant breeders try to stay ahead of the biotypes by producing wheat varieties with different resistance genes. These resistance genes are usually given the letter H and a number, for



Figure 8. The variety on the left has resistance to Hessian fly. The variety on the right does not.

example, the H6 gene, the H7H8 gene, etc. Unfortunately, the Hessian fly can overcome host plant resistance mechanisms, resulting in the formation of new strains, called biotypes (as strains are discovered, they are named with letters). Hessian fly biotypes look identical to each other, but differ in the varieties they can develop and reproduce on.

For southeastern Alabama, there are many wheat varieties that have resistance to the prevailing biotypes of Hessian fly (Table 1). Most of these contain the H7H8 gene for resistance. For more information on Hessian fly resistant varieties, consult the University of Georgia Hessian fly screening test results from Plains (see the insects section of “Small Grain Updates” for the most recent year at <http://www.swvt.uga.edu/small.html>). The biotypes of Hessian fly at Plains are similar to those that occur in southeastern Alabama.

Only a few wheat varieties are resistant to biotype L, which occurs in northern and in western Alabama (Table 1). Breeding lines with biotype L resistance should result in more Hessian fly resistant varieties

Table 1. Wheat Varieties That Are Resistant or Susceptible to Hessian Fly

Resistant to most southern strains of Hessian fly ¹	AgriPro Hickory, AgriPro Crawford, AgriPro Magnolia, AGS 2000, AGS 2010 ² , AGS 2020, AGS 2026 ² , AGS 2485, AGS 2060, Florida 304, GA-Dozier, GA-Gore, GA-Stuckey, Madison, Novartis Coker 9134, Novartis Coker 9766, Novartis Coker 9835, Oglethorpe ² , Pioneer 2555, Pioneer 2566, Pioneer 2580, Pioneer 2628, Pioneer 26R31, Pioneer 26R38, Pioneer 26R61 ² , SS 8641, Saluda, Stacy, USG 3592
Susceptible to most southern strains of Hessian fly	AgriPro Mason, AgriPro Panola, AgriPro Savannah, AGS 2031, AGS 2050, Clark ³ , Clemson 201, Dominion, Fleming, Florida 301, Florida 302, Florida 303, Hunter, Jackson, Jaypee, McIntosh, Novartis Coker 9227, Novartis Coker 9543, Novartis Coker 9663 ⁴ , Novartis Coker 9803, Novartis Coker 9511, Novartis Coker 9553, Novartis Coker 9700, Novartis Coker all 3-digit lines, Pioneer 2548, Pioneer 2643, Pioneer 2684, Pioneer 2691, Pioneer 2897 ⁴ , Pioneer 26R12, Pioneer 26R15, Pioneer 26R22, Pioneer 26R24, Pioneer 26R87, Roberts, SS 520, SS 524, SS535, SS 560, SS 8308 ⁴ , SS 8404, Tribute, Verne ³ , Wakefield, USG 3209, USG 3295, USG 3477, USG 3665 ⁴ , USG 3910, Vigoro V9510, Vigoro V9412
¹ Resistant to Biotypes E, G, M, and O.	
² Varieties with resistance to Biotype L (see text).	
³ Contains Hessian fly resistance genes that are no longer effective in the South.	
⁴ Moderately resistant to Biotypes E, G, M, and O. Variable results observed in field, depending on Hessian fly pressure.	

for these areas. The University of Georgia tests from Griffin, Georgia, will provide some guidance on what varieties do well under pressure from biotype L.

Variety recommendations change from year to year. Check the latest version of “Small Grains Insect, Disease, and Weed Control Recommendations,” in Extension’s *ANR-500-A, Alabama Pest Management Handbook, Volume 1*.

Practices that Reduce Number of Hessian Flies

Burying wheat stubble, where Hessian flies overwinter, will reduce the emergence of Hessian fly adults. Burning crop debris has also been recommended for Hessian fly control. However, burning destroys flaxseeds that are present in the straw, but does not kill flaxseeds that have fallen out of the crop debris onto the ground.

Control of volunteer wheat well before planting is recommended because Hessian flies are attracted to volunteer wheat when they emerge in

September. Wildlife plantings of wheat, which are often planted early, can be a source of Hessian flies.

Crop rotation helps reduce the chance of infestation by Hessian flies, but is not infallible, because Hessian fly adults will fly up to a mile in search of host plants.

