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Printed 11/06

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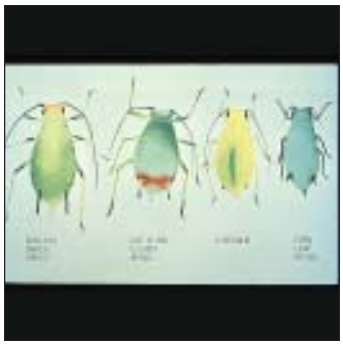

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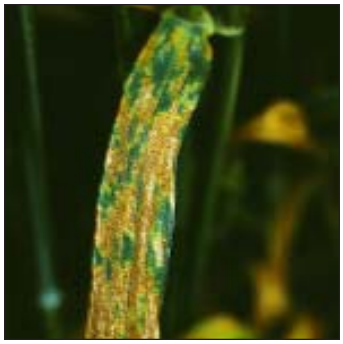

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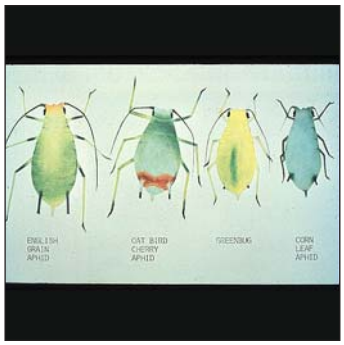
Life Cycles and Scouting Suggestions

John L. Wedberg

During most years and in most locations, these crops do not have economic populations of pest insects. Of all the potential pests mentioned below, the armyworm is of the most concern on a yearly basis.

Aphids



Description

The English grain aphid, bird-cherry oat aphid and greenbug are our most common species; adult aphids are approximately 1/16 - inch long. Winged and wingless forms may be found on the same plant, and it is possible to find all three species in the same field. The English grain aphid usually is dark green, but can be yellow or pink with a brown head. There is often a dusky dorsal patch on the abdomen. The long cornicles (two small tubes extending back from the rear of the abdomen) and antennae are entirely black.

The bird-cherry oat aphid, is mottled yellowish or olive green to greenish black. Often there are reddish patches around the bases of the cornicles. The antennae are entirely black, but the legs and cornicles are green with black tips.

The greenbug, the least common of the three species, are pale green with a darker green stripe down the middle of the back. The legs and cornicles are also green, except for the tips which are usually black.

Life cycle

For aphids to survive winter in northern latitudes they must be capable of producing eggs in the fall. Both the bird-cherry oat aphid and the English grain aphid do this and they are believed to overwinter in Wisconsin. During the rest of the year they exist as parthenogenetic females. That is, they give birth to living young without fertilization. The greenbug, does not produce eggs under our conditions and is not believed to overwinter here. Our infestations originate from winged migrants from southern states.

Aphids are very prolific and a single female usually gives birth to 10-30 offspring, which doesn't sound dramatic until one realizes that generations may overlap. The first-born of an individual may mature and begin reproduction while its mother is still bearing young. Under optimal growing conditions, a 20-fold population increase in one week is not uncommon.

Damage

Aphids damage small grains by sucking sap and transmitting Barley Yellow Dwarf Mosaic Virus (BYDV) while feeding. Although (BYDV) is not widespread in Wisconsin during most years it is capable of being a serious problem during years with an early arrival of spring that is accompanied by reinforcement of our overwintering populations with winged virus carrying migrants from southern states.

The greenbug injects a toxin chemical while feeding that causes enxymatic destruction of cell walls which leads to chlorosis (reddening and yellowing) and eventually necrosis (browning) of leaf tissue.

BYDV is a persistent aphid-transmitted virus. As the name implies, it attacks barley but can also infect wheat and oats. In oats the disease is called oat red leaf because of the characteristic symptoms. The plants eventually turn various shades of yellow-red, orange-red or reddish-brown. Plants are stunted if infection takes place early and spikelets are blasted. Root development is also reduced. Yields may be reduced 50 percent or more. Of our small grains, most of the damage is found in oats.

These aphids can also reduce yields even in the absence of the virus. Seedlings are the most susceptible to injury, which may result in plant loss, stunting and delayed maturity. Injury to older plants causes stunting and reduced kernel size and quality. As the plants mature, the English grain aphid exhibits the tendency to move to the head of the plant.

