INSECT PESTS OF MISSOURI WHEAT

Several aphid species can be found infesting wheat plants in Missouri fields. The greenbug is the most important as it has the potential to cause severe damage when populations of this aphid increase to outbreak levels. Depending on the aphid species present, injury to wheat can result from the sucking of sap by large numbers of aphids, injection of a toxic saliva that discolors and destroys tissue or by transmission of the barley yellow dwarf virus (BYDV). The greenbug can cause damage to wheat through all of these actions. Other aphids of lesser importance found inhabiting wheat plants include the bird cherry-oat aphid, English grain aphid and corn leaf aphid (see Appendix).

Figure 52. Greenbugs.

Figure 53. Aphid colony on wheat leaf.

Greenbug

Schizaphis graminum (Rondani)

Family Aphididae

Quick identification: Pale green to greenish yellow aphid with a darker green internal stripe running the length of its back (Figures 52 and 54). Cornicles are tipped in black and point toward the tip of the abdomen.

Status: Occasional pest. Greenbug outbreaks often occur after a mild winter followed by a cool spring.

Distribution: Statewide

Damage: The greenbug is the most destructive aphid that attacks wheat in Missouri. Host plants include wheat, oats and several species of wild and cultivated grasses. Greenbug outbreaks generally begin in states south of Missouri and move northward on prevailing winds in the spring of the year. Greenbug populations often develop during periods of cool weather when development of natural enemies and parasites is slowed. Greenbug injury to wheat may result from the sucking of plant sap by large numbers of aphids, by injection of a toxic saliva that discolors and destroys plant tissues or by transmission of the barley yellow dwarf virus. Aphid colonies may be found on upper and lower leaf surfaces and will generally increase in numbers as the crop develops grain (Figure 53). Injection of toxins during feeding by greenbugs may result in necrotic spots on leaf tissue. Other aphids frequently found on wheat do not cause this type of damage.

Pest description and life cycle: Greenbugs are about 1/16 inch long when mature. They are light green in color with a dark green stripe running down the center of their backs. The eyes and antennae are black with the antennae length being greater than half the length of the body. Legs and cornicles ("tailpipes") are pale green and tipped in black. Greenbugs feed and reproduce by giving birth to living young throughout the year. In more northern states, greenbugs overwinter in the egg stage and wingless females emerge in the spring. Within about two weeks of emerging, females begin to give birth and produce approximately 50 to 60 female young over a one-month period. Several generations of females are produced up until fall, when winged females and males both are produced, mate and lay overwintering eggs. Several generations are produced each year.

Scouting/Economic damage: Scout for greenbugs by examining 20 plants in five locations within the field. Greenbug colonies often develop on lower plant leaves, so inspect this area of plants first. Treatment is generally recommended if an average of 50 or more greenbugs are found per linear foot of row on small plants in the fall, or when 100 or more greenbugs are present per linear foot in the early spring before plants joint or when wheat foliage becomes discolored.

Control: In addition to insecticides, insect predators and parasites may greatly reduce numbers of this pest.

Figure 54. Greenbugs.

Bird cherry-oat aphid
***Rhopalosiphum padi* (L.)**

This aphid is most easily identified by its olive green to olive gray body color with a reddish orange area surrounding the base of the cornicles. The reddish orange coloring may fade under cool conditions. Antennae are black and more than half as long as the aphid body. Legs and cornicles are tipped in black. Bird cherry-oat aphids are common in Missouri wheat statewide but rarely require control. This aphid is an efficient vector of barley yellow dwarf virus.

English grain aphid
***Sitobion avenae* (Fabricius)**

The English grain aphid is most often found on developing heads of wheat during the spring. Body color is light to dark green, and antennae are more than half as long as the body. Cornicles are longer than those of most other aphids and solid black in color. Although it feeds directly on the heads of maturing grain and may cause shriveled kernels and yield reductions, ladybird beetle and other predators generally keep populations below economic levels and minimize impact. This aphid can be a vector of barley yellow dwarf virus.

Corn leaf aphid
***Rhopalosiphum maidis* (Fitch)**

This dark green to black aphid is a common pest of corn, sorghum and some weed species in Missouri but only occasionally infests wheat. When infestations occur in wheat, aphid colonies often develop in protected locations such as plant leaf sheaths, whorls and heads. Although capable of transmitting barley yellow dwarf virus, it is not considered an important Missouri wheat pest.

Figure 57. Armyworm feeding damage in wheat field with defoliation of plants.

Figure 58. Armyworm feeding damage in wheat field with defoliation of plants.

