Greenbug, *Schizaphis graminum* (Homoptera: Aphididae)

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Identification

Greenbugs are small, pale green aphids with a dark green line down the back and antennae as long as the body (Fig. 1). On plants, they are usually found feeding on the undersides of lower leaves (Fig. 2). Greenbug damage, whether on wheat or sorghum, begins as yellow spots that soon turn reddish and coalesce into large, chlorotic patches. Problems in seedling wheat are often noticeable as yellowish or reddish-brown patches in the field where infested plants are dying.

Life History and Behavior

The greenbug infests a wide range of graminaceous plants, both weeds and crops. This aphid reproduces asexually year-round as far north as Oklahoma, although in more northern latitudes it will produce sexual forms in the fall that, in turn, produce eggs that

overwinter. However, the greenbug can be considered a warm season aphid that does not survive Kansas winters as well as the Russian wheat aphid. Currently, many spring infestations in Kansas wheat, and many summer infestations in sorghum, appear to be initiated by winged migrants arriving on the wind from more southern regions. In addition, the potential exists for greenbugs to overwinter within wheat fields, either by continued asexual reproduction during warm, dry winters, or in the egg form. The greenbug can tolerate warmer weather better than most other cereal aphids, although it does not survive temperatures above 95 °F (35 °C) and will cease reproduction before this temperature is reached. Nevertheless, populations can thrive at ambient temperatures above 100 °F by taking advantage of the cooler microclimate under the canopy of large sorghum plants, especially in irrigated fields where soil temperatures are reduced by evaporative cooling.

Under suitable conditions, the growth rate of greenbug colonies can be dramatic, with populations doubling every few days. Colonies that escape biological control can reach 100,000's of aphids per leaf on a large sorghum plant. This is possible because all individuals are parthenogenetic females that are literally 'born pregnant' with embryos already developing inside them. An entire generation can be completed in 8 or 9 days. The saliva of the greenbug has enzymatic activity that breaks down plant cell walls and chloroplasts, eventually killing the plant. As the plant declines in quality, the immature aphids begin developing into alates, (winged migrants) that disperse to infest other plants.

Management

Over the past decade, widespread greenbug outbreaks have largely disappeared from Kansas, however isolated infestations do occur, particularly in southern portions of the state. Although causal relationships are difficult to establish, changing agricultural practices are thought to play a role in diminishing the economic impact of the greenbug on the High Plains, particularly the widespread adoption of 'no-till' practices and the reduced irrigation of wheat and sorghum fields to the south. The net result is that fewer winged migrants arrive to colonize these crops in Kansas and natural biological control is normally sufficient to keep populations below economic thresholds. Consequently, when greenbugs are detected, it is important to note both the extent of the infestation and the numbers of natural enemies present. These include a number of lady beetle species, especially the convergent lady beetle, *Hippodamia convergens*, and the seven-spotted lady beetle, *Coccinella septempunctata*. Other important natural enemies contributing to greenbug control include predaceous larvae of green lacewings (Neuroptera: Chrysopidae) and hover flies (Diptera: Syrphidae) and the parasitic wasp *Lysiphlebus testaceipes*. Detailed information on these insects is available in the publication Biological Control of Insect Pests of Field Crops in Kansas.

Wheat. The greenbug has been a pest of wheat in Kansas for over 100 years. Although originally described from wheat in Italy, its region of origin remains a mystery. Greenbug populations in wheat are often expressed as the number of insects per row foot for convenience in sampling, but it is more meaningful to consider numbers of insects per plant, giving consideration to the density of the stand, the size of the plants, and their

overall condition. Thus, 50 greenbugs per row foot (or 2 – 3 greenbugs per tiller) is considered damaging in a thin stand of seedling wheat with fewer than 3 tillers per plant, whereas the damage threshold for 3-6 inch wheat with 3 or more tillers per plant is 100-300 greenbugs per row foot (10 – 30 per tiller). Drought-stressed or weakened plants are more susceptible, whereas healthy, vigorously growing plants can tolerate more aphids. For plants taller than 6 inches, the damage threshold rises to 300-500 greenbugs per row foot (30 – 50 per tiller).

Because seedling wheat is most susceptible to greenbug damage, vigilance following wheat emergence in early fall is recommended. Treatment should be applied as soon as possible if damaging levels are encountered, unless large numbers of beneficial insects are active. When 10-15% of aphids are parasitized (look for brown, dried aphid 'mummies' adhering to leaves, Fig. 3), the population is typically in decline and treatment is not warranted.

