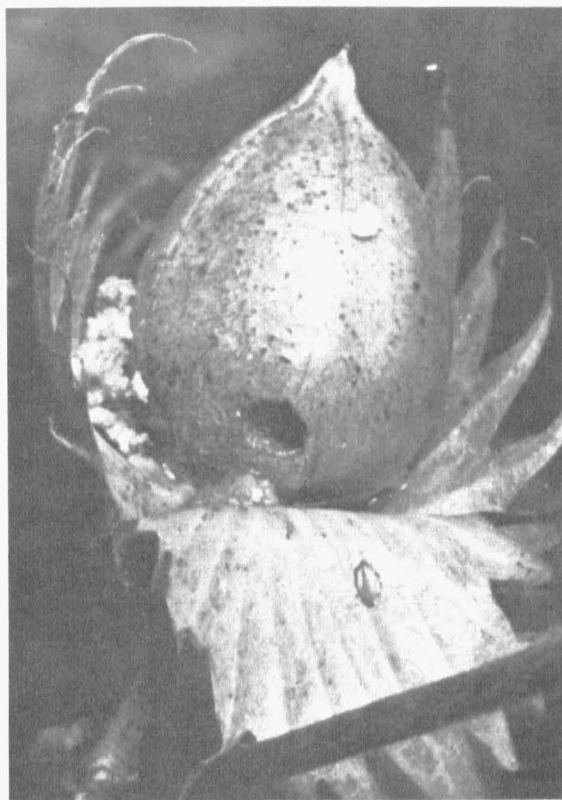


# COTTON INSECTS AND THEIR CONTROL IN MISSOURI

W. R. Enns



Damage by Cotton Bollworm

UNIVERSITY OF MISSOURI      COLLEGE OF AGRICULTURE  
AGRICULTURAL EXPERIMENT STATION

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Cotton Bollworm. This larva is diseased.



Cotton Bollworm in cotton blossom.

# COTTON INSECTS AND THEIR CONTROL IN MISSOURI

W. R. ENNS\*

Cotton growers in Missouri are fortunate in that they usually have few serious insect problems with this crop. At irregular intervals, however, localized or general infestations may develop. At such times, the use of the right insecticides may be highly profitable.

The purpose of this bulletin is to describe briefly the principal pests which attack cotton in Missouri and to indicate the most effective insecticidal control methods.

It should always be borne in mind that insecticides are supplemental to good cultural practices and not substitutes for them. Furthermore, under Missouri conditions, the cost of insecticides and their application may outweigh the yield increases resulting from insect control. It requires good judgment plus careful observation on the degree of infestation in a field to avoid losing money by applying insecticides.

The following discussion is designed to indicate the minimum degree of infestation of a given pest which would make insecticidal control profitable. The insecticides are listed in the order of their preference.

Tests conducted by the Missouri Experiment Station in cooperation with Deering Farms, Incorporated, at Deering, Missouri, in 1949 and 1950 show that a regular program of applying insecticides to cotton *early in the season, late in the season, or all season long, did not pay the cost of the insecticides—not to mention the cost of application.* This program was, of course, applied without regard to the actual presence or absence of an infestation; hence it demonstrated the futility of such a procedure.

On the other hand, in 1950 in one Missouri county alone, where a heavy infestation of cotton leafworm developed in September, the application of insecticides timed to hit the young worms of the second brood saved cotton worth many thousands of dollars. Yet, even in this county, some growers spent money needlessly because infestation of their fields was not serious enough to justify the expenditure.

The identification of the pests infesting cotton is frequently difficult but should be definitely determined before treatment is undertaken. County agents have descriptive literature which will aid in the identification of cotton insects. In case of doubt, specimens should be put in glass vials of alcohol (rubbing alcohol will do), carefully packed, and sent to the Department of Entomology, Columbia, Missouri, for determination. In any case, be sure of the identity of the pest before attempting to poison it.

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\***Acknowledgment.**—The photographs used in this bulletin were contributed by Lee Jenkins, Associate Professor of Entomology.

