3 to 4 days and larvae develop over 3 to 4 weeks in normal weather conditions. When the temperature is a constant 80 degrees F, larvae spend an average of 3 days per instar. They pupate in the soil, usually burrowing to a depth of an inch or more before constructing the pupal cell. Pupation lasts 9 to 21 days, with an average of about 13 days.

Damage

The first visible evidence of armyworm damage is "windowpaning" of corn leaves. Small armyworm larvae in the whorl may eat through one or more layers of the rolled leaf, making several holes across the width of the leaf. Later damage will appear as small holes eaten in the leaf or small areas of the leaf edge eaten away. Late-in-star larvae may eat large sections of leaf edges, leaving only the midrib. If there is excessive defoliation, yield will be reduced and stalks will dry prematurely, which can cause lodging.

Armyworm feeding damage.

Corn, small grains, forage crops, and many grass and broadleaf weed species are the preferred hosts. Armyworms are more common in corn grown in reduced tillage or no-till systems, or in cultivated fields where grass weeds are a problem. If armyworms are present when grass weeds in or near corn are killed by cultivation or herbicides, the surviving armyworms will move to the crop. Also, as cereal crops mature, or if they are defoliated by armyworms, the armyworms may migrate in large numbers to nearby corn crops. Large populations of armyworms can completely defoliate a corn crop.

Scouting

Look for armyworm larvae in grass crops and weeds outside the field, and on weeds inside the field. If corn leaves are chewed, determine whether the source of the problem is the true armyworm, fall armyworm, corn earworm, grasshoppers, or some other pest.

Control

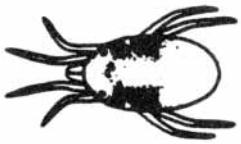
Controlling grass weeds in or around fields and in nearby small grain crops often prevents an armyworm problem. The treatment threshold is when an average of three leaves per corn plant are destroyed by larvae. It is often economical to treat the margins of a declining or devoured corn field in which large numbers of armyworms are present.

Spider Mites

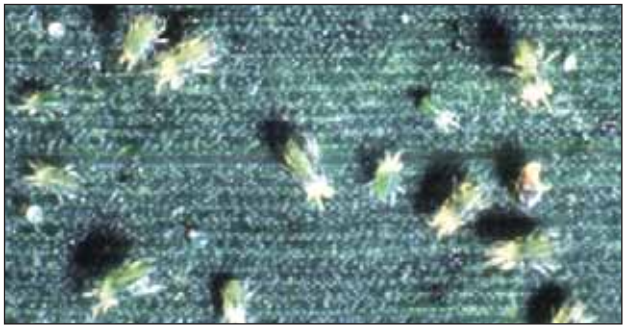
Banks grass mite – *Oligonychus pratensis* (Banks)

Twospotted spider mite – *Tetranychus urticae* Koch

Banks grass mite



Twospotted spider mite



Banks grass mites.

Spider mites are a widespread and serious problem in the High Plains and Rio Grande Valley regions. Although areawide infestations may not reach damaging levels each year, there can be locally damaging infestations yearly. Populations begin to increase early in the growing season, but temperature, rainfall, drought stress, and pesticide applications for other pests affect this pest's significance in a particular year.

Biology

Spider mites are not insects, but they are close relatives. They belong to the Acarina group that also includes ticks. Spider mites are extremely small; the eight-legged adults are barely visible without magnification. Larvae (six legs), protonymphs (eight legs) and deutonymphs (eight legs), the other life stages, are even smaller. A 10X or greater hand lens is necessary to detect spider mites and eggs.

High Plains corn is affected by four spider mite species, but the Banks grass mite (*Oligonychus pratensis* (Banks)) and the twospotted spider mite (*Tetranychus urticae* Koch) are by far the most important. Banks grass mite is usually the most abundant species throughout the season, but twospotted spider mites increase later in the season and can become serious pests, especially if insecticides eliminate beneficial insects after tasseling.

It is critical that the particular mite species be identified before miticides are applied because each may require a different miticide. A product applied to control Banks grass mites might have little or no effect on twospotted mites. The primary way to differentiate between the two species is to examine the outer edges of the body where the dark food sacks appear. In Banks grass mite adults, the food particles extend all the way down both sides of the body. In the twospotted mite, the food particles form dark areas toward the front of the body, and the mites appear to have only two spots when viewed from above.