Armyworm (True)
***Pseudaletia unipuncta* (Haworth)**
Family Noctuidae

Quick identification: The best identifying characteristic of larvae is the presence of a dark band on the outer side and a dark tip on the inner side of each insect proleg.

Status: Common pest of wheat, fescue seed fields and grass pastures.

Distribution: Statewide

Host crops: Wheat, corn, milo, oat, barley, rye, tall fescue and many other grass species.

Timing: Damage may occur from late April through late June.

Figure 55 (left) and **Figure 56** (right). Armyworm feeding damage on wheat foliage.

Damage: Every few years the true armyworm is a serious pest in Missouri although noneconomic infestations are present in most years. During pest outbreaks, armyworm larvae can destroy grass vegetation over many hundreds of acres. Outbreaks often occur during cold, wet springs that reduce parasite populations. Damage usually starts at field margins, where worms migrate into fields as "armies" from another crop. Because small larvae hide from sunlight, initial feeding occurs on lower leaf tissue and moves upward as larvae mature (Figures 55-59). Economic damage in wheat usually results from larvae feeding on the flag leaf. In addition, severe yield loss occurs when larvae clip wheat heads from plants. Outbreak populations of this pest clip wheat heads in some years but not others. The "trigger" to initiate wheat head clipping is unknown. Small armyworms are usually found in plant debris near the soil surface during daylight hours before moving upward on plants to feed at night or on overcast days. Larvae spend greater amounts of time feeding on upper plant tissues and flag leaves as larvae approach maturity.

Disease transmission: None

Pest description and life cycle: The tan-gray moths have wingspans of about 1½ inches and can be most easily identified by the presence of a small white dot in the center of each forewing (Figure 60). Like many other species of cutworms, the true armyworm moths migrate into the state on prevailing winds and storm fronts during early spring. In some years, armyworm larvae may overwinter in Missouri. In either situation, these

nocturnal moths lay egg masses on leaf blades and sheaths at night. About a week after eggs are laid, larvae emerge and begin feeding on host plants. Mature larvae may grow to 1½ inches in length and are nearly hairless and smooth. Larvae are greenish brown in color and typically have alternating dark and light stripes with two orange stripes located on each side of the body (Figures 61-63). Each proleg has a dark band on its outer side and a dark tip on the inner side, and the tan head is covered with dark lines. Large numbers of larvae can quickly consume wheat vegetation and are forced to move to new fields to feed. The name armyworm comes from the way larvae move to new sites as a group or "army" of larvae. The first generation of larvae usually is responsible for most wheat damage. There may be three generations of this pest produced in northern states and numerous generations in southern states.

Scouting/Economic thresholds: Small larvae are nocturnal feeders, whereas larger larvae spend more time feeding on wheat foliage and heads during the day. Scouting for this pest is done by examining three linear feet of row in five or more areas. Check plants for feeding on the edge of leaves when larvae are small or for the presence of feeding on the flag leaf or head cutting when larvae are approaching maturity. Treatment is justified when there is an average of six or more ¾- to 1¼-inch long nonparasitized larvae present per linear foot of row or before head clipping is noted. If a square foot measure is taken, the threshold is reached when an average of four or more nonparasitized half-grown or larger larvae per square foot are present, or before 2-3 percent of the heads are clipped from stems. To determine if larvae are parasitized, look for small white egg or eggshells of parasites attached behind the heads of armyworm larvae.

Figure 59. Almost complete defoliation of plants from armyworm feeding.

Control: Several insecticides are labeled for control of armyworm in wheat. In addition, parasites, insect predators, various diseases and several other organisms help keep the armyworm under control in small grains. The effectiveness of these natural control agents is reduced during cool, wet springs and during growing seasons that follow drought years.

Figure 60. Armyworm moth with small white dot in the center of each forewing.

Figure 61. Armyworm larva on the ground in a wheat field.

Figure 62. Armyworm larvae on the ground in a wheat field.

Figure 63. Armyworm larva on a wheat head. The black bands on the prolegs help identify this insect.

Cereal leaf beetle (CLB)
Oulema melanopus (L.)
Family Chrysomelidae

Quick identification: "Sluglike" larvae appear brown in color because of a covering of fecal material spread over their bodies (Figure 64). Removal of the covering reveals pale yellow larvae with brown heads and feet (Figure 65). Small larvae are usually found on the upper side of leaf surfaces, especially the flag leaf.

Status: Occasional pest of cereal grain crops, especially oats and wheat.

Timing: Economic damage may occur from pre-boot through grain fill when larvae feed on flag leaf of wheat or foliage of oats. Often a pest in years lacking heavy spring rains.

