

FIELD GUIDE TO THE INSECTS AND MITES ASSOCIATED WITH PECAN

BILL REE AND ALLEN KNUTSON



**FIELD GUIDE
TO THE INSECTS
AND MITES
ASSOCIATED
WITH PECAN**

by Bill Ree and Allen Knutson

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Introduction

This field guide was written to help pecan growers identify some of the insects and mites commonly seen in pecans, both pests and natural enemies. As a native tree, the pecan has been called home by hundreds of insects. Detailed studies have reported more than 600 species of insects and 60 species of mites present in pecan trees. A very small portion of these arthropods can be pests. Many are important natural enemies of potential pests while others are a part of the orchard ecology and have no bearing on pecan production. This field guide includes many of the more important pest and natural enemy species growers may observe in their orchards. Other insects in this guide are neither pests nor natural enemies but are often observed and stimulate curiosity. Other natural enemies, such as parasitic wasps, are important but because they are seldom seen, are not included in this guide.

Proper identification of an insect or mite as a pest species or beneficial insect is important in making a management decision. Many species of insects and mites are beneficial and help keep pest numbers below damaging levels. Recognizing and protecting these natural enemies is an important part of a pecan Integrated Pest Management (IPM) program.

All too often, insecticides have been applied unnecessarily to control an insect misidentified as a pest. As an example, the rice stink bug feeds on developing seeds of grasses and is commonly found on grasses in the orchard. As the orchard floor is shredded, rice stink bugs may fly into pecan trees. Because of their similarity to other species of stink bugs that feed on nuts, growers may become concerned as rice stink bugs appear in the trees. However, the rice stink bug does not feed on pecans.

Acknowledgments

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How to Use This Book

Insects and mites discussed in this book are divided among nut feeders; foliage feeders; twig, stem, branch and trunk feeders; and natural enemies. Knowing where the insect or mite was feeding on the tree and using the color photographs and written description should aid in identification. Tree and nut development can serve as a guide in anticipating the need to scout the orchard for major insect pests (pages 6 and 7). Insects and mites that cannot be identified may be taken to the county office of the Texas Agricultural Extension Service or your state Cooperative Extension Service for further assistance. Information on managing and controlling insect and mite pests is available in Further Reading.

Insect Biology

Insects change in form and function as they grow and develop. This process, called metamorphosis, differs among different insects. Some insects such as aphids change very little. Immature aphids appear much like adult aphids, except adults may have wings. Development of other insects, such as beetles, flies, wasps and moths, includes the egg, larva, pupa and adult stage. These stages appear very different and can make identification difficult. For some groups of insects, the damaging stage may include both the immature and adult stages. For example, the pecan weevil damages pecans as an adult and as a larva, whereas the pecan nut casebearer is a pest only in the larval stage. Feeding habits of beneficial insects vary with developmental stage and species. Lacewing larvae feed on many kinds of soft-bodied insects while the adults of some species feed only on nectar and honeydew. In contrast, both lady beetle larvae and adults feed on aphids.

Further Reading

Managing Insect and Mite Pests of Commercial Pecans in Texas, B-1238, Publication and Supply Distribution, Texas Agricultural Extension Service, P.O. Box 1209, Bryan, TX 77806-1209

Pecan Pest Management CD - Dr. Marvin Harris, Allen Dean, Texas A&M University. The Olde Pecan Bookstore, P.O. Drawer CC, College Station, TX 77841.

Pecan Production in the Southeast - Circular ANR-459, Alabama Cooperative Extension Service, Information Services, Auburn University, AL 36849-5623

Texas Pecan Handbook - Extension Horticulture, Texas A&M University, Rm 225 Horticulture/Forest Sciences Bldg., College Station, TX 77843-2134

Seasonal Pecan Pest Profile

The development of various pecan pests is usually closely related to the seasonal development of the pecan. Although the severity of insect problems cannot be predicted on a seasonal basis, producers should frequently determine tree and nut development to aid them in predicting insect problems and planning control strategies. The seasonal pecan pest profile indicates possible insect problems associated with various developmental stages of the pecan.

_____ Yellow Aphids _____

Pecan Nut Casebearer _____

----- Spider Mites _____

Walnut Caterpillar _____

----- Fall Webworm _____

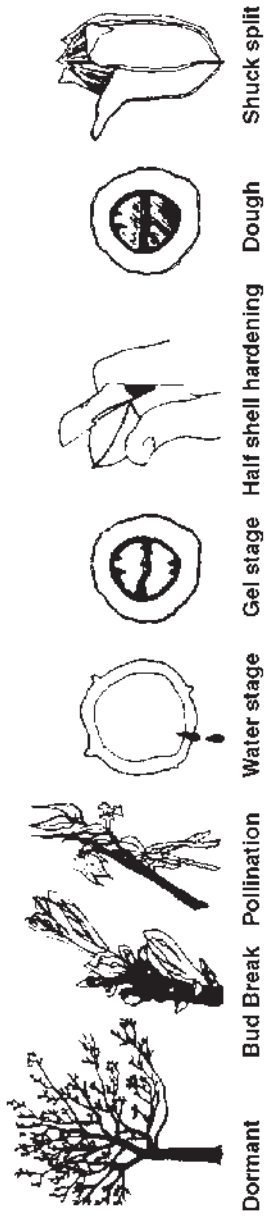
_____ Phylloxera _____

_____ Hickory Shuckworm _____

Pecan Weevil _____

----- Black Aphid _____

----- Occasionally occurs
_____ Commonly occurs



Dormant

Bud Break

Pollination

Water stage

Gel stage

Half shell hardening

Dough

Shuck split

Developmental Stages of the Pecan

Dormant: Period from leaf drop to bud break.

Bud break: The bud scale splits and the leaf begins to expand.

Pollination: Catkins are shedding pollen and stigmas are receptive.

Water stage: The nut interior is filled with water.

Gel stage: Interior of the immature kernel is filled with a gel-like substance.

Half shell hardening: Resistance can be felt when making a cross section cut through the middle of the pecan nut.

Dough: The gel of the kernel begins to solidify.

Shuck split: Shucks begin to split, exposing the shell.

Fire ant

Solenopsis invicta Buren

Damage: Fire ants do not damage pecan trees but have been reported entering fallen pecans that have cracked and feeding on pecan kernels. Their aggressive nature and painful sting interfere with orchard operations such as grafting, mowing and harvesting. Fire ants also feed on aphid honeydew and "farm" aphids by driving away or killing beneficial insects that feed on them. Efforts to release beneficial insects such as lacewings in pecan have been hampered by fire ants feeding on the released eggs or larvae.

Characteristics: For pecan growers throughout the Southeast, the fire ant needs no introduction. These reddish-brown ants are easily identified by their aggressive nature and painful stings.

Prey: Fire ants crawl up pecan trunks and search the canopy, where they feed on insects, both pests and beneficial species, and aphid honeydew. They have been observed feeding on casebearer and hickory shuckworm larvae in nutlets or shucks and on grubs of pecan weevils as they drop onto the soil. While they do feed on some pests, their overall impact in pecans is probably negative because of their stinging nuisance and predation on beneficial insects.



Fire ants feeding on pecan kernel.
Credit: B. Ree



Fire ants attacking a caterpillar.
Credit: W. Sterling

Hickory shuckworm

Cydia caryana (Fitch)

Damage: Tunneling by larvae in developing nutlets prior to shell hardening causes nutlets to fall. After shell hardening, larvae tunnel in the shuck, which interferes with water and nutrient movement to the kernel. Heavy infestations can result in low kernel weight and scarring of the pecan shell. Also, heavily infested pecans may not open properly in the fall, resulting in "sticktights."

Adults: The adult moth is a dark brown to grayish-black moth about 3/8 inch long with a wing span of 1/2 inch. Females deposit eggs directly on the shucks. Often a white stain is visible at the oviposition site and where larvae enter the shuck.

Larvae: Larvae are creamy to dirty white with a light brown head capsule. Mature larvae are 1/3 to 1/2 inch in length. Larvae have thoracic and abdominal legs, which distinguish them from curculio larvae, which do not have legs. The average larval period is 33 days and includes six to seven instars. Shuckworms overwinter as mature larvae in the shucks on the orchard floor or on the tree.

Pupae: Pupal period ranges from 7 to 13 days. Pupae are found in tunnels in shucks.

Hickory
shuckworm
damage to pecan
shuck and shell
tracking by larvae.
Credit: J. Robinson



Hickory
shuckworm larva.
Credit: Anonymous

Hickory
shuckworm
adult.
Credit: B.
Ree



Pupal skin of
hickory
shuckworm
protruding
from shuck.
Credit: J.
Robinson

Leaffooted bugs

Acanthocephala femorata (Fabricius)

Leptoglossus phyllopus (L.)

Damage: Several species of leaffooted bugs are associated with pecan. Prior to shell hardening, feeding on nutlets by these insects causes a condition referred to as black pit, which causes nutlets to abort. This same condition is also caused by several species of stink bugs. After shell hardening, it is thought that feeding by leaffooted bugs is restricted to the shuck with little or no kernel spotting.

