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G89-936 Russian Wheat Aphid

Gary L. Hein
University of Nebraska - Lincoln, ghein1@unl.edu

Frederick P. Baxendale
University of Nebraska - Lincoln, fbaxendale1@unl.edu

John B. Campbell
University of Nebraska - Lincoln, jcampbell1@unl.edu

Arthur F. Hagen
University of Nebraska - Lincoln

James A. Kalisch
University of Nebraska - Lincoln, jkalisch1@unl.edu

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Russian Wheat Aphid

The Russian wheat aphid is a serious insect threat to small grains. Its description, damage and control are discussed here.

Gary L. Hein, Extension Entomologist
Frederick P. Baxendale, Extension Entomologist
John B. Campbell, Extension Entomologist
Arthur F. Hagen, Extension Entomologist
James A. Kalisch, Extension Technologist

The Russian wheat aphid (RWA) is a serious insect threat to wheat and other small grains. Growers should examine small grain fields regularly for this pest throughout the fall. In the spring, weekly examinations are needed from the time wheat resumes growth through the late heading stages.

Farmers are encouraged to collect samples of unknown aphids on small grains and have them identified by the Cooperative Extension Service. Proper identification of the aphid is critical in determining the need for insecticidal controls. Even a relatively few RWA may justify treatment costs.

Russian Wheat Aphid, *Diuraphis noxia* (Mordw.)

The Russian wheat aphid first was detected in central Mexico in 1981. The first U.S. collection was in the Texas Panhandle in March 1986. That summer, damaging infestations were observed in wheat and barley fields in New Mexico, Kansas, Oklahoma and Colorado.

The RWA was discovered in Nebraska in the fall of 1986 in volunteer wheat and winter barley in Kimball

and Banner counties. By July 1987, all Panhandle and several southwest counties of Nebraska had confirmed infestations. Infestations in the fall of 1987 and in the spring of 1988 generally were light, although severe aphid infestations occurred in localized areas in the Panhandle where the aphids overwintered. In other areas the aphid was present in the fall but did not survive the winter.

The RWA is expected to be a continuing threat to Nebraska wheat and barley production. The extent of the problem each year will vary greatly and will depend on several factors.

Infestations will be most severe where the aphid is able to overwinter and produce spring infestations, or oversummer and produce fall infestations. Infestations may be initiated or increased by an influx of migrating aphids from other areas.

Several environmental factors influence overwintering, oversummering and migration. As yet we cannot predict these events, so growers must be familiar with the damage and appearance of the aphid and with the management options for the RWA.

Description

The Russian wheat aphid is small (less than 1/10 inch) and greenish to grayish-green. Identification should be made with the aid of at least a 10X magnifier. Several characteristics are important in identification *(Figures 1 and 2)*.

The shape of the insect is distinctive. The RWA is more elongate (spindle-shaped) than other aphids, which are teardrop-shaped. The antennae are short less than half the length of the body. The cornicles ("tail-pipes"), which are obvious on most other aphids, are very short (as wide as long) on the RWA. Viewed from the side, the cauda and the supracaudal process appear to make up a "double tail." This double tail is not conspicuous on winged RWA.

These characteristics, in combination, distinguish the RWA from other common aphids found in small grains.

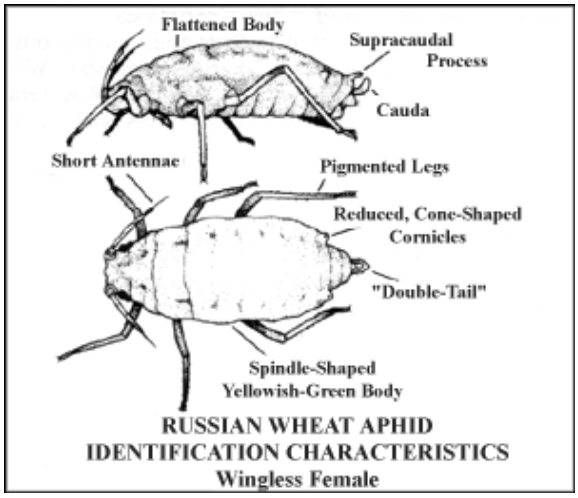

Figure 1. Russian wheat aphid identification characteristics wingless female

Life History of the Russian Wheat Aphid

Aphids are soft-bodied insects that suck sap from a wide variety of plants. There are several reasons aphids, including the RWA, become serious pests.