Scouting suggestions

Examine the number of aphids per plant by sampling plants in 10 areas of each field. Separate the aphids as to species because the economic thresholds will vary.

Economic thresholds

There are no thresholds for disease control because it is basically impossible to control BYDV by insecticidal means. However in terms of direct plant damage caused by aphid feeding the following treatment thresholds are suggested:

Growth stage	Bird-Cherry Oat Aphid English Grain Aphid	Greenbug
Seedling	30 aphids per stem	20 aphids/stem
Boot to heading	50 aphids per stem	30 aphids/stem

Armyworm

Description

Fully grown larvae are approximately two inches long, are greenish to nearly black, and usually have a prominent pale stripe along each side and a thin pale stripe down the center of the back. As larvae grow larger they become more voracious and damage seems to appear almost overnight.

The adult is a rather nondescript buff moths with a wingspread of about 1-1/2 inches and a small white spot in the center of each forewing. The female lays eggs on the leaves of grasses in groups of up to 500. The female also folds the leaf and cements the edges of the leaf over the cluster of eggs with a sticky secretion. Eggs are most frequently laid in dense stands of grasses and in lodged areas of small grain fields.

Life cycle

Moths appear as early as April either from a dispersal from southern states or possibly form overwintering pupae or adults. These early moths deposit eggs on grass blades and an early generation of larvae matures and pupates without apparent damage to small grain. Moths emerge from these pupae and begin to fly in late June and early July and it is the resulting larvae that cause our problems in small grain crops. In early July, armyworms feed on grassy weeds and small grain leaves; they frequently will clip the stem just below the grain head as the crop nears maturity. Armyworms will move from field to field when numerous; hence the name “armyworm”. When mature, the worms enter the soil and change into a pupae. This produces moths that start a third generation which is of no consequence to small grain production.

Damage

Although defoliation can result in reduced yields the real threat to production results from the clipped heads.

Scouting suggestions

To guard against severe losses, check several areas of each field carefully. Check thick, lodged areas first because armyworm moths prefer dense, lush stands of vegetation for egg laying. Shake several plants vigorously and check the soil surface, under plant debris, and under soil clods for the presence of larvae. If you find no larvae in these denser areas the odds are good that there are no heavy infestations in the rest of the field. On the other hand, if you do find larvae in these potential trouble spots it is necessary to carefully search the rest of the field. This process requires careful searching because early damage is hard to detect and the nocturnal feeding habits of the armyworm itself makes it hard to detect. When the armyworms decide to “march” they become very obvious because of their numbers and because this will occur at anytime during day or night. Numbers can also be so great that their crushed bodies make highways slippery.

Remember that small armyworms are hard to locate and look nothing like the fully-grown larvae. Small armyworms are white to pale green, have a definite dark head, three pair of small ‘true’ legs just behind the head, and 5 pair of fleshy legs (called prolegs) near the rear of their bodies. Until they are about one-half grown, the armyworms will move with a “looping” motion.

There is a species of sawfly whose coloration is almost identical to that of a fully grown armyworm. You will find them on the leaves during the day, which is not typical behavior for armyworms, and they will always have 6 or more pairs of abdominal prolegs (small, unsegmented, fleshly and leg-like appendages) along the abdomen, just behind the three pairs of “true” legs. Armyworms have 4 pairs of abdominal prolegs and one pair on the anal segment. This sawfly larva is not a threat to any of our small grain crops.

Economic thresholds

Examine the soil between two rows at several points in the field and determine the number of armyworms per square foot. When the population reaches 3 larvae per square foot, an insecticide application is justified.

Cereal Leaf Beetle

Description

First identified in Michigan and Indiana in 1962, it was detected in Walworth County, Wisconsin in 1971. Although it is uncommon in Wisconsin and has not reached economic proportions, it is advisable for field scouts to routinely check for its presence.

The adult is an attractive 3/16 inch long beetle that has a reddish-orange thorax and blue body. Eggs are readily seen on small grain foliage. They are 1/10 inch long and yellow in color when newly deposited, and are either laid singly or in short chains on the upper surface of grain crops. Lady beetle eggs are about the same size and color but they stand on end. Larvae are yellow grubs, and usually are covered with their own dark fecal material.

