HESSIAN FLY
A Pest of Wheat, Triticale, Barley and Rye

The Hessian fly, *Mayetiola destructor* (Say), got its common name from the belief that it was introduced to North America in the straw bedding of Hessian mercenaries during the Revolutionary War. It was first reported attacking small grain on Long Island in 1779. By 1845 it was causing damage in Georgia and has remained a sporadic pest of wheat in the South. Hessian fly can cause economic injury anywhere in South Carolina, but fields in the southern Coastal Plain usually have greater risk. Annual damage exceeded $4 million dollars in several outbreaks from 1984 -1989.

Contributing factors for severe infestation include use of a susceptible variety, early planting, unusually warm Nov. – Dec. weather, reduced tillage into wheat stubble, volunteer wheat, and lack of rotation. Hessian fly attacks wheat, triticale, barley, and rye in that order of damage severity. Oats are not affected.

Life Cycle

The life cycle is shown in Fig. 1. The adult (fly) stage will very seldom be noticed even where damage is severe. It is a black gnat about 1/8 inch long. The female is filled with eggs, which give the body a red color. Many harmless or beneficial insects are often confused with Hessian fly adults and it is probably best to not be concerned with identification of the adult stage. Adults live only 2 to 3 days, long enough to mate and lay eggs.

Hessian fly egg. Laid on upper leaf surface of new leaves. Eggs look like pink sausages laid end-to-end in grooves of wheat leaves. 10X hand lens needed to see eggs in field. Photo: JWC

The female deposits the oblong red eggs individually on the upper surface of leaves. Newer leaves are preferred for egg laying. Eggs are almost microscopic, but when abundant can barely be seen with the unaided eye if the leaf is held at an angle to bright sunlight. Under 10X magnification eggs can clearly be seen lying in parallel grooves of the upper leaf surface. When abundant, they resemble a string of pink sausages laid end to end.

White larvae and brown pupal cases are found by peeling wheat leaves away from stem on dead, weak, or lodged tillers. Always found below the soil line until jointing. Photo: JWC

In 3 to 5 days a red larva or maggot emerges from the egg, crawls down the upper leaf surface and then down between the leaf sheath and stem (Figure 1). The feeding site is just above the point of attachment of the leaf sheath to the stem. Here the maggot begins rasping and feeding on plant juices. Once feeding begins, the larva moves little if at all. It does not bore into the plant, but forms a depression in the stem as the maggot grows. The maggot has three developmental stages: the small red larva, then a white maggot up to 3/16 inch, followed by a nonfeeding larval stage inside the loosened larval skin (puparium).

The puparium changes color from white to a dark brown. This is often referred to as the "flaxseed" stage because it resembles a seed about 3/16 inch long. This is the most obvious stage to look for. A common misconception is that the puparium or flaxseed is an egg from which a maggot hatches. The entire larval phase can be as short as 11 days.

The pupal stage also occurs within the dark brown puparium (flax seed). The length of the pupal stage ranges from approximately 7-35 days, before the adult fly emerges to mate and again lay eggs.

The entire life cycle from adult to adult may take from 21 days up to several years under arid conditions not found in the Southeast. Length of the life cycle is dependent on temperature and host plant availability. Optimal developmental temperature is about 70 ^{0}F, with no development occurring below 35 ^{0}F or above 80 ^{0}F. Drought-breaking rains germinate volunteer wheat and trigger increased emergence of adults to lay eggs on the newly available host plants. Conversely, drought suppresses emergence and reduces survival of any subsequent eggs and larvae.

In the South Carolina Coastal Plain there can be up to five generations or broods per year. The annual life history is illustrated in Figure 2. The months of June, July, and August are spent inside the dark brown puparium in wheat stubble of the previous crop. The first fall brood occurs in September, on volunteer wheat. Pupation begins in August and the adults begin to emerge during the first week of September and lay eggs on volunteer wheat germinated from the previous crop. A second fall brood attacks volunteer and planted wheat in October and early November. This can be followed by a winter brood spread out through December, January, and February. The fourth brood occurs in March and April, and a partial fifth (second spring generation) can occur in May. This second spring brood primarily attacks less mature secondary tillers which contribute little to yield.