Adults: Adult leaffooted bugs are approximately 1/2 inch, longer and more slender in body shape than stink bugs. The hind section of the hind legs is flattened into a leaflike segment. This leaflike structure of the hind leg is one way to separate this group of plant feeders from predacious assassin bugs. The adult *A. femorata* is more robust than other species of leaffooted bugs and the hind legs contain spines rather than the flattened leaf-shaped segment. This species is not as damaging as other leaffooted bugs and can feed on other insects. Leaffooted bugs have slender mouth parts as compared to predacious assassin bugs (pages 94, 126), which have broad mouth parts.

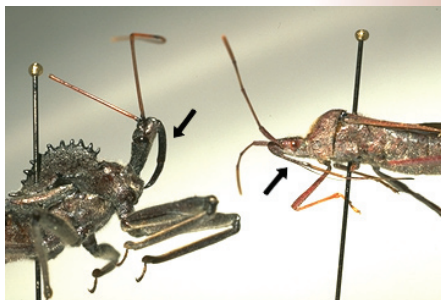
Immatures: Immatures look like small adults but lack fully formed wings. Immatures may be found in pecan trees.



Adult *A. femorata*.
Credit: B. Ree



Adult *L. phyllopus*.
Credit: W.L. Tedders



Mouth parts of predacious assassin bug (left) and plant feeding leaf-footed bug (right). Arrows denote mouth parts.
Credit: B. Ree

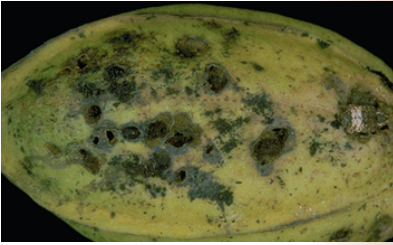
Nut curculio

Conotrachelus hickoriae (Schoof)

Damage: Feeding by adults on the shucks during June and July will cause scarring of the shuck. Larvae feeding in the developing nutlets prior to shell hardening (June and July) will cause nutlets to bleed brown sap and drop from the tree. Aborted nutlets exhibit a brown tobacco-like stain on the pecan shuck.

Adults: Adult curculios are very small, about 3/16 inch long and dark gray to reddish brown. The snouts are slightly curved and approximately one-third the body length.

Larvae: Larvae are small, 1/5 inch or less, creamy white grubs with dark brown heads. Larvae do not have legs, which distinguishes them from hickory shuckworm larvae, which have both thoracic and abdominal legs. There is usually one larva per nut.



Adult feeding damage to shuck.
Credit: M. Hall



Adult nut curculio.
Credit: M. Hall



Nut curculio larva (legless).
Credit: M. Hall



Nuts showing brown stain.
Credit: W.L. Tedders

Pecan nut casebearer

Acrobasis nuxvorella Neunzig

Damage: Damage occurs from larvae feeding in developing nutlets. Prior to shell hardening, larvae tunnel throughout the nutlet. After shell hardening, tunneling is restricted to the shuck. Infestations are characterized by frass (excrement) and webbing around infested nutlets.

Adults: The adult casebearer moth is gray to almost black and about 1/3 inch long. Adults, which are active only at night, have a ridge of scales across the forewings about one-third the distance from the base of the wing.

Eggs: Casebearer eggs are oval, flat and very small (.36 x .65 mm), or just large enough to be seen with the unaided eye. Eggs are generally laid around the pistil end of the nutlet on the stigma, at the base of the calyx lobes or on the side of the nutlet. Eggs are greenish white to white when first laid. Tiny red spots appear within hours after oviposition. Eggs appear pink and red prior to hatch. Time from egg lay to hatch can range from 4 to 5 days in the spring.

Larvae: Larvae are an olive gray color until just prior to pupation, when they turn jade green. Full-grown larvae are about 1/2 inch in length. The larval stage can last from 3 to 4 weeks in the spring.



Pecan nut casebearer damage. Credit: W.L. Tedders

Pecan nut casebearer adults. Credit: A. Knutson



Pecan nut casebearer egg. Credit: B. Ree

Pecan nut casebearer

(Continued)

Pupae: New pupae are jade green, later turning brownish yellow to dark brown. Duration of the pupal stage ranges from 5 to 24 days, averaging 9 days in summer and 12 to 14 days in spring.



Pecan nut casebearer larva.
Credit: W.L. Tedders



Pecan nut casebearer pupae.
Credit: B. Ree

Pecan weevil

Curculio caryae (Horn)

Damage: Developing larvae or "red heads" feed in the pecan on the developing kernel. Adults also feed on nuts. Nuts fed upon in the water or gel stage will drop.

Adults: The adult is a brownish weevil about 3/8 inch long. The female's snout is as long as the body while the male's snout is somewhat shorter. Adults emerge from the soil from late July through October, depending on soil type and rainfall.

Larvae: Larvae are cream-colored with reddish heads and when mature reach a length of 3/5 inch. Three to four larvae may be found in an individual pecan. Time from oviposition to larval emergence from the pecan is approximately 42 days. Once larvae finish feeding, they exit the pecan, drop to the orchard floor and burrow into the soil to a depth of 4 to 12 inches, where they construct earthen cells. They will remain in the larval stage for 1 to 2 years.

Pupae: Pupation takes place in the soil during the fall. Adults emerge from the pupae several weeks later but remain in the soil until the following summer and fall. Most adults emerge from the soil 2 years after entering as larvae. The remainder emerge after 3 years.

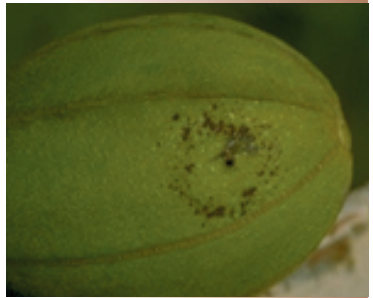


Pecan weevil adults (male left, female right).
Credit: B. Ree



Pecan weevil larvae.
Credit:
Anonymous

Pecan weevil feeding sign (note circular tracking pattern around puncture site).
Credit: A. Knutson



Pecan weevil larvae emergence holes.
Credit: A. Knutson

Rice stink bug

Oebalus pugnax (Frabricius)

The rice stink bug feeds on developing seeds of a wide range of grasses and is common in many pecan orchards. However, the rice stink bug **DOES NOT** feed on or damage pecan. It is included in this guide so producers will not treat for this species since it is not a threat to pecan production.

Adults: The adult rice stink bug is slender and straw colored, with spines on the "shoulder" pointing forward. It can be confused with the spined soldier bug (page 118), but has a very slender beak, unlike the latter.

Immatures: Young rice stink bugs appear much like the adults but lack fully developed wings. Immatures, like the adults, are not a threat to pecans.



Adult rice stink bug feeding on grass.
Credit: B. Ree

Stink bugs

Brown stink bug

Euschistus servus (Say)

Conchuela stink bug

Chlorochroa ligata (Say)

Green stink bug

Acrosternum hilare (Say)

Southern green stink bug

Nezara viridula (Linnaeus)

Damage: Adults have piercing sucking mouth parts and feed on plant juices. Feeding by adult stink bugs prior to shell hardening results in a condition known as black pit and will cause nuts to abort. After shell hardening, nuts stay on the tree but black spots form on the kernel at the feeding site. Kernels with black spots have a bitter taste and are considered inedible.

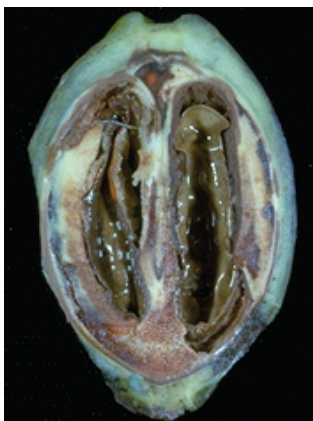
Adults: The adults are the only stage found in the tree. Eggs of kernel-feeding stink bugs are not laid in the trees. Adult southern green stink bugs are light green and between 1/2 and 3/4 inch in length. Adult brown stink bugs are approximately 1/2 inch in length. The adult conchuela stink bug ranges in color from a dull olive ash gray to green or reddish brown. The key characteristics of this species are an orange-red band along the margin of the wings and a spot of the same color in the middle of the back. The



Kernel spots caused by stink bugs.
Credit: W.L. Tedders



Kernel spot
caused by
stink bug.
Credit: B. Ree



Black pit damage
caused by stink bugs
and leaffooted bugs.
Credit: W.L. Tedders

Stink bugs

(Continued)

green stink bug is similar in color to the southern green stink bug but smaller in size.

Stink bugs overwinter as adults in sheltered areas. Eggs are laid on many crops and weeds on which immatures feed. Fields of sorghum, soybeans and other legumes may be sources of adult stink bugs that fly to pecan orchards in late summer and fall.



