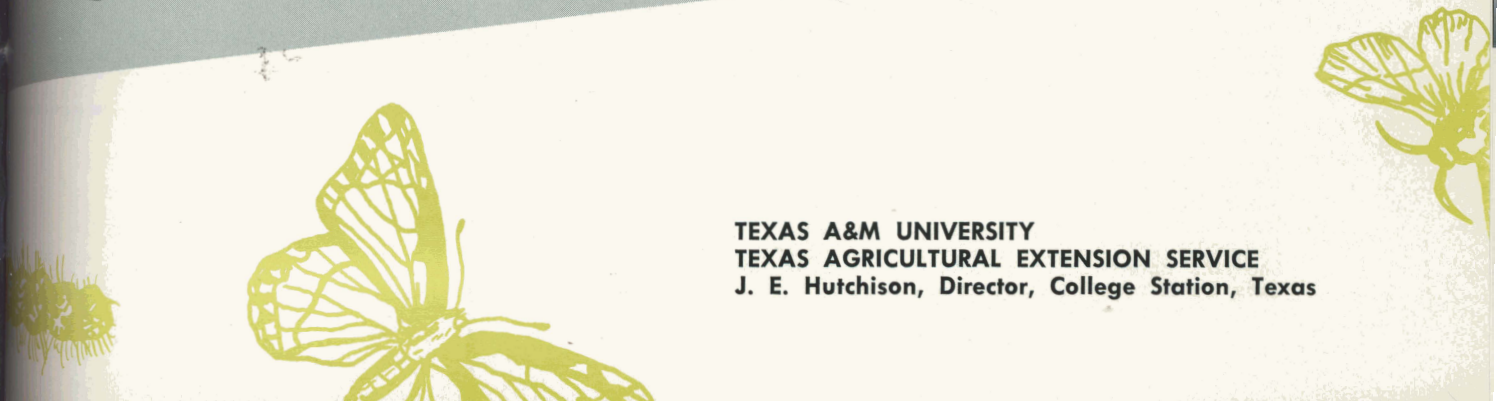
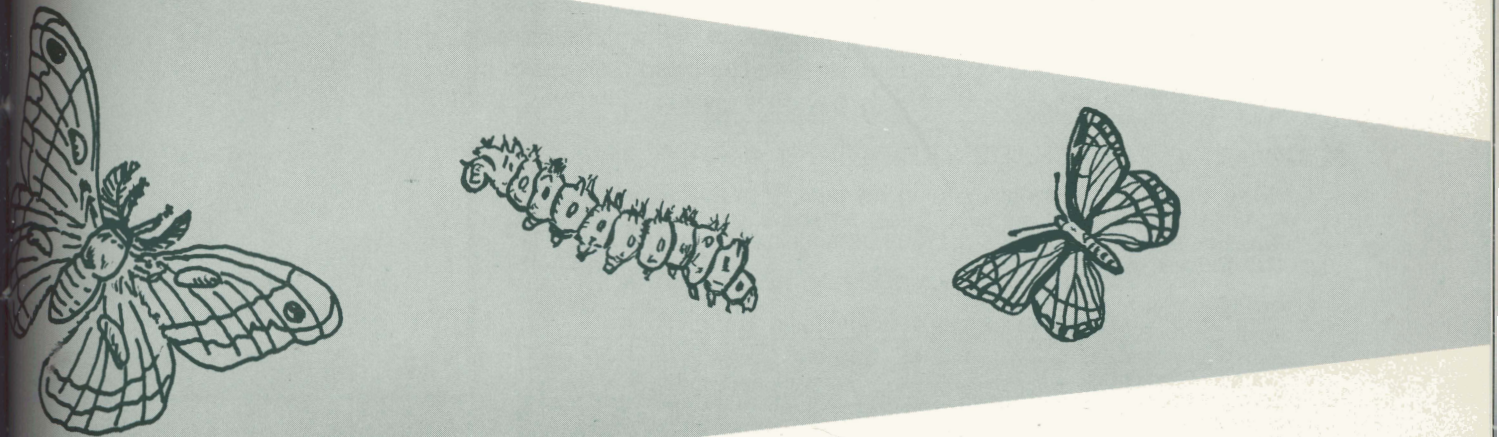


# INSECTS and RELATED PESTS

Attacking Lawns and Ornamental Plants



TEXAS A&M UNIVERSITY  
TEXAS AGRICULTURAL EXTENSION SERVICE  
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Photographs in this publication have two numbering series. Any figure number followed by a small "a" refers to a colored illustration. All colored illustrations appear on pages 12 through 15.

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# INSECTS and RELATED PESTS

## Attacking Lawns and Ornamental Plants

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**P**ractically every ornamental plant, established lawn and shade tree in Texas is subject to attack by insect or mite pests. The potential beauty of an ornamental plant may be marred or the plant killed by a pest infestation. Pests usually can be controlled, but unsightly damage may occur before the cause is discovered.

Successful insect and mite control depends upon recognizing common pests and understanding their habits so that recommended and timely control measures can be initiated.

This publication includes discussions of frequently encountered pests in Texas yards and ornamental gardens. Specific control recommendations for these pests are presented in L-199, *Texas Guide for Controlling Insects on Ornamental Plants*, available from county Extension agents or the Department of Agricultural Information, Texas A&M University, College Station.

Proper cultural and management practices are important in avoiding or reducing insect damage to ornamental plants. The following measures also help beautify home grounds and gardens:

- Proper fertilization
- Adequate watering
- Selection of adapted plant varieties
- Vigorous, healthy, insect-free plants
- Insect resistant plant material, when available
- Avoiding mechanical injury to plants and proper protection of pruning wounds.

Most ornamental pests are grouped according to the type of mouthparts — sucking or chewing — and the observed damage to the plants. However, the mouthparts of some insects do not indicate the kind of damage they do. Many of these are gall-formers, tree borers or leaf miners. The mouthparts of sucking insects consist of a hollow beak which they insert into plant tissue and withdraw plant juices. This weakens the plant and may cause death if infestations are sufficiently heavy. Chewing insects consume foliage, thus reducing the plant's food-manufacturing ability and destroying natural beauty. Some chewing insects habitually girdle or sever the plant near the soil surface.

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# Pests Attacking Lawns

## Sucking Pests

### SOUTHERN CHINCH BUGS, *Blissus insularis* Barber

**Description.** Adult chinch bugs are 1/6 to 1/5 inch long, have a black body, reddish-yellow legs and fully developed wings, which lie flat against the back, figure 1. Each front wing is mostly white but has an irregular black patch at the middle of the outer margin. The newly hatched nymphs (young) are bright red with a whitish band across the back. With each successive molt, the young darken and more nearly resemble adults, but have no wings.

**Life history.** Chinch bugs overwinter as adults in many sheltered areas near or in lawns. In the spring, adults emerge and lay eggs, which hatch in a few days into tiny nymphs. The nymphal stage lasts about 30 days, and the life cycle is completed within 7 to 8 weeks.

**Damage.** Chinch bugs have piercing-sucking mouthparts and feed by sucking plant fluids. Damage first appears as small, wilted areas which soon become yellow or brown, figure 1a. These areas increase in size as the insect population increases and as chinch bugs move from damaged or dead plants to healthy ones. Early symptoms of infestation may be confused with several lawn diseases and other problems. Chinch bug infestations can be diagnosed accurately only if the insects are observed. Damage is most common on St. Augustine lawns. Common bermudagrass is seldom attacked.

When damage is severe and bugs are plentiful, they usually can be found by spreading the grass and carefully observing the soil surface. When yellow or brown patches of grass are first noticed, a large coffee can or gallon can with both ends removed can be used to determine if chinch bugs are responsible. Press one end of the can 2 or 3 inches into the soil at the edge of the yellowing grass. Fill the can with water and keep it almost full for about 5 minutes, figure 1a. If chinch bugs are present, they will float to the surface. Repeat in several different locations. Careful observation is required to see the small nymphs.

### BERMUDAGRASS MITES, *Aceria neocynodonis* Keifer

**Description.** Bermudagrass mites are microscopic, eight-legged pests which cause considerable damage to bermudagrass lawns. These cigar-shaped mites differ from those commonly seen around the home, figure 2a. They are oblong and white, whereas many common mites are oval and reddish.

**Life history.** Bermudagrass mites multiply rapidly and cause severe damage in a short time. The females lay eggs in protected sites on the plant. Immature mites hatching from eggs are six-legged larvae. They then become nymphs with eight legs, as have adults. The life cycle is complete in about 1 week.

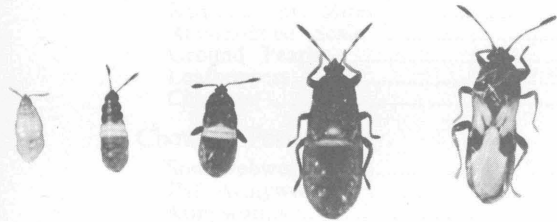


Figure 1. Chinch bugs, showing, left to right, first through fifth instar nymphs and adult.

**Damage.** Bermudagrass mites suck juices from grass stems and leaves, resulting in yellowed or browned areas and a generally unhealthy appearance. Stunted internodes, causing the grass to look bushy, are characteristic of injury, figure 2. When mite damage is severe, grass is severely thinned and weeds usually replace dead grass. Bermudagrass is the preferred host.

#### RHODES-GRASS SCALE, *Antonina graminis* (Maskell)

**Description.** Adults are about 1/8 inch in diameter, globular, dark purplish brown and covered with a felted, white, cottony secretion, figure 3. The oblong, oval, cream-colored first instar larvae or crawlers move about but become sedentary following the first molt. The sac-like second instar larvae insert their sucking mouthparts into the plant and lose their legs, appendages and antennae. They secrete a waxy covering for protection.

**Life history.** All Rhodes-grass scales are females. They give birth to living young for a period of about 50 days. Newly born larvae remain on the body of the female under the waxy covering for several hours, then emerge from the sac, become very active and run over the plant in search of a feeding site.

The larvae wedge themselves beneath a leaf sheath at a node or in the crown of the host, insert the mouthparts and begin their immobile existence. The felted waxy sac covering is secreted at this time.

The life cycle requires about 50 to 60 days and there are five generations annually. Reproduction continues throughout the winter in southern Texas.

**Damage.** Adults and nymphs damage lawns by attacking plant crowns, causing infested plants to turn brown and die.

Rhodes-grass scale attacks bermudagrass and St. Augustine grass in South Texas.

#### BERMUDAGRASS SCALE, *Odonaspis ruthae* Kotinsky

**Description.** Adults are about 1/16 inch long, oval, covered with a white, hard, waxy secretion and have sucking mouthparts.

**Damage.** This insect infests bermudagrass and is especially active in shady areas. It kills grass; causing bare, brown patches.

#### GROUND PEARLS, *Margarodes* spp.

**Description and Life history.** The female adult secretes a white, waxy sac in which she places about 100 pinkish-white eggs. Slender nymphs hatch and feed on fine grass rootlets. Nymphs cover themselves with hard globular shells resembling tiny pearls. They are about 1/8 inch in diameter.

**Damage.** Ground pearls sometimes seriously damage bermudagrass in the South and Southwest, and centipede grass in the South. Attacked grass turns brown in summer and dies in fall, leaving irregular dead spots.

#### LEAFHOPPERS, Family Cicadellidae

**Description.** Leafhoppers are wedge-shaped, frequently mottled insects that fly or hop when disturbed, figure 3a. They are less than 1/5 inch long and are green, yellow or brownish gray.