Practices that Prevent or Avoid Fall Infestation

In northern states, the use of a “fly free date,” after which it is safe to plant wheat, is practical. Late planting as a Hessian fly management tactic is not usually feasible in Alabama because adult Hessian flies may be looking for host plants well into December. By that time, the late planting itself results in severe yield penalties. Nevertheless, plantings in northern Alabama on or after November 1 should limit fall infestation in most years. Growers should use the recommended planting dates for their area (Table 2). Late plantings avoid fall infestation but may still be at risk of having severe damage

during the spring. Forage wheat is planted earlier, and is more vulnerable to Hessian fly infestation, as well as to infestation by aphids, armyworms, and grasshoppers.

Few insecticide options are currently available for control of Hessian fly. At-planting granular insecticides, such as Di-Syston or Thimet are no longer registered for use on wheat and cereal grains. The seed treatment Gaucho 480 or Gaucho 600 provides fair to good control of fall infestations of Hessian flies when applied at the high rate of 0.06 pound (ai) per 100 pounds of seed. Cruiser 5FS applied as a seed treatment at the maximum rate of 1.33 ounces/cwt of seed also provides suppression of fall infestation. The low rates of Gaucho and Cruiser (1 fluid ounce/100 pounds of seed) used for aphid control generally are not effective against Hessian fly. These seed treatments tend to be more effective in the northern portions of the state than they are in the southern portions. They will not provide control of the late winter/spring infestation.

Table 2. Recommended Planting Dates for Wheat in Alabama

	Wheat Planted For		
	Grain	Forage Plus Grain	Forage Only
North	Oct 15 - Nov 1	Sept 15 - Nov 1	Aug 25 - Sept 10
Central	Oct 15 - Nov 15	Sept 15 - Nov 1	Sept 1 - 15
South	Nov 1 - Dec 1	Oct 1 - Nov 15	Sept 15 - 30

Table 3. Suggested Insecticides for Chemical Control of Hessian Fly

Insecticide	Rate	Comments
imidacloprid GAUCHO 480 or GAUCHO 600	2 fl oz/100 lb seed 1.6 fl oz/100 lb of seed	Use as a seed treatment. A commercially applied seed treatment is recommended, but an on-farm slurry treatment can be used. Observe a 45-day interval between planting and grazing. Cover crops can be planted at any time, but do not graze these or harvest for food or feed.
imidacloprid + metalaxyl + tebuconazole Gaucht XT plus Gaucht 600	3.4 fl oz Gaucht XT mixed with 1 fl oz Gaucht 600/100 lb of seed	Metalaxyl and tebuconazole are fungicides. A commercially applied seed treatment is recommended, but an on-farm slurry treatment can be used. Observe a 45-day interval between planting and grazing. Cover crops can be planted at any time, but do not graze these or harvest for food or feed.
thiomethoxam CRUISER 5FS	1.33 fl oz/100 lb of seed	Apply as a slurry on-farm or as a commercially applied seed treatment. See label for crop plant-back restrictions.
lambda cyhalothrin WARRIOR II CS or Karate Z Similar products	1.92 fl oz/acre 1.92 fl oz/acre	Apply as foliar spray in fall or late winter when adults are actively laying eggs.

Controlling Hessian fly in susceptible varieties using insecticides after planting is difficult. Other states have had some success using lambda-cyhalothrin (Warrior, Karate, and similar products) as a foliar application in late winter. This application must be applied when adults are actively laying eggs and larvae are hatching. Properly timing this application without repeated sampling is difficult. In northern Alabama, the best time to suppress infestation with a foliar spray would most likely be in early to mid March. In southern Alabama, egg laying varies with weather conditions and it may be more difficult to properly time an application without sampling.

Late Winter Scouting for Hessian Flies

Growers, especially those planting Hessian fly susceptible varieties, should inspect their wheat before

making their customary nitrogen applications in late winter. Tillers, especially dead tillers and stunted tillers, should be examined by peeling the leaf sheaths back carefully to look for Hessian fly maggots or pupae. If 20 percent of the tillers are infested with Hessian fly maggots or pupae at this time, significant yield losses can be expected and the money spent on nitrogen may not produce the desired yield response.

Post-Harvest Practices that Spread New Biotypes

Hessian flies arrived in this country on infested straw. New biotypes can just as easily be spread when straw from heavily infested fields is baled and transported into new areas.

Summary of Hessian Fly Management Practices

- Select a Hessian fly resistant variety.
- Plant rye, oats, or a Hessian-fly resistant wheat for grazing.
- If possible, use a tillage method that will bury wheat debris.
- Control volunteer wheat.
- Do not use susceptible wheat for wildlife plantings.
- Avoid continuous planting of wheat in the same field.
- Do not plant wheat before the recommended planting date for your area.
- If a susceptible variety is grown, consider using a systemic seed treatment.



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Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label.

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency and the Alabama Department of Agriculture and Industries. If a registration is changed or cancelled, the rate listed here is no longer recommended. Before you apply any pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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