Adult southern green stink bug.
Credit: J.W. Stewart



Adult brown stink bug.
Credit: W.L. Tedders



Adult green stink bug.
Credit: W.L. Tedders



Adult conchuela stink bug.
Credit: B. Ree

Aphid: Black pecan

Melanocallis caryaefoliae (Davis)

Damage: This species is considered more damaging than the two yellow aphid species because even low numbers can result in defoliation during the late summer and early fall. Feeding by adults and immatures produces angular yellow areas on the leaflets between leaf veins. The yellow areas, which later turn brown, are confined by leaf veins giving the damage an angular or rectangular appearance. This characteristic can be used to distinguish black pecan aphid damage from disease or nutritional problems.

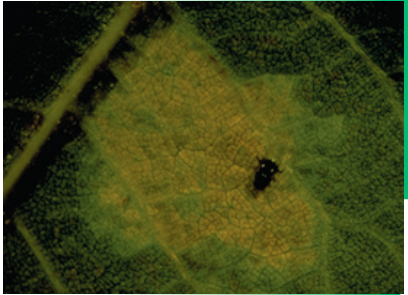
Adults: Adults are black, pear-shaped, and found with immatures feeding on both sides of the leaves. Winged females hold their wings rooflike over the body and readily fly when disturbed. Only females are present in the summer, and young are born alive. There can be 26 to 30 generations annually.

Immatures: Immatures are wingless and light to olive green in color. Immatures can be found on both sides of the leaf and, like adults, cause yellow blotches to form between leaf veins. Male and female forms appear in the fall, and females deposit eggs that overwinter on the bark.



Black pecan aphid damage.
Credit: Anonymous

Black pecan
aphid adult.
Credit:
Anonymous



Black pecan
aphid nymph.
Credit:
Anonymous

Aphids: Yellow

Blackmargined aphid

Monellia caryella (Fitch)

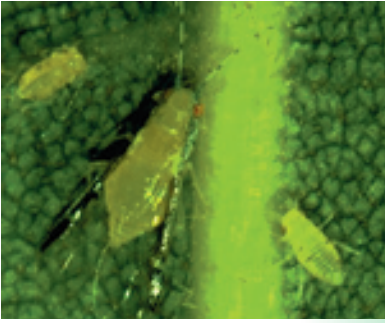
Yellow pecan aphid

Monelliopsis pecanis Bissell

Damage: Adults and immatures of both species feed primarily on the underside of the foliage. Adults and immatures remove plant juices from the foliage and excrete a sticky syrup-like substance referred to as honeydew. Feeding by high populations can damage the vascular system of the leaves and remove plant nutrients. The honeydew covers the foliage and supports the growth of a black sooty mold, which can interfere with the photosynthetic ability of the leaf.

Adults: Winged adults of the blackmargined aphid hold their wings flat over the body, and a black margin is along the outside edge of the wing. Winged yellow pecan aphids hold their wings rooflike over the body and do not have a black area on the wings. Both species are sometimes referred to collectively as "yellow aphids" and can be found together.

Immatures: Immatures of both species are difficult to separate in the field without magnification. Immatures feed on plant juices and excrete honeydew. Yellow aphids overwinter as eggs hidden in bark crevices. During the summer females give birth to live young and males are not present.



Winged
blackmar-
gined aphid.
Credit:
Anonymous



Aphid honeydew and
yellow aphids.
Credit: Anonymous



Aphids and cast
aphid skins.
Credit: A. Knut-
son

Yellow pecan
aphids and
parasitized
yellow aphids
(black). (See
page 92.)
Credit: W.L.
Teddars



Fall webworm

Hyphantria cunea (Drury)

Damage: Damage is caused by gregarious larvae feeding on leaves within silken webs. High numbers of webs in trees will reduce nut production but not cause tree mortality. In urban areas, the webs represent an aesthetic problem. In commercial orchards, high numbers of webs per tree rarely occur.

Adults: Adult moths have a wing span of approximately 1 1/2 inches and are white. Small dark brown spots are sometimes present on the forewings.

Eggs: Eggs are greenish white when first laid. Egg masses, which may contain several hundred eggs, are laid on the underside of pecan leaflets. Egg masses can be laid in a single or double layer and are covered by a "fuzz." This fuzz distinguishes fall webworm egg masses from those of the walnut caterpillar, which are clean.

Larvae: Larvae are gregarious by nature and feed within webs in groups of 100+. All feeding takes place within the web. Full-grown larvae are approximately 1 inch in length, pale green or yellow, and covered with tufts of long white and black hairs. When larvae finish feeding within the web, they migrate to the base of the tree or orchard floor where they pupate in debris. There can be several generations per year.



Fall webworm web.
Credit: Anonymous

Fall webworm adult
and egg mass.
Credit: B. Ree



Fall webworm larva.
Credit: Anonymous

Fall webworm
larvae hatch-
ing from eggs
and egg mass.
Credit: B. Ree
and A.
Knutson



Golden headed weevil

Compsus auricephalus (Say)

Damage: This broad-nosed weevil can be found in the orchard feeding on foliage. This weevil feeds on many different kinds of plants and is not generally considered an economic pest of pecan. However, timely weed control in young orchards prevents this insect from building up on weeds and moving to pecan canopies when weeds are killed.

Adults: This grey-green weevil has a broad "nose" or snout and a golden area on its head. Little is known about its life cycle or biology.



Adult *C. auricephalus* feeding on pecan leaf.
Credit: B. Ree



Adult *C. auricephalus* feeding on pecan leaf.
Credit: B. Ree

June beetles

Phyllophaga spp.

Damage: Adult June beetles, sometimes referred to as May beetles or June bugs, fly to trees at dusk and feed on leaves. Heavy infestations may occur in the spring and can result in defoliation on young trees. Feeding on older trees is generally not important.

Adults: Adults are 1/2- to 3/4-inch long hard-bodied beetles that are light to dark brown. During the day, beetles hide just below the surface of the ground.

Immatures: Immatures are white, C-shaped grubs called "white grubs" and feed in the soil on grass roots. The grubs rarely cause injury to pecans.



Adult June beetle.
Credit: M. Merchant

Leafminers

Pecan serpentine leafminer

Stigmella juglandifoliella (Clemens)

Upper-surface blotch leafminer

Cameraria caryaefoliella (Clemens)

Lower-surface blotch leafminer

Phyllonorycter caryaealbella (Chambers)

Damage: The larvae of several species of leafminers tunnel and feed within leaf tissue. Serpentine leafminers make random winding tunnels, whereas blotch leafminers make large blotch mines. Individual mines are not detrimental to the tree but heavy infestations can result in defoliation.

Adults: Five species of leafmining insects have been identified on pecan. Adults are all very tiny but brightly colored moths. Moths of the serpentine leafminer are very small with a wingspan of only 1/8 inch and are purple and white in color. Adults of the upper-surface blotch leafminer, *C. caryaefoliella*, have a 1/4-inch wingspan and are gold and white. *P. caryaealbella* adults are bright gold and white with a 1/4-inch wingspan.

Larvae: All feeding by the larvae takes place within the leaf tissue. There are four or five generations per year.



Serpentine
leafminer mine.
Credit: W.L.
Teddars

Upper surface
blotch
leafminer
mine.
Credit: W.L.
Teddars



Lower surface
blotch leafminer
mine.
Credit: W.L.
Teddars



Mirids

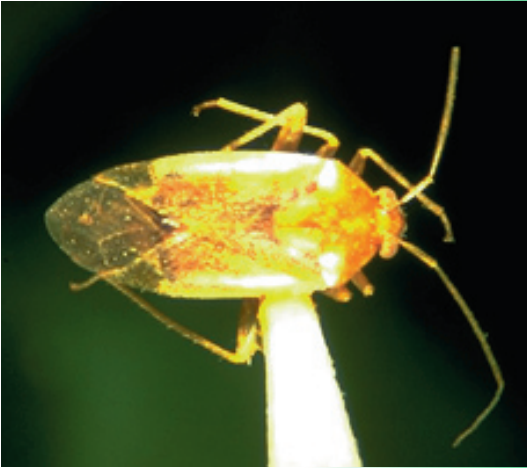
Lygocoris caryae Knight

Plagiognathus caryae Knight

Damage: Although adults and nymphs of both species are commonly found around terminals, nutlets and catkins in spring, no economic damage can be attributed to either species. This group of insects has piercing, sucking mouth parts and feeds on plant juices.

Adults: Adults of *Lygocoris* are approximately 1/4 inch in length and can vary in color from a mottled brown to green. Adults of *Plagiognathus* are smaller, approximately 1/8 inch in length, and mottled brown.

Immatures: Immatures resemble adults except they lack wings. Older immatures have wing pads.