Figure 2. Bermudagrass mite damage. Note shortened internodes and "bunchy" appearance of grass.



Figure 3. Rhodes-grass scale on Bell Rhodes-grass.

**Life history.** Most species overwinter as adults; a few overwinter in the egg or nymphal stage. Eggs are inserted into the tissue of the host plant. These hatch in 5 to 14 days and produce nymphs which resemble the adults except in size and the presence of wings. There are commonly from one to four generations annually.

**Damage.** Many species of leafhoppers infest lawns, sucking sap from grass leaves and stems. New lawns may be damaged so extensively that reseeding is necessary. Damage to established lawns is generally negligible unless the lawn also suffers from moisture or fertilizer deficiencies.

#### CHIGGERS, *Trombicula* spp.

**Description.** These are the familiar red-colored mites that are so troublesome. The small, red adults may be seen travelling slowly over the surface of the ground. The females die soon after depositing their eggs in soil. The active feeding stage or first instar larva has three pairs of legs, is reddish and small enough to be difficult to see.

**Life history.** Eggs laid by the female hatch into immature chiggers called larvae. Only the larvae are parasitic on man and animals. Larvae transform into nymphs and the nymphs into adults. Nymphs and adults feed on insect eggs, small insects and other organisms found on or near woody decaying substances. The adult of the common chigger spends the winter in an earthen cell, about 1 to 1-1/2 inches deep in the soil.

**Damage.** Chiggers do not damage grass but are pests to animals and human beings. On warm-blooded animals, larvae search for a suitable location to feed. They prefer parts of the body where clothing fits tightly or where flesh is thin, tender or wrinkled.

Chiggers insert their mouthparts into the skin and then inject a fluid (enzyme) which liquefies the tissue. This fluid causes reddish welts, swelling, itching and fever in sensitive individuals.

A chigger attached in a pore or at the base of a hair may be so enveloped in swollen skin that it appears to be burrowing into the skin. But chiggers do not embed themselves in skin.

When suffering from chigger bites, take a bath as soon as possible; then apply antiseptic to each of the welts. This kills any chiggers not killed or removed by the bath, and it helps prevent infection. Destroying chiggers reduces itching but does not stop it. Fluid injected by the chigger causes itching. No practical way to remove chiggers has been found, and no treatment is known that will give permanent relief from itching.

### Chewing Pests

#### SOD WEBWORMS, *Crambus* spp.

**Description.** Sod webworms are the larvae of lawn moths. Adults are small, whitish or gray moths with a snout-like projection in front of the head. Wings are folded closely about the body when at rest. The larvae or sod webworms are about 3/4 inch long, slender and light brown with dark spots.

**Life history.** Lawn moths hide in shrubbery or other sheltered spots during the day. In early evening, they fly over the lawn and the females scatter eggs. The eggs hatch in about 1 week, and the larvae begin feeding. These insects remain larvae for 3 to 4 weeks, then pupate. Adults appear about 1 week later. A life cycle is completed in 5 to 6 weeks.

with several generations within a year. They overwinter in the soil as larvae in silken webs.

**Damage.** The newly-hatched larvae feed on grass and, as they grow, build burrows or tunnels slightly below the soil surface. They cut off blades of grass, drag them into the burrows and eat them. Sod webworms feed only at night, remaining in their silken webs during the day.

The first signs of sod webworm damage are areas of unevenly cropped grass and patches of brown or dying grass. Soon large areas may turn brown and die, figure 4a.

Extremely close observation is required to detect larvae in lawns. Sod webworms can be detected by examining the grass at the soil surface for webbing. These larvae also can be found by breaking apart some of the drying sod. If there are three or four larvae within a 6-inch square section, an insecticide treatment is recommended.

#### FALL ARMYWORMS, *Spodoptera frugiperda* (Smith)

**Description.** The adult is an ash-gray moth. Its forewings are mottled with irregular, white or light-gray spots near the extreme tip. Forewings of the female are much duller than those of the male. Hindwings of both sexes are white with a narrow, smoky-brown edge. When expanded, the wings are about 1-1/2 inches across.

Newly hatched larvae are white with black heads. Their bodies darken as they feed until they are full grown. Full-grown larvae are about 1-1/2 inches long. Their color ranges from light green to almost black with several light stripes along the body. The front of the head is marked with an inverted white "Y", figure 5a.

**Life history.** After mating, female moths lay their eggs at night on leaves of grass. Eggs are laid in masses of 50 to several hundred, and they hatch into larvae in 2 to 4 days.

During growth, they may curl up in leaf sheaths, suspend themselves from plants by threads or move about on the ground. Fall armyworm larvae complete their feeding in 2 to 3 weeks. Then they burrow an inch or two into the soil, make small cells and pupate. In 10 days to 2 weeks, the moths emerge. The fall armyworm may have as many as six generations a year.

**Damage.** The fall armyworm is one of the most destructive insects to lawn grasses in certain years, particularly bermudagrass. Most severe outbreaks usually occur following a cold, wet spring.

Young larvae feed on the lower surfaces of leaves, leaving the epidermis intact. At first they eat only tender parts of leaves. Later, as they grow, they devour all foliage except plant stems. Damage at first may appear as whitish patches in the lawn where the grass has been skeletonized.

Fall armyworm larvae feed mostly at night, concealing themselves under plant foliage during the day. If forced by hunger to seek other food, they may migrate in the daytime. The larvae may attack and devour one another when crowded or migrating.

#### ARMYWORMS, *Pseudaletia unipuncta* (Haworth)

**Description.** The adult of the armyworm is a moth. It is brownish gray with a small, white spot near the center of each front wing. When expanded, wings are about 1-1/2 inches across.

Figure 4. True armyworm.

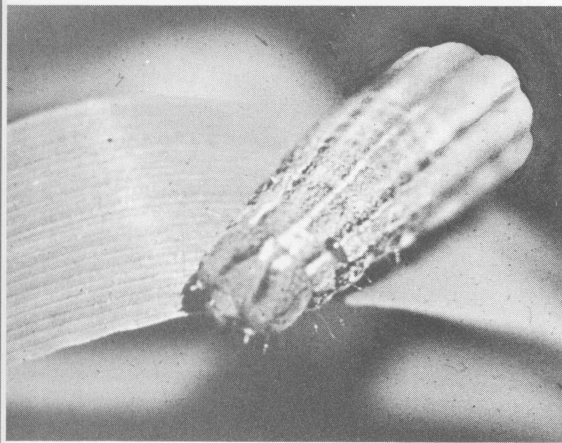
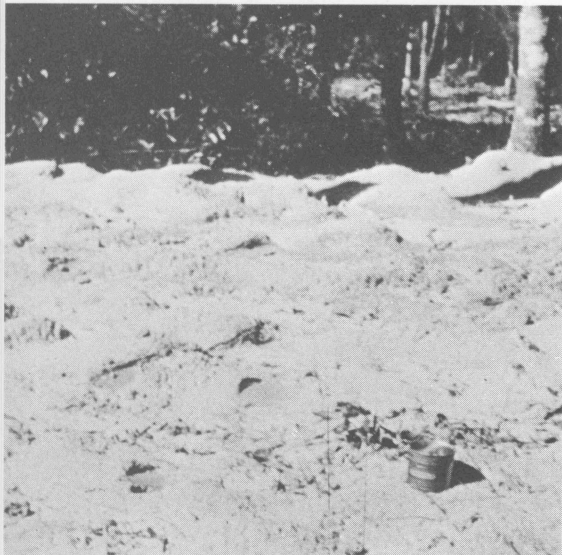


Figure 5. Imported fire ant mounds.



Young larvae are pale green and loop when crawling until about half grown. Full-grown larvae are smooth, striped, almost hairless and about 1-1/2 inches long, figure 4. Usually, they are greenish having one stripe along each side and a broad stripe down the center of the back; stripes are dark and often nearly black. The middle stripe usually has a fine, light-colored, broken stripe down its center. The body between the dark stripes ranges from greenish brown to reddish brown. The head is greenish brown and is finely mottled with darker brown spots.

**Life history.** After mating, female moths lay their eggs at night in folded leaves or under leaf sheaths of grains and grasses. They prefer moist or shady spots for egg laying.

Larvae complete their feeding in 3 to 4 weeks. Then they burrow under litter on the ground, under clods or 2 to 3 inches into the soil. There they make small cells and change into pupae.

The armyworm usually has three broods each year. It overwinters in the larval stage or sometimes in the pupal stage. In South Texas, all stages of the insect may be present during winter. Mild, dry winters followed by cool springs are favorable for its survival and development.

**Damage.** Damage to lawns caused by armyworms is similar to that caused by fall armyworms, but is usually not so severe.

#### WHITE GRUBS, Family Scarabaeidae

**Description.** White grubs are the larvae of several species of May or June beetles. They are white or gray, have a brown head, six legs and usually lie in a curled (C-shaped) position, figure 6a. Full grown larvae may be 1-1/2 inches long.

**Life history.** Most white grubs spend about 10 months in the ground; some remain 2 or 3 years. In mild weather, they live 1 to 3 inches below the soil surface, while in winter they move deeper.

**Damage.** White grubs burrow about an inch below the soil surface and feed on grass roots. Damage appears as areas of dead, dry grass. Grass in infested areas can be lifted out of the soil very easily or rolled back into a mat of runners and foliage. Grubs often can be found between this mat and the soil.

#### MOLE CRICKETS, *Scapteriscus* spp. and *Gryllotalpa* spp.

**Description and Damage.** Mole crickets can be recognized by their broad, shovel-like front legs, figure 7a. With these legs, mole crickets burrow into moist, light soils for food. This burrowing often results in the roots of plants being severed and seedling plants uprooted. Newly seeded lawns are especially susceptible.

#### ANTS, Family Formicidae

Several species of ants may build nests in lawn turf. Some ants form hills around the openings of their nests; fire ants build large mounds, figure 5. The ant hills or mounds often smother the surrounding grass. Where the ants nest, grass roots may be destroyed. Ants also destroy grass seeds and may prevent good stands in seeded lawns.

Some ants are a nuisance because of their sting; fire and harvester ants are especially vicious.



# Pests

## Attacking

### Shrubs And Flowers

#### Sucking Pests

##### THRIPS, Order Thysanoptera

**Description.** Thrips are 1/16 to 1/25 inch long, fitted with peculiar rasping-sucking mouthparts. The underside of the head is drawn out into a cone-shaped structure. In this structure are slender stylets used to rasp the plant surface. The cone is placed over the rasped area and all contents are sucked up through the cone. The body and wings are long and slender, and the wings are fringed with delicate hairs. Color may vary from light yellow to black.

**Life history.** With most plant-feeding thrips, the female inserts her eggs into host plant tissue. The first three instars resemble the adults, except in size and the presence of wings. The feeding of these larvae is similar to that of the adult.

The larval stage is followed by an active prepupal stage in which wing pads suddenly appear. The fifth instar is inactive and precedes the adult stage. A life cycle varies from 15 to 30 days, and a number of generations may be developed in one season.

**Damage.** Many species attack foliage and/or flowers of various plants. Typical damage consists of brownish or yellowish scarifications on the surface of the foliage or flowers, figure 8a. Russetted or blackened flower buds and stems often fail to open. Chrysanthemums, roses, gardenias, gladiolus, hemerocallis, iris and other tender plants are commonly damaged by thrips.