Distribution: Statewide

The cereal leaf beetle is native to Europe and was first found in Michigan in 1962. Within 10 years, it expanded its range and appeared in the St. Louis area in 1972. In the mid-1980s, this pest expanded its range throughout Missouri.

Host crops: Although oat and wheat are preferred hosts, this insect feeds on many cereal grains and grasses, including barley, rye, corn, timothy, reeds canarygrass, quackgrass and some ornamental grasses.

Damage: Larval feeding on flag leaves may result in economic damage of wheat, although both adults and larvae feed on plant tissues. Adult beetles chew holes through plant leaves but rarely cause economic damage. Larvae feed on the flag leaf by removing the green layer from the upper leaf surface while moving up and down the length of the leaf. The translucent lower leaf surface is left intact and produces a "window pane" type of damage, which is seen as long strips of translucent leaf tissue running parallel to leaf veins (Figures 64, 66 and 67). The tips of damaged leaves often turn white and dry, producing a "frosted" appearance in heavily damaged fields. Because the flag leaf converts much of the energy needed for grain production, damage to the flag leaf may result in substantial yield loss.

Disease transmission: None in wheat but may vector maize chlorotic mottle virus (MCMV), resulting in lethal necrosis of corn.

Pest description and life cycle: Adults are slender, 3⁄16 inch long beetles with metallic blue wing covers and head and reddish orange prothorax (neck region) and legs (Figure 68). Adult beetles overwinter in woods and field borders and move into wheat fields in early spring to feed and lay eggs. Larvae emerge in about five days, depending on temperature, and begin feeding. Larvae are yellow but appear brown in the field because their bodies are covered in fecal material, which helps repel parasites and predators (Figure 64). Removing this fecal covering will reveal pale yellow larvae with brown heads and feet (Figure 65). Larvae typically feed for about 10 days and then move to the upper two inches of soil to pupate. Adults emerge in about three weeks and briefly feed before entering summer diapause. In the fall, beetles move to overwintering sites. One generation is produced annually.

Scouting/Economic thresholds: Scouting is best accomplished by examining 20 plants each at five locations randomly selected in the field. The economic threshold is based on the average number of tillers or flag leaves infested by cereal leaf beetle larvae. If an average of one or more larva is present per wheat tiller or flag leaf, the economic threshold has been reached and implementation of control measures is justified. Yield reductions of up to 30 percent may result if flag leaves are severely damaged by larval feeding.

Control: Cereal leaf beetle infestations occur in most years in Missouri, but they typically do not reach economic threshold levels. In many cases, heavy spring rains cause significant larval

Figure 64. Cereal leaf beetle larvae and feeding damage on wheat flag leaf.

Figure 65. Pale yellow cereal leaf beetle larva with fecal covering scrapped to the side.

Figure 66. Cereal leaf beetle feeding damage on wheat leaf.

Figure 67. Cereal leaf beetle feeding damage on wheat leaf.

mortality when larvae are washed from host plants. Occasionally, wheat and oat fields will require an insecticide application, but damage to corn and other host plants is minimal. Several insecticides are labeled for control of this pest. Natural enemies such as egg and larval parasites may help reduce cereal leaf beetle numbers, although their impact on pest populations are thought to be minimal at this time. Predatory insects, including several lady beetle species and a fungal pathogen, are important natural enemies of cereal leaf beetle larvae.

Hessian fly
Mayetiola destructor (Say)
Family Cecidomyiidae

Quick identification: Legless small white maggots found feeding on leaf sheath tissue of wheat crown at or just below the soil surface (Figure 69).

Status: Occasional pest of wheat and cereal grains in Missouri. An important worldwide pest introduced into the United States in straw bedding used by Hessian mercenary troops during the Revolutionary War. Hessian fly was first reported in Missouri in 1870.

Distribution: Statewide

Host crops: Mainly wheat but to a lesser extent rye, barley and several species of grasses.

Damage: Winter wheat is most often damaged by the fall (second) generation of this pest in Missouri. Damage results when maggots emerge in early September to feed on newly emerged wheat; feeding may continue through mid-October. Maggots feed on the base of leaf sheaths, resulting in weakened plants that fail to tiller properly and may die during the winter. (Figures 70 and 71). If damaged plants survive the winter, they may produce reduced yields or be barren of grain the following spring. The maggots produced by the spring (first) generation of Hessian fly are usually heavily parasitized and cause minimal reductions in grain yield.

Disease transmission: None

Pest description and life cycle: The Hessian fly adult is less than ⅛ inch long and resembles a small mosquito or midge (Figure 72). Adults emerge during April (first generation) to use their 2-3 day life cycles to mate and lay eggs on wheat plants. Maggots feed at the first and

Figure 70. Thin stand with weakened plants from Hessian fly damage.