Exceptionally mild winters increase survival of the winter generation, leading to greater infestation from the first spring brood. There can also be some minor egg laying and larval development on volunteer wheat in the summer as shown in Figure 2. In the Piedmont there is often no winter brood and only one spring brood, for a total of three per year.

Damage and Diagnosis

Damage occurs from the maggot rasping and feeding on plant juices. This not only robs plant nutrients, but also has a toxic effect on the plant. Small tillers are permanently stunted or killed. When seedlings are attacked by the fall brood, the entire plant may be killed, resulting in severe stand loss.

Tillers infested during jointing may form small, poorly filled heads. When larvae attack higher nodes, straw strength is weakened, resulting in lodging.

Symptoms such as stunted and dead tillers, stand loss, small or deformed heads, uneven plant height and maturity, or lodged stems indicate the possibility of Hessian fly damage.

The problem is easy to diagnose. Uproot suspect plants and examine the dead or stunted tillers by peeling all the leaf sheaths away from the stem, all the way down to their point of attachment. This is below the soil line on tillers that have not yet jointed. The white maggots or brown seed-like puparia are always located at the feeding site above the attachment point of the leaf sheath to the stem. On lodged stems look for the insect just above the node where the stem broke. If maggots or puparia can not be found, Hessian fly is not the cause of the problem. Even after the adult emerges, the tell-tale brown pupal case remains behind in a depression on the stem.

Symptoms of Hessian fly damage can include weak stands, dead tillers, stunted, erratic head height, and lodging. Photo: JWC

Management

Control Stubble and Volunteer Wheat

The increasing use of reduced tillage systems makes cultural control of Hessian fly less feasible. Nevertheless, burial of wheat stubble and volunteer wheat is highly effective where it can be used. Burning straw by itself does not provide adequate control, since many of the puparia are located below the soil line. Thorough burial of infested stubble is necessary to prevent fly emergence the following fall. Volunteer wheat in fallow fields and wildlife strips should also be buried. Early planted rye for grazing can also serve as a fly nursery for adjacent wheat.

Planting Date

There is no “fly-free” planting date in S. C., however earlier planting increases Hessian fly risk. For overall agronomic performance, the optimal wheat planting interval is between 15 Nov. and 1 Dec in the southern S. C. Coastal Plain and about two weeks earlier in the northern Coastal Plain or Piedmont. Even though December planted wheat has less Hessian fly risk, delayed planting is not a practical control option in S.

C. It makes little sense to deliberately reduce yield potential to avoid a possible yield reduction from Hessian fly. However, avoid planting before the recommended interval to reduce the risk from Hessian fly, aphids / barley yellow dwarf, and spring freeze injury. Consider planting more susceptible varieties later in the recommended planting interval when feasible.

Variety Resistance

Varietal resistance is the ideal control option for Hessian fly. Some wheat varieties can chemically recognize the digestive enzymes of the small maggot when it first begins feeding and block the activity of these enzymes. In effect the maggot starves before it can injure the plant. Many different sources or genes for resistance have been identified.

Likewise, many different races of Hessian fly have been determined according to their ability to survive on a combination of resistant genes. At least nine races of Hessian fly have been identified in South Carolina. The frequency of these different fly races in any field population determines how well a variety with a given source of resistance will tolerate exposure to that population of Hessian fly.

See the latest version of the Wheat Cheat Sheet for varieties that have resistance or partial resistance in South Carolina.

Chemical Control

Previously effective in-furrow organophosphate insecticides are no longer labeled for use on wheat. Gaucho or Cruiser seed treatments can suppress Hessian fly and prevent severe fall infestation.