##### APHIDS, Family Aphididae

**Description.** Aphids or plant lice suck plant juices through a short, stout beak (proboscis) inserted into the tissue. They have soft, rounded or pear-shaped bodies, and may be winged or wingless, figure 9a. Most species have a pair of small tubes called cornicles, projecting from the top and rear of the abdomen. Some aphids appear woolly or powdery because of a waxy covering on their bodies. Color of different species varies from light yellow to green to black. Size also varies considerably from 1/25 to 1/4 inch long.

**Life history.** The life histories with the involved life cycles and relationships of many species are intriguing and of much interest. The following is a general life cycle which is applicable to most species.

Aphids usually reproduce parthenogenetically (only females in population) and by giving birth to living young. With few exceptions, males and eggs of aphids do not occur in Texas. In the North, most species have a true sexual generation in the fall. These forms mate and the females deposit shiny, black overwintering eggs.

Most aphids are wingless; winged forms being common as populations become crowded. Aphids have one of the highest reproductive

potentials of any insect. There may be as many as 50 generations annually. Each female is capable of producing from 50 to 100 young. The life cycle for most is about 5-10 days.

**Damage.** Aphids attack a variety of ornamental plants, causing curled, cupped and distorted leaves. Root-feeding aphids stunt or may kill plants. Some aphids transmit virus diseases of flowering plants.

Aphids excrete a colorless, sweet, sticky honeydew which may attract ants. Honeydew also is a medium for a black fungus or sooty mold.

#### SPIDER MITES, Order Acarina

**Description.** Spider mites are generally oval, reddish and have four pairs of legs. Immature spider mites are somewhat paler in color. All stages of spider mites can be found on the foliage (usually on the underside) of infested plants. A generation may be completed in about 2 weeks or less. Thus, a tremendous number of spider mites can develop in a relatively short period.

**Life history.** Some spider mites winter in protected places, such as buds and crowns of perennials and weeds, and attack new growth as soon as it starts in the spring. Other species hibernate in the egg stage on the bark and under bud scales of various plants. Generally, spider mites are prolific with damaging infestations developing in a few days. Hot, dry weather favors rapid population development.

**Damage.** Spider mites suck juices from leaves and other tender plant tissue. Their attack causes discoloration or browning of the foliage, which resembles stippling on close observation, figure 10a. Sometimes infested plant parts are covered with fine webbing, and in heavy infestations, mites can be found on the undersides of leaves or running over the webbing, figure 6. If the infestation is light, little webbing may be present; some species do not web. Individual mites are so small they can scarcely be seen.

#### WHITEFLIES, Family Aleyrodidae

**Description.** Whiteflies are tiny, inconspicuous sucking insects injurious in both the nymphal (immature) and adult stages. Adults are tiny (about 1/16 inch long), wedge-shaped, whitish insects which resemble snowflakes in flight. The nymphs are about the size of a pin-head and vary from almost transparent to pale green to white, figure 11a. They are rounded, flat, immobile and resemble scales. They are attached to the underside of leaves until they are mature.

**Life history.** Eggs are attached to the lower leaf surface of the host by means of tiny stalks. Eggs hatch into larvae or crawlers which attach themselves to the underside of leaves. With the first molt the larvae lose their legs and antennae. Following two additional molts, the insects enter a pupal or transformation stage from which the winged adults soon emerge.

Each female lays around 100 eggs. The larval stage requires about 30 days. There are several overlapping generations produced in the course of a year.

**Damage.** Heavy feeding makes infested leaves appear mottled or causes them to turn yellow and die. The sticky honeydew excreted by the insect often glazes the upper surfaces of lower leaves and permits black sooty mold to develop, figure 11a. This mold detracts from plant beauty and interferes with photosynthesis.

Figure 6. Spider mites on lower leaf surface.



Whiteflies attack a variety of ornamentals in Texas. Gardenias, however, are common hosts. Privet is another favorite host.

#### LACE BUGS, Family Tingidae

**Description.** The adult lace bug is an ornate, sucking insect about 1/8 inch long with lace-like wings lying flat over the oval body, figure 12a. Most species also have a lacy projection over the head. Nymphs are wingless with spiny projections over the body.

**Life history.** Eggs are deposited in plant tissue and are usually covered by a secretion which hardens and forms conical projections on the surface. Nymphs are usually darker and have little resemblance to the adults. There may be two to several generations each season. Most species overwinter as eggs. Other species may overwinter as adults.

**Damage.** Lace bugs sometimes become troublesome on ornamental plants. Favorite hosts are azalea, chrysanthemum, rhododendron and sycamore.

Injury to plants appears as spotted or mottled grayish discolorations on the upper leaf surface and a generally unhealthy appearance, figure 7. On the lower leaf surface are tiny, dark, resinous spots resembling varnish.

#### LEAFHOPPERS, Family Cicadellidae

**Description.** Leafhoppers are small, slender, wedge-shaped, sucking insects which vary from brown to pale green, figure 13a. They are usually less than 1/8 inch long. These active pests hop some distance when disturbed.

**Life history.** Eggs are laid in the leaf tissue or stalks, and two or more broods occur annually. For additional information, see page 4.

**Damage.** Leafhoppers imbibe plant sap, causing the leaves to wilt and curl, resulting in death to tender tips. The leafhopper causes the edges of host leaves to die. This browning or burning is commonly called "hopperburn," figure 13a. Some species transmit plant diseases; for example, the aster leafhopper transmits aster yellows virus from diseased to healthy plants.

#### MEALYBUGS, Family Pseudococcidae

**Description.** Mealybugs are elongated, oval insects covered with a white, powdery wax extending from the sides in short filaments. They are about 1/5 inch long when mature. The young resemble adults but have very little wax covering their bodies. They have sucking mouthparts.

**Life history.** Some species deposit eggs in a mass resembling a small tuft of cotton while others give birth to living young. Each female produces 200 to 600 offspring. A life cycle requires about 9 weeks. There are commonly several generations a year.

**Damage.** Infested plants may lose color, wilt and may die. A variety of plants are attacked, but mealybugs prefer more succulent plants commonly used in flower boxes or borders. Coleus and geranium are particularly susceptible to infestation. Mealybugs excrete copious amounts of honeydew, a medium for black sooty mold, which mars plant appearance.



Figure 7. Lace bug nymphs on lower leaf surface (left) and stippling or chlorosis of upper leaf surface (right).

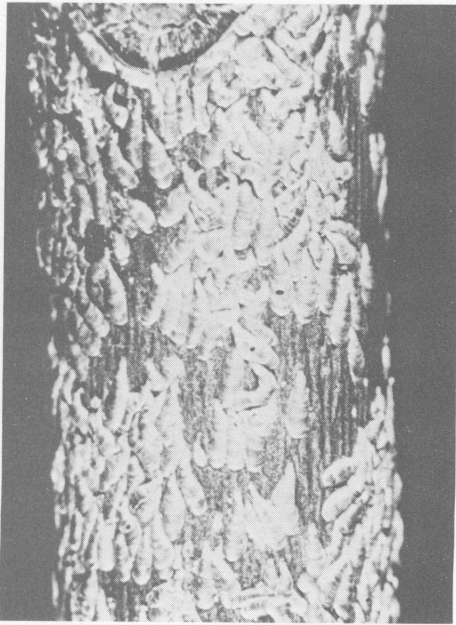


Figure 8. Oyster-shell scale.



Figure 9. Obscure scale.

## SCALE INSECTS, Family Coccidae

**Description.** Many species of scale insects infest ornamental shrubs and garden plants. They all have a waxy, shell-like covering or scale that protects the body. Very young scale insects do not have this covering, but it develops and enlarges as the insect grows. Size varies among the species from 1/16 to 1/8 inch in diameter, but a few species are about four times larger. Some scale are hemispherical, some oval and some are shaped like an oystershell, see figures 8, 9, 14a and 15a. Colors range from white to black, with browns and grays predominating.

**Life history.** Some species lay eggs in a whitish sac secreted from under the scale; these can be mistaken for mealybugs if not examined closely for the shell-like covering. After the crawler (very young) stage, the scale inserts its beak into the plant tissue and becomes sedentary. Some species primarily infest the leaves of plants, others both stems and leaves and still others attack chiefly the stems.

**Damage.** Scale insects suck plant sap, causing poor growth or stunted plants. They excrete droplets of honeydew which attracts ants. Honeydew causes the foliage to appear shiny and provides a food source for sooty mold.

In most areas of the state, scale insects are inactive during winter and populations are generally lightest. Control on perennials during the winter is commonly recommended. Killing scale insects at this time reduces their potential damage to plants the following season.

## Chewing Pests

### ARMYWORMS, Family Noctuidae

**Description.** Both the armyworm (*Pseudaletia unipuncta*) and the fall armyworm (*Spodoptera frugiperda*) occasionally infest tender ornamental plants. See pages 5 and 6 for details.

**Damage.** Damage to ornamental plants is usually leaf ragging. In some plants, such as canna, larvae may feed in the whorl causing "shot-holes" in unfolding leaves.

### CABBAGE LOOPERS, *Trichoplusia ni* (Hubner)

**Description.** Newly hatched larvae are pale green and delicate. Full-grown, they are about 1-1/2 inches long and green with a white stripe along each side of the body, figure 16a. Larvae loop as they crawl.

**Life history.** The incubation period of the egg stage requires about 6 days. The larvae feed about 14 days before spinning a cocoon in which to pupate. The moth emerges from the pupal skin in about 10 days.

Egg-to-adult development requires about 30 days. Three or four generations a season are common.

**Damage.** The cabbage looper chews irregular holes in leaves and buds of carnation, chrysanthemum, mignonette, geranium, German ivy and other flowering and ornamental plants. It generally feeds from the underside of the leaf, producing large, ragged holes and leaving dark pellets of excrement. The pellets may be the most noticeable, since the larva is nearly the same color as its host.

### CORN EARWORMS, *Heliothis zea* (Boddie)

**Description.** The adults, or moths, vary from light brown with a greenish cast in the male to a deep reddish-brown in the female; the

wingspread is about 1-1/2 inches. Newly hatched larvae are whitish with black heads. Full-grown larvae may be up to 1-1/2 inches long and vary in color. Some have conspicuous cream, yellow, brown, slate or black stripes. Others, without stripes, may be pink, green, cream or yellow, figure 17a.

**Life history.** The adults (moths) live about 12 days. One female may lay 400 to 3,000 eggs. The average is about 1,000. Eggs are deposited on various plant parts. Eggs at first are pearly white but turn dusky brown before hatching, in 2-8 days. Larval development requires 13 to 28 days, depending on temperature. When grown, the larvae drop to the ground, burrow 2 to 4 inches into the soil and construct cells in which to pupate. Moths emerge in about 14 days. The earworm passes winter in the pupal stage.

**Damage.** Corn earworm damage is similar to that of other caterpillars attacking buds or foliage of plants. This insect is also known as the cotton bollworm or tomato fruitworm.

#### TIGER MOTHS, Family Arctiidae

**Description.** Tiger moths are the adult stage of several fuzzy or hairy caterpillars called "wooly bears." The two most important species in Texas are the salt-marsh caterpillar, *Estigmene acrea* (Drury), and the yellow wooly bear, *Diacrisia virginica* (Fabricius). Colors range from yellowish to dark brown or almost black. Mature caterpillars are about 2 inches long and are covered with long hairs, which give them a fuzzy appearance, figure 18a.