## CULTURAL CONTROL

Growers are urged to remember that good cultural practices are often the key to producing good cotton without having to cope with insect problems. Such practices include: (1) planting in good soil; (2) carrying out soil fertilizing programs based on soil tests; (3) using disease resistant, prolific, early maturing varieties adapted to the particular area; (4) reasonably early planting; (5) clean cultivation; (6) using cover crops and green manure crops; and (7) rotation of crops.

## PRECAUTIONS IN USING INSECTICIDES

All insecticides are poisons. Insecticides kill not only harmful pests but also beneficial insects, fish and other wildlife. If used carelessly, these poisons may also kill pets, livestock and even humans.

Read the labels on the containers before using any insecticide and follow to the letter the directions for safety in handling it. Be especially careful if the insecticide contains phosphorus or if it is a chlorinated hydrocarbon. Many poisons are readily absorbed through the skin, so avoid contact with poisons on any part of the body.

Use no more than the recommended amount per acre. Many of the newer insecticides are extremely specific; that is, effective against only one pest. Make sure you know your pest and know your insecticide and how to use it. The individual grower cannot afford to experiment with new and untried materials when there are tax-supported institutions whose business it is to test and evaluate poisonous chemicals. If you must try out new insecticides, try them on one or two rows first, and use every precaution possible.

## COTTON PESTS AND THEIR CHEMICAL CONTROLS

1. **Cotton Aphids or Plant Lice.** These are small, soft-bodied, sucking insects, slow-moving, usually green in color but occasionally yellowish to black. Some may have small transparent wings but most of them are wingless. They suck the sap from the leaves and tender parts of the stems of cotton. This results in curling of the leaves, wilting of terminals, and may cause the death of seedlings early in the season. However, greater damage may be done later in the season when heavy attacks by aphids may cause premature shedding of leaves, loss of yield, and reduced grade of cotton because the bolls cannot mature properly.

Aphids secrete a sweet, sticky substance known as honeydew which drops on bolls and leaves, giving them a shiny, varnished appearance. Ants are very fond of honeydew and may often be seen running over aphid-infested plants tending the aphids.

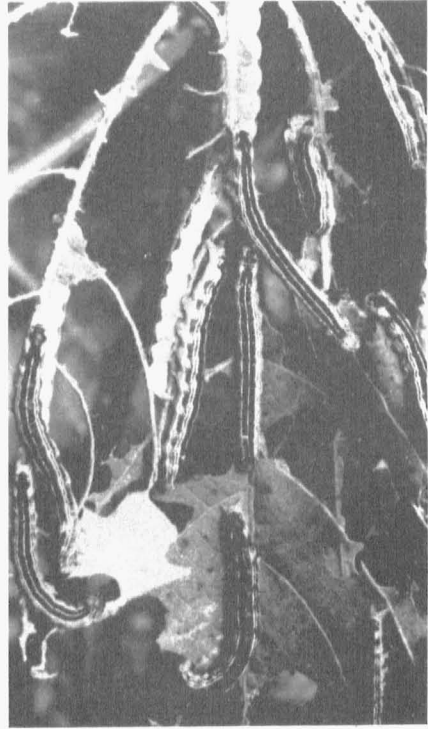
The Cotton Aphid *Aphis gossypii* Glover is also known as the Melon Aphid since it is commonly the principal aphid on melon crops. The Cowpea Aphid *Aphis medicaginis* Koch and the Corn-root Aphid *Anuraphis maidi-*

*radicis* (Forbes) and two or three other species of aphids may also occur on cotton but are of little or no importance in Missouri.

Insecticidal treatments should not be started until curled leaves or honeydew or both are observed throughout the field or concentrated in certain areas of the field. In the latter event, spot treatments will eradicate an infestation before the whole field is involved. Cool, wet seasons are conducive to high aphid populations. Keep cotton and melon fields well separated.



Cotton plant defoliated by Leafworms (Mo., 1950).



Cotton Leafworms, showing gregarious feeding habits.