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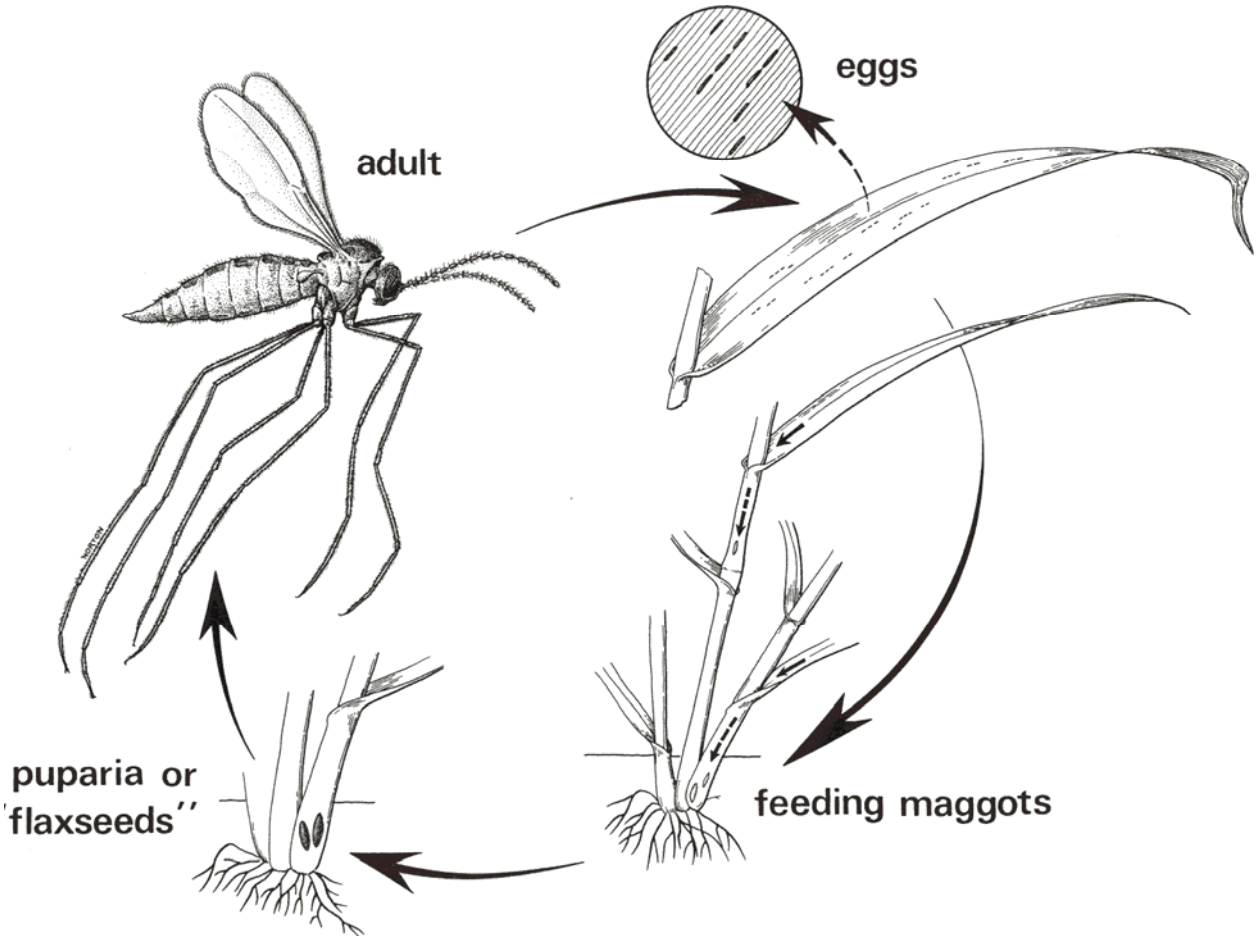

Fig. 1 Hessian Fly Life Cycle. Red eggs are laid along parallel grooves on upper surface of new leaves. The larvae (maggots) hatch and crawl down between leaf sheath and stem to where leaf attaches at node. Maggots feed on plant juices, turn white as they grow, then develop in a brown pupal case sometimes referred to as a "flax seed". The fly emerges from the brown pupal case, mates and lays eggs of another generation. The feeding sites are all below ground until after wheat joints in March.