**Life history.** Eggs are laid in clusters, usually on the underside of leaves of the host plants. Winter is passed either as larvae or pupae. About 6 weeks are required for egg-to-adult development. There are three to four generations annually.

**Damage.** Most species are general feeders on a variety of ornamental plants. They are foliage feeders and may cause considerable leaf ragging. Tiger moth larvae have no stinging or urticating hairs; however, some "hairy" caterpillars can cause painful skin reactions. See page 24.

#### CUTWORMS, Family Noctuidae

**Description.** Larvae are usually a dirty, dull-to-shiny, grayish-black, figure 10. They curl into a ball or tight C-shape when disturbed. Mature larvae average 1 to 1-1/2 inches long. Adults are grayish-brown to black, medium-sized moths.

**Life history.** There are a large number of cutworm species and variations in life histories is the rule. The following examples are representative of the group:

**Subterranean cutworms.** Members of this group feed almost entirely beneath the surface of the soil. The pale western cutworm, *Agrotis orthogonia* (Morr.), is a representative of this group. It passes the winter as a tiny larva within the egg shell. Eggs are deposited in the soil by the adults. The worm emerges during early spring and feeds for a short time upon leaves of the host, but soon assumes the subterranean habit. There is only one generation annually.

**Tunnel makers.** These cutworms live in tunnels that open at the surface of the soil. An important member of this group is the black

Figure 10. Subterranean cutworm.



cutworm, *Agrotis ipsilon* (Hufnagel). The worm cuts off a plant, pulls it into its tunnel and usually devours the plant. There are several generations a year but the greatest damage commonly is done by the first generation. This generation occurs from April to June. Outbreaks frequently occur on "overflow land."

*Surface feeders.* Of the several species in this category, the army cutworm, *Chorizagrotis auxiliaris* (Grote), is an ornamental pest. Species in this group cut off small plants at or near the soil surface and devour the fallen host. The worms are active mostly at night and hide in the soil or under surface trash during the day.

The army cutworm may be active at temperatures slightly above freezing and frequently damages plants during early spring. During cold weather, the larva cuts off a plant tiller or leaf, pulls one end of it into the burrow and feeds on the plant. There is only one generation per year and the insect passes the winter as a larva in the soil or in debris affording it protection from extremely cold weather.

The granulate cutworm, *Feltia subterranea* (F.), is an important pest of garden vegetables in Central and South Texas. The insect passes the winter in the pupal stage in the soil. There are three to five generations annually in Texas.

*Climbing cutworms.* Included in this group are several species of cutworms that climb the host plant to feed on foliage, stems, leaves and fruit. Like other cutworms, they feed primarily at night and hide under debris and other objects during the day. Some feeding may occur on cool, cloudy days.

The variegated cutworm, *Peridroma saucia* (Hubn.), is an important representative of this group. In most parts of Texas, this worm survives the winter in the larval stage. The number of generations vary, but most of the damage is caused by a generation that occurs during the April-June period.

**Damage.** Several species of cutworms may be found in the yard. They are not easily seen since they stay in the soil during the day and feed mostly at night. Cutworms feed on the stem near the plant base and may sever the plant near the soil line. The larvae can usually be found near severed plants by digging the soil at the plant base.

#### BLISTER BEETLES, Family Meloidae

**Description.** Blister beetles range from 1/2 to 1-1/4 inches long. Their bodies are cylindrical and relatively soft. Color and markings of the adult vary from gray, black or brown to striped or spotted forms with a combination of colors, figure 19a. The antennae are conspicuous, and the head is larger than the thorax. These insects are called "blister beetles" because they secrete a substance from the abdomen which can cause painful skin blisters.

**Life history.** Blister beetles have a rather unusual life cycle in that the larvae appear in a different form after each molt. Females lay 50 to 300 eggs each in cavities prepared in the ground. The eggs hatch into active and very agile larvae known as triungulins. These triungulins search for pods of grasshopper eggs. Once found, the egg pod is immediately fed upon by the larva. Shortly afterward, the larvae molt and form the second stage, the caraboid. This stage molts and emerges as

(Continued on page 17)



Figure 1a. Water-can method of detecting chinch bugs. Note small damaged areas beginning to appear. Cans should be placed in margin between damaged and healthy grass.

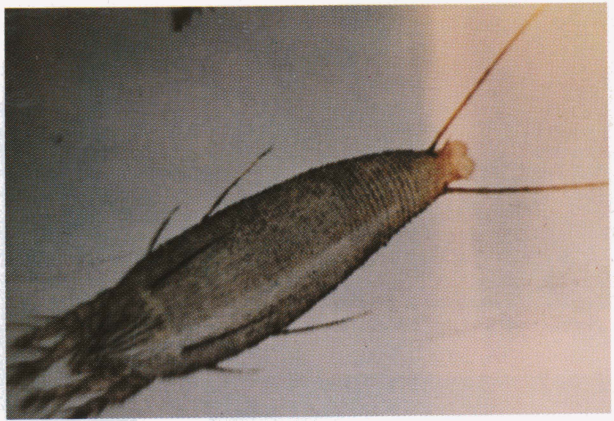


Figure 2a. Bermudagrass mite (greatly enlarged).



Figure 3a. Typical leafhopper shape. Color and size vary with species.



Figure 4a. Sod webworm damage in lawn.

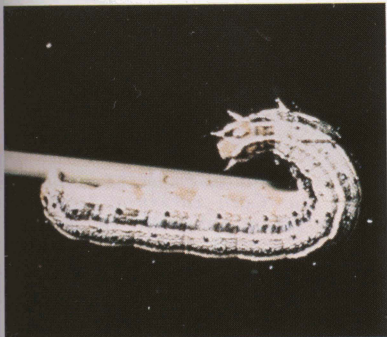


Figure 5a. Fall armyworm. Note white inverted "Y" on head.



Figure 6a. White grub (right) and May or June beetle (left).



Figure 8a. Thrips damage to petals of gladiola blooms.



Figure 7a. Mole cricket.

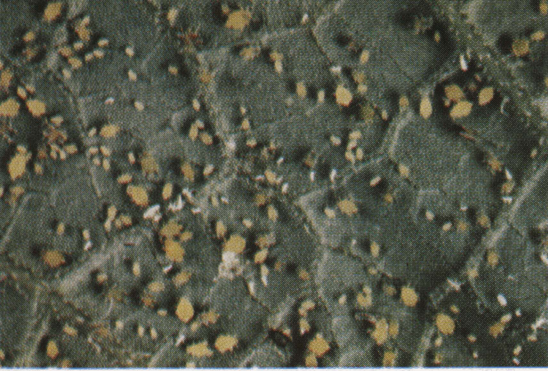


Figure 9a. Aphid or plant lice on lower leaf surface.

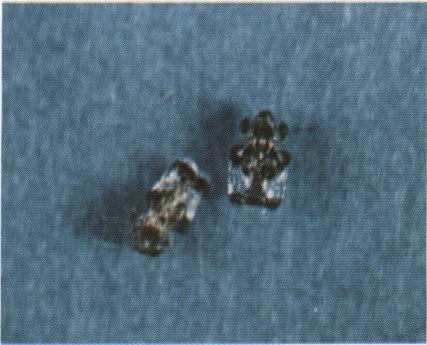


Figure 12a. Adult lace bugs.



Figure 13a. Leaf hoppers (right) and injury or "hopper burn" (left).

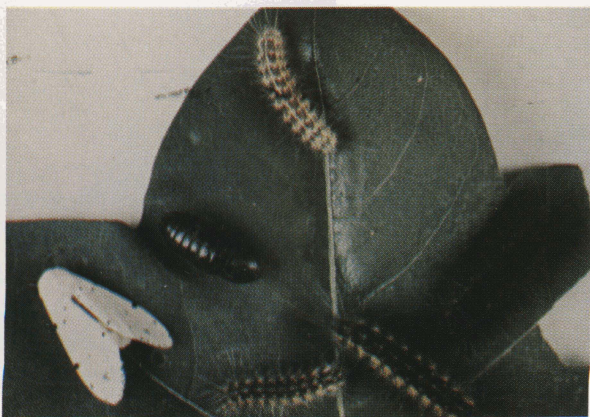


Figure 18a. Salt-marsh caterpillar, larvae, pupa and adult.



Figure 10a. Spider mite damage on arborvitae.



Figure 14a. Euonymus scale.



Figure 16a. Cabbage looper.

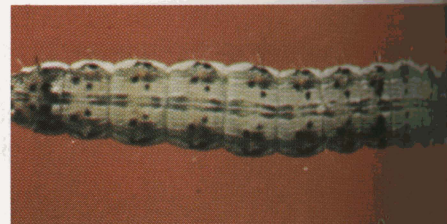


Figure 17a. Corn earworm, tomato fruit-worm or cotton bollworm, *Heliothis zea*.



Figure 19a. Left, blister beetles showing variation in color and size of different species.



Figure 11a. White flies on garden (left). Note scale-like shape and appearance of sooty mold growing on honeydew from white flies (right).



Figure 15a. Cottony cushion scale on leaf.

Figure 20a. Below, leaf rollers of *racantha*.







Figure 21a. Leaf roller on pecan.



Figure 22a. Oak apple gall caused by cynipid wasps.

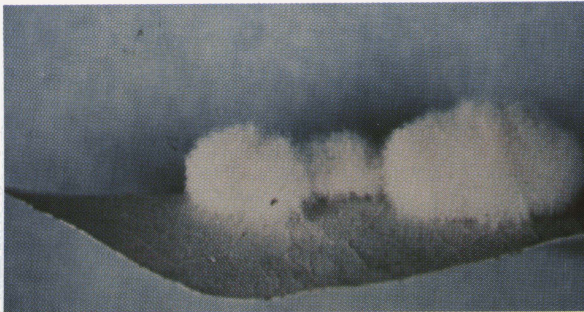


Figure 23a. Woolly oak gall caused by cynipid wasps.



Figure 24a. Forest tent caterpillar feeding on oak.



Figure 25a. Eastern tent caterpillar.



Figure 26a. Webbing of eastern tent caterpillar constructed in crotch of peach tree.



Figure 27a. Heavy bagworm population on arborvitae.



Figure 28a. Elm leaf beetle adult.



Figure 29a. Elm leaf beetle larvae and feeding damage.



Figure 30a. Eggs of elm leaf beetle.



Figure 31a. Puss caterpillar on oak.



Figure 32a. Saddleback caterpillar.



Figure 33a. Larval stage of Nantucket pine tip moth and damaged shoot.



Figure 34a. Pine shoot damage caused by tunnelling larva of Nantucket pine tip moth (right); normal shoot (left).



Figure 35a. Long-horned beetle. Adult stage of roundheaded borer.



Figure 36a. Metallic wood borer. Adult stage of flatheaded borer.



Figure 37a. Flatheaded borer. Larval stage of metallic wood borer.

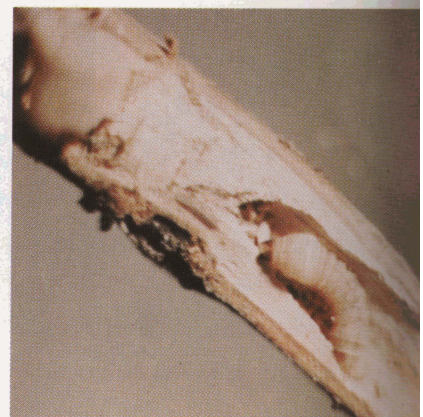


Figure 38a. Larvae of twig girdler.