Life cycle

Adults overwinter in hollow grain stubble and weed stems, in corn debris and under tree bark. Survival is best among individuals located below the snow line. When spring temperatures exceed 60 °F, the adults moves to wild grasses, then to winter grains and finally oats. Eggs are laid on the leaf blade and hatch in approximately five days. Larvae require another 10 days for development. Pupation takes place in the soil and adult emergence approximately 20 days later. These adults feed briefly on corn and other foliage but then go into diapause (physiological arrestment) from July until the following spring. There is only one generation each year.

Damage

Both adults and larvae can damage small grain foliage. The adults make longitudinal slits between the veins, and completely through the leaf, while larvae eat only the outer surface of leaves. A damaged field has a silver cast and appears frosted. Peak larval feeding may be expected in early June in southern Wisconsin, if we ever develop economic infestations. High populations can kill a small grain stand.

Economic thresholds

Because we have had no economic infestations in the past there are no thresholds set for Wisconsin. However, Michigan State University offers the following suggestion to determine when spraying is needed:

1. Grain has not reached boot stage and there is a total of three or more eggs and larvae per stem, or
2. Grain is heading and there is one or more larvae per flag leaf.

Wireworms

Description

These larval insects are copper colored and wire-like. When fully grown they are approximately one inch long. Adults are dark colored beetles commonly known as click beetles.

Life cycle

Many species have a four-year life cycle. Eggs are laid in the soil of grassy fields during June and the resulting larvae feed on grass roots. They move below the frost line during winter and return to the soil surface the next spring. Two more winters are passed in the larval stage and finally in the fourth summer the insects pass through a pupal stage to become adults. This stage passes the fourth winter.

Damage

Oats is the only small grain attacked by wireworms and this is only in the Spencer-Alamena soil of west-central Wisconsin. This soil has a hardpan at approximately nine inches and the surface soil tends to remain wet. Wireworms tend to be attracted to such soil for egg laying. When an infested field is plowed and seeded, the wireworms move into the row and attack the underground portions of seedling plant stems. This attack becomes apparent with the presence of dying and dead plant tops at scattered sites within a field.

Scouting suggestions

Because there are no control methods, scouting is of questionable value. Fortunately, damage to small grains has been limited in recent years.

Economic thresholds

None established. Growers will observe the larvae while plowing and these infestations are often spotty. As many as 48 wireworms per square foot have been noted near Marshfield.

Wheat and Barley Disease Management

Wisconsin was a major wheat producing state in the 1800's. However, wheat gave way to corn and forages and Wisconsin's dairy industry. However, in recent years, wheat has made a modest comeback, especially in eastern Wisconsin. Wheat diseases are definitely a major production problem. Diseases such as leaf rust, powdery mildew, loose smut, take-all and barley yellow dwarf are recognized as potential problems. Septoria leaf blotch is becoming more of a factor as the intensity of wheat production increases. Winter wheat makes up most of Wisconsin's wheat crop, but spring wheat is grown in northwestern Wisconsin.

Barley is not a major field crop in Wisconsin. However, disease problems do occur on the few acres that are planted in Wisconsin. Similar diseases develop in barley as those in wheat. Symptoms, disease cycles and controls are identical in most cases.

Table 1. Wheat Diseases at Growth Stages.

Disease	Initial Seedling	Culm tillering	Boot formation	stage	Heading	Mature
Seedling blights	3	2	1	0	0	0
Septoria spot blotch	1	1	2	3	3	3
Powdery mildew	1	2	2	3	3	3
Barley Yellow dwarf	1	2	3	3	3	3
Stem rust	1	1	2	3	3	3
Leaf rust	1	1	2	3	3	3
Scab	0	0	0	0	2	3
Loose smut	0	0	0	1	3	3
Bunt	0	0	1	3	3	3
Take-all	0	1	2	3	3	3

Probability of incidence and/or severity:
0=none
1=low
2=moderate
3=high

[a]Caused by Fusarium, Helminthosporium, and Pythium. Rust

Leaf rust and stem rust

Leaf rust and stem rust are two separate diseases of wheat. Leaf rust is caused by the fungus *Puccinia recondita* f. sp. tritici which only infects wheat. Stem rust is caused by the fungus *Puccinia graminis* f. sp. tritici. The wheat stem rust fungus is a specialized strain that only infects wheat. However, symptoms are similar to stem rust of other small grains.

