The Russian Wheat Aphid

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SUMMARY

Since its identification in the United States in early 1986, the Russian wheat aphid (RWA) has rapidly developed into a major aphid pest throughout most of the western wheat production area. The severity of infestation and potential yield loss varies depending upon aphid numbers, wheat variety, environmental conditions, and stage of wheat growth when the aphid attacks.

Symptoms of infestation vary widely, and producers should closely monitor their fields from emergence through heading. The most effective time for chemical control appears to be when 10% of the plants in any field are infested with RWA. This may occur in fall-planted wheat or in early spring when the wheat plant begins to grow rapidly. If aphid numbers and infested plants are not significant during the early season, they may build rapidly during the jointing period, and chemical controls will be necessary. Wheat producers should be aware that this pest will not disappear, and it will continue to do damage until the wheat plant matures. To prevent significant yield losses, the latest stage for chemical control should be just before emergence of the flag leaf, providing aphid numbers have not previously resulted in extreme damage. This pest is so destructive to most small grains it is necessary to emphasize that chemical control is almost always necessary to preserve the yield capacity of the crop. By virtue of their proximity to oversummering locations, dryland wheat may be more vulnerable to aphid infestations in New Mexico than irrigated wheat.

The Russian Wheat Aphid

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The Russian wheat aphid (RWA), *Diuraphis noxia* (Mordwilko ex Kurdijumov, 1913) was first identified as a pest in wheat and barley in Russia during the early 1900s. It spread to wheat-producing areas of Iran, Afghanistan, Turkey, and other countries bordering the Mediterranean. The RWA was identified as a problem in wheat regions of South Africa in 1978. In 1981 it was found in central Mexico and by 1983 it had spread to northern Mexico. In early 1986, samples of aphids from Texas were identified as RWA. Subsequent samples from all over the Western United States proved this new pest was infesting broad areas of wheat production.

Conventional knowledge of this aphid's behavior and biology, coupled with weather patterns, has led to speculation that the aphid arrived in the United States on the unseasonably warm, strong prevailing winds from Mexico during the fall and winter of 1985–86. Records from Texas indicate the RWA was present in south Texas in the spring of 1985.

The RWA is now found throughout much of the western and mid-western wheat production areas of the United States. Their preferred host plants include wheat, barley, and triticale. Oats may also serve as a host. RWA also has a fairly wide host range of grasses belonging to the genus *Bromus*, including rescue grass and downy brome. Other grasses such as Johnsongrass, grammas, jointed goatgrass, wheatgrasses, and barnyard grass may also be infested. This wide range of hosts and the availability of Conservation Reserve Program acreages would seem to ensure RWA survival throughout the wheat belt. There is no evidence that the RWA will infest corn or sorghum plants.

DESCRIPTION

The RWA is a small (approximately $^{1}/_{16}$ inch in length) soft-bodied insect. The body shape is somewhat flattened top to bottom and elongated in shape. Although several morphological characteristics can be used to distinguish the RWA from other wheat feeding aphids (fig. 1), the presence of a supracaudal process above the cauda and the absence of prominent cornicles (tail pipes) are the most distinct characteristics. These can be easily seen in the field with 5–10X magnification. Characteristics for the four most common aphids in New Mexico wheat are illustrated in fig. 2. Because many of our aphids infesting wheat are rarely found to be of economic significance, accurate identification is critical prior to any control decisions.

Both winged and wingless RWA female forms may be found in the field. Although the presence of males has yet to be confirmed in the United States, they have been reported in other parts of the world. The RWA typically oversummers either on alternate host plants or on volunteer wheat. As summer sites become unfavorable, winged RWAs migrate to nearby wheat fields. This migration normally occurs during the months of November through March. When winged females land on suitable host plants, they begin to feed and give birth to live young, which develop rapidly into wingless females. The RWA typically begins producing young 10 days after birth and may live up to 40 days. Each female can produce up to 70 nymphs during her life span. During the growth and development of the wheat plant, young leaves are continually infested. RWA populations increase significantly from March through May in New Mexico wheat fields.

Fig. 1. Russian wheat aphid.