Insecticides recommended for aphids are:

3% nicotine dust, 10 to 15 lbs. per acre *or*

3% benzene hexachloride, 5% DDT, 40% sulfur dust (3-5-40 mixture) at 10 to 15 lbs. per acre *or*

3% gamma benzene hexachloride dust at 10 lbs. per acre. This dust is recommended for use only early in the season. Its use later in the season may result in bollworm build-up.

Growers equipped to use liquid sprays can control aphids effectively with emulsifiable benzene hexachloride or lindane applied so as to get one-third of

a pound of the gamma isomer per acre on the cotton.\*

For late season control of aphids, emulsifiable toxaphene or DDT should be added to either of the two above preparations to prevent build-up of boll-worms. Add enough toxaphene to get on 2 or 3 lbs. of the technical material per acre, or enough DDT to get 1 to 1½ lbs. of technical DDT per acre. Repeat in 5 to 7 days if needed.

*Thorough coverage is essential* for good control of aphids regardless of the material used.



Yellow-striped Armyworm or "Cotton Armyworm".

**2. Armyworms and Cutworms.** There are several species of cutworms and armyworms which may attack cotton in Missouri. These include the Fall Armyworm *Laphygma frugiperda* (Abbott & Smith); the Yellow-striped Armyworm or "Cotton Cutworm" *Prodenia ornithogalli* (Guenee); the Variegated Cutworm *Peridroma margaritosa* (Haworth); the Granulate Cutworm *Feltia subterranea* (Fabricius) and the Black Cutworm *Agrotis ypsilon* (Rottemburg). For correct identification of the species involved, experts should be consulted. Most cutworms feed only at night or on gloomy, cloudy days and usually rest just underground or under trash during bright days. Some feed underground,

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\*Unfortunately, different formulations vary in the amount of technical insecticide they contain so it is impossible to make specific dilution recommendations. Applications made by ground machinery differ from those made by aircraft which further complicates the situation. However, the labels on the containers of all insecticides state the amount of technical toxicant included and dilutions can readily be computed from this information.

some cut off plants at the soil surface, and some climb the plant and eat the upper parts. They usually spend the winter as small worms in weedy fence rows or sod but may also overwinter as adults or as eggs.

In general, treatments should not be started unless one or two worms per linear foot of row are present or until migration starts into a field. Repeat in a week or ten days if necessary. A careful survey should be made to determine the possible need for treatment.

Recommended insecticides for cutworms are:

20% toxaphene dust at 10 to 15 lbs. per acre *or*

Toxaphene emulsion sprays applied so as to get 2 to 3 lbs. of the technical material per acre.

Poison-bran baits containing toxaphene, Paris green, sodium fluosilicate, or cryolite may also be used and are more effective than sprays or dusts where vegetation is sparse. It is recommended that cotton fields should be plowed three weeks before planting to avoid cutworm trouble.

A few species of cutworms may be controlled with 10 lbs. of 10% DDT dust per acre. Much depends on the species involved. **Timeliness and thoroughness** of application are very important in cutworm control.

**3. Cotton Boll Weevil.** The true Cotton Boll Weevil (*Anthonomus grandis* Boheman) normally does not occur in Missouri. When it does reach Missouri by migration from the south, it usually cannot survive the cold of winter and hence has not become established. However, in 1914, 1917, 1918, 1923, 1925, and 1926 this weevil did cause some damage to cotton in Missouri, the reduction from full yield per acre varying from an estimated one per cent to seven per cent. In 1949, a few weevils reached Missouri, overwintered successfully, and infested a few fields in Butler, Ripley, Ozark, and Oregon counties, causing some reduction in yield in 1950. These were the first boll weevils found in Missouri in 23 years.