Figure 71. Field trial showing difference in damage from Hessian fly between resistant (on left) and susceptible (on right) wheat varieties.

Figure 68. Cereal leaf beetle adult on wheat head.

Figure 69. Hessian fly maggots on wheat crown.

Figure 72. Hessian fly adult on wheat plant.

Figure 73. Overwintering puparia or flaxseeds of Hessian fly on wheat.

Figure 74. Yellow-green, parallel edged streaks on leaves from wheat streak mosaic vectored by wheat curl mite.

Figure 75. Yellowing and drying of leaves from wheat curl mite feeding damage and wheat streak mosaic vectored by the wheat curl mite.

second nodes of developing wheat plants for 4-6 weeks. They then change into puparia and remain in this stage until August and September when adult flies emerge and lay eggs for the fall (second) generation. Maggots emerge from eggs in 3-10 days and begin feeding at the base of leave sheaths. They feed by rasping leaf surfaces and sucking up plant juices oozing from the wounds. Feeding continues for 4-6 weeks after which Hessian flies overwinter as full-grown maggots inside puparia that resemble the seed of flax (Figure 73). The overwintering puparia are often referred to as "flaxseed." In the spring, pupation is completed and adult flies emerge to become the first of two generations produced annually.

Scouting/Economic thresholds: Scouting for the presence of Hessian fly is best accomplished by examining the base of the leaf sheath and the first and second nodes of several plants at several locations in the field. Look for the presence of maggots or puparia. Areas of reduced wheat stands and the presence of stunted plants may indicate a Hessian fly infestation.

Control/Timing: Hessian fly populations are difficult to manage with “rescue” insecticide applications. Management of this pest is best achieved by cultural methods of pest management that prevent the development of economic infestations of the Hessian fly. Cultural methods include destruction of wheat stubble and volunteer wheat throughout summer and fall months; planting of pest-resistant wheat varieties; and planting winter wheat after the fly-free date, when Hessian fly adults die in late summer. Fly-free planting dates range from Sept. 28 in northern Missouri to Oct. 16 in southeastern counties (Figure 2). After the fly-free date, adult Hessian flies are no longer present to lay eggs on emerging wheat plants. In addition to cultural control methods, several species of parasitic wasps provide some control of Hessian fly, especially the spring generation of this pest.

Wheat curl mite
Eriophyes tulipae keifer (Acari)
Family Eriophyidae

Quick identification: Tiny, white, cigar-shaped mite with four forward-directed legs located near the head. Difficult to see with the naked eye, as mites are about 1/100 inch long.

Status: Occasional pest of wheat and cereal grains in Missouri.

Distribution: Statewide

Host crops: Mainly wheat but to a lesser extent proso millet, corn, Canada wild rye and a few species of weedy grasses.

Damage: Plants infested with wheat curl mites are normally stunted with mottled and streaked leaves. Streaks on leaves are characterized by discontinuous, yellow-green streaks possessing parallel sides and may be a result of wheat curl mite damage or wheat steak mosaic (Figure 74). Infested leaves remain erect with lateral margins of leaves curled (rolled) inward toward their midribs. Infested leaves may have a dry or desiccated appearance.

Disease transmission: Wheat streak mosaic virus (WSMV) is thought to be transmitted only by the wheat curl mite (Figure 75).

Pest description and life cycle: This microscopic plant-feeding pest goes through the life stages of egg, two larval stages and adult. This mite is capable of producing a new generation every 7-10 days when temperatures range between 75 to 85 F. During the winter, this mite can survive freezing temperatures for several months. Normal summer temperatures and mild winters favor mite reproduction, whereas harsh winters and hot dry summers hinder reproduction. Eggs are laid in rows along leaf veins. Emerging larvae feed between leaf veins, generally on terminal leaves. Mites rapidly mature and reproduce during summer months, but they also may reproduce during periods of warm, winter weather. All life stages can be found on wheat and perennial grasses throughout most months of the year. Mites are wingless but often crawl to wheat heads, where they are picked up by the wind and transported to new locations. Mites may be moved several miles when winds reach or exceed 15 mph and temperatures are mild.

Scouting/Economic thresholds/Control: Scouting for wheat curl mites is difficult because of their microscopic size. Stunted plants, curled leaves and leaf streak injury are characteristics of wheat curl mite damage. Economic thresholds for curl mite in wheat have not been developed. Management of this pest using foliar acaricides traditionally has been difficult to achieve. Recommended management options include late planting of wheat; elimination of volunteer wheat and alternate host grasses around field borders; and use of resistant wheat varieties.