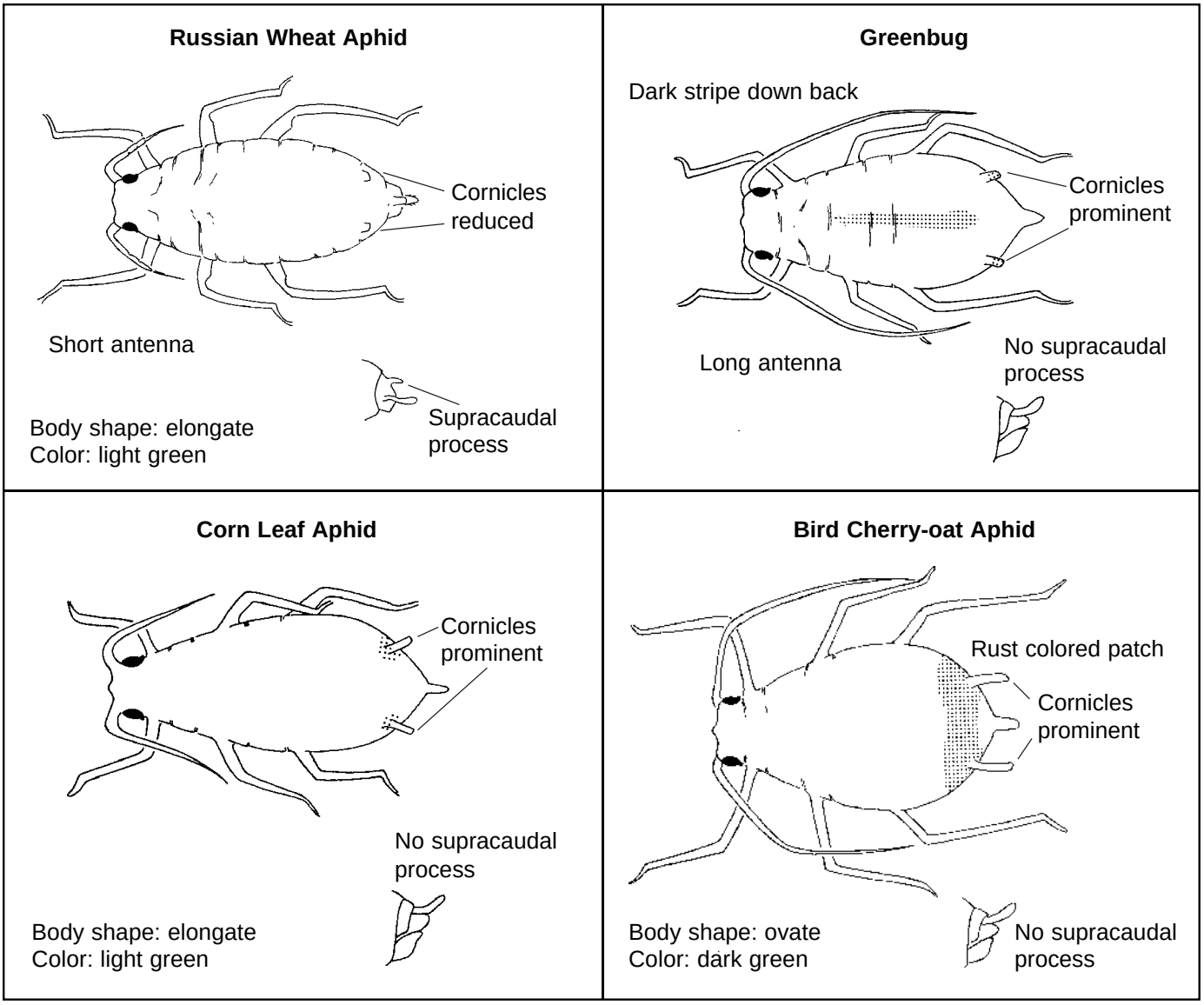

Fig. 2. Common aphids infesting New Mexico wheat. *Drawings by Laura Stacy Booth*

As the wheat crop matures and begins to dry down, winged RWAs migrate back to oversummering sites. This flight period usually occurs from May through July in the southern portion of the state and June and July in the northern regions.

DAMAGE SYMPTOMS

The RWA feeds at the top of wheat plant, in contrast to the greenbug and other aphids that generally feed on the lower leaves. However, recent observations have found greenbugs feeding with the RWA in the upper leaves. Presence of the RWA can be determined by examining the newest leaves of the wheat plant. If RWA are present, they will be found in the tightly rolled new leaves of the plant. In some cases, aphids may be present without noticeable damage symptoms.

RWA causes plant damage by injecting a toxin into the plant that prevents production of chlorophyll. These toxins may give rise to the bright purple discoloration that develops in some wheat varieties.