Figure 39a. Twig girdler, one of the long-horned beetles.



Figure 40a. Egg of twig girdler exposed by removing bark of elm limb.

a scarabaeoid larva. These are summer stages. The scarabaeoid stage changes to a pseudopupa which is the overwintering form.

In the spring the pseudopupa molts into an active stage which prepares a cell in which it soon pupates. The adult emerges about 2 weeks later. Some species may remain in the soil cell as pseudopupa for 1 to 2 years. Normally there is one generation annually, but some species are known to have a partial second generation in Texas.

**Damage.** Several species of blister beetles damage some ornamental plants by eating and ragging the foliage. Adults feed on potatoes, tomatoes, eggplants, beans, peas, melons, spinach, carrots, chard and many flowering plants around the home.

#### MAY OF JUNE BEETLES, *Phyllophaga* spp.

**Description.** May beetles vary in color and size according to the species, but the most common are metallic green, brown or brownish-black and are 1/2 to 1-1/4 inches long, figure 6a.

**Life History.** For details on the life history, see page 6.

**Damage.** May beetles are the adults of white grubs (see page 6). May beetles sometimes occur in sufficient numbers to damage ornamental plant foliage. The cause of ragging is sometimes a mystery since the beetles feed principally at night. They can easily be found at night with a flashlight.

#### GRASSHOPPERS, Families Acrididae and Tettigoniidae

**Description.** There are over 600 grasshopper species in the U. S. There is a tremendous variation in color, size and habits. Grasshoppers commonly have chewing mouthparts and two pairs of wings, the fore wings are more or less parchment-like with distinct venation. The hind wings are membranous and folded fan-like when at rest. The nymphs resemble the adults, but are wingless.

**Life history.** Eggs are laid in the summer and fall, remain in the ground during the winter, and hatch in the spring or early summer. The egg pods, containing 10 to 90 eggs, are commonly found in fence rows, idle land, field margins, roadsides, rangeland or even cultivated land. The egg pods are generally located about 1 to 2 inches below the soil surface. The eggs hatch in spring or early summer. Nymphs require around 40 to 60 days to reach the adult stage. Only one generation a year is common for most species.

**Damage.** Grasshoppers eat leaves and sometimes girdle stems, causing injury or death to the stem or plant. For more information, see L-429, *Grasshoppers Common to Texas*.

#### LEAF ROLLERS, LEAF TIERS AND LEAF CRUMPLERS, Families Olethreutidae and Tortricidae

**Description.** These insects are discussed as a group because of similarities in damage and habit. The damaging stage is the larva. Larvae of the different species vary from pale yellow to dark green. They are about 3/4 inch long when mature.

**Damage.** The larvae roll, fold or tie together a group of leaves or the terminal growth, figures 20a and 21a. They feed on inner surfaces of bunched leaves and may eat buds. Larvae are often overlooked since they are in these flimsy structures. This activity mars the plant

beauty and may interfere with normal growth. These ornamental plants are especially subject to attack: pyracantha, canna, carnation, chrysanthemum, dahlia, geranium, rose, zinnia, honeysuckle and verbena.

**LEAF MINERS**, Family Buprestidae (Coleoptera), Family Agromyzidae (Diptera) and Numerous Families in the Order Lepidoptera

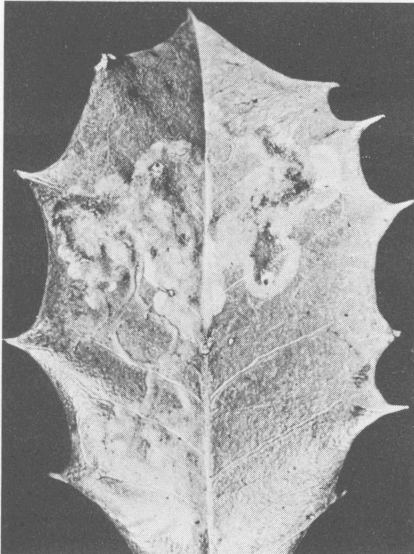
**Description.** Leaf miners are included as chewing insects for lack of a better category. The immature stage of leaf miners is most commonly colorless and small. The lepidopterous larvae are legged, while the beetle and fly or midge larvae are legless.

**Life history.** The eggs of leaf miners are commonly deposited by the female in the plant tissue. On hatching, the larvae feed between the dermal cells of the foliage. Pupation occurs in the leaf tissue in most instances. There are commonly several generations in a growing season.

**Damage.** The damaging stage is the tiny larva, which tunnels between the upper and lower leaf surfaces. Many plants are attacked, but azalea, chrysanthemum, columbine, zinnia and verbena are particularly susceptible. Each species of leaf miner has a rather specific host range.

The mines caused by tunneling larvae assume two forms — blotches (blisters) and serpentine mines. Blotch leaf miners cause whitish, blister-looking areas on the leaf, figure 11; whereas serpentine leaf miners leave a whitish, winding tunnel which gradually widens as the larva develops, figure 12. Larvae can usually be found by separating layers of leaf tissue at the damage point.

Figure 11. Leaf blotch miner damage.



#### SOWBUGS AND PILLBUGS, Class Crustacea

**Description.** Sowbugs and pillbugs are light gray-to-slate arthropods about 1/2 inch long. They have segmented bodies and seven pairs of legs. When disturbed, pillbugs roll up into tiny balls.

**Life history.** These creatures reproduce by means of eggs which are retained in the female for about 2 months. The young, on hatching, do not leave the female for some time; 25 to 75 constitute a brood. The young resemble the adults except in size. About 1 year is required for the young to mature.

**Damage.** Sowbugs and pillbugs are found on damp ground under stones, boards, dead leaves or in damp basements. They feed on organic matter in the soil and sometimes on grass and other plants.

Control measures are not usually necessary except on tender plants; however, these crustaceans may become pestiferous on entering homes.

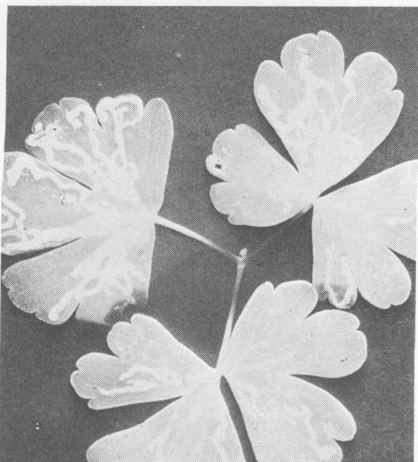
#### SNAILS AND SLUGS, Class Gastropoda

**Description.** Snails are distinguished from slugs by the presence of a shell. Though there are many species of each, slugs are the most damaging in Texas. The shells of snails may be quite colorful, but slugs are generally gray or grayish-brown, slimy, legless, soft-bodied creatures from 1/2 to 4 inches long.

**Life history.** Eggs are laid in masses, in damp places beneath boards, flowerpots, bricks or in soil. They are held together by a sticky secretion which turns yellow before the eggs hatch. In about 1 month the eggs hatch and the immature forms closely resemble the adults except for size. They develop slowly and commonly live for a year or more.

**Damage.** Several species of snails and slugs may damage ornamental plants. Snails and slugs feed on leaves, flowers, stems or roots by scrap-

Figure 12. Serpentine leaf miner.



ing off the tissue or eating holes in leaves or flowers. They leave a glistening trail of slime wherever they crawl.

Snails and slugs normally hide during the day under wood, pottery, fallen leaves or mulches and are active at night. They also move about on damp, dark days.

## Pests Attacking Shade Trees

### Sucking Pests

SCALE INSECTS, Aphids, Lace Bugs, Spider Mites

Scale insects, aphids, lace bugs and spider mites are discussed on pages 8-10. Their damage to shade trees is the same as discussed for shrubs.

BOXELDER BUGS, *Leptocoris trivittatus* (Say)

**Description.** These are flat-backed, narrow bugs about 1/2 inch long. They are brownish-black, with three longitudinal red stripes on the thorax or shoulders and red veins on the wings, figure 13. The nymphal or immature stage is bright red.

**Life history.** There are usually two generations per year in Texas. They overwinter in the adult stage in buildings or other dry, sheltered places. Eggs are laid on the bark or leaves of host plants. Eggs hatch in 8 to 14 days and the young nymphs begin feeding. Feeding preference is shown for the fruit of host plants, especially boxelder.

**Damage.** These strikingly marked, red and black sucking bugs often feed on flowers, fruits, foliage and tender twigs of several trees, especially boxelder and ash. Very little damage results from their feeding in most cases. They are often nuisances during fall and warm winter days when they swarm into houses or congregate in great numbers on tree trunks, porches, walls and walks. These insects do not bite or harm food, clothing or other household articles.

GALL-FORMING PESTS, Several Families

Galls are deformities of plant tissue. Certain insects and mites are enveloped by the cancerous-like growth of host plant tissue. Although the gall is entirely plant tissue, the insect (or mite) controls the size and shape of the gall which provides shelter and food for the inhabitant(s). The site of a gall on a given plant is consistent for a given insect or mite species, though quite variable between species.

Generally, gall insects do not occur on shade trees in large enough numbers to cause serious damage. Control measures usually are not necessary. However, under certain conditions, gall insects can damage trees. Unhealthy trees are damaged more than healthy trees. Shade trees should be fertilized and watered to keep them growing vigorously. This helps the tree overcome gall infestations and also minimizes damage from wood boring insects.

After the galls have begun to form, insecticide applications are of little value.

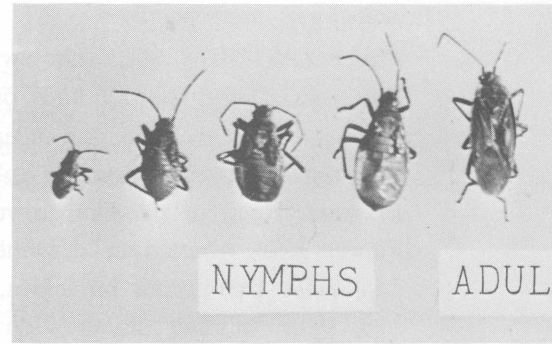


Figure 13. Boxelder nymphs and adult.

Principal gall types include:

*Blister galls.* Many blister-like swellings on leaves.

*Bud galls.* Deformities of buds or florets.

*Bullet galls.* Nearly solid, one-celled, bullet-shaped.

*Cecidomyia.* Catch-all for any gall type produced by gall midges.

*Erineum.* Hairy or pile-like growths on leaf surfaces.

*Flower galls.* Aborted or deformed flowers or masses of flowers.

*Leaf galls.* Deformities on leaves, figure 14.

*Leaf spots.* Marked discoloration on leaves.

*Many-celled or polythalamous.* Galls containing two or more young or larvae in more or less separated cells.

*Oak apples.* Large galls on oak, figure 22a.

*One-celled or monothalamous.* Galls inhabited by a larva or several larvae in one cell or cavity.

*Pouch galls.* Pouch-like deformities usually caused by a depression in the leaf surface.

*Roly-poly galls.* Galls with a loose, usually oval cell within a large cavity.

*Root galls.* Galls on root system of the host.

*Rosette galls.* Galls where a central cell is surrounded by a rosette of partly developed leaves; usually at the tip or apical end of a twig.

