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G73-46 Hessian Fly on Wheat

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Hessian Fly on Wheat

This NebGuide discusses the life cycle, control and prevention of the Hessian fly. Plant-safe dates and resistant wheat varieties are also examined.

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The Hessian fly, *Mayetiola destructor* (Say), is not native to the United States, but was probably introduced by Hessian soldiers during the Revolutionary War. This insect was given its common name by Americans because of its damage on Long Island in 1779. The pest has become distributed throughout the United States wheat production areas since then.

The Hessian fly belongs to the family of insects known as gall midges (Diptera: Cecidomyiidae), a group noted for their habit of producing galls on many kinds of plants. The Hessian fly is one of the most destructive insect pests of wheat in the United States. Severe infestations are sporadic in Nebraska with the greatest damage potential occurring in the eastern half of the state; however, severe infestations have been noted as far west as Ogallala. Although the Hessian fly is injurious chiefly to wheat, at times it damages barley, rye and triticale. It has been found in grasses, but does not infest them heavily, and does not attack oats.

Life Cycle

Annually, there are two generations of the Hessian fly, one in the spring and another in the fall. In September, the fly lays eggs in seedling wheat or volunteer wheat. The second generation occurs the next spring after overwintering larvae develop into adults.

The insect survives the summer in the flaxseed stage (*Figure 1*) in wheat stubble. This shiny brown, seedlike puparium is found at the base of old plant crowns, and also may occur in

the straw, near the nodes behind the leaf sheaths. Within the flaxseed is the fourth-stage larva, which does not resume development until a general soaking rain breaks dormancy. Shortly thereafter, development is completed, and the larva pupates and emerges as an adult fly in about two weeks. In central Nebraska, such a rain will normally occur in mid to late August, triggering fly emergence in early September. Volunteer wheat or wheat planted early will be in the seedling stage when flies emerge.

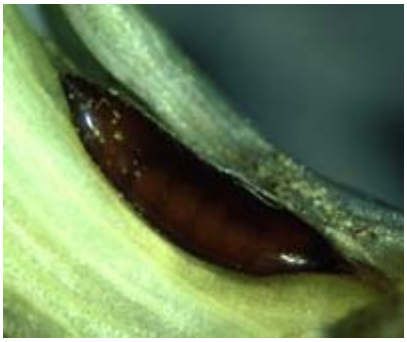


Figure 1. Hessian fly flazseed stage.


Figure 2. Adult Hessian flies.

Adult Hessian flies resemble small mosquitoes (*Figure 2*). They are smoky gray, fragile, and have pointed abdomens. The abdomen of the female fly is reddish which is caused by the color of the eggs developing inside. Adult flies are weak fliers and only live about three days. Emergence occurs during the early morning hours with the males emerging first followed shortly by the females. Newly emerged females cling to a plant leaf and extend their abdomens, releasing a sex pheromone, which attracts the males for mating.

Shortly after mating, females deposit reddish, elongated eggs in rows deposited in grooves on the upper surfaces of wheat leaves (*Figure 3*), giving them an appearance similar to a string of hot dogs when viewed with magnification. Seedling wheat plants or tillers are preferred for egg-laying. A single female fly lays about 200 eggs which hatch in 3-10 days, depending on temperature.

The reddish, first-stage larvae move from the empty eggshell and crawl downward, gradually reaching the base of the leaf. Here, beneath the leaf sheath, the young larva initiates feeding with its head in a downward position. Larvae press their mouthparts against the plant, injecting their saliva into the plant, which causes the tissue to release the cell contents. A single larva, feeding for just three days, is capable of permanently stunting a young wheat plant or tiller.

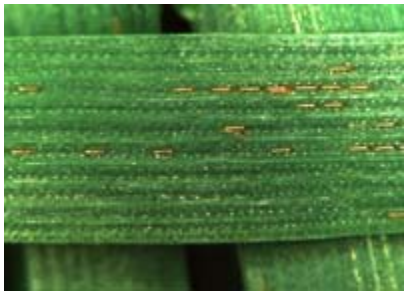

Figure 3. Hessian fly eggs on wheat.

