



# Hessian Fly Management in Oklahoma Winter Wheat

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Hessian fly has become a noticeable pest of winter wheat in Oklahoma since about 2004. While not documented through research, circumstantial evidence suggests that Hessian fly infestations have increased as more wheat producers have adopted minimum or no-till production practices for growing wheat. When combined with other practices, such as continuous wheat production, early sowing, and planting Hessian fly-susceptible winter wheat varieties, the adoption of minimum/no-till practices have probably contributed to greater occurrence of Hessian fly. Because Hessian fly is not easily controlled with rescue insecticide applications, management should focus on preventive practices that reduce its survival and reproduction, but are still compatible with other production practices.

Hessian fly was most likely introduced into the United States from straw bedding used by Hessian troops during the Revolutionary War in 1779 in New York. Hessian fly has been present in Oklahoma since the late 1800s and has been an occasional serious pest of winter wheat. Hessian fly was a frequent and widespread pest in wheat from 1900 through about 1970, but its pest status diminished after 1970. Since 2004, Hessian fly outbreaks have occurred in Oklahoma every year, and appear to be increasing in frequency.

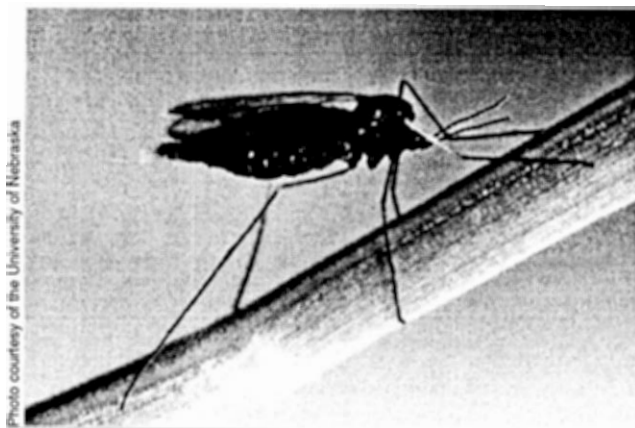


Figure 1. Adult female Hessian fly

## Description

The adult Hessian fly is a tiny gnat-like fly measuring one-eighth of an inch long (Figure 1).

Eggs are oblong, orange, and measure less than 1/50 inch and can be mistaken for early signs of leaf rust (Figure 2).

A newly hatched first instar larva is also orange and quickly crawls downward to its favored feeding site, the area between the sheath and stem just above the crown and just below the soil surface. Larvae feed by consuming plant sap. Just before molting, larvae become more robust and "sluglike." After molting, the second instar larva is immobile, whitish-green and measures 3/16 inch when fully grown (Figure 3).

Full-grown larvae form rice-like, shiny, dark brown puparia commonly referred to as "flaxseeds," which represent the overwintering and oversummering life stages (Figure 4).

## Lifecycle and Seasonal Occurrence

Hessian fly can complete its lifecycle in about 40 to 50 days, but once the "flaxseed" stage is reached, it may remain dormant for three to four months. Oklahoma experiences three or more generations per crop season, but we typically experience a major generation in the fall and another in the spring. Several other "pulses" or minor infestations can occur.

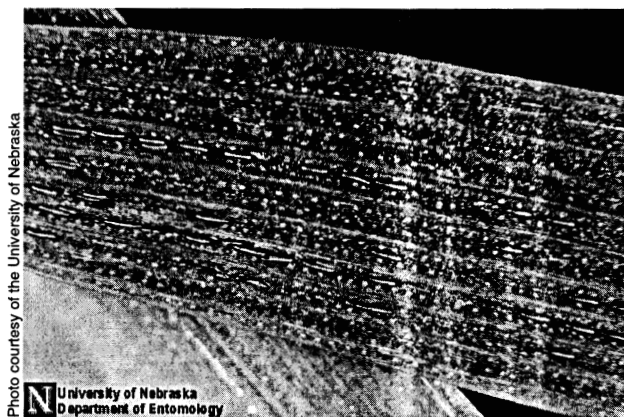
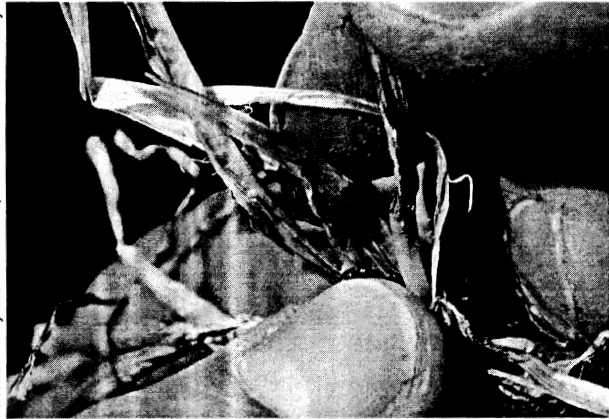


Figure 2. Hessian fly eggs are laid on the upper side of a wheat leaf between the veins. Note the orange color of the eggs are similar in color to leaf rust.



**Figure 3.** The second instar larvae of the Hessian fly can be found by splitting open stems in late winter. Note the whitish/green color of the larvae at this stage.



**Figure 4.** Full-grown Hessian fly larvae form rice-like puparia that are shiny and dark brown. The puparium is commonly referred to as a "flaxseed."

cur anytime during the winter or spring when temperatures exceed 45° to 50° F accompanied by a stimulating rain of ½ inch or more. The spring generation of Hessian fly emerges sometime from March through May. The female fly mates and lays eggs in between the leaf margins of its host plant. Newly hatched larvae crawl down the plant and begin feeding, usually above the first aboveground node. The fall generation flaxseed overwinters through spring, and the spring generation flaxseed oversummers in wheat stubble.