In describing the damage symptoms caused by the RWA, it is important to note that symptoms will vary depending on the severity of aphid infestation, host plant, variety, environment conditions, and stage of growth and plant condition. Generally, the first noticeable damage symptom will be a slight to moderate yellowing or

discoloration of small areas within the field. As aphid numbers increase, the field will begin to show more yellowing or discoloration with off-color brownish or purple spots. In addition, the field will appear to be under drought stress, even if moisture supplies are adequate. Closer examination of damaged plants will reveal light to bright-colored purple leaves. In some cases, especially where aphid numbers are high, plant leaves will develop white longitudinal streaks (fig. 3). Other symptoms may include moderate to severe leaf rolling, providing a protective environment for the RWA. On some wheat varieties, the RWA may be present without any noticeable symptoms. Depending on the severity of infestation, wheat variety and existing environmental conditions, wheat leaves may begin to die from the tip to the base of the plant. A complex of aphids may be found along with heavily infested wheat leaves (fig. 4). When aphid numbers are high, individual tillers may begin to die (fig. 5).

When the wheat plant begins to joint, damage symptoms become more apparent. The wheat plant becomes stunted, the crown area spreads out along the ground, and a bright purple discoloration develops (fig. 6).

When the wheat plant begins the boot to heading stage, damage symptoms will vary. The flag leaf generally becomes twisted, resulting in an abnormal emergence of the wheat head (fig. 7). By this time, much of the purple discoloration is gone and the wheat heads become bleached and distorted. Damage during this period is significant. Poor emergence and distortion of the head results in little or no pollination, as well as destruction of the flag leaf, which is responsible for up to 70% of the wheat yield potential (fig. 8).

CONTROL

Biological

Beneficial arthropods that normally help suppress other aphid populations have been found to be relatively ineffective in controlling RWA. In response to RWA feeding, the wheat plant rolls its leaves tightly around the feeding aphids. This plant reaction excludes many of our common predators and parasites such as ladybird beetles, lacewings, and spiders. However, research in this area of control continues.

Cultural

A number of cultural practices may help reduce RWA damage to small grains. Wheat fields with poor stands, or stands stressed for fertilizer or water, seem to be more susceptible to aphid damage. Therefore, producers need to pay close attention to seed bed preparation, seeding rate, fertility, and irrigation where available. Control of volunteer wheat, barley or triticale, and other host plants such as rescue grass in and around field margins will reduce RWA aphid populations by eliminating oversummering areas. While some small grain varieties may vary in the symptoms they exhibit from RWA, there are no commercial varieties of wheat, barley, or triticale resistant to RWA damage. Some oat varieties have exhibited minor resistance to the RWA and resistant varieties are being developed. Research efforts continue on developing resistant wheat varieties for commercial use.

Chemical

The use of insecticides remains the most common method of suppressing RWA populations. Several insecticides are registered for control of aphids in small grains. Table 1 lists the most commonly used insecticides applied to wheat for aphid suppression and their recommended dosages. Because RWA migration into New Mexico wheat fields typically occurs three to five months after planting, the use of at-planting insecticides, such as Thimet, is not recommended.

Table 1. Commonly used insecticides for wheat aphid suppression in wheat.

Insecticide	Rate/acre	Grazing interval (days)	Harvest interval (days)
Dimethoate (Cygon 400)	.25-.375 lb/ai	14	60
Di-Syston 8	4–12 oz	Do not graze	30
Parathion*	.25–.75 lb/ai	15	15
Lorsban 4E**	.25–.5 lb/ai	14	28

* Parathion alone is not recommended as an insecticide treatment. Use in mixture with other recommended insecticide is suggested when other aphids such as greenbugs are present.

**Check label for environmental restrictions.

Timing

Yield potential appears to be most affected when plants are infested during the period just before the appearance of the flag leaf and flowering. Plant yield is also affected when infestations occur after jointing and prior to the appearance of the flag leaf. Chemical applications made to wheat prior to jointing are seldom of economic value except in extreme cases where high aphid populations threaten plant vigor. It is recommended that chemical controls should be made at the 10–20% infestation level. Plants are considered to be infested if only one tiller of a plant has RWA. Research has indicated an average of 5% yield loss for every 10% infested plants. Yield potential must be considered before making a management decision.

Fig. 3. Russian wheat aphid damage caused the white longitudinal streaking.

Fig. 4. The wheat leaf is heavily infested with Russian wheat aphids, along with oat-bird cherry aphids.

Fig. 5. A severe Russian wheat aphid infestation resulted in death of individual tillers.

Fig. 6. Russian wheat aphid damage at jointing resulted in bright purple discoloration, spreading crown, and tightly rolled leaves.

Fig. 7. Russian wheat aphid damage at booting to heading resulted in a tightly rolled flag leaf and head distortion.

Fig. 8. Russian wheat aphids on a newly emerged head destroyed the flag leaf and caused the poorly developed head.

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