This identification method works only with adults, and even then it is not always accurate. If a good microscope is available, the two species can be distinguished by looking at the empodium claw on the first segment of the tarsus (foot). The Banks grass mite has an extended, curved empodium claw. The empodium on the twospotted mite is not extended and not curved.

Both species of spider mites produce webbing. It is not very noticeable when colonies are small, but becomes more prominent as larger portions of the leaf are infested. Twospotted spider mites produce more webbing than Banks grass mites.

Banks grass mite colony webbing.

Both mite species move from wheat and noncrop vegetation to corn, usually assisted by wind. It takes only 6 to 10 days for a mite to develop from an egg to an adult. Adult females live an average of 23 days and lay about 45 eggs during this time. Development occurs most rapidly at temperatures of 77 to 98 degrees F and is probably favored by low humidity. Offspring generally stay near the female on the underside of a leaf, and together they form a colony. Colonies remain on lower leaves during the vegetative growth stages of corn and, under the right environmental conditions, move up the plant as the season progresses and damage on lower leaves expands.

Once corn reaches the reproductive stage, mite populations increase more rapidly, possibly because of changes in plant biochemistry at this time. Also, mites are favored by the hot, dry weather that usually coincides with the reproductive stage of corn. Mites develop more quickly on corn suffering moderate drought stress, and more slowly on fully irrigated corn or corn with severe drought stress. Cool, wet weather often reduces mite populations significantly. Fields should be rescouted for mite numbers after such weather.

Damage

Spider mites can damage and kill the leaves of young corn plants, but serious early-season infestations are usually confined to field margins exposed to prevailing winds.

Spider mites suck juices from the plant and kill the plant tissue. It is estimated that a twospotted spider mite can puncture 18 to 22 leaf cells per minute. Small colonies cause oval areas of dead tissue, generally near the midrib on the underside of a leaf. As colonies grow, they spread

out on the leaf, and the area of dead plant cells enlarges. Eventually, mites can cover and kill entire leaves. Lower leaves are usually killed first. If left unchecked, mites will move up the plant killing more leaves. Severely infested plants may have dead leaves even above the ear leaf.

Spider mite feeding alters the chlorophyll content, transpiration and photosynthesis of a leaf. Yield is reduced because dead leaf cells cannot manufacture the carbohydrates needed for grain filling. Banks grass mite and twospotted spider mite do similar amounts of damage at similar densities. Yield can be reduced by as much as 20 percent, even after a producer has incurred the high costs of irrigation and insecticide applications. Heavily infested plants may develop stalk rot later in the season, which can cause harvest losses from lodging. However, studies differ as to whether spider mite damage contributes significantly to stalk rot. Spider mites do not affect yield after corn reaches the dent stage.

Scouting

When mite numbers are low, look for individual colonies near the midrib on the undersides of lower leaves. Rather than look for individual mites, look for the eliptical chlorotic areas that result from their feeding. Also scout for beneficial species that help keep low populations of mites in check. These include thrips (western flower thrips and the six-spotted thrips) at field borders during the early part of the growing season. The spider mite destroyer (*Stethorus punctum*), minute pirate bugs (*Orius* spp.), and predatory spider mite species such as *Neoseiulus fallacies* are known mite predators. Their ability to suppress mite species often declines as the mite population grows rapidly when corn enters the reproductive stage.

If an insecticide, especially a synthetic pyrethroid, is used on the field for any nonmite pest, expect it to kill most of the beneficial species present. If the insecticide is used at tasseling or silking, it will kill beneficial species at precisely the time that mite populations begin their most rapid growth. Scouting should intensify well before tasseling and continue weekly until the dent stage is reached.

With the right weather and water stress conditions, mite colonies will grow to cover more leaf area, making their webbing more apparent. Moderate mite infestations that have killed many of the lower leaves often can be seen from the road. When mites are found, identify the species; it will be important in choosing a miticide.

Texas spider mite treatment thresholds are dynamic and based on plant damage, pesticide costs, and crop value. The thresholds help determine whether a miticide should be applied as soon as possible. The thresholds do not allow one to predict mite populations at some future date based on current field counts. This is important to know because, to be effective, some miticides must be applied well before action thresholds are reached. Current thresholds are not helpful in making this decision.