L. caryae adult.
Credit: B. Ree



P. caryae adult.
Credit: B. Ree

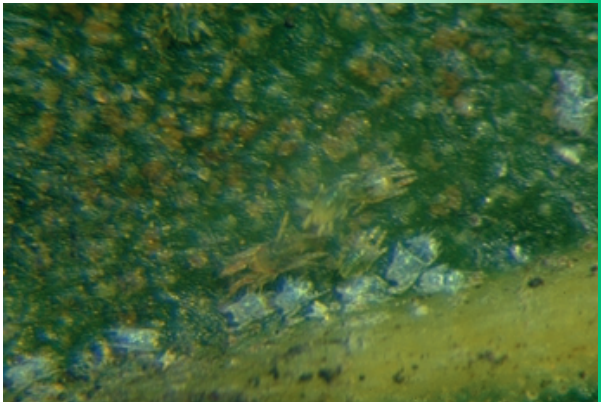
Oligonychus mite

Oligonychus viridis (Banks)

Damage: This mite feeds on the upper surface of leaflets. Feeding by this species damages chlorophyll and gives the foliage a grayish color. The amount of damage this mite causes by reducing the photosynthetic ability of the leaf is unknown.



Pecan leaflet showing damage from *O. viridis*.
Credit: W.L. Tedders



Mites and cast skins.
Credit: W.L. Tedders

Pecan budmoth

Gretchena boliana (Slingerland)

Damage: This insect is most damaging in pecan nurseries. Larvae feed on terminal buds and foliage. Destruction of the terminal bud causes terminals to branch and slows growth. This is a serious problem for nurseries.

Adults: Adult moths have a wing span of 2/3 inch. The overall color is gray with black to brown spots on the forewings. Adults are the overwintering stage.

Larvae: Early instar larvae are creamy white, later changing to yellow green. Larvae obtain a length of approximately 1/2 inch. After reaching maturity, larvae pupate in rolled leaves, damaged buds or under bark scales. Larvae occasionally feed on nutlets in the spring and infest shucks in the fall.

Eggs: Adult females lay eggs on twigs, bursting buds and shoot apices in early spring about the time buds are opening. Following foliation, most eggs are laid on the upper



Adult pecan budmoth.
Credit: W.L. Tedders



Folding of leaf by pecan budmoth larvae.
Credit: W.L. Tedders

surfaces of leaves.

Pecan catocala

Catocala spp. (Hulst)

Damage: Larvae feed on foliage during the spring. Economic damage is rarely observed in managed orchards.

Adults: Adult moths have a wing span of 3 to 3 1/2 inches. The forewing is mottled gray with irregular black and white spots, whereas the hind wing is dark brown with a white border.

Larvae: Larvae reach a length of 2 1/2 to 3 inches. Their dark gray color closely matches that of the tree bark, making them difficult to see. Larvae typically sit very still but whip their bodies from side to side when disturbed. Larvae feed on the foliage during the spring and early summer before pupating in loose silken cocoons attached to the foliage.



Adult catocala moth.
Credit: Anonymous



Pecan catocala larva.
Credit: W.L. Tedders

Pecan cigar casebearer

Coleophora laticornella Clemens

Damage: Damage occurs when larvae feed on buds and foliage during early spring and summer. This insect is generally not a serious pest. The pecan cigar casebearer also attacks hickory and black walnut.

Adults: Adult moths have a wingspan of about 1/2 inch, are brown in color and rarely seen.

Larvae: Early instar larvae feed as leafminers creating small "windows" in leaflets. Older larvae feed on buds and foliage, creating many tiny holes in the leaflets. These larger larvae live inside a 1/4-inch cigar-shaped case that may be observed attached to limbs, twigs or leaflets. Nearly grown larvae overwinter in their cases at-



Larva of pecan cigar casebearer in case.
Credit: W.L. Tedders

tached to twigs and branches.

Pecan leaf casebearer

Acrobasis juglandis (LeBaron)

Damage: Larvae overwinter on the tree and in the spring; emerging larvae feed on buds and new foliage. Damaging infestations are rare; however, heavy spring infestations can keep a tree defoliated for several weeks. Later-generation larvae feed in winding cases on the underside of the leaf.

Adults: Adults moths vary in color and have a wing span of 1/2 to 3/4 inch. There is one generation per year.

Larvae: Larvae emerging from eggs are only 0.04 inch in length, and mature larvae obtain a length of a little over 1/2 inch. Leaf casebearers overwinter as larvae in a hibernaculum at the base of dormant buds.

Eggs: Eggs are deposited singly on the underside of the leaf near the junction of the leaf midrib and a leaf vein.



Adult pecan leaf casebearer.
Credit: W.L. Tedders

Damage to leaf by pecan leaf casebearer larva.
Credit: W.L. Tedders



Bud damage by pecan leaf casebearer larva.
Credit: W.L. Tedders

Pecan leaf casebearer larva in case.
Credit: W.L. Tedders



Pecan leaf phylloxera

Phylloxera notabilis Pergande

Damage: Infestations of leaf phylloxera result in galls 1/8 to 1/4 inch in diameter on the leaf tissue. Galls are formed on leaf tissue only and develop between veins. New galls can be formed during the season as long as new foliage is being produced. Leaf phylloxera are generally not considered as a serious pest.

Adults: Adults are small, soft cream to pale yellow, soft-bodied insects resembling aphids. Of the five species of phylloxera infesting pecan, only the pecan leaf phylloxera has more than one generation per year.

Biology: Phylloxera survive the winter as eggs in bark crevices. In spring, the tiny nymphs emerge during budbreak and feed on new growth. Nymphs secrete a substance while feeding that stimulates plant tissue to develop into galls. The young phylloxera are soon enclosed in the gall tissue and feed inside the gall. Two generations are completed inside the galls. Galls crack open in mid-May and winged, adult phylloxera emerge to lay eggs.



Leaf phylloxera galls.
Credit: B. Wiseman

Pecan leaf roll mite

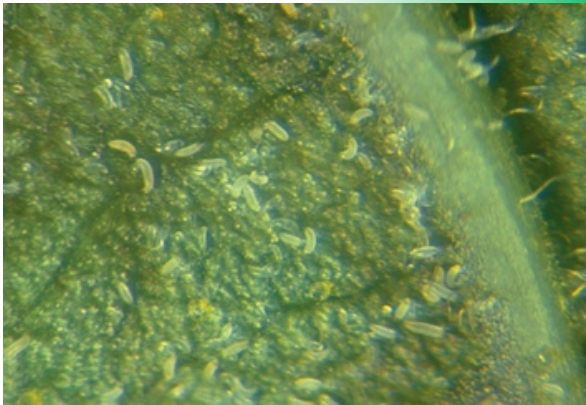
Eriophyes caryae Keifer

Damage: Mites feed along leaf margins and cause galls to form resulting in the leaf edges curling inward. Leaf edges soon turn brown. The distortion of the leaves usually does not result in leaf drop or other significant harm to the tree.

Adults: Adult mites are extremely small, white and shaped like a worm with four legs. They can be found in the rolled up margins of the leaf. In Georgia, leaf curl mites are most common in May and August.



Pecan leaf margin curled by pecan leaf roll mite.
Credit: B. Ree



Close-up of mites.
Credit: W.L. Tedders

Pecan leaf scorch mite

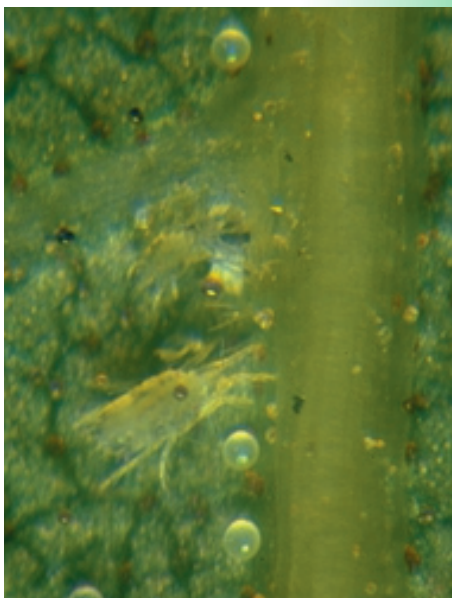
Eotetranychus hicoriae (McGregor)

Damage: These tiny mites feed on the underside of leaves, causing irregular brown spots with damaged leaves appearing russeted or scorched. Mite colonies develop along the leaf midrib and spread outward. A thin silken webbing is often present over the mite colony. Infestations often start in the lower interior portion of the canopy. Damage may be confused with fungal leaf scorch; however, fungal leaf scorch begins at the leaf margin and progresses inward.

Adults: Adult mites are barely visible to the naked eye and best seen with a hand lens. Adults are light green with a dark green spot on each side of an oval-shaped body. During summer, mites reproduce quickly, and a generation can be completed in less than two weeks.