Every year numbers of small insects vaguely resembling boll weevils are sent in for identification. Of course, there are numerous insects always to be found on cotton, even certain weevils regularly occur on cotton but these are not necessarily the Cotton Boll Weevil. The Cotton Boll Weevil adult is a very small snout beetle about one-fourth of an inch in length, reddish-brown in color darkening to black as it grows older. The adults like to feed in the blossoms and when found there are often so covered with pollen that it is difficult to tell what color they actually are. However, the most reliable identifying characteristics of the real Cotton Boll Weevil are the **two blunt teeth or projections on the inner sides of the front femora** (the stout part of the leg) and one small inconspicuous tooth on the femora of the middle pair of legs. The snout on the front of the head looks like it is formed for piercing and sucking but such is not the case. At the end of the snout are the small but complete chewing mouthparts.



Cotton Boll Weevil, adult.



Cotton Boll Weevil, larva.

The female chews a very small deep hole in a square or boll (they prefer squares) and lays a single egg in it. From the egg the small, white, legless grub hatches and feeds on the tissues of the square or boll until full-grown whereupon it pupates and soon emerges as an adult. Very small squares usually drop off soon after being attacked but more advanced squares and bolls may hang on the plant for some time even after the weevil has emerged, though they usually do not develop. Even if they do develop, they usually are deformed. The time required for a complete cycle of the beetle from egg to adult is about three weeks, hence several generations are produced each season. Only the adults overwinter, usually under trash in or near cotton fields and gins or in adjacent woodlands. They emerge in the spring when cotton begins to grow. Of course, they do not all come out at one time so the period of emergence from hibernation quarters is considerably spread out. In the South, populations usually build up in July and migration begins in August. The beetles can travel long distances, flying from field to field in short to moderately long flights.

Normally it will not pay to treat cotton with insecticides for boll weevil control until 25 out of every 100 bolls and squares examined are infested with weevils (bolls or squares showing egg punctures are considered infested).



To survey a field, walk diagonally through the field from one corner to the other counting five bolls and squares on each of twenty plants making sure plants at both corners and the middle of the field are included in the counts. It requires close observation to detect egg punctures—squares and bolls should be picked and opened as they are counted.

Recommended insecticides include:

Toxaphene 20% plus sulfur 40% dust at 10-15 lbs. per acre or

3-5-40 dust mixture at 10-15 lbs. per acre or

Calcium arsenate dust at 10-15 lbs. per acre or

Emulsifiable toxaphene spray at the rate of 2 to 3 lbs. of the technical material per acre or

Emulsifiable toxaphene and DDT mixture at the rate of 1 to 2 lbs. of technical toxaphene and  $\frac{1}{2}$  to 1 lb. of technical DDT per acre.

Insecticides should be applied at four- to five-day intervals until the infestation is under control and further applications made when necessary as revealed by weekly inspections of the fields.

4. **Bollworm.** Also known as the *Corn Earworm* and the *Tomato Fruitworm*.

Everyone who grows corn, tomatoes, beans, or cotton is familiar with the Bollworm *Heliothis armigera* (Hubner). This is the striped, green or brown or buff colored worm which bores into corn ears, tomatoes, bean pods, cotton squares and bolls, tobacco, and almost any other vegetable or crop or even weeds. They overwinter as pupae in the ground but infestation may also occur in spring from adult moths migrating from the South. Several generations are completed each season. Early sweet corn is usually attacked first, the eggs being deposited on the fresh young silks. Later in the season they may move into cotton in which case the eggs are laid on the terminals of the plant. There is usually enough late corn in silk in Missouri to absorb most of the bollworms and thus prevent damage to cotton. The larvae are prodigious eaters and one larva may chew up all the squares and bolls on one branch or all the tomatoes in a cluster since they do not confine themselves to one fruit but move on from one to the other. They are also cannibalistic, hence usually only one large worm is found in one tomato or boll or in the same part of an ear of corn.

Good cultural practices are important in control because early maturing, prolific crops will largely escape infestation and injury.

It will not pay to apply insecticides for bollworm control unless eggs and four or five worms are found for every 100 terminals examined. Continue applications at five-day intervals until the infestation is under control. The field should be surveyed as described above for the Boll Weevil except that terminals as well as squares or bolls are examined. The importance of making careful surveys to determine infestations before treating can hardly be over-emphasized.