### Hosts

Hessian fly is known to feed on barley, rye, and triticale, but its preferred host is wheat. Hessian fly does not attack oat, but will feed on several wild grasses (quackgrass, western wheatgrass, little barley, goatgrass, and timothy).

### Damage

Hessian fly larvae injure the wheat by feeding on stem tissue at the crown of young plants or just above the nodes

of jointed wheat. As they feed, they inhibit growth of the plant. During a fall infestation, young infested plants become dark green to bluish-green and are stunted with thickened leaves. Individual infested tillers eventually die. Some varieties of wheat may compensate by producing secondary tillers, but others fail to produce any secondary tillers after being infested. Often, wheat that is infested in the fall becomes less winter hardy and dies.

During the spring, Hessian flies emerge around the time jointing begins. Larvae feed just above the node between the leaf sheath and stem. Feeding inhibits stem elongation and the plant's ability to transport nutrients to the developing wheat head. Often the wheat head has poor grain fill and the stem breaks at the weakened feeding area. A field that is heavily infested by the spring generation appears to have suffered hail damage from lodging. In such fields, lodged plants nearly always contain flaxseeds that are inserted at the first joint of the stem just under the leaf sheath.

### Inspection and Management

Fields should be checked for signs and symptoms of Hessian fly beginning in early October through November. Infestations may be heavier along field margins. Pay particular attention to any volunteer wheat. Plants will be stunted with thickened leaves and often are darker green compared to uninfested plants. Pull up plants and look for dead or dying tillers. Peel back leaves to their point of attachment to the stem and look for flaxseeds. In spring, damage is best assessed as the wheat matures. Look for broken stems above the first node and check stems for flaxseed. Yield loss can be estimated by counting infested plants. A field with 10 percent infested plants may suffer one bushel of yield loss, which rapidly increases as infestations rise above 10 percent.

### Biological Control

There are several known natural enemies of Hessian fly, but little information is known about their biology, distribution, or effectiveness in Oklahoma. A survey conducted in Idaho identified seven species of parasitoids that attacked Hessian fly, but none occurred in large numbers. Because so little is known about these natural enemies in Oklahoma, they can not effectively be utilized as a management component.

### Stubble Destruction

Since Hessian fly passes the summer as a flaxseed in the stubble, incorporation of wheat stubble into the soil to a depth of 4 inches can reduce Hessian fly survival by nearly 100 percent.

### Burning and Grazing

Research suggests that some flaxseeds residing above the soil surface can be destroyed by burning or intensive grazing, but flaxseeds that lay at the surface in the crown or below the soil surface typically survive burning or grazing. It is also important to consider that valuable crop nutrients such as phosphorus and nitrogen contained in wheat residue will likely be lost as a result of burning.

### Volunteer Wheat Destruction

Research shows volunteer wheat, if allowed to persist, can be a source of Hessian fly infestations even in clean-

tilled fields because they can be a source of "extra brood" that emerges from the volunteer wheat to infest a field after plants have emerged. Therefore, volunteer wheat should be destroyed at least two weeks before the plants emerge. This practice will also reduce the incidence and severity of some wheat viral diseases such as the High Plains Virus. For more information on High Plains Virus, refer to OSU Extension Fact Sheet PSS-2136 "Considerations When Rotating Wheat Behind Corn."

### **Crop Rotation**

Continuous wheat production serves as a constant food source for Hessian fly. Since it is the preferred food host and can't survive on other crops such as corn, sorghum, soybean, or canola, non-host crops should be rotated with wheat when feasible. Crop rotation will not only reduce the likelihood of Hessian fly, but will also reduce the incidence and severity of several wheat diseases and improve wheat yield in many cases. For more information on the benefits of crop rotation, refer to OSU Extension Fact Sheet PSS-2132 "No-till wheat production in Oklahoma."

### **Delayed Planting**

In many areas in the U.S., a "fly free" planting date has been identified that can help a producer manage Hessian fly. If the field is planted after the fly free date, the likelihood the field will be infested is reduced. Unfortunately, the "fly free" planting date is not effective in Oklahoma because weather patterns during the winter allow flies to emerge at various times through the growing season. It may become impractical to delay planting long enough to plant in the "fly free" date without suffering yield losses. Additionally, wheat planted extremely late (November/December) is more vulnerable to

attack by the spring brood of Hessian fly and to other pests such as Russian wheat aphid. Even so, fields planted later, (e.g. October), are at lower risk of a fall infestation. In addition, October-sown wheat will generally produce greater grain yield than September-sown wheat.

### **Resistant Varieties**

There are numerous "strains" of Hessian fly, also called *biotypes*, that have been identified based upon their ability to overcome specific known resistance genes present in wheat. If the most prevalent biotypes of the Hessian fly are known, resistant varieties can be developed through OSU's wheat breeding program. Presently, there are few varieties that have resistance to Hessian fly, and even fewer are well adapted to Oklahoma growing conditions. For more information on which varieties are resistant to Hessian fly, refer to OSU Extension Fact Sheet PSS-2142 "2009 Wheat Variety Comparison Chart."

### **Chemical Control**

Wheat seed can be treated with imidacloprid or thiamethoxam insecticide to reduce fall infestations. However, seed treatments do not last much longer than 30 days, so they will be less effective at reducing Hessian fly infestations when wheat is planted early. There is no effective insecticide control for spring infestations; however, researchers in the southeastern U.S. have obtained some control by timing a pyrethroid insecticide application coinciding with spring emergence of adult flies. For all information related to chemical control suggestions, consult OSU Extension Current Report CR-7194, "Management of Insect and Mite Pests of Small Grains," or the current edition of circular E-832, "OSU Extension Agents' Handbook of Insect, Plant Disease, and Weed Control."

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