Pecan leaf scorch mite damage.
Credit: W.L. Tedders



Close-up of pecan leaf scorch mite.
Credit: W.L. Tedders

Sawfly

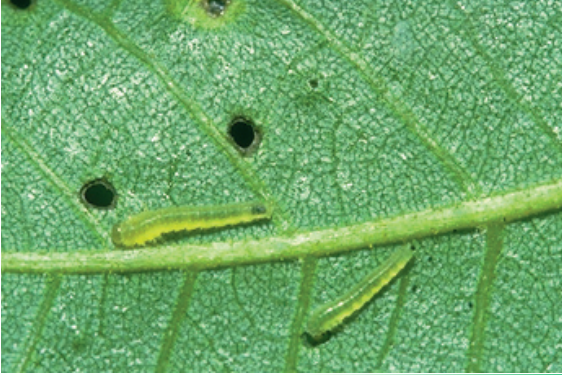
Periclista marginicollis (Norton)

Megaxyela major (Creson)

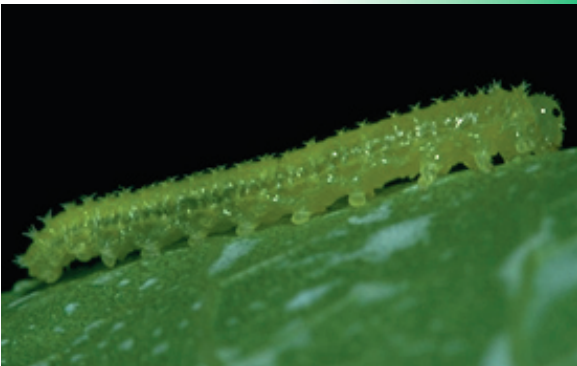
Damage: Two species of sawflies are common on pecan. Larvae of *P. marginicollis* feed on the underside of leaflets during the spring, leaving small holes in the foliage. *M. major* larvae generally consume the entire leaflet.

Adults: Adult sawflies are small, bee-like in appearance and about 1/4 to 1/3 inch long. Adults emerge from the soil in the spring to deposit eggs on new foliage. There is only one generation per year.

Larvae: Sawfly larvae resemble caterpillars but they are actually larvae of a wasp. Larvae of moths and butterflies have 1 to 4 sets of abdominal prolegs, whereas sawfly larvae have 6 sets. Larvae of *P. marginicollis* are spiny green and will attain a length of 2/3 inch when mature. Larvae of *M. major* are yellowish brown to orange with several black spots along the body. *M. major* larvae usually consume all parts of the leaf except for the midrib vein. Once larvae finish feeding, they drop to the ground and burrow into the soil to overwinter.



Larvae of *P. marginicollis* and damage.
Credit: B. Ree



Larvae of *P. marginicollis* showing 6 sets of abdominal prolegs.
Credit: B. Ree

Unicorn caterpillar

Schizura unicornis (J.E. Smith)

Damage: Damage is from larvae feeding on foliage. Larvae feed in groups after hatching but later disperse. Large mature larvae will consume the entire leaf. Heavy infestations can cause defoliation.

Larvae: Larvae are green and brown and well-camouflaged. Larvae have a large projection or horn, for which they are named, on the first abdominal segment. Full-grown larvae obtain a length of 1 1/2 inches or larger. Larvae feed on several species of deciduous hardwoods including elm, locust, dogwood, alder, apple, hawthorn, oak and pecan.



Larvae of the unicorn caterpillar.
Credit: B. Ree

Walnut caterpillar

Datana integerrima Grote & Robinson

Damage: Damage is caused by large numbers of larvae stripping foliage from the canopy. Depending on the tree size, several colonies per tree could completely defoliate a tree.

Adults: Adult moths have a wingspan of 1 1/2 to 2 inches with four narrow brown bands on the forewings.

Eggs: Eggs are laid in masses about the size of silver dollars on the underside of the leaflets. Egg masses are white and can contain 500 or more eggs. Unlike fall webworm egg masses, those of walnut caterpillar are not covered with any type of "fuzz." Eggs hatch in about 10 days.

Larvae: Larvae are gregarious by nature, feeding in groups of several hundred. The young reddish brown larvae only skeletonize leaves, but larger larvae will consume the entire leaflet including the midvein. Larvae do not form any type of web. When larvae molt, they move in a mass to the lower portion of the trunk or a main scaffold limb to shed their skins. After molting, they move back up the tree to finish feeding. Full-grown larvae are about 2 inches long, black with grayish lines and covered with long soft gray hairs. Approximately 80 percent of all foliage consumed is done in the last instar or stage. There can be 2 or 3 generations per season.



Walnut caterpillar, full grown - last instar.
Credit: Anonymous

Walnut caterpillar larvae.
Credit: Anonymous



Foliage Feeders



Walnut caterpillar egg mass.
Credit: Anonymous

Larvae.
Credit: Anonymous



Ambrosia beetle

Xylosandrus crassiusculus (Motschulsky)

Damage: Infestations start with mated females boring into the trunk or main scaffold limbs of host plants. As females infest the tree to construct galleries, they inoculate the gallery with a fungus. During gallery excavation, females push out "sawdust-like" material, which sticks together to form "toothpick-like" projections. Infestations during spring can cause host plants to die. Initial signs of an infestation during the spring include the toothpick-like projections and the wilting of new foliage.

Adults: Adult female ambrosia beetles are 2.1 to 2.9 mm long and reddish brown. Adult males are somewhat smaller (1.5 mm long) with a "hunchback" appearance. Adult males do not have functional wings and generally remain in the host plant.

Larvae: Larvae are white, legless, and "C"-shaped and feed together in a common gallery. Larvae that develop into females are larger than larvae that develop into males. There is approximately one male per 13 females.

Eggs: Eggs are laid in a common gallery.



Host plant infested with *X. crassiusculus*.
Credit: B. Ree



Adult female.
Credit: B. Ree



X. crassiusculus larvae in infested branch.
Credit: B. Ree

Flatheaded apple tree borer

Chrysobothris femorata (Olivier)

Damage: Damage results from larvae tunneling in the sapwood. This insect attacks trees of any age, particularly those that have recently been transplanted, are weak, or have been damaged by sun scald, freezes or mechanical injury. Young trees may be girdled or killed by the larvae. Infestations can weaken trees, which can lead to additional infestations. Infestations can be detected by darkened bark areas that may look wet or greasy and have a white frothy sap oozing from cracks.

Adults: Adult beetles are metallic colored, about 1/2 inch long and flattened in appearance. Adult females deposit eggs in bark crevices or in tree wounds.

Larvae: Larvae are yellowish white, legless with flattened heads. When fully grown, larvae are approximately 1 inch in length. Evidence of larvae feeding includes frass or excrement that has been pushed out and dark, depressed areas of bark.



Adult flatheaded apple tree borer.
Credit: B. Ree

Hickory shoot curculio

Conotrachelus aratus (Germar)

Damage: Adult females deposit eggs in developing stems during early spring. The developing larvae feed in new shoots near the point of attachment and cause premature defoliation. Severe infestations can weaken trees and reduce nut production.

Adults: Adults are dark gray to reddish brown weevils approximately 3/16 inch in length with a long curved snout. The hickory shoot curculio has an indistinct broad band of yellowish pubescence behind the middle of the wing and a narrow line of the same color on each side of the thorax.

Larvae: Larvae are legless, yellowish-white grubs with brown heads and black mandibles. Larva feed in developing stems until they are fully mature. Mature larvae drop to the ground to pupate in the soil. There is one larva per infested stem.



Adult hickory shoot curculio.
Credit: W.L. Tedders



Larva and damage caused by hickory shoot curculio.
Credit: W.L. Tedders

Hickory spiral borer

Agrilus arcuatus Say

Damage: Damage occurs from larvae severing branches (up to 1 1/2 inches in diameter). The end of the severed branch has a characteristic spiral pattern while branches severed by branch pruners have a smooth cut (page 83). Heavily infested trees have a ragged appearance and reduced nut production. Continued infestation gives trees a misshapened appearance. Severe damage is usually confined to individual trees located near wooded areas containing hickories.

Adults: Adult beetles are dark, slender and metallic colored. Adult males are greenish bronze with purplish black wing covers. Adult females are bronze in color.

Larvae: Full-grown larvae are 15 to 20 mm long. Larvae are legless, yellowish-white and have dark brown or black mouth parts and tail forceps. Larvae sever branches from the inside, and a spiral cut is characteristic of this insect.



Severed pecan branch caused by the larva of the hickory spiral borer.

Credit: M. Merchant

Mirid

Orthotylus ramus Knight

Damage: Females of this species lay eggs in stems of the current season's growth, leaving tiny, discolored areas beneath the bark. One study documented an average of 18.8 oviposition scars per shoot in El Paso where this insect can be extremely abundant. Even under these heavy infestations, no direct reductions in yield and no increased incidence of disease because of puncture wounds by this insect have been documented.