Nearly all aphid species have a tremendous ability to reproduce, enabling rapid population increases and causing a rapid progression of crop damage. Several of the major aphid pest species migrate from areas where conditions are less favorable for survival to areas that may be more favorable.

Low numbers of aphids can cause significant crop losses if they transmit plant virus diseases. Some species of aphids cause extensive plant tissue destruction through the injection of salivary secretions.

Aphids are characterized by their ability to reproduce either sexually or asexually (parthenogenesis). While some species deposit eggs, others, like the RWA, retain their eggs inside the female, and she "gives birth" to living young.

Figure 2. Russian wheat aphid adult wingless female

In many species of aphids, males are present only in the fall when a sexual generation of aphids results in the production of eggs able to overwinter. No RWA males have been found in the United States, and apparently eggs are not necessary for RWA overwintering.

Because the adult female is able to overwinter, those areas where females are present in the fall are more susceptible to early spring damage because infestations begin earlier and at a higher level. The overwintering conditions the RWA tolerates are not known.

The RWA can overwinter in Nebraska in certain situations, but the extent of the overwintering may vary considerably from year to year.

Aphid development is determined by temperature. The maximum reproductive potential for the RWA occurs from 60-70^{o}F. At these temperatures adults can live nearly a month and produce an average of 1.5 young (nymphs) per day. An individual female may produce up to four nymphs per day. The nymphs develop into reproducing adults in about 10 (70^{o}F) to 16 (60^{o}F) days.

Warmer temperatures speed development and reproduction, but shorten the adult life span. Conversely, cooler temperatures, down to about 40^{o}F, slow development and reproduction, but lengthen the life span. Temperatures below 40^{o}F nearly stop reproduction and development.

A major factor in the severity of the RWA as a pest in Nebraska is the insect's ability to migrate. Two types of adult aphids□wingless and winged□are found in many RWA colonies. With many species of aphids, winged forms often are produced when the quality of the host plant declines. The reasons for RWA flights are not known, but the potential for migrations of RWA into Nebraska exists both in the spring (April-June) and in the fall (August-November).

Extensive efforts to demonstrate the transmission of the viral strains present in the United States indicate the RWA is not a vector of the strains of barley yellow dwarf virus found in the country, and the RWA is a poor vector of brome mosaic virus. Currently, disease transmission by the RWA is not a major concern.

Feeding Habits and Damage

Typically, the RWA initiates feeding at the base of the leaves near the top of the plant. As the colony develops, the leaf edges begin to roll inward, enclosing the aphids in a tubular, protective structure. This protection makes the RWA less accessible to natural enemies and insecticidal sprays.

As a result of salivary toxins injected as the aphids feed, plants become purplish and leaves develop longitudinal yellowish and whitish streaks *(Figure 3)*. Tillers of heavily infested plants often run parallel to the ground, giving them a prostrate appearance.

Aphids feeding in the fall move from the leaves to the more protected area in the crown during cooler periods. As feeding conditions become more favorable, they again move up to the leaves to feed. As a result, aphids may be difficult to find on infested plants, and all the leaves or tillers that show symptoms may not be infested.

In the spring, as wheat stems begin to elongate, the insects move upward to infest the new leaves. Eventually the aphids reach the flag leaf, causing it to roll and "trap" the emerging head and awns. The "trapped" head then curls, resulting in poor pollination *(Figure 4)*. These curled heads resemble heads damaged by 2,4-D or wheat curl mites.