Symptoms

Leaf rust is recognized by oval pustules which are orange and primarily are located on the leaves. Pustules of stem rust are cinnamon to brick red, more elongated and more commonly are observed on stems and leaf sheaths.

Disease cycle

Spores of both the leaf rust and stem rust fungus are carried to Wisconsin by wind each year. Both fungi survive on winter wheat in Texas and Mexico during the winter months. Once inoculum arrives, moderate air temperatures and prolonged leaf wettness favor infection. Both pathogens produce abundant spores and spread from plant to plant and field to field. The leaf rust fungus can survive on winter wheat plants during the winter months if snow cover is early and continuous.

Control

Most wheat varieties are resistant to prevalent races of the stem rust fungus. However, this is not the situation for leaf rust.

Early planting spring wheat can result in avoiding problems with leaf rust and stem rust. Both fungi do not readily survive in Wisconsin because their alternate hosts are rare.

Foliar fungicides are registered for rust control.

Loose Smut of Wheat

Loose smut is caused by the fungus *Ustilago tritici*. Loose smut is always a threat to wheat production in Wisconsin. The smut fungus completely replaces all the grain in individual heads with its spores. Thus, yield loss is directly related to the percentage of diseased heads.

Symptoms

Loose smut symptoms are obvious after the heads emerge. Diseased heads are black as the grain is replaced with the black spores of the smut fungus. The spores are dislodged and eventually only a bare stalk remains of what should have been a normal appearing head problems do occur on the few acres that are planted in Wisconsin.

vegetative growth that is attractive to aphids. BYD can be avoided by planting winter wheat after mid-September in northern Wisconsin and late September in southern Wisconsin. 3) Aphid control with insecticides is available. However, this is an added expense. The cultural practices mentioned above provide a more practical control strategy.

Barley Yellow Dwarf of Wheat

Barley yellow dwarf of wheat is caused by the barley yellow dwarf virus. This is the same virus that infects oats and causes red leaf. BYD is more of a problem on winter than spring wheat. Different problems arise because winter wheat is planted in the fall.

Symptoms

For most varieties, leaves will turn yellow, usually starting at the tips. Some reddening may occur, but not as intensely as in oats. Good leaf symptoms develop if warm temperatures prevail. Plants may be stunted and plants exhibit a stiff, erect habit of the upper leaves. Leaves may also exhibit a long tapered appearance. Symptoms of BYD may be confused with yellowing caused by cool soil temperatures and nitrogen deficiency.

Disease Cycle

BYDV is transmitted by aphids. Winter wheat is very prone for infection if aphids are active after planting in fall and vegetative growth is attractive to aphids. Aphids that acquire the virus from other hosts and move into winter wheat fields in the fall. Grasses and oats are believed to be main sources of the virus, but corn is a symptomless host and can serve as an additional source of the virus.

Control:

1) Wheat varieties with moderate degree of resistance to BYDV are available. 2) Early planted spring wheat can avoid BYD problems like the situation for oats. However, winter wheat that is planted in late August or early September is very prone to BYD problems. Virus infected aphids may be active well into September. If winter wheat is planted early, the crop may sustain enough vegetative growth that is attractive to aphids. BYD can be avoided by planting winter wheat after mid September in northern Wisconsin and late September in southern Wisconsin. 3) Aphid control with insecticides is available. However, this is an added expense. The cultural practices mentioned above provide a more practical control strategy.

Head Blight or Scab of Wheat

Scab of wheat is manifested by the premature death or blighting of spikelets. The disease occurs on all small grains, but is most serious on wheat and barley. Significant yield losses result from floret sterility and poor seed development. The scab fungus may also infect other plant parts. Thus, damage to heads may coincide with root or leaf infection or associated with seedling blights when seed from scabby plants are planted in subsequent years.

Symptoms

Scab is caused by the fungus Fusarium graminearum and is best recognized on emerged immature heads that are still green in color. Infected spikelets on the entire head may prematurely bleach. Small black structures called perithecia eventually become evident on blackened tissues. Pink to salmon orange mycelium can be observed at the base of individual spikelets. Infected seed may be shriveled or appear normal.