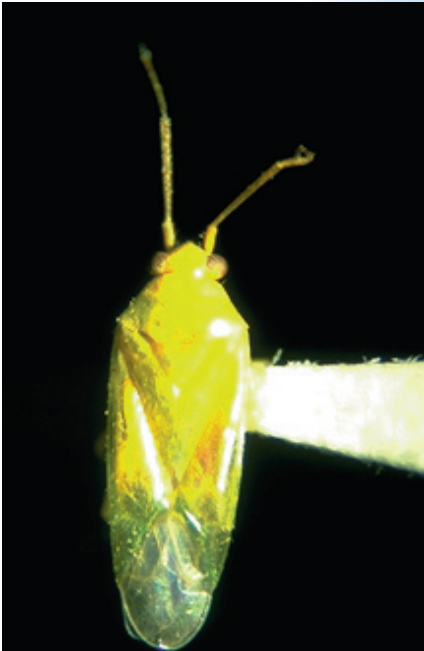
Adults: Oviposition by adults is completed by late May in El Paso. Females generally deposit two eggs per oviposition site.

Nymphs: Nymphs hatch from eggs deposited in stems shortly after budbreak, feed on foliage for a few weeks and become adults. Foliage feeding is not considered important.



Pecan stem with bark removed showing oviposition scars from *O. ramus*.

Credit: M. Harris



Adult *O. ramus*.

Credit: B. Ree

Obscure scale

Melanaspis obscura (Comstock)

Damage: Obscure scales suck plant juices from limbs and trunks. Infestations often go unnoticed. Infested trees have less vigor and are more susceptible to wood-boring insects. Infested branches up 3 inches in diameter may be killed. Larger branches can be weakened, limiting production. This insect is reported to be a pest in Texas, Louisiana, Arkansas and Mississippi. It also attacks chestnut, oak and hickory.

Adults: Scales resemble bark texture and color and can be difficult to see. The waxy covering of the adult female is approximately 1/16 to 1/8 inch in diameter, flat, dark and circular in shape. The male is somewhat smaller in size. Upon maturing, males emerge as winged adults to seek out females, which remain under their scale covering. After emerging, males live less than 24 hours. There is one generation per year.

Crawlers: Crawlers are immature scales that hatch from eggs laid by overwintering females. Crawlers emerge from under female scales and migrate to new feeding sites. Once settled, they begin to feed on plant juices, produce their waxy covering and never move again.



Obscure scale on oak branch.
Credit: M. Merchant.

Pecan phylloxera

Phylloxera devastatrix Pergande

Damage: Infestations cause galls to form on the woody portion of the current season's growth. This includes stems, leaf petioles and developing nutlets. Beginning in May, galls split open, releasing winged adults. If the gall is on a leaf petiole, defoliation will occur. Galls located on nutlets will prevent nutlets from maturing. Heavy infestations limit production and stress trees.

Eggs: Pecan phylloxera overwinter as eggs inside bodies of dead females in bark crevices. Eggs deposited by adults emerging from galls are laid on the foliage near the gall. These eggs are yellow and give rise to females that overwinter.

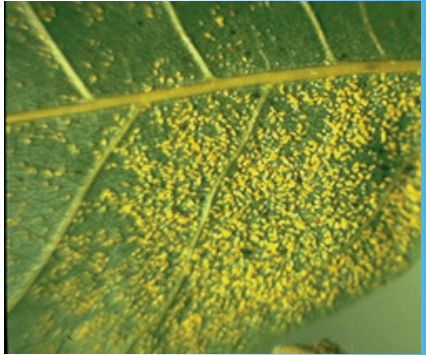
Immatures: At bud break, immatures hatch from overwintering eggs and migrate to unfolding leaves. These immatures, sometimes referred to as "stem mothers," settle on new foliage to feed. A feeding reaction of the tree to the phylloxera causes tissue to grow around the phylloxera and form a gall. The stem mother finishes feeding inside the gall and, when mature, lays eggs. Eggs hatch in the gall and another generation is formed. Unlike pecan leaf phylloxera (page 53), galls are formed only once in the spring.

Adults: Adults emerging from galls resemble aphids. Winged adults have a yellow abdomen, and the wings are folded flat over the body when at rest. Only one generation of galls is produced each year.



Pecan phylloxera galls.
Credit: J. Owens

Eggs of pecan phylloxera on foliage.
Credit: H.A. Turney



Adult phylloxera.
Credit: Anonymous

Pecan spittle bug

Clastoptera achatina Germar

Clastoptera obtusa Say

Damage: Immatures feed in groups in a white spittle mass that is produced by these insects. The immatures feed on plant juices from buds, new shoots and nutlets. Feeding by immatures can result in terminal dieback and shedding of nutlets.

Adults: Adults of *C. obtusa* are about 1/4 inch long and pale brown with a reddish tinge. When disturbed, adults readily jump. Adults of *C. achatina* are pale green to white.

Immatures: Nymphs can be found in white frothy masses on tender shoots and nutlets. When immatures have matured, they leave the spittle mass, and the spittle mass dries up.



White spittle mass produced by nymphs.
Credit: B. Ree



Spittle bug nymph removed from spittle mass.
Credit: B. Ree

Planthoppers

Flatidae

Damage: Several species of planthoppers are associated with trees and shrubs. These insects feed on plant juices or sap and are not considered harmful to pecan. The white cottony material produced by the nymphs could affect the aesthetic value of nursery stock.

Adults: Adults appear wedge-shaped when resting, and numerous veins can be seen on the wings.

Nymphs: Nymphs can be mistaken for mealy bugs because of the white cottony substance produced by the nymphs.



Adult planthopper.
Credit: B. Ree



Immature planthopper.
Credit: B. Ree

Pruners

Oak twig pruner

Anelaphus parallelus Newman

Twig pruner

Anelaphus villosus (F.)

Branch pruner

Psyrassa unicolor (Randall)

Damage: Damage occurs when larvae sever pecan branches from the inside. The size of branch can range from 1/2 inch up to several inches in diameter. Branches generally break at the junction of the main branch and a small twig. The ends of branches cut by pruners are smooth whereas those cut by the adult twig girdler (page 89) have a beveled end and those severed by the hickory spiral borer (page 71) have a spiral cut.

Adults: Adults are longhorn beetles, so named for their long antennae, ranging from 1/2 to 3/4 inch in length. Color varies from light to dark brown. They are covered with irregular patches of fine gray hairs giving the insect a mottled appearance. Tips of the wing covers are notched and have spines. Adult beetles emerge from severed branches during the spring and early summer (April to June).

Larvae: Larvae hatch from eggs deposited in small twigs attached to the branch. The small whitish larva tunnels through the twig to the main branch. It feeds within the main



Severed pecan branch.
Credit: B. Ree



Adult *p. unicolor*.
Credit: B. Ree

Pruners

(Continued)

branch making a smooth cut and then migrates into the terminal end of the severed branch to finish developing. An oval exit hole a few inches from the branch end is an indication the larva has matured and exited as an adult.



Adult *A. villosus*.
Credit: B. Ree



Larva in severed branch.
Credit: B. Ree

Red-shouldered shothole borer

Xylobiops basilaris (Say)

Damage: Infestations are usually secondary in nature because this insect generally attacks stressed or dying trees. Trunks of healthy trees growing close to heavy infestations may be attacked. Signs of an infestation are small round "shot holes" from which adults have emerged.

Adults: Adults are approximately 1/8 inch in length and emerge from infested trunks and limbs during the summer. Once a favorable host is found, adults bore through the bark into the sapwood to construct galleries and lay eggs. Tunnels are constructed across the grain just under the bark.

Larvae: Larvae feed mostly in the sapwood but may tunnel into the heartwood. While adult tunnels run across the grain, larval tunnels run parallel with the grain and are packed with a fine white powder dust. Mature larvae overwinter in the tunnels and will pupate during the following spring and summer.



Adult red-shouldered shothole borer.
Credit: B. Ree

Twig girdler

Oncideres cingulata (Say)

Damage: Adult females girdle small pencil size twigs during the late summer and fall. Stems girdled by females will have beveled ends whereas branches severed by branch pruners (page 83) and the hickory spiral borer (page 71) will have smooth or spiral cuts. Also, branches severed by branch pruners and hickory spiral borers will be much larger than those severed by the twig girdler. The stems weakened by the twig girdler will break off during wind storms or hang in the tree. Heavy infestations on young trees can limit production.

Adults: Adult beetles are approximately 5/8 inch long, reddish-brown with long antennae.

Larvae: Larvae hatch from eggs deposited in the severed stems. Larvae feed within the girdled twig, completing development during August.



Adult twig girdler and girdled twig.
Credit: Anonymous

Yellow-bellied sapsucker

Sphyrapicus varius L.

Damage: Although the yellow-bellied sapsucker is not an insect, the damage it causes is often confused with an insect problem. For that reason it is included in the guide. Damage results from the bird pecking small holes in tree bark. Holes are generally arranged in a pattern or circle a branch. Some branches can become weakened and break.

Biology: The yellow-bellied sapsucker is a member of the woodpecker family. The sapsucker's diet consists of the tree cambium and tree sap. A single bird will have several trees on which it feeds on a frequent basis. Some trees are visited several times in a day. The bird returns to a tree to feed on the tree sap around the wound and on insects attracted to the wound that get stuck in the sap.