Plants may be killed by heavy infestations of RWA. Yield losses can result from stand reductions during fall and early spring infestations. Severely infested plants will have reduced vigor, will be less able to compete with weeds, and will be more susceptible to winterkill or other environmental stresses.

Figure 3. Russian wheat aphid damage to winter wheat leaves

The most significant late-spring yield losses occur when RWA damages and curls the flag leaf. If the heads are able to emerge, the aphids move up into the heads and continue feeding. This late feeding on the heads may result in reduced grain quality (i.e. test weight).

Under heavy infestations, severe yield reductions of up to 100 percent can result. Grain test weights can be reduced to only 20 percent of normal.

Figure 4. "Trapped" heads caused by rolled flag leaf

Host Plants

The Russian wheat aphid is a serious pest of wheat and barley. Limited problems also have been noted in triticale, oats and rye. Other grass crops, such as corn, sorghum and proso millet, so far have proven to be nonhosts for the RWA.

A major concern in managing the RWA is how the aphid "bridges the gap" between small grain harvest and the planting of new winter wheat. The most likely way it passes the summer is on alternate hosts, primarily volunteer wheat.

Many of the grasses planted in the Conservation Reserve Program (CRP) and present in grassland areas provide additional hosts for successful oversummering. Alternate host plants include most of the wheatgrasses, downy brome, jointed goatgrass, wild rye, and several other grasses (mostly cool season grasses).

Russian Wheat Aphid Management

Since this pest is a relatively new arrival, we have limited information on appropriate management tactics. However, there are several strategies to reduce the potential for infestations.

Because it is present in wheat fields, the most probable oversummering host of RWA is volunteer wheat. Volunteer wheat can serve as a RWA nursery for aphids that will infest the newly planted wheat. Volunteer wheat should be controlled for at least two to three weeks before planting.

Another potential source of RWA oversummering is late-planted spring grains used as cover crops for CRP plantings or forages. If small grains or other potential host vegetation are present through August, adjacent winter wheat is at an increased risk in the fall.

A second recommendation to reduce RWA potential in winter wheat is to avoid early planting. This extends the oversummering period and allows for maximum plant vigor going into the winter. Spring grains should be planted early to allow maximum maturity of the grain before immigrating RWA are likely to arrive.

These two recommendations, controlling volunteer wheat and planting at appropriate times, also reduce the potential for wheat streak mosaic and other diseases.

A final recommendation for improving the RWA situation involves maintaining maximum plant vigor. The maintenance of vigorous growing conditions is important in providing plants that will not be susceptible to damage. Included in this are correct planting date, planting quality seed, proper fertilization, and reducing weed competition.

Healthy plants will not be resistant to RWA, but they will be less affected by its presence.

Scouting for Aphids

Fall infestations can originate from two sources. Aphids may move from adjacent wheat stubble or grass areas into the new plantings. If this is the case, infestations begin building on the edge of the field.

The potential for incoming flights of aphids exists in the fall and spring. Little is known of the factors that influence these flights, so follow a regular scouting program to detect infestations once fields are planted.

The advantages of early detection of aphids are obvious. Damage is minor and control more effective, reducing the potential need for repeat applications.

When fields are examined for RWA, first observe the general condition of the plants in the field. RWA infestations tend to be worse in stressed areas, so these areas should be inspected separately.

The sampling unit should be entire plants for fall infestations, and tillers for spring infestations. Select 20 areas of the field at random, and closely inspect five plants or tillers at each of these sites for aphids. Use a total of at least 100 plants or tillers per field to estimate the infestation of the field. It is extremely important to make an accurate identification of the aphids present, because several less damaging aphids frequent these small grain fields.

Thresholds for Treatment

Infestations arising from aphids oversummering in adjacent grasses or overwintering in particular areas of the field will be isolated *(Figure 5)*. Infestations limited to small areas of the field can be spot treated when the infestation level reaches 10 percent. This leads to longer term control because the population is limited, the plants are less stressed, and natural enemies are not killed in untreated areas of the field, and are able to recolonize treated areas.