*Stem or twig galls.* Deformities on stems or twigs and usually affecting entire circumference.

*Subcortical galls.* Swelling just under the bark; usually on one side of a stem or twig and frequently irregularly shaped.

Principal gall producers include:

*Mites, Order Acarina.* Several species of mites attack new growth of trees in early spring and may continue to infest throughout the growing season. Gall mites produce leaf pouches or pocket galls and velvety growths caused by excessive development of plant hairs. Ash, oak, hackberry and walnut are common hosts in Texas.

*Plant lice, Families Aphididae and Phylloxeridae.* The leaf petiole gall, figure 15, caused by aphids is common on cottonwood and poplar. This is an oval gall on the petiole near the leaf base. Close inspection reveals a slit in the side of the gall through which the aphids emerge when mature. Some species of aphids attacking oak leaves cause wool-like growths on the leaves. Others cause severe curling and twisting of leaves, particularly on live oak.

Other species form hollow pockets or pouches on the upper leaf surface. Mature aphids emerge through a slit-like orifice opening on the underside of the leaf. These galls are commonly found on elms and also on other shade trees.

Phylloxera galls, figure 16, are common on pecan, hickory and hackberry in Texas. The abnormal growths occur on newly formed stems and leaves.

*Gall midges, Family Cecidomyiidae.* Several species of small flies or midges attack a variety of plants. Galls vary greatly in size and shape. Frequently small, ball-like clusters of galls occur on new growth. They are common on hackberry.

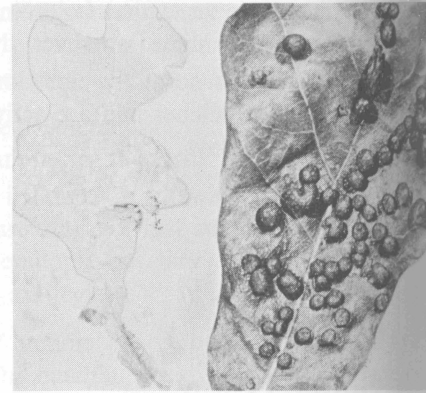


Figure 14. Cynipid wasp galls on oak. One of the leaf galls.

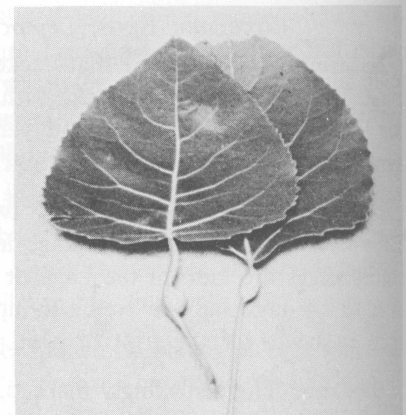
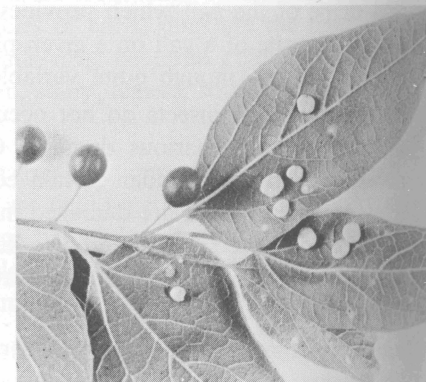


Figure 15. Petiole gall on poplar caused by an aphid.

Figure 16. Hackberry gall caused by phylloxera.



*Gall wasps*, Family Cynipidae. These are very small wasps which are easily overlooked. They are called cynipids, and attacks by certain species cause galls on oak, figure 23a. In general the common galls are round to oval and have a hard covering. Many galls are as small as a pinhead, but some may be 1/2 inch in diameter. Galls usually occur on leaves or stems, but some cynipids attack small twigs, causing swelling at the point of attack.

*Jumping Plant-lice*, Family Psyllidae. These insects look much like a miniature cicada (locust). They are 1/15 to 1/8 of an inch long. Psyllids form galls on hackberry and other shade trees. The appearance of galls caused by different species varies considerably, and the growth may be formed on leaf petioles, on leaves or both. Generally, the leaf galls are raised areas on the upper surface of the leaf and resemble a match head in size and shape. Galls on the petiole are usually oval or round, harder and woodier than those on leaves. Young psyllids develop in chambers inside the galls and emerge when mature.

### Chewing Pests

#### TENT CATERPILLARS, *Malacasoma* spp.

Outbreaks of these insects may cause considerable defoliation of oak, ash, pecan and other ornamental and fruit trees. At least three species of "tent caterpillars" attack ornamentals: the forest tent caterpillar, *Malacasoma disstria* Hubner, a closely-related species, *Malacasoma tigris*, and the eastern tent caterpillar, *Malacasoma americanum* (Fabricius).

**Description.** The forest tent caterpillar, *M. disstria*, is pale blue to grayish-brown with a row of keyhole-shaped, white spots down the back and pale yellow stripes along the sides, figure 24a. The body is covered with long, fine hairs making the caterpillar appear fuzzy. At maturity, it is 1-1/2 inches long. *M. tigris* looks similar but lacks the white spots down the back. The eastern tent caterpillar, *M. americanum* is similar but has a white stripe down the back rather than the keyhole-shaped markings, figure 25a.

**Life history.** *M. disstria* and *M. tigris* overwinter as larvae inside egg cases deposited the previous summer. The larvae hatch in March or early April, migrate to the foliage and begin feeding. A trail of silk is left wherever they go. In several days irregular webs can be seen.

Larvae mature and pupate in 4 to 6 weeks. At maturity, larvae crawl down the tree in search of a pupation site. Cocoons may be found on trunks or limbs of trees, in trash, along fence rows or in other sheltered places.

Moths emerge from these cocoons in 2 to 3 weeks, mate and begin depositing eggs for next year's generation. The female moth begins to deposit eggs around June 15. About 200 eggs are placed in a collar-like mass about 1/2 inch long which encircles or partly encircles small terminal stems which range in size from a matchstick to a lead pencil, figure 17. Eggs are covered with a waxy material which, when dry, gives them a varnished appearance.

The egg mass is honeycombed with each larva having an individual cell. Eggs hatch during late summer, but worms do not emerge until the following spring, about the time new leaves begin to develop.

The life history of the eastern tent caterpillar is similar to the previously described species. The eastern tent caterpillar, however, constructs



Figure 17. Egg cases of forest tent caterpillar. Overwintering stage of this species.



Figure 18. Webbing of fall webworm. Webbing is on terminal portions of the limbs rather than in the crotch, which is characteristic of the forest and eastern tent caterpillars.

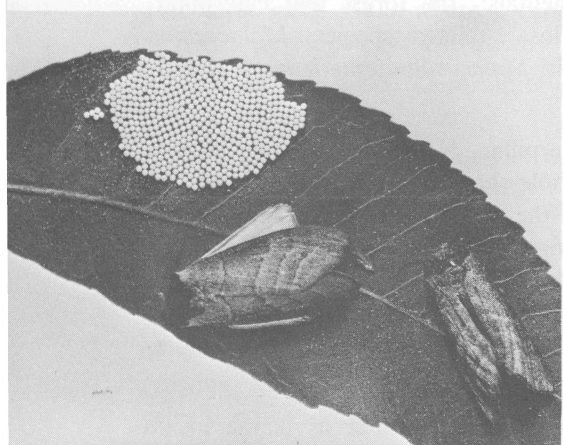


Figure 19. Walnut caterpillar adults and egg mass.

Figure 20. Tree completely defoliated by walnut caterpillars.



distinct webs in the crotches of trees, figure 26a, and congregates in these webs during the night and rainy periods. The larvae leave the webs to feed during the day. All species of tent caterpillars mentioned have only one generation per year.

**Damage.** All three tent caterpillars consume foliage. Whenever their food supply is exhausted before maturity, the larvae often crawl down the tree and move as a group in search of food, sometimes damaging grass, vegetables and other plants. The eastern tent caterpillar feeds mostly on native and wild fruit trees. The forest tent caterpillar and *M. tigris* prefer aspen, poplar, oaks, maple, ash, basswood, elm and birch.

#### FALL WEBWORMS, *Hyphantria cunea* (Drury)

**Description.** Adults are white moths, which may have black or brown spots on the forewings. The wingspan is about 1 inch. The larval or immature stages are pale yellow, spotted with black. They are 1 inch long when grown and are covered with long, black and white hairs.

**Life history.** The insect overwinters as a pupa in lightly woven cocoons in debris on the soil or under bark. Moths emerge in spring and lay masses of greenish-white eggs on leaves. After hatching, the larvae feed for 4 to 6 weeks before pupating. A second generation occurs in early fall.

**Damage.** The presence of this insect is indicated by loosely woven, dirty-white webs enclosing foliage and branches, figure 18. The larvae in the webs feed on foliage. Fall webworms feed on a variety of fruit and shade trees, but do not attack evergreens.

#### WALNUT CATERpillARS, *Datana integerrima* Grote and Robinson

**Description.** Fully grown larvae are about 2 inches long, black and clothed with soft, long, gray hairs. Younger larval stages are reddish brown, with narrow yellow lines extending along the body. When disturbed, the larva raises its head and the tip of the abdomen to an upright position and holds to the branch with its abdominal prolegs. The moth has a wingspread of 1-1/2 to 2 inches. The forewings are light brown with darker wavy lines. The hind wings are lighter without lines, figure 19.

**Life history.** This insect overwinters in the soil as a pupa. The adult emerges in spring and deposits eggs in masses on the underside of leaves, figure 19. The first generation occurs in the late spring and the second in late summer or early fall.

**Damage.** The walnut caterpillar feeds mainly on walnut, pecan, hickory and oak. The larvae feed together and congregate in masses on tree trunks during molting periods. These insects feed on leaves and may strip entire trees of foliage, figure 20.

#### SPRING CANKERWORMS, *Paleacrita vernata* (Peck)

**Description.** The adult male, a moth, has a wingspread of 7/8 to 1-1/4 inches, but the mature female is wingless. The male's front wings are silky, with loosely-attached, brownish-gray scales. The hind wings are a pale, ashy-gray with a dusky distal spot. The female is whitish or brown and black, but her color is not uniform.

Full-grown larvae of spring cankerworms are 3/4 to 1 inch long and vary from reddish to yellowish-brown or green to almost black. The head is dirty white, mottled with brown. Spring cankerworm larvae



have only two pairs of prolegs, on the sixth abdominal segment and the anal segment. Because of a "looping" movement, they are often called "measuring worms or inchworms."

**Life history.** Cankerworms overwinter as pupae in a cell in the soil. Adults emerge in spring and mate. The wingless females must crawl up the tree trunk to lay eggs in bark crevices. Eggs are laid in masses ranging from a few to a hundred or more per mass. Eggs hatch in late spring, and young larvae begin skeletonizing newly-formed leaves. Larvae are full grown in 4 to 6 weeks, enter the soil and pupate.

**Damage.** Spring cankerworms attack a variety of trees, including elm, oak and hickory. Heavy infestations often defoliate trees. When only a few trees are involved, sticky bands around the trees help reduce infestations. These bands trap female moths and prevent them from crawling up the tree in search of a desirable egg laying site.

#### BAGWORMS, *Thyridopteryx ephemeraeformis* (Haworth) and Others in Family Psychidae

**Description.** Bagworms are easily identified by the spindle-shaped bags of silk covered with bits of needles or leaves which they construct around themselves, figure 27a. This silk bag is very tough, and the pieces of needles or leaves provide an excellent camouflage. Their presence often is overlooked until trees or shrubs have been seriously defoliated.