Recommended insecticides are:

10% DDT plus 40% sulfur dust at 10-15 lbs. per acre *or*

20% toxaphene plus 40% sulfur dust at 10-15 lbs. per acre *or*

3-5-40 dust mixture at 10-15 lbs. per acre *or*

Calcium arsenate at 16 lbs. per acre may be used but is less effective than any of those listed above *or*

Emulsifiable toxaphene or toxaphene plus DDT to give 2-3 lbs. per acre of technical toxaphene and 1 lb. of technical DDT per acre may be applied as a spray.

*Timeliness of application and thoroughness of coverage* are essential for successful control.

**Note:** Avoid the use of benzene hexachloride *by itself* late in the season as its use may encourage build-up of Cotton Bollworm.

5. **Cotton Fleahopper *Psallus seriatus* (Reuter).** Fleahoppers are small, very active, sap-sucking leaf bugs, light greenish in color, the adults not over one-eighth of an inch in length. The nymphs or young ones are very hard to see because they are so exactly the color of the plant terminals they infest. Also they are very small, and they move very rapidly. They spend the winter as eggs just under the bark of many different kinds of weeds but especially of goatweed and croton. They hatch out early in spring and feed on weeds often completing one generation there before they move into cotton. Under favorable conditions a generation may be completed in 2 to 3 weeks. Wet seasons are favorable for fleahopper increase and often it is difficult to determine whether fleahoppers or excessive rains are causing injury to the cotton since the effect is much the same. Fleahoppers attack the tender terminals and tiny squares just as they start to form, the result being the loss of the squares which wither and fall to the ground. Plants so injured grow tall and show a noticeable whip-like growth with little or no flowering and bolls usually only in the tops of the plants. Clean culture is very important in preventing outbreaks.

Insecticidal treatments should not be started unless 25 to 30 fleahoppers are found per 100 terminals examined. Often only spot treatments are necessary to give effective control.

Recommended insecticides are:

10% toxaphene plus 40% sulfur dust at 10-15 lbs. per acre *or*

5% DDT plus 75% sulfur dust at 10-15 lbs. per acre *or*

3-5-40 dust mixture at 10-15 lbs. per acre *or*

Dusting sulfur at 10-15 lbs. per acre *or*

for spraying, emulsifiable toxaphene at 1 lb. of technical material per acre *or*

Emulsifiable toxaphene at  $\frac{1}{2}$  lb. of technical material plus DDT at  $\frac{1}{4}$  lb. of technical material per acre.

**Note:** The use of DDT alone may result in build-up of aphids and red spiders.

6. **Grasshoppers.** Three species of grasshoppers may injure cotton in Missouri. They are the Differential Grasshopper *Melanoplus differentialis* (Thomas); the Lesser Migratory Grasshopper *Melanoplus mexicanus* (Sausure); and the Red-legged Grasshopper *Melanoplus femur-rubrum* (De Geer). Two others, the Two-striped Grasshopper *Melanoplus bivittatus* (Say) and the American grasshopper *Schistocerca americana* (Drury) may occasionally also be of importance.

The Differential grasshopper is our common large yellow grasshopper too well known to need further description. The Migratory and Red-legged grasshoppers look very much alike and only experts can tell them apart. They are small, blackish above with yellow abdomens and reddish hind legs. They seldom exceed one inch in length. The Two-striped grasshopper is larger, about the size of the Differential grasshopper, black above with a white or yellowish stripe down either side of its back. The American grasshopper is often called the "Bird Locust" because it is so large and flies like a bird. It may attain a length of 3 inches or more.

Treatments normally will not be economical until 4 or 5 hoppers per square yard occur over the field or unless heavy concentrations of nymphs are found on hatching beds. The best time to control grasshoppers is when they are still concentrated on the hatching beds at which time spot treatments will practically eliminate the infestation. Clean culture and especially fall plowing will do much to avoid grasshopper outbreaks.

Recommended insecticidal treatments include:

Toxaphene dust or spray applied so that 2 to 2½ lbs. of technical toxaphene per acre is deposited or

Chlordane dust or spray at 1 to 1½ lbs. of technical chlordane per acre or

Benzene hexachloride ⅓ to ½ lb. gamma isomer an acre dust or spray, or

Aldrin ¼ lb. an acre, dust or spray, but follow precautions on label.