If the infestation is limited to a few spots or the field borders and the entire field is sprayed, a good deal of money will be wasted. Infestations up to 50 percent in these isolated spots

may be needed to make treatment of the entire field economical. This depends on the relative size of the infested areas.

Infestations may arise from an influx of migrating aphids in the fall or spring. These infestations probably will be distributed over the entire field; control should be considered if 10 percent or more of the plants or tillers are infested. Control problems may arise if infestations are left to develop above the threshold.

If extremely high numbers of aphids are present in the curled leaves, it will be difficult to achieve satisfactory control. The few survivors likely under heavy infestations will be able to rapidly recolonize the plant and possibly adjacent plants.

Figure 5. Isolated Russian wheat aphid infestation (yellow area in background) in otherwise healthy field of wither wheat

The economic threshold of 10 percent infestation is not a static figure. It pertains to a situation with average control costs and average market value of the crop.

The threshold in fields expected to be significantly better than 40 bushels/acre probably needs to be below 10 percent because a smaller amount of damage is economically significant. The threshold in more marginal fields with expected yields well below 40 bushels/acre is well above 10 percent because a larger amount of damage is needed to reach a point where losses are economic. Therefore, the threshold for treatment may range from about 5-30 percent.

Economic infestations should be controlled in the fall to ensure a healthy stand of wheat entering the winter. Spring control should be aimed at enabling plants to produce a healthy flag leaf not infested or rolled by RWA.

If the plants are free of aphids during the flag leaf and early heading stages, it is unlikely significant numbers will develop during the heading stages. If sub-threshold population levels are present at the time of heading, the buildup of aphids should be followed through the early dough stages. After early dough it is unlikely that damage would be severe enough to warrant treatments.

Insecticide Control Measures

Insecticides for Russian wheat aphid control can be used under the generic "aphid" labeling for small grains. The presence of the RWA probably will result in additional insecticides being labeled for aphid control in small grains. For current aphid control recommendations, consult your local CES office and EC1511, *Insect Management Guide: Alfalfa, Soybeans, Wheat, Range, and Pasture*.

Foliar treatments with systemic insecticides, disulfoton (Di-Syston) and dimethoate (Cygon), appear to be the most effective chemical control. Control insecticides (ethyl and methyl parathion) may provide reasonable control, if aphids are exposed while feeding on the emerged head.

With foliar treatments, several application considerations are important. Thorough plant coverage is important, especially in the spring and early summer when the amount of foliage is the greatest. Use at least two gallons of finished spray per acre to obtain reasonable control by aerial application.

During both the fall and early spring, cool weather can have an adverse effect on the chemical.

With the exception of dimethoate, daytime temperatures should be in the upper 60s and 70s for several hours following application for adequate aphid control. Dimethoate performs adequately when temperatures are in the upper 50s and 60s.

Fall planting-time treatments with granular systemic insecticides are economically questionable and not recommended. Widespread infestations have not occurred frequently enough to warrant the cost of this type of application. **Note:** Insecticide granules may reduce germination when placed in contact with seed. Granules should **NOT** be mixed with the seed, but should be applied using separate granule application equipment.

Resistant Varieties

Research is underway to find varieties resistant to RWA. The best source of resistance, thus far, was found by Colorado researchers in a non-commercial Russian variety of a soft, white winter wheat with few desirable characteristics (i.e. tall, weak-strawed, disease susceptible). It may be several years before this resistance can be incorporated into commercially acceptable varieties. Estimates are that it may be accomplished by the mid-90s.

Natural Control

Several natural control agents, including various species of lady beetles, syrphid fly larvae, and parasitic wasps help reduce RWA populations. However, their relatively low numbers and lack of effectiveness do not enable them to keep RWA populations below the damaging levels. Current research seeks to determine ways to better use these natural controls, and expeditions are underway to find more effective natural enemies in areas of the world where the RWA is native.

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