Damage from the yellow-bellied sapsucker.
Credit: W.L. Tedders

Aphid parasite

Aphelinus perpallidus Gahan

Characteristics: The adult aphid parasite is a very tiny yellow wasp which is seldom seen. Immature wasps develop inside yellow aphids. Aphids containing this wasp parasite become attached to the leaf and turn black. These black aphid mummies are sometimes confused with black pecan aphids (page 29). This aphid parasite is found from Georgia west to West Texas.

Host: This parasite attacks the yellow pecan aphid and blackmargined aphid. It is not known to attack the black pecan aphid.

Biology: The adult female wasp uses her stinger to pierce the pecan aphid and deposit an egg inside the aphid's body. The parasite egg hatches and the parasite grub feeds internally on the aphid. The aphid soon dies, turns black and becomes attached to the leaf. The parasite grub pupates inside the parasitized aphid, which is termed a "mummy." Several days later the adult wasp emerges through a hole it cuts in the aphid mummy.



Black mummies of yellow aphids parasitized by *A. perpallidus*.

Credit: W.L. Tedders

Assassin bugs

Zelus exsanguis (Stal.)

Sinea spinipes (H.-S.)

Characteristics: Assassin bugs are slow moving, medium to large insects (1/2 to 3/4 inch) with a long curved beak held beneath the body. The head of an assassin bug is narrow and extended, and its legs are long and slender. *Sinea* is uniform brown with front legs that are slightly swollen and covered with spines. *Zelus* is red and green. The front legs lack spines but are covered with hairs that secrete a sticky substance. It is common to see bodies of prey attached to the front legs. Nymphs resemble adults but lack wings.

Prey: Assassin bug nymphs and adults eat a variety of prey including caterpillars, aphids and many other insects such as lady beetles and spiders.

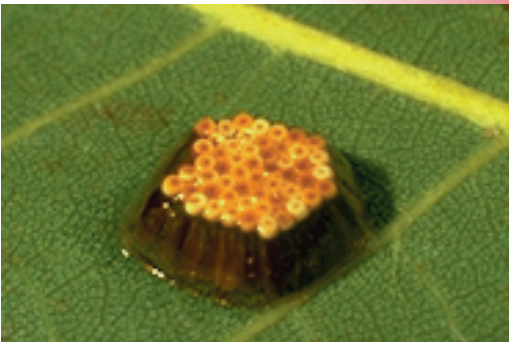
General Biology: Eggs of *Z. exsanguis* are laid in very compact 5- or 6-sided masses. Each egg stands on end and is pressed tightly by the surrounding eggs, giving the egg a definite hexagonal shape. The eggs are embedded in and almost entirely surrounded by a cement. The egg mass is brown when viewed from the side and white when viewed from the top. Each egg mass contains approximately 50 eggs. Eggs hatch in about 14 days, and nymphs require 25 to 35 days to complete development. Adults live 1 to 2 months.



Adult *Z. exsanguis*.
Credit: W.L. Tedders



Adult *S. spinipes*.
Credit: W.L. Tedders



Assassin bug egg mass.
Credit: B. Ree

Brown lacewings

Hemerobius humulinus L.

Micromus posticus (Walker)

Symphorobius barberi Banks

Characteristics: Adults are similar in appearance to the adult green lacewing but are smaller, brown with black eyes and appear to be hairy. Larvae are reddish brown with two to four white spots in the middle of the body. They are alligator-shaped with long sickle-like mouthparts which are used to suck juices from their prey. Brown lacewing larvae can be identified by the "head-wagging" behavior as they crawl.

Prey: Adults and larvae feed on aphids and insect eggs.

General Biology: Unlike green lacewings, brown lacewing eggs are not placed on a stalk. Eggs are laid on the underside of leaves and in bark crevices. Eggs turn a cream color to pink or purple before hatching. A full-grown larva pupates in an elliptical cocoon made of loosely woven silk through which the pupa is visible. Adults fly during the evening and night.



Adult *M. posticus*.
Credit: W. Sterling



Larvae of *M. posticus*.
Credit: W.L. Tedders

Green lacewings

Chrysoperla carnea (Stephens)

Chrysoperla rufilabris (Burmeister)

Chrysopa nigricornis Burmeister

Chrysopa quadripunctata Burmeister

Characteristics: Adults are delicate, slender insects 1/2 to 3/4 inch long, green with golden eyes and long antennae. The wings are large, delicate and held roof-like over the back. Larvae are alligator-shaped, grayish-brown with long sickle-shaped mandibles projecting from the head. Full grown larvae are 1/2 to 3/8 inch long and can consume 25 to 30 aphids per day. Some species lay eggs singly on top of a fine thread attached to leaves and stems while other species lay single eggs in tight clusters.

Prey: Larvae are important predators of aphids, mites, small larvae of lepidoptera (caterpillars) and eggs of various insects. Adults and larvae of *Chrysopa* species feed on insects while adults of *Chrysoperla* species feed only on honeydew, nectar and pollen.

General Biology: Eggs hatch in 3 to 6 days. Larvae feed for 2 weeks and then spin spherical white cocoons of tough silk which can be found around nut clusters on the foliage and in the rough bark. Adults are active at night and may travel several miles during the first 2 to 3 nights after emergence. Females lay first eggs 4 to 6 days after emergence. They produce a total of 200 to 800 eggs and will live for several weeks.



Green lacewing adult.
Credit: Anonymous



Larva of *C. rufilabris*.
Credit: W.L. Tedders



Green lacewing eggs.
Credit: A. Knutson



Green lacewing pupa.
Credit: Anonymous

Insidious flower bug

Orius insidiosus (Say)

Characteristics: Adults of the insidious flower bug are very small, 1/16 inch long, flat and oval-shaped. Adults have a black "V"-shaped mark on their back and a prominent forward-projecting beak. Immatures are pear-shaped and brown to reddish-orange in color.

Prey: Insidious flower bug adults and nymphs feed on thrips, aphids, small caterpillars and insect eggs. Adults and nymphs have piercing sucking mouth parts that are used to suck fluids from their prey.

General Biology: Eggs are inserted into plant tissue. Emerging nymphs require 12 to 20 days to mature. Adults live 2 to 3 weeks and females lay 100 eggs.



Adult insidious flower bug.
Credit: A. Knutson

Lady beetles:

Ash-gray/Southern two-spotted lady beetle

Olla v-nigrum

Characteristics: Adult beetles of this species occur in two distinct color forms. One form is black with two red spots and called the southern two-spotted lady beetle. This form is almost identical to the twicestabbed lady beetle (page 111) except southern two-spotted has the white margin around the pronotum (shield over the head). The second form is tan-gray with two rows of black spots and is called the ash-gray. Although different in color, the twicestabbed and ash-gray are the same species. Larvae are alligator-shaped and appear similar to other lady beetle species. Eggs are laid in masses and resemble yellow footballs standing on end.

Prey: Adults and larvae feed on aphids.

Biology: Eggs are similar to those of other lady beetle species. Larvae feed for several weeks before entering the pupae stage. Adults emerge from pupae.



Adult *O. v-nigrum*, gray form.
Credit: B. Ree



Adult *O. v-nigrum*, southern two-spotted form.
Credit: W.L. Tedders



Lady beetle egg mass.
Credit: B. Ree

Lady beetles:

Convergent

Hippodamia convergens Guerin-Meneville

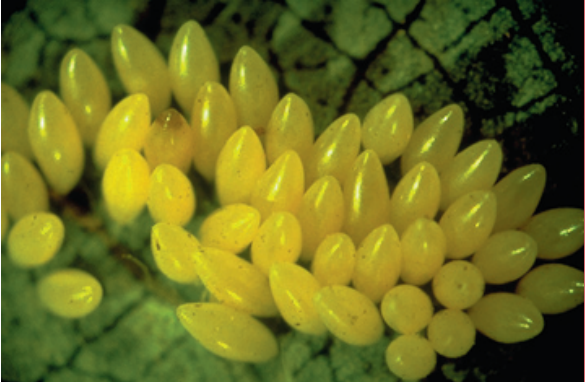
Characteristics: The convergent lady beetle is named for the two white lines on the pronotum (plate behind the head) that if extended would converge. The margin of the pronotum is also lined with white. The number of black dots on the adults ranges from only a few to up to 13. Larvae are alligator-shaped and black with rows of orange spots. Eggs are bright yellow, football-shaped and laid in clusters of 10 or more. Pupae are immobile, attached to the plant, and resemble spotted bike helmets. The convergent lady beetle is found throughout the U.S.

Prey: Adults and larvae feed primarily on aphids. Convergent lady beetles and larvae can become very abundant when aphids are present. Adults also feed on nectar and pollen.

General Biology: Females lay 200 to 1,000 eggs during a 1- to 3-month life span. Eggs hatch in 3 to 4 days and larvae feed for 2 to 3 weeks before pupating. Adults emerge from the pupal stage in about a week. There are several generations per year. Adults congregate in sheltered areas to overwinter.