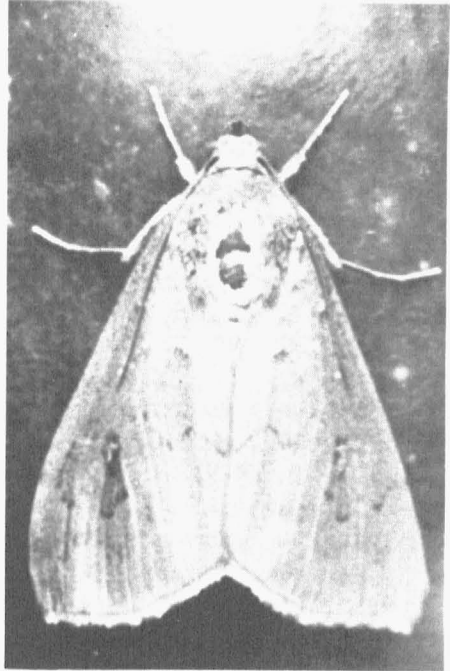
When vegetation is very sparse, a poison-bran bait will be more effective than sprays or dusts. Consult State and Federal recommendations for best formulae and other insecticide recommendations.

7. **Cotton Leafworm** *Alabama argillacea* (Hubner). As with the Bollworm, most growers are familiar with the Cotton Leafworm. The worms are long and slender, yellowish to green or black in color with dark stripes down the back. They do not overwinter in the United States but adult moths from the tropics migrate northward each year and reinfest the cotton belt. The worms feed only on cotton. The adult moths sometimes injure ripe peaches, grapes, and other soft fruits. Eggs are laid singly on the underside of cotton leaves, the larvae mature in about two or three weeks, pupate in a folded leaf and emerge as moths a week or ten days later.

In Missouri leafworms normally are not dangerous pests and growers usually consider them as beneficial in their capacity as late season defoliators thus hastening maturity of bolls, making picking easier, especially where pick-



Cotton Leafworm larvae on cotton boll.



Cotton Leafworm, adult moth.

ing machines are used, and discouraging other insect pest development including late season boll weevil infestations. However, following mild winters they may come early enough to develop two broods and then extensive injury may occur unless insecticides are used. When general infestations of leafworms are noted early in the season the grower should prepare to apply treatments when the second brood appears. Apply as soon as newly hatched worms are found and repeat at 5- to 7-day intervals until the infestation is under control.

Recommended insecticides and rates of application:

20% toxaphene plus 40% sulfur dust at 10-15 lbs. per acre *or*  
 3% benzene hexachloride, 10% DDT, 40% sulfur dust (3-10-40 mixture)  
 at 10-15 lbs. per acre *or*

Calcium arsenate at 10-15 lbs. per acre *or*

Paris green at 10-15 lbs. per acre *or*

Lead arsenate at 10-15 lbs. per acre *or*

Emulsifiable toxaphene spray at 2 to 3 lbs. of technical toxaphene per acre.

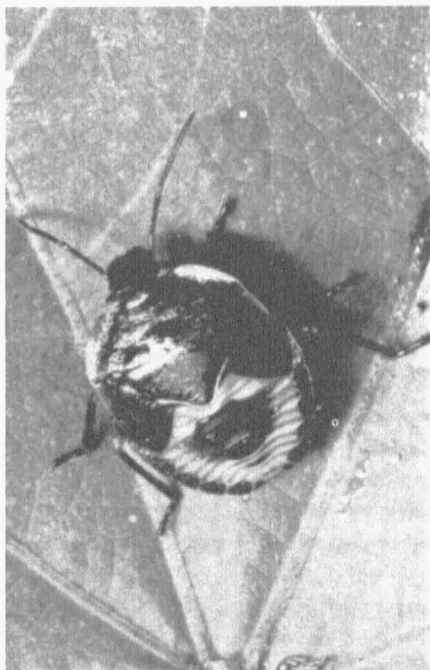
**8. Tarnished Plant Bug** *Lygus oblineatus* (Say), **Rapid Plant Bug** *Adelphocoris rapidus* (Say), and **other Plant Bugs** (*Lygus* and *Neurocolpus* species).