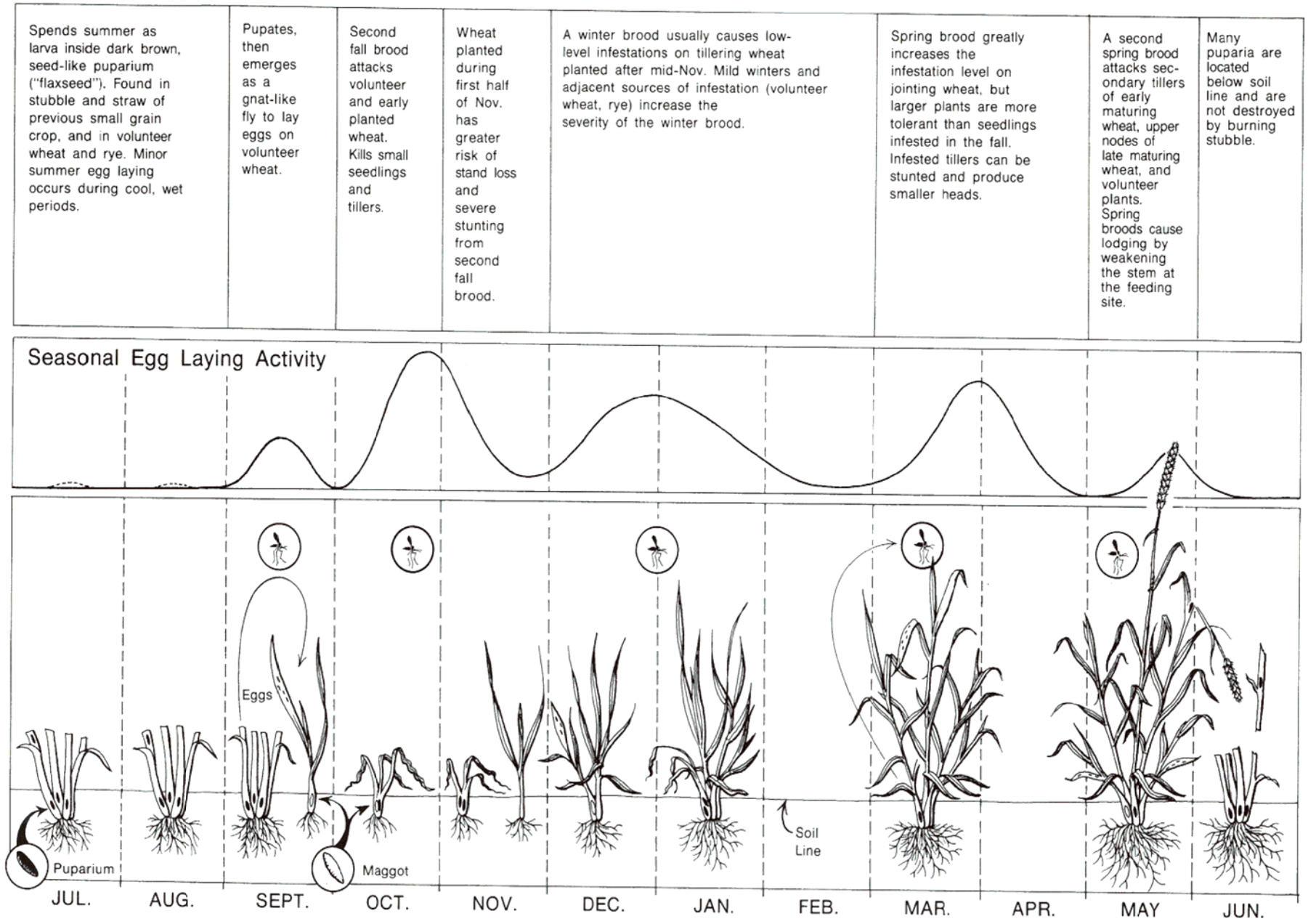

Fig. 2 Hessian Fly Egg Laying Cycles in the Southern Coastal Plain of South Carolina. Hessian fly spends the summer on wheat stubble inside a brown seed-like pupal case. Flies emerging in the fall can severely stunt or kill early planted wheat. In warm winters wheat can be infested by eggs laid in Dec. – Jan. Jointed wheat is then reinfested by a spring generation of eggs laid in Mar. – Apr.