Cold temperatures normally prevent damaging populations from developing during winter months, unless there is a prolonged warm spell. However, populations can expand rapidly in spring as wheat breaks dormancy and enters a period of rapid growth. The emergence of natural enemies, especially lady beetles, is normally well synchronized with aphid population development at this time of year, although exceptions may occur, such as when there is a cold snap in late spring. If low temperatures persist for even a few days, this tends to impede natural enemy effectiveness to a much greater extent than it retards aphid population growth. Cool weather also prolongs the period required to mature the grain, extending the period during which plants are vulnerable to greenbug damage.

Greenbug resistance is no longer a breeding priority for wheat in Kansas and older wheat cultivars expressing greenbug resistance (e.g. TAM 110) no longer express adequate resistance to stripe rust and other important wheat diseases. Please refer to the current K-State Research and Extension Wheat Insect Management guide for materials currently registered for greenbug control, along with their application rates and preharvest intervals.

Sorghum. Greenbugs were first discovered attacking sorghum in 1916, but did not become a major problem on this crop until 1968, when biotype C was recognized. Other novel greenbug biotypes have evolved over the years – strains of the aphid able to overcome particular resistance genes in crop cultivars. Those currently present Kansas are mostly biotype E, I and K and are only distinguished by the reactions they produce on different sorghum lines; wheat responds similarly to these three biotypes.

In the past, frequent insecticide use led to the evolution of insecticide resistance in some greenbug populations. Current levels of insecticide resistance are much lower due to the adoption of integrated management tactics with less reliance on chemicals. Insecticide resistance is independent of greenbug virulence to particular sorghum cultivars, the criteria used to distinguish biotypes C through K. Most new sorghum cultivars are still screened for resistance to biotype I, so greenbug resistant hybrids remain one tactic for reducing risk of yield loss. However, growers should be mindful that resistance to greenbug works by reducing aphid growth and reproduction, and that this in turn permits natural enemies more time to eliminate aphid colonies before they become so large that they escape control.

Sorghum reacts strongly to greenbug saliva, developing reddish brown patches on the leaves (Fig. 4). Plants are susceptible to infestation at all growth stages, but problem infestations more often develop on large, established plants than on seedlings. Various factors may contribute to this effect. With fewer greenbugs leaving wheat fields in recent years, and less migration from southern latitudes, fewer colonies are initiated on sorghum in early growth stages. Colony establishment is difficult for greenbugs colonizing small sorghum plants as these provide little physical protection from high temperatures and pounding rains that can be major sources of aphid mortality. Finally, most sorghum seed is now treated with either imidacloprid or thiamethoxam, systemic insecticides that are effective in protecting seedlings against damage by a wide variety of insect pests, including greenbug. Planting treated seed is a wise choice wherever greenbugs or chinch bugs are a problem and is a tactic compatible with biological control because beneficial insects are not directly exposed to the insecticide. No till cultivation also encourages biological control and reduces rates of aphids settling on plants by reducing their color contrast with bare soil.

It is also important to distinguish greenbugs from corn leaf aphids that frequently colonize sorghum in the whorl stage, usually disappearing by the time panicles emerge. Corn leaf aphids are larger, more blue-green in color, and infest the interior of the whorl rather than the undersides of leaves. They normally do not cause chlorosis or harm the plant apart from removal of some photosynthate, but they do serve to attract large numbers of aphid natural enemies. Thirty years of data from Texas indicate that greenbugs do not reach economic threshold in sorghum as long as corn leaf aphid populations peak prior to the boot stage. Typically, ladybeetles, lacewings and parasitoids are all able to complete a generation feeding on corn leaf aphids, amplifying their numbers prior to the peak summer flight of greenbugs. Thus, it is important that corn leaf aphids are not mistaken for greenbugs as any chemical treatment applied against them could disrupt this cycle of biological control.

Foliar insecticide applications should only be used as rescue treatments when greenbugs escape biological control. Treatment decisions should be based on counts of aphids on a series of 25 plants. Treatment thresholds vary according to plant size and range from 25 aphids per plant at the seedling stage to 1000 aphids per plant at late whorl stage. Consult the current K-State Research and Extension Sorghum Insect Management Guide for detailed information on thresholds and treatment options.

Author: J.P. Michaud
Assistant Professor of Entomology
Agricultural Research Center-Hays

Kansas State University Agricultural Experiment Station and Cooperative Extension Service