These are sucking plant bugs almost always present in all cotton fields but seldom in sufficient numbers to warrant insecticidal treatment. They are close relatives of the fleahopper being members of the same family and having

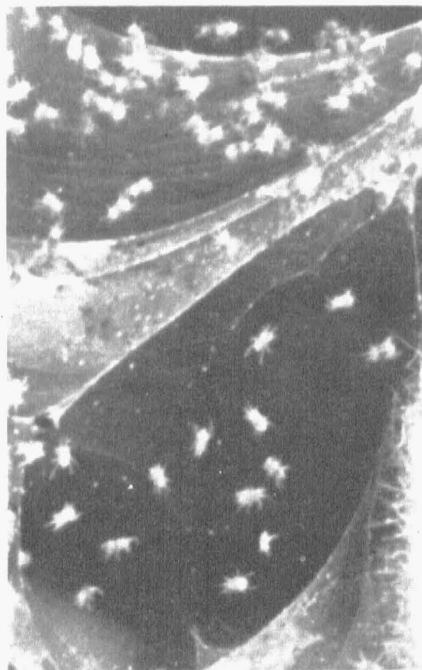
similar life habits except that they normally overwinter as adults. The injury is similar to that done by fleahoppers and stinkbugs. The controls used against fleahoppers will also control these insects. Cultural practices are important. Keeping fields of legumes distant from cotton will aid in keeping down infestations.

9. **Stinkbugs.** Several species of stinkbugs may injure cotton occasionally in Missouri similarly to the way fleahoppers injure cotton. The most common species on cotton in Missouri is the Green stinkbug *Acrosternum hilare* (Say). It is seldom numerous enough to warrant treatment. The same measures used to control fleahoppers and lygus bugs will control stinkbugs.

10. **Red Spiders.** These are really mites, not spiders, and of course not insects. The common species in Missouri is the two-spotted spider mite (*Tetranychus bimaculatus* Harvey). These mites are very small, barely visible to the naked eye, clear to yellowish to red in color with two small dark spots on the back. They feed on the undersides of the leaves, sucking out sap causing the leaves to turn red or rusty and fall off which in turn reduces yields or even kills the plants. They are spread by wind, water, birds, insects, and other agents going through cotton fields. They have many generations per year, overwintering as adults under trash or, further south, on plants whose leaves remain green all winter. These mites are also troublesome in orchards and in



Nymph of Green Stinkbug.



Red Spider Mites greatly enlarged.

gardens. When cotton leaves show red spots on top, later reddening all over and assuming the color of rust, drying up, curling, or dropping off with webs showing around the edges, a thorough examination of the field should be made. It is better to control them as soon as discovered when spot treatments may eradicate them before the field becomes generally infested.

Recommended chemical controls are:

Sulfur dust at 20 lbs. per acre *or*

Compound 88R (Aramite, Aramex, etc.) at 10 lbs. of 5% dust per acre.

Note: Under Missouri conditions, no insecticides should be applied to cotton that do not contain at least 40% sulfur or other suitable miticide to avoid trouble with red spider mites.

11. *Thrips (Thysanoptera; Thripidae)*. Thrips are very small, feathery-winged insects, commonly known as "oat-bugs" which may attack cotton early in spring resulting in blasted plants. They overwinter as adults under leaves and plants such as mullein. When they come out of hibernation they may attack cotton but generally are of little importance in Missouri. They have rasping-sucking mouthparts and injured plants usually show speckled or whitened areas where the plant tissue has been rasped. The same measures that control fleahoppers and aphids will control thrips.

