



# Hessian Fly Management in Oklahoma Winter Wheat

Tom A. Royer  
Professor and IPM Coordinator

Jeff Edwards  
Assistant Professor

Kristopher L. Giles  
Professor, Field Crops

Hessian fly is believed to have been introduced into the U.S. from straw bedding used by Hessian troops during the Revolutionary War in New York. It has been present in Oklahoma since the late 1800s, and was a frequent and widespread pest in wheat from 1900 through about 1970. Thereafter, its pest status diminished.

Since 2004, Hessian fly outbreaks have become more common and severe local infestations are documented in Oklahoma every year. The combination of reduced tillage, continuous wheat production, early sowing and planting Hessian fly-susceptible winter wheat varieties has probably contributed to greater occurrence of Hessian fly. Hessian fly is not easily controlled with seed treatments or rescue insecticide applications, so management should focus on preventive practices to reduce its survival and reproduction.

## Description

The adult Hessian fly is a tiny gnat-like fly, measuring one-eighth inch long.

Hessian fly eggs are oblong, orange, measure less than 1/50 inch and can be mistaken for early signs of leaf rust.



Figure 1. Adult female Hessian fly.

Oklahoma Cooperative Extension Fact Sheets  
are also available on our website at:  
<http://osufacts.okstate.edu>

A newly hatched first-instar larva is also orange and quickly crawls downward to its favored feeding site. Larvae feed by consuming plant sap. Just before molting, larvae become more robust and slug-like. After molting, the second-instar larva is immobile, whitish/green and measures 3/16 inch when fully grown.

Second instar larvae form a rice-like, shiny, dark brown puparia commonly referred to as a "flaxseeds." They molt into a 3<sup>rd</sup> instar larvae, which then pupate within the puparia. This represents the overwintering and oversummering life stages.

## Lifecycle and Seasonal Occurrence

Hessian fly completes its lifecycle in about 40 days to 50 days, but once the "flaxseed" stage is reached, it may remain dormant for three months to four months. After emergence and mating, the female fly lays eggs in between the leaf margins of its host plant. Newly hatched larvae crawl down the plant and begin feeding in the area between the sheath and stem just above the crown, just below the soil surface (fall) or between the stem and leaf sheath at the first node above the soil surface (spring). The fall generation overwinters as flaxseed, emerging in spring; the spring generation oversummers as flaxseed in wheat stubble, emerging in the fall.



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.”

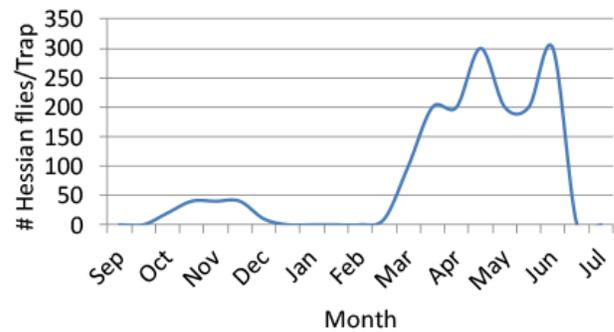
Oklahoma experiences two to three generations per crop season, but two major generations occur—one in the fall, and one in the spring. Flushes of emerged Hessian flies may occur during the winter or spring when temperatures exceed 45 F to 50 F for an extended time. A recent study followed the emergence patterns of Hessian fly for two growing seasons using pheromone traps and showed the fall generation adults emerged from mid-October through early December and spring generation adults emerged from March through May.

### 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.



**Figure 5.** Hessian Fly emergence patterns in Oklahoma 2011-2013. Compiled by Nathan Bradford, M.S., 2014.

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, fall-infested wheat 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, resulting in poor grain fill and/or stem breakage at the weakened feeding area. Significant lodging can occur and an infested field is often mistaken to have suffered hail damage. In such fields, careful inspection of lodged plants will reveal Hessian fly flaxseeds that are inserted at the first joint of the stem just under the leaf sheath.

### Inspection and Management

Fields exhibiting poor growth should be checked for signs and symptoms beginning in early October through November. Infestations may be heavier along field margins. Pay particular attention to the presence of volunteer wheat in field margins or ditches. Plants will be stunted with thickened leaves and are often 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 or number of flaxseeds per tiller. A field averaging 10 percent infested plants may suffer one bushel of yield loss. Based on studies in Oklahoma, an average count of one flaxseed per tiller will result in a 5 bu/A yield loss on susceptible varieties.