Adult convergent lady beetle.
Credit: W.L. Tedders



Egg mass.
Credit: Anonymous

Lady beetles:

Harmonia or Multicolored Asian

Harmonia axyridis (Pallas)

Characteristics: Adults are a bright yellow-orange to reddish orange to red. The number of spots varies from 0 to 20. A black "M"-shaped mark or solid mark in the center of the white pronotum (shield-like area just behind the head) identifies the harmonia or Asian lady beetle. The two large white areas on each side of the pronotum create the appearance of two large white "eyes." Larvae are alligator-shaped, black with an orange jagged streak or blaze on each side of the abdomen. Eggs are yellow, football-shaped and laid in masses of 10 to 30 on leaves.

Prey: Both adults and larvae feed primarily on aphids but will also feed on insect eggs and small lepidoptera larvae or caterpillars.

General Biology: The harmonia lady beetle was introduced into the U.S. to control aphids on pecan trees. It is found on many other crops and plants feeding on aphids. Eggs hatch in 4 days and the larvae feed for about 2 weeks before entering the pupal stage. After a 6-day pupal stage adults emerge. Females begin laying eggs 7 to 12 days later. Each female can produce 500 to 700 eggs. Adults live 30 to 80 days under laboratory conditions. Adults overwinter in masses in protected areas, sometimes becoming a nuisance in homes.



Adult harmonia lady beetles showing variation in color pattern.
Credit: B. Ree



Larva of harmonia.
Credit: A. Knutson



Adult and pupae of harmonia.
Credit: M. Merchant

Lady beetles:

Other Species

Cycloneda munda (Say)

Chilocorus stigma (Say)

Coleomegilla maculata (DeGreer)

Coccinella septempunctata Linnaeus

Characteristics: These four species of lady beetles can also be found in pecan. *C. maculata* is pink with six very large black spots on each forewing and is called the pink spotted lady beetle. *C. septempunctata* has seven black spots on the wing cover and is called the sevenspotted lady beetle. *C. stigma* is about 1/4 inch long and feeds on scale insects. It is referred to as the twice-stabbed lady beetle. This species can be confused with the dark form of *Olla v-nigrum*, the southern two-spotted lady beetle (page 103). *C. munda* is orange-red in color, has no spots and is about 1/4 inch in length. White markings are visible near the head. Only *C. munda* does not have a common name.

Prey: The adults and larvae of these species feed primarily on aphids except *Chilocorus* which feeds on scale insects. In addition to aphids, the pink spotted lady beetle also feeds on pollen and moth eggs.

General Biology: Eggs are typically yellow, spindle-shaped, and laid in masses on leaves and branches, often near aphid colonies. Eggs hatch into alligator-shaped larvae which crawl about in search of food. After feeding



Adult *C. munda*.
Credit: W.L. Tedders



Adult *C. maculata*.
Credit: W.L. Tedders

Lady beetles:

(Continued)

for several weeks, larvae transform into pupae. Pupae are immobile and attached to leaves or twigs. The adults emerge from the pupae in about a week. There are usually several generations a year, and the adults spend the winter in protected areas.



Adult seven-spotted lady beetle,
C. septempunctata
Credit: W.L. Tedders



Adult twicestabbed lady beetle, *C. stigma*.
Credit: W.L. Tedders

Lady beetles:

Scymnus

Scymnus (Pullus) loewii Mulsant

Characteristics: Scymnus lady beetles are very small, (1/16 inch), dull orange to brown. One species, *S. loewii*, has a black center which forms a "V" pattern on the wing covers. Larvae are covered with long white streamers of wax. These fuzzy white larvae are sometimes confused with mealybugs.

Prey: Adults and larvae feed primarily on aphids but may feed on mites.

General Biology: Eggs are tiny, barrel-shaped and golden and laid singly on the tree. Eggs hatch in 3 to 4 days and larvae develop in 14 to 17 days. Pupae resemble larvae in that they are covered with wax but unlike larvae, do not move. The wax covering may provide some protection from fire ants. Adults emerge from pupae after 5 to 8 days and live 3 to 6 weeks. There can be two or three generations per year.



Adult scymnus lady beetle.
Credit: W.L. Tedders



Larva of scymnus lady beetle feeding on black-margined pecan aphid.
Credit: Anonymous

Predatory mirid

Deraeocoris nebulosus (Uhler)

Characteristics: This predator is found on more than 50 species of ornamentals. Nymphs lack wings and are grayish in color while the adult is mottled brown and winged. Both adults and nymphs are predacious on a wide range of insects and mites.

Prey: Adults and immatures feed on a wide range of small soft bodied insects and mites. Some common prey include a wide range of aphids, small caterpillars, mites, eggs and scale crawlers.

Biology: This species overwinters as an adult in protected areas such as under bark. There are five nymphal stages with the nymphal period ranging from 20 to 25 days depending on the abundance of prey.



Adult *D. nebulosus*.
Credit: B. Ree



Immature *D. nebulosus*.
Credit: W.L. Tedders

Spiders

Jumping spiders

Crab spiders

Characteristics: More than 40 species of spiders, both hunting and web-making species, have been found in pecans. Twenty-six species have been observed to feed on blackmargined aphids. Jumping spiders have compact, rectangular bodies with short, powerful legs. They range in size from 1/8 to 1/2 inch, and many have metallic green or purple spots. Jumping spiders do not build webs but quickly leap upon their prey.

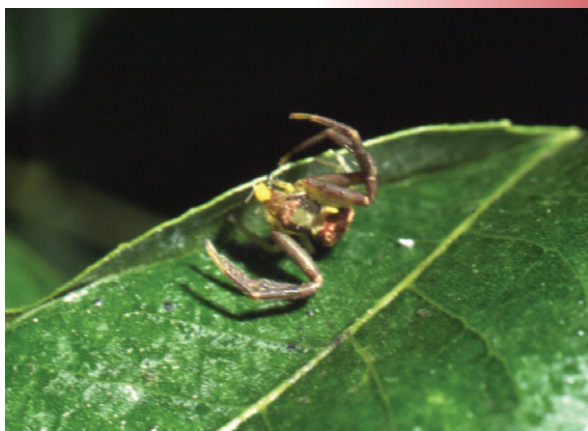
Crab spiders have very long front legs and move quickly backwards or sideways, much like a crab. These brightly colored spiders do not build webs but hide and wait to leap out and grasp passing prey. Like jumping spiders, several species of crab spiders can be found in pecans.

Prey: Jumping spiders and crab spiders feed on many different kinds of insects, including aphids, caterpillars and occasionally beneficial insects.

Biology: Jumping spider eggs are laid in silk sacs attached to rough bark. The spiderlings disperse and feed. There is one generation a year. Crab spiders disperse by ballooning. Small spiders are carried on strands of silk blown by the wind. There are one or two generations of crab spiders per year.



Jumping spider.
Credit: W. Sterling



Crab spider.
Credit: B. Ree

Stink bugs: beneficial

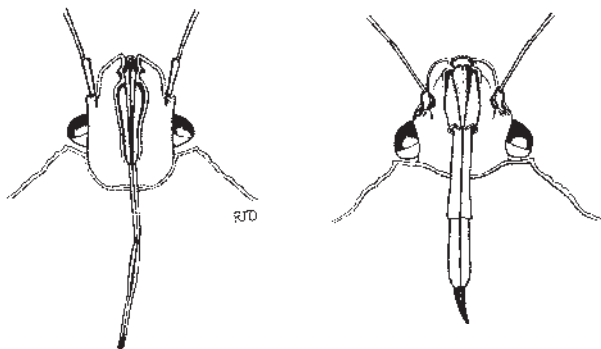
Spined soldier bug

Podisus maculiventris (Sa7)

Euthyrhynchus floridanus (L.)

Stiretus anchorago (F.)

Characteristics: This group of insects belongs to the same family as the plant feeding stink bugs (page 22). However, unlike their cousins, these beneficial stink bugs feed on other insects instead of plants. As a group, beneficial stink bugs feed on a wide range on insects which occasionally may include other beneficial insects. Beneficial stink bugs can be separated from plant feeders by examining the mouth parts. If the "beak" is broad (twice the width of the antenna) and stout, it is a predatory stink bug. If the mouth part is thin (equal to the width of the antenna), it is a plant feeder.



Mouth parts of plant feeding species (left) and predatory stink bug (right).

Credit: R. Ottens



Adult spined soldier bug.
Credit: W.L. Tedders



Egg mass of spined soldier bug.
Credit: W. Sterling

Stink bugs: beneficial

(Continued)

Prey: This group feeds on a wide range of insects including caterpillars, sawfly larvae and immature stages of other insects.

Biology: Nearly all species overwinter as adults. Eggs are brightly colored, barrel-shaped and laid in clusters. Eggs of the spined soldier bug are metallic silver or gold with a