Larvae carry these bags with them, with only the front part of their bodies protruding for feeding and movement. The bagworm larvae enlarge these bags as they grow. The full-grown larvae are 3/4 to 1 inch long and are enclosed in the 1-1/2 to 2 inch long bags.

The male bagworm is a black, hairy moth with about a 1-inch wingspan. The female bagworms are mahogany brown, worm-like, with no wings.

**Life history.** The life cycle of bagworms begins in spring when eggs hatch and developing larvae begin to feed on foliage. Larvae immediately spin a bag of silk around themselves and attach bits of foliage to the outside as they feed. When the larvae become full-grown, they attach the bags to twigs with a strong band of silk. The larvae then pupate inside the bags. As adults, male moths leave the bags and fly to bags containing females, where mating takes place. The female deposits a mass of eggs (500 or more) in the bag, crawls out, drops to the ground and dies. There is only one generation per year.

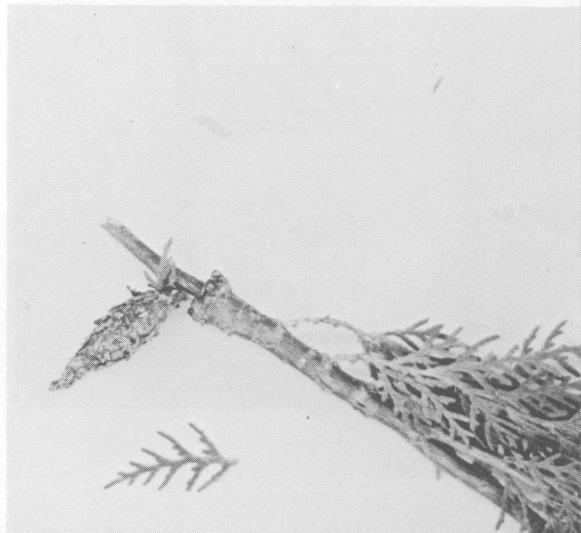
Depending on the species, bagworms overwinter either as eggs or larvae inside bags. If they overwinter as eggs, the larvae pupate in late summer or early autumn, become adults, mate and lay eggs for overwintering. If the species overwinters as full-grown larvae, the pupal and adult stages are not reached until the following spring.

**Damage.** Damage to trees and shrubs is caused by the larvae inside the bag; larvae eat needles or leaves of plants. A heavy infestation can completely strip a plant. Complete defoliation usually results in the plant's death. When a bag is firmly attached to a twig and is not removed, girdling of the twig can occur as the plant grows, figure 21. Although they are more frequently found on evergreens, bagworms occasionally attack broad-leaved plants and other ornamentals.

#### ELM LEAF BEETLES, *Gallerucella xanthomelaena* (Schrank)

**Description.** Adult elm leaf beetles are about 1/4 inch long and

Figure 21. Twig which is almost girdled by firmly attached bag of pupating bagworm.



yellowish to olive green with a frequently indistinct black stripe along the margins of each wing cover, figure 28a. The eyes are black and the antennae and legs are yellowish. The newly hatched larva or grub is yellowish but appears nearly black because of dark tubercles and hairs. The full-grown larva is about 1/2 inch long and dull yellow with two black stripes down the back, figure 29a. The head and legs are black.

**Life history.** Elm leaf beetles overwinter as adults on or near the tree on which they fed as larvae. Often they overwinter in buildings, especially in house attics, barns and sheds. During warm weather periods in winter, many become active and cause annoyance by crawling into living quarters. In spring they emerge from hibernation, fly to nearby elm trees and begin chewing holes in new leaves. Shortly after emergence, females begin laying eggs on the underside of leaves. The eggs are orange-yellow, somewhat spindle-shaped and laid in groups of 5 to 25, figure 30a. Each female lays 400 to 800 eggs over several weeks. Eggs hatch in about a week and the larvae begin feeding on the undersurface of the leaves. These larvae feed for 2 or 3 weeks then move down the tree to find a pupation site. They often pupate in crevices in the bark or at the base of the tree, emerging about 10 days later as adults.

**Damage.** Adults and larvae skeletonize leaves causing them to dry up and drop prematurely. Heavy defoliation weakens trees and predisposes them to attack by other insects and diseases. The adults chew oval holes through leaves, while the larvae eat all but the upper leaf surfaces.

#### PUSS CATERpillARS, *Megalopyge opercularis* (Smith)

**Description.** Puss caterpillars are the larvae of flannel moths. Adults are yellowish brown with a wingspan of 1-1/2 inches. Larvae are convex, stout-bodied caterpillars about 3/4 to 1-1/2 inches long when grown. These caterpillars are covered with long, grayish-to-tan hairs. The hairs near the posterior end of the caterpillar are tufted to form a sort of tail, figure 31a. Underneath these hairs are stiff spines connected to poison glands. When the caterpillar is touched, these spines may be broken off and the poison released. This proteinaceous, acid material causes severe pain when it comes in contact with the skin. The severity of pain and extent of injury varies with the sensitivity of different individuals.

**Life history.** These insects overwinter in a cocoon, usually spun on the host plant, figure 22. Adults emerge from overwintering usually from April to June and begin depositing eggs, with 300 to 600 eggs per female being laid. Eggs are laid in small batches on leaves and are covered with hair from the abdomen of the female. The eggs hatch in 4 to 8 days into larvae or caterpillars, which later become densely clothed with long hair. There may be two generations per year: the first in June or July and the second usually in September or October.

**Damage.** Puss caterpillars feed on foliage of deciduous trees and shrubs, including citrus, hackberry, elm, plum, sycamore, oak and rose. The larvae feed gregariously for a few days, skeletonizing the foliage, but larger larvae eat the entire leaf. Puss caterpillars are at times numerous enough to cause considerable defoliation.

#### SADDLEBACK CATERpillARS, *Sibine stimulea* (Clem.)

**Description.** Saddleback caterpillars are brown with a green back

Figure 22. Cocoon containing pupae of puss caterpillar on live oak leaf. These are commonly found in the mortar area between bricks around homes and other buildings.



and flank on which is a conspicuous brown, oval central area, usually bordered with white, figure 32a. The main nettling hairs are on the back on fleshy projections near the front and rear of the body. Smaller nettling hairs are located in a lateral row on each side.

**Damage.** Saddleback caterpillars feed on foliage. The damage caused is similar to that of other chewing insects.

#### BUCK MOTHS, *Hemileuca maia* (Drury)

**Description.** The larvae of these urticating caterpillars are dull brown to black with red heads. Full-grown larvae are about 2-1/2 inches long, covered with small, pale-yellowish dots. Along the body are several rows of reddish or black nettling spines.

**Life history.** Buck moths overwinter as larvae in egg cases attached to the host plant. In spring the larvae become active and feed on foliage of the host tree. In late spring or early summer larvae mature and pupate. Moths later emerge, mate and lay eggs which hatch into overwintering larvae.

**Damage.** The larvae feed gregariously and almost exclusively on the foliage of oak. When many larvae invade a tree, they can do considerable damage; however, they are most important because of their nettling hairs.

#### NANTUCKET PINE TIP MOTHS, *Rhyacionia frustrana* (Comstock)

**Description.** Nantucket pine tip moths (commonly called pine tip moths) are reddish-brown with gray markings and have a wingspan of about 7/16 inch. When full-grown, the larvae are about 3/8 inch long and yellowish to pale brown with a brown head, figure 33a.

**Life history.** Pine tip moths overwinter as pupae. The following spring, adult moths emerge, mate and lay eggs singly on needles, buds or shoots of the host. Upon hatching, the small larvae bore into buds and twigs and continue to feed there until mature; they then pupate in the twig or bud. There are four to six generations per year.

**Damage.** Pine tip moth infestations are first indicated by yellowing shoots, which turn red and finally brown, figure 34a. Dead, hollowed-out buds and twigs on tops or sides of infested pine trees may be found. A small silk web is spun by larvae between the buds. Webs soon become covered with a hard, thin, easily seen crust of white resin. Because of tunneling in buds or shoots, trees become bushy, forked and many-stemmed. Infestation also slows tree growth, causing poorly-formed, poor-quality trees.

This insect is a pest of young loblolly and shortleaf pines. Longleaf and slash pines may be fed upon, but there has been no evidence of severe injury. Young pines growing in full sunlight are most heavily infested.

#### PINE BARK BEETLES, Family Scolytidae

Southern pine beetles, turpentine beetles and the *Ips* beetles are among the most destructive insects attacking pine trees. These beetles kill pines by tunneling beneath the bark, eventually girdling the tree. Bark beetles also transmit a blue stain fungus which cuts off water conduction within the tree.

Usually only weakened trees are attacked; however, when the insects are concentrated in an area, they can kill apparently healthy,

vigorous trees. Bark beetles may be attracted from considerable distances by the odor of scorched bark or fresh resin. When these beetles attack a weakened tree, they chew entrance holes through the bark and engrave deep tunnels into the bark and wood. They then deposit eggs along the sides of the tunnels. Upon hatching, the larvae begin tunneling.

**SOUTHERN PINE BEETLES, *Dendroctonus frontalis*, Zimmerman**

**Description.** The immature southern pine beetle is a small, whitish, legless grub with a reddish-brown head. Adult beetles are brown or black and about 1/8 inch long. The posterior end of the body is smoothly rounded.

**Life history.** Southern pine beetles overwinter in all stages in the bark. In spring, they emerge and begin attacking trees. Eggs are laid in S-shaped egg tunnels on the inner bark or wood surface. The larvae form short tunnels leading off from the side of the egg tunnels. The life cycle from egg to adult requires only 30 to 40 days with five or six overlapping generations in a year.

**Damage.** Southern pine beetles cause discoloration of the crowns of infested trees. It begins with the yellowing of needles in the upper crown and progresses rapidly over the whole crown; the fading needles soon turn a reddish-brown. The middle and upper portion of the trunks of the trees are most commonly attacked. Examination of the tree trunk reveals small, yellowish-white masses of pitch, called pitch tubes, which are 1/4 to 1/2 inch in diameter. These pitch tubes mark the site where beetles entered the tree. Sometimes there may be only traces of pitch tubes, and the only evidence of attack may be reddish-brown boring dust lodged in bark crevices around the tree base.

Removal of a piece of bark from an infested pine tree reveals S-shaped winding galleries on inner bark and on the wood surface. Larvae and adult beetles make the tunnels.

**BLACK TURPENTINE BEETLES, *Dendroctonus terebrans* (Olivier)**

**Description.** Turpentine beetles are the largest bark beetles in Texas. They are black and 1/4 to 1/2 inch long.

**Life history.** The adults construct broad, winding tunnels beneath the bark and deposit egg masses along the tunnels' sides. Eggs hatch into grubs, which feed in groups and destroy irregular patches of wood tissue beneath the bark. In warmer climates, all stages of turpentine beetles may be found throughout the year. There are one to two generations per year depending upon the length of warm weather.

**Damage.** Tunneling usually does not girdle the tree. The damage caused by turpentine beetles commonly heals and the tree survives.

These beetles invade the lower trunk and larger roots of pines. Trees with injured bark or damaged roots attract these insects. Pitch tubes of turpentine beetles are distinctive because of their thumb-like appearance and sugary texture. Pitch tubes may occur singly on a tree or in numbers surrounding the lower trunk and larger roots.