### Biological Control

There are several 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. A recent Oklahoma survey revealed only one species, which was found in low numbers. Because so little is known about these natural enemies, they cannot 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 some flaxseeds residing above the soil surface can be destroyed by burning or intensive grazing, but those 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

Volunteer wheat can be a source of Hessian fly infestations even in clean-tilled fields because they provide an extra brood that emerges from the volunteer wheat, infesting a field after new plants have emerged. Therefore, volunteer wheat should be destroyed at least two weeks before the planted field emerges. This practice will also reduce the incidence and severity of some wheat virus diseases such as Wheat streak mosaic, High Plains and Triticum mosaic disease. For more information on High Plains Virus, refer to OSU Facts EPP 7328 *Wheat Streak Mosaic, High Plains Disease and Triticum Mosaic: Three Virus Diseases of Wheat in Oklahoma*

## 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 where 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 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 to help wheat producers manage Hessian fly. A field planted after the fly free date is less likely to become infested. Unfortunately, the fly free planting date is not effective in Oklahoma because we experience extended emergence of flies in the fall and spring. For dual purpose wheat, it is impractical to delay planting long enough without suffering significant forage availability for grazing stocker cattle. For grain production, October-sown wheat is at lower risk for a fall infestation and generally produces higher grain yields than September-sown wheat. Wheat planted extremely late (November/December) is more vulnerable to attack by the spring brood of Hessian fly, and other pests such as Russian wheat aphid.

## Resistant Varieties

Various *biotypes* of Hessian fly have been identified, based upon their ability to overcome specific known resistance genes present in wheat. The wheat breeding program at OSU screens breeding lines and varieties for resistance to field populations of Hessian fly. Presently, there are a few Hessian fly-resistant varieties that are well adapted to Oklahoma growing conditions. Resistant varieties are very effective management tools and yield well when fly pressure is high, but also have been effectively used to reduce local Hessian fly populations. For more information on which varieties are resistant to Hessian fly, refer to OSU Facts PSS-2142 *Wheat variety comparison chart*, which is updated annually.

## Chemical Control

Wheat seed can be treated with imidacloprid or thiamethoxam insecticide; however, seed treatments probably last 20 days to 30 days after germination, while Hessian fly may infest wheat well beyond that time. Recent evaluations of insecticide seed treatments have shown they are generally not effective in reducing fall infestations for the same reasons that the fly free planting date is not effective. There is no effective insecticide control for spring infestations.

## The Oklahoma Cooperative Extension Service Bringing the University to You!

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
  - It is administered by the land-grant university as designated by the state legislature through an Extension director.
  - Extension programs are nonpolitical, objective, and research-based information.
  - It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
  - More than a million volunteers help multiply the impact of the Extension professional staff.
  - It dispenses no funds to the public.
  - It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
  - Local programs are developed and carried out in full recognition of national problems and goals.
  - The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
  - Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

Oklahoma State University, in compliance with Title VI and VII of the Civil Rights Act of 1964, Executive Order 11246 as amended, and Title IX of the Education Amendments of 1972 (Higher Education Act), the Americans with Disabilities Act of 1990, and other federal and state laws and regulations, does not discriminate on the basis of race, color, national origin, genetic information, sex, age, sexual orientation, gender identity, religion, disability, or status as a veteran, in any of its policies, practices or procedures. This provision includes, but is not limited to admissions, employment, financial aid, and educational services. The Director of Equal Opportunity, 408 Whitehurst, OSU, Stillwater, OK 74078-1035; Phone 405-744-5371; email: [eeo@okstate.edu](mailto:eeo@okstate.edu) has been designated to handle inquiries regarding non-discrimination policies; Director of Equal Opportunity. Any person (student, faculty, or staff) who believes that discriminatory practices have been engaged in based on gender may discuss his or her concerns and file informal or formal complaints of possible violations of Title IX with OSU's Title IX Coordinator 405-744-9154.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President, Dean, and Director of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of 42 cents per copy. Revised 0615 GH.