12. *Garden Webworm Loxostege similalis* (Guenee). Occasionally cotton in Missouri may become infested with webworms although legumes are more subject to attack than cotton. Webs will be found on the plants and inside the webs greenish caterpillars about an inch long when full grown. They have a light stripe down the middle of the back and on each segment of the body three dark spots on either side of the stripe. One to three hairs project from each spot. The worms enclose the leaves of the plant in the webs. Two to four generations may be produced in one season.

Spot treatments may be very effective in eliminating an infestation. Apply insecticides as soon as webbing shows up. Recommended insecticides:

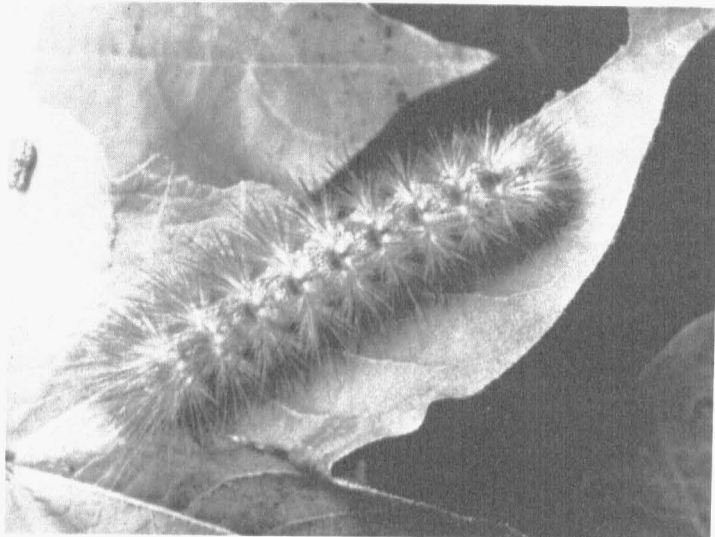
20% toxaphene plus 40% sulfur dust at 10-15 lbs. per acre *or*

3-5-40 dust mixture at 10-15 lbs. per acre *or*

Calcium arsenate at 10-15 lbs. per acre.

13. *Salt-Marsh Caterpillar Estigmene acrea* (Drury). This is one of the so-called "Woolly-bear" caterpillars, the adults of which are called Tiger Moths. The caterpillars occur regularly on cotton in Missouri but have never been known to cause extensive damage here. They can be very destructive, however, and have been known to ruin whole fields of cotton more particularly in Arizona and the Southwest.

So far, treatments have not been necessary in Missouri. Should an infestation develop where five or six worms are found per hundred plants treatment with toxaphene at the rate of 3 lbs. of the technical material per acre may be advisable.



Salt-marsh Caterpillar or "Woolly Worm".

14. **Miscellaneous Insects.** Several species of insects in addition to those discussed above may occasionally attack cotton in Missouri. Among these are the Cabbage Looper *Trichoplusia ni* (Hubner); the Grape Colaspis *Colaspis flavida* (Say); various Flea-beetles (*Chrysomelidae-Halticinae*); Leafhoppers or "Sharpshooters" (*Homoptera-Cicadellidae*); the Cotton Square Borer *Strymon melinus* (Hubner); and the Tobacco Budworm *Heliothis virescens* (Fabricius). The last two species attack squares and bolls similar to the way the bollworm causes injury. All the insects listed above may be controlled with the same insecticides recommended for bollworm control.

Stored cottonseed may be attacked by several pests including the Indian Meal Moth *Plodia interpunctella* (Hubner); the Mediterranean Flour Moth *Ephestia kuhniella* (Zeller); the Cigarette Beetle *Lasioderma serricorne* (Fabricius); and mice. Cottonseed that is to be used *only for planting* may be treated with 20% toxaphene dust before placing in storage. Generally, good sanitation in storage bins or rooms is all that is needed. In severe cases, fumigation with methyl bromide may be necessary.

For mouse control, heavy applications of 10% DDT dust or 50% wettable DDT powder, one pound in three gallons of water, may be sprayed over the bags of stored seed and along the runways where mice may travel.

Adequate precautions should be taken to avoid contaminating seed with insecticides if the seed is to be crushed for meal.