To use the economic thresholds in Table 9:

Step 1. Estimate the per-acre cost of control and the expected per-acre value of the crop. Then scout several areas of the field and determine the percentage of leaves that are infested by colonies of any size. To do this, look at whole plants and divide the number of mite-infested leaves by the total number of leaves. Check Table 9 for the first number in what looks like a fraction under the

Table 9. Economic injury level for the Banks grass mite and/or twospotted spider mite on corn, based on the percentage of infested leaves per plant/percentage of leaf area damaged.

Control cost ($) per acre	Market value ($) per acre										
	200	250	300	350	400	450	500	550	600	650	700
5	15/8	12/6	10/5	8/5	7/4	7/3	6/3	5/6	5/3	5/2	4/2
10	29/16	24/13	20/10	17/9	15/8	13/7	12/6	11/6	10/5	9/5	8/4
15	44/23	35/19	29/16	25/13	22/12	20/10	18/9	16/9	15/8	14/7	13/7
20	59/31	47/25	39/21	34/18	29/16	26/14	24/13	21/11	20/10	18/10	17/9
25	74/39	59/31	49/26	42/22	37/20	33/17	29/16	27/14	25/13	23/12	21/11

appropriate row (control cost) and column (market value) heading. If your percentage of leaves infested equals or exceeds this number, go to step 2 and determine the percentage of leaf area damaged. If your percentage is lower than this number, continue to monitor the field over time.

Step 2. To determine the percentage of leaf area damaged, look at all the leaves on a plant (damaged and undamaged) and estimate the percentage of the total leaf area that is chlorotic because of mite feeding. Then refer to the second number (the one after the "/" mark) in the appropriate place in Table 9. If your percent leaf area damaged equals or exceeds that number, it is time to treat the field.

Control

It must be understood that Banks grass mites and twospotted spider mites co-exist in fields, and the suggested miticides are not necessarily the same for both species. It is usually difficult to control the more common Banks grass mite, and attempting to do so usually kills beneficial insect and mite species. This often leads to outbreaks of twospotted spider mites, which are extremely difficult to control with any miticide on the market at this time. Growers often give up on fields where twospotted spider mites are the predominant species.

There are three miticides that can be applied early, before populations reach threshold levels. They are hexythiazox (Onager®), spiromesifen (Oberon®), and propargite (Comite®). These products "set back" the growth of colonies by killing the immature stages, but not necessarily adults, although propargite is effective on adults when spray coverage is good. The well-timed use of these products may prevent a far more serious problem later. However, if mite numbers have reached the threshold level, a rescue treatment is in order, and these miticides are not appropriate. Rescue treatments may not be effective, especially since some spider mite populations have developed resistance to organophosphate and pyrethroid insecticides. New miticides may be available soon, so contact your county Extension agent for information on available products.

Corn in the High Plains area frequently reaches the economic threshold for second-generation southwestern corn borer after silking. If an insecticide treatment is needed for southwestern corn borer and mite populations are relatively low, choose a nonpyrethroid insecticide that will not "flare" mite populations. Methoxyfenozide (Intrepid®) and spinosad (Tracer®) are two such products. If, however, mite populations are increasing rapidly, consider tank mixing a miticide with the southwestern corn borer insecticide.

As mentioned above, spider mite populations increase most rapidly when corn is moderately drought stressed and the weather is hot and dry. Corn reaches its peak water demand from silking to grain filling, precisely the time spider mite infestations begin their rapid increase. Adequate irrigation at this time is a good way to both maximize yield and minimize spider mite numbers to the extent possible.

Southwestern Corn Borer

Diatraea grandiosella Dyar

First generation southwestern corn borer larva.

Southwestern corn borer adult.

Biology

Where it occurs, the southwestern corn borer is a major pest of corn that often causes significant yield losses. The adult stage is a dull white to cream-colored moth. Newly emerged moths have faint tan lines along the wing vein margins. As moths age this feature becomes less evident. The palpi at the front of the head protrude forward to give the appearance of a snout. The wingspan is $1^{2}/_{10}$ to $1^{6}/_{10}$ inches. When at rest, the wings are folded roof-like over the abdomen, and the moths measure $^{7}/_{10}$ to $^{9}/_{10}$ inch from the snout to the rear edge of the wing. Males are usually smaller than females.

Eggs are laid singly or in masses. An individual egg is elliptical, measures $^{3}/_{100}$ inch by $^{5}/_{100}$ inch,