Grain from scabby plants is usually less palatable by livestock and often contains mycotoxins produced by the scab fungus. The mycotoxin, zearalonone (F2) and vomitoxin frequently contaminate scabby grain. The scab fungus ceases to produce mycotoxins in storage if the grain moisture content is below 20%.

Disease Cycle

The scab fungus survives on colonized wheat or corn debris. The scab fungus causes root rot, stalk rot and ear rot of corn. Thus, scab can be more of a problem when wheat is planted after corn or after wheat or barley. The scab fungus is commonly found in the soil, thus crop rotation is not always an effective control practice. Most wheat crops are unavoidably exposed to spores of the scab fungus. Infection occurs during moist warm weather. Blight symptoms develop within 3 days after infection when temperatures range from 75-85°F and moisture is continuous. Excessive wheat or corn debris left on the soil surface will increase the inoculum of the scab fungus and enhances the probability of severe scab development.

Control

No highly-resistant wheat varieties are available, but small differences in susceptibility may exist.

Although the scab fungus is ubiquitous, crop rotations that avoid corn or small grains preceding the wheat crop can suppress scab development. Conventional tillage to bury crop residues is also recommended because the fungus survives best on the surface debris.

Septoria Leaf Blotch

Septoria Leaf Blotch is caused by the fungus *Septoria tritici*. The disease is very prevalent in Wisconsin and is capable of causing a 30% reduction in yield.

Symptoms

Small, light green-to-yellow spots on the leaves and sheaths enlarge and merge to form irregular, tan-to-reddish-brown blotches with gray-brown to ash-colored centers often partly surrounded by a yellow margin. Black specks (pycnidia) form in older lesions or at stem nodes. Affected leaves often turn yellow, wither and die early.

Disease cycle

The fungus survives in living and dead wheat plants and in seed. Infections in the fall can serve as a major source of inoculum in the following spring. Spores are disseminated to new foliage by wind and rain. Disease development is favored by moderate air temperatures and prolonged leaf wetness.

Control

1) Wheat varieties differ in susceptibility. 2) Crop rotation offers some control. If wheat is planted in fields that were cropped to wheat the previous year, deep incorporation of wheat residues offers some control. 3) Apply foliar fungicides at the boot stage to protect the flag leaf of plants.

Powdery Mildew

Powdery Mildew is caused by the fungus Erysiphe graminis f. sp. tritici. The disease is common in Wisconsin, but lacks the destructive potential like that of leaf rust and Septoria leaf blotch.

Symptoms

White-to-light gray, powdery patches form on the leaves, sheathes, stems and floral bracts. Black, speck-sized cleistothecia form in the mildew growth as the crop matures. Spores are produced in cleistothecia that serve as primary inoculum the following year. When severe, infected leaves wither and die early. Mildew can develop on wheat heads and is an indication that significant yield loss will likely occur.

Disease cycle

The fungus overseasons on living and dead plants. Spores are produced and spread to leaves. Infection is favored by cool and moist conditions. Periods of hot and dry weather are very suppressive for the disease. Spores are readily produced and disseminated during favorable conditions resulting in sudden and severe outbreaks of the disease.

Control

1) Wheat varieties differ in susceptibility. 2) Apply foliar fungicides if the disease is present on lower leaves and the plants or reaching the boot stage.

Fungicides for Control of Foliar Diseases of Wheat

Septoria leaf blotch, powdery mildew and leaf rust are potentially damaging leaf diseases of wheat and especially for winter wheat. Resistant varieties or cultural practices are not always available or practical to control foliar diseases of wheat. Currently, three fungicides are registered for wheat for the control of foliar disease. However, it is often difficult to determine whether fungicides are needed or when to apply these fungicides. The following discussion hopefully provides some guidelines for the determination of their use. However, fundamental research is needed in order to fine tune fungicide recommendations for the control of leaf diseases of wheat.

Fungicides should be used in conjunction with other management practices designed to maximize wheat yields. Soil fertility, high performance varieties and control of other diseases and pests must be addressed. If factors other than fungal leaf diseases have not been controlled, then fungicide application would not be economically feasible.

Most foliar diseases do not reduce wheat yields unless the flag leaf (leaf below head) is diseased. Thus, a fungicide program is designed to keep the flag leaf healthy. For most fungicides, application may be delayed until the flag leaf forms, but before heading.