**IPS BEETLES, *Ips* spp.**

**Description.** There are three common, distinct species of ips beetles in Texas. They are distinguished from southern pine beetles and turpentine beetles by the shape of the abdomen. The tip of the ips beetle's

abdomen is concave and bears toothed projections. Southern pine beetles and turpentine beetles have a rounded, convex abdominal tip.

The smallest ips (*Ips avulsus* Eichh.) in Texas is about 1/8 inch long and prefers twigs and branches of the upper crown. The middle-sized ips (*Ips grandicollis* Eichh.) is about 3/16 inch long and commonly infests the middle trunk and large limbs. The larger species of ips (*Ips calligraphus* Germ.) is about 1/4 inch long and usually invades lower tree portions. The species may work together in the same tree, their tunnels overlapping, or they may work independently, or in succession. They may also associate with southern pine and turpentine beetles.

**Life history.** Ips beetles generally complete a life cycle in 2 months with one to five generations per year, depending on length of warm weather. They overwinter either as adults or larvae beneath the bark or in ground litter.

**Damage.** Ips beetles normally attack unhealthy pine trees. Infested trees usually have many pink or reddish-brown pitch tubes about the size of a dime on the bark of branches or the trunk. The first sign of attack is the reddish boring dust in the bark crevices at the tree base.

Under infested bark, primary tunnels of the ips beetles run almost straight up and down, parallel with the wood grain. They are usually Y- or H-shaped. These characteristic tunnels also separate ips beetles from southern pine beetles.

#### SHADE TREE BORERS, *Orders Coleoptera, Lepidoptera* and *Hymenoptera*

The larvae of several beetles and moths are called borers. Other larvae belonging to the Order Hymenoptera cause similar damage. In this group are insects which feed in terminal shoots and burrow beneath the bark, frequently girdling and killing the tree. Still others tunnel in the heartwood, making the tree vulnerable to wood-rotting organisms and wind damage. Some species attack healthy trees, but most attack trees and shrubs weakened by transplant shock, drought, flooding, dirt fills, poor soil fertility or mechanical damage.

The presence of borers often is not evident until too late to prevent extensive damage and, in many cases, to save the tree. Therefore, *sound tree management practices are important* in preventing borer attack. The following practices should be followed:

1. Wrap trunks of young or transplanted trees with nursery wrapping paper, burlap, aluminum foil or newspaper to prevent egg laying. Wrapping also helps prevent sun scald and mechanical injury. Injured bark areas are particularly vulnerable to attack. Spray trunks before wrapping. Use insecticides in wettable powder form to prevent injury to the bark of the young trees when wrapped. Keep the wrapping on all year and replace it if torn.
2. Stimulate vigorous growth by proper fertilizing and watering.
3. Prune out all dead or dying branches and paint the wounds with a good wound paint. Treat wounds caused by lawn mowers, automobiles, etc., in the same manner.
4. Select trees and shrubs adapted to your particular geographical area. When landscaping, select trees which are less susceptible to borer attack. Ash, cottonwood, linden, soft maple and poplar are susceptible.

## ROUNDHEADED BORERS, Family Cerambycidae

**Description.** Adults of roundheaded borers are called long-horned beetles, because their antennae are as long as or longer than their body. Their length varies from less than 1/4 inch to over 3 inches. Adults are cylindrical or straight-sided, hard-shelled beetles, which frequently are beautifully banded, spotted or striped with contrasting colors, figures 23, 24 and 35a.

The larvae make galleries beneath the bark and tunnel into the heartwood of devitalized, diseased, transplanted or susceptible trees. The larvae are legless, white to yellowish rather round-bodied grubs. They have a circular enlargement behind the head with a horny plate on the upper side (dorsum), figure 25.

**Life history.** The life cycle of this group of borers varies with the species. Some species emerge as adults in early spring and begin egg laying, while others emerge and deposit eggs during summer or early fall. All species deposit eggs in cracks and crevices in the bark. Young grubs enter the tree on hatching and continue tunneling until they pupate. In some species, this occurs each year, while in others larvae may not complete development for 2 or 3 years. Pupation occurs in a "cell" hollowed out in the tree. The adult emerges and the life cycle is repeated.

**Damage.** The roundheaded borers are more numerous and destructive than flatheaded borers. They burrow into the heartwood, tunneling out holes as large as a pencil or larger. The entrance to these burrows is usually packed with coarse, excelsior-like frass. These wood fibers or frass often accumulate around the trunk base. A discharge of sap from the tunnel opening wets and discolors the tree bark for some distance.

## FLATHEADED BORERS, Family Buprestidae

**Description.** Adults of flatheaded borers are generally beautifully colored or metallic, boat-shaped beetles, 1/3 to 1 inch long, figures 26 and 36a. Adults are called metallic wood borers. Larvae or grubs are 1/4 to 2 inches long, yellowish-white and legless with a pronounced flattened enlargement of the body (thorax) just behind the head, figure 37a. This enlargement bears a horny plate on both the upper and the under sides. The species of borers in this group are especially injurious to newly established shade and ornamental trees.

**Life history.** The life cycle of many flatheaded borers is completed in 1 year; however, some species require 2 to 3 years. Typically, winter is passed in the larval or borer stage within infested wood. In spring, pupation occurs; adults emerge, mate and females begin depositing eggs in cracks or crevices in the bark. Upon hatching, borers begin tunneling into the inner bark, becoming full-grown by fall. There is generally 1 generation per year.

**Damage.** Typical injury to trees consists of shallow, long, winding, oval galleries packed with frass beneath the bark. This is most prevalent on the south or southwest side (sunny side) of the tree. Most species damage or kill ornamental and shade trees by mining beneath bark, while others tunnel into sapwood and heartwood. The burrowing causes dark-colored, dead areas of bark which often exude sap. Tunnels of flatheaded borers have no exit holes to the outside, although the saw-

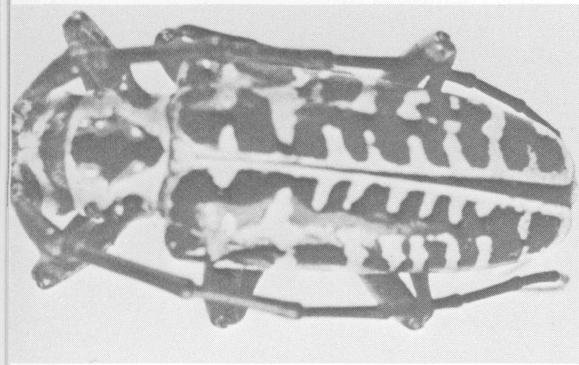


Figure 23. Cottonwood tree borer, one of the long-horned beetles. Adult stage of the roundheaded cottonwood borer.

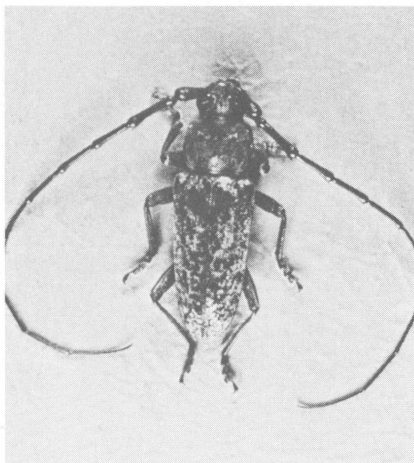


Figure 24. Long-horned beetle, cerambycid. Adult stage of roundheaded borer.

Figure 25. Roundheaded borer. Larval stage of a long-horned or cerambycid beetle.



dust-like frass may be visible in cracks in the bark or where bark sloughs from the tree.

#### SHOT-HOLE BORERS, Family Scolytidae

**Description.** The larvae of shot-hole borers are legless, pinkish-white grubs about 1/8 inch long. Adults are black beetles about 1/10 inch long. The body is blunt at both ends. Adults have well-developed wings and can fly considerable distances.

**Life history.** Larvae or grubs overwinter in the inner bark. In early spring, larvae pupate and adult beetles emerge. After mating, females seek out unhealthy trees. They enter the bark along a branch or twig and excavate a gallery 1-1/4 to 2 inches long, usually running parallel with the length of the trunk or branch. The female then deposits eggs at short intervals on either side of the parent gallery. She then dies with the tip of her body blocking the entrance to the egg gallery.

Upon hatching, young grubs begin burrowing into the inner bark at a sharp angle from the parent gallery. They burrow until they are full-grown, 6 to 8 weeks. Larval burrows are packed with frass, while the parent gallery is clean. When full-grown, larvae pupate and adult beetles emerge at the end of the larval burrow from holes gnawed directly outward through the bark. There are one to three generations per year.

**Damage.** Shot-hole borers attack many trees including apple, peach, pear, plum and cherry. These insects eat holes about the size of a pencil lead through the bark. The holes are indicated by bits of sawdust or borings on the tree. On peach, cherry and other stone fruits, holes are usually covered and sealed by dried droplets of gum, which hang from twigs like teardrops. The branches and trunks of weakened, infested trees are perforated with numerous shot-hole-like openings, for which the beetles are named. Removal of the bark exposes many winding, sawdust-filled, gradually enlarging galleries leading out from a shorter central gallery.

#### TWIG GIRDLEERS, Family Ceramycidae

**Description.** The larvae of twig girdlers are roundheaded borers. They are legless and have a circular enlargement just behind the head, figure 38a. Adults are long-horned beetles and can be recognized because the antennae are as long as or longer than the body, figure 39a.

**Life history.** In late summer or early fall, females appear and feed on the thin bark before laying eggs. She girdles branches of the host tree by cutting circular incisions through the bark deep into the wood. Girdled twigs are 1/4 to 1-1/2 inches in diameter. In small scars gnawed through the bark of these twigs, the female deposits eggs, figure 40a. The girdled twig soon dies and falls to the ground. Until the middle of the following summer, larvae feed in the wood of these dead twigs. Many larvae may die because too many borers occupy the same twig or because of excessive drying of branches.

**Damage.** Damage is entirely restricted to the pruning of small limbs by the adult females. Extensive damage occurs when females are numerous. Where practical, all fallen twigs should be collected and burned during the winter. This destroys the overwintering larvae. Twig girdlers attack a variety of trees including mimosa, hickory, oak, pecan, persimmon, apple, pear, peach, elm, poplar and dogwood.

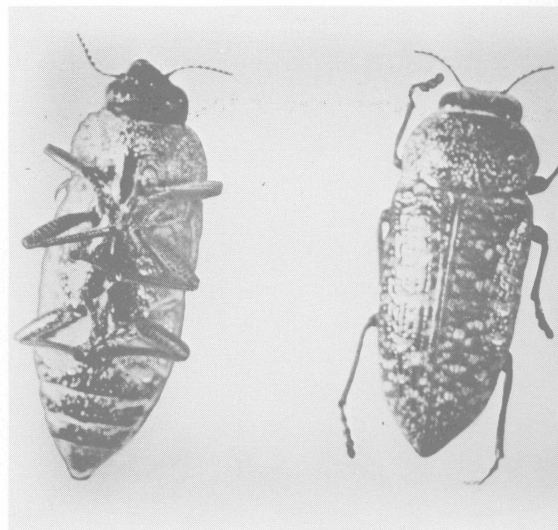


Figure 26. Metallic wood borer. Adult stage of a flatheaded tree borer.



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