The larva passes through three stages (instars) as it feeds. The first-instar larva gradually becomes white as it increases in size. After the first molt (or shedding of the skin), the second-stage larva is clear white with no distinguishing marks. The third-stage larvae are white with an internal green gut coloration appearing as a dorsal stripe (*Figure 4*). Larvae feed about two to three weeks prior to forming the puparium, or flaxseed. The flaxseed is actually the hardened unshed skin of the third-stage larva. Inside this structure is the nonfeeding fourth-stage larva, which overwinters.

Some mortality of the flaxseed occurs each winter, depending on many factors, including temperature, moisture and natural enemies. In the spring, usually in March or April, development resumes and the larva transforms into a pupa inside the puparium. Spring emergence of adult flies occurs shortly thereafter. These flies deposit eggs on leaves of wheat plants in the jointing stage. The newly hatched larvae move from the site of egg-laying downward behind the leaf sheaths to the nodes, where feeding is initiated. Development then proceeds until the larva reaches the flaxseed stage, which is usually in early-to-mid June prior to wheat ripening.

Figure 4. Hessian fly larval stages.

Damage

Damage is related to degree of infestation by the Hessian fly larvae. Even a single larva can cause significant damage to a wheat plant because salivary toxins released while feeding interfere with normal wheat growth. Plants attacked at the one-leaf stage may be killed outright. Wheat attacked later will be severely stunted, with perhaps the first tillers killed and plant growth delayed. Plants infested in the fall can easily be recognized by their darker than normal bluish coloration (*Figure 5*) and leaves with unusually broad blades. Young plants or tillers infested in the fall often die during the winter. Plants attacked in the spring have shortened and weakened stems that may eventually break just above the first or second node, causing plants to lodge near harvest. Heavily infested fields will have reduced yields and lower quality grain caused by adverse physiological effects (reduced plant growth and kernel size and number) and mechanical damage (breakage due to weakening of stems).

Figure 5. Wheat damaged by Hessian fly.

Prevention/Control

Cultural Practices

Cultural practices alone are not enough to control the fly, but will help to reduce populations. Perhaps the most important single cultural practice is the destruction of volunteer wheat, which serves as a late summer host for the fly. Destruction of volunteer wheat will reduce the potential for late-summer and fall hosts for the fly.

Delayed Planting

Late summer rains of about one inch trigger development of aestivating (oversummering) Hessian flies. Light scattered rainfall is insufficient to cause fly development. About 10-12 days later, the first Hessian fly adults appear. At this time, flies can infest volunteer wheat or early planted winter wheat. Severe fall

infestations are usually caused by the existence of two favorable conditions: an earlier than normal planting date and a Hessian fly-susceptible variety of wheat. Simply delaying planting until the fly-free date would, in most years, reduce or prevent infestation, and still provide ample time for wheat plant growth and development. Farmers who consistently plant early are inviting a problem, particularly if they are growing cultivars susceptible to Hessian flies. While fly-free dates are usually effective, they are not always perfect because of seasonal weather variations, particularly rainfall and temperature which affect fly development and activity. The following planting dates are average fly-free dates for Nebraska. Fly-safe dates have only been estimated for extreme western Nebraska counties. The increased elevation requires the earlier planting of wheat than allowed with fly-free dates.

Fly-safe planting dates for eastern Nebraska counties.

County	*Date*		*County*	*Date*		*County*	*Date*
Adams	Sept 26-27		Jefferson	Sept 29-30		Platte	Sept 23-24
Burt	Sept 24		Johnson	Sept 29-30		Richardson	Sept 30-Oct 1
Butler	Sept 25-26		Lancaster	Sept 27-28		Sarpy	Sept 27
Cass	Sept 27-28		Merrick	Sept 24-25		Saunders	Sept 25-26
Clay	Sept 26-27		Nance	Sept 24		Seward	Sept 26-27
Colfax	Sept 24-25		Nemaha	Sept 29-30		Thayer	Sept 28-29
Dodge	Sept 24-25		Nuckolls	Sept 28		Washington	Sept 25-26
Fillmore	Sept 27-28		Otoe	Sept 28-29		Webster	Sept 27-28
Gage	Sept 29-30		Pawnee	Sept 30-Oct 1		York	Sept 26-27
Hamilton	Sept 25-26		Polk	Sept 25			

Estimated fly-safe planting dates for western Nebraska counties.

County	*Date*		*County*	*Date*		*County*	*Date*
Buffalo	Sept 24-25		Gosper	Sept 24-25		Phelps	Sept 25-26
Custer	Sept 22-24		Harlan	Sept 26-27		Red Willow	Sept 25
Dawson	Sept 24		Howard	Sept 24-25		Sherman	Sept 23
Franklin	Sept 26-27		Hall	Sept 24-25		Valley	Sept 23
Furnas	Sept 25-27		Kearney	Sept 25-26			
Greeley	Sept 23-24		Lincoln	Sept 23-25			

Resistant Varieties

The use of resistant wheat varieties has been highly effective in reducing Hessian fly damage. Before developing Hessian fly resistance in wheat, tremendous yield losses occurred in Nebraska and other Plains states. Using resistant varieties alone, or in combination with delayed planting dates and destruction of volunteer wheat, has greatly reduced the fly as a major concern in most wheat-producing states. The primary resistance mechanism is antibiosis, where young larvae that initiate feeding on resistant plants are killed by natural substances in the plant. Even on resistant varieties, a small

percentage of flies may survive to reproduce. Therefore, because of this gradual selection of virulent flies over a period of years, resistant varieties must be monitored continuously. The Hessian fly is constantly producing new virulent biotypes (strains) which can overcome plant resistance. Entomologists and plant breeders work as a team to watch for new fly biotypes and to deploy effective genes into wheat well ahead of the plant resistance/virulent biotype problem. Constant research, vigilance and planning by researchers and farmers are necessary to prevent devastating losses to Hessian fly. The following is a list of some wheat varieties and their Hessian fly resistance ratings.

While variety resistance is important, the fly-resistant cultivars must also be agronomically suitable. Consult state recommendations for cultivars most likely to perform well in your area. Additional consideration must be given to selecting a variety that simultaneously contains resistance to other important wheat pests.

Resistant	*Moderately resistant*	
2137	Alliance	
2163	Arapahoe	
Brule	Buckskin	
Dawn	Polansky brand Dominator	
Ike	Quantum brand hybrid 566	
Redland	Larned	
Vista		
Moderately resistant	*Moderately susceptible*	
Moderately susceptible		
AgriPro brand Coronado	AGSECO brand Colby 94	
Quantum brand hybrid 562	AGSECO brand Mankato	
Quantum brand hybrid AP7601	Centura	
Rawhide	Pronghorn	
Roughrider	Quantum brand hybrid AP7501	
Vona		
Susceptible		
AgriPro brand Abilene	AGSECO brand 7805	Scout 66
AgriPro brand Big Dawg	AGSECO brand 7853	Siouxland
AgriPro brand Hawk	Akron	Star brand Champ
AgriPro brand Hickok	CWRF brand Halt	TAM 107
AgriPro brand Laredo	Jagger	TAM 110

AgriPro brand Longhorn	Jules	TAM 200
AgriPro brand Ogallala	Karl/Karl 92	Windstar
AgriPro brand Ponderosa	Lamar	Yuma
AgriPro brand Rowdy	Nekota	Sandy
AgriPro brand Sierra	Newton	Halt
AgriPro brand Thunderbird	Niobrara	Prowers
AgriPro brand Tomahawk	Yumar	
AgriPro brand Victory	Quantum brand hybrids 542, 549, 577, and AP7510	

Insecticides

Insecticides registered for use at planting for Hessian fly control are not recommended. Because of the sporadic occurrence of severe infestations, the economics do not support insecticide use at planting. Delayed planting dates and resistant varieties can be used with little or no additional cost to the farmer.

Natural Enemies

The Hessian fly has some natural enemies, including two species of parasitic wasps. In Kansas, these wasps have reduced Hessian fly populations substantially. Like all natural enemies, they are most effective when host (Hessian fly) populations are high. Natural enemies are not effective enough to prevent wheat crop loss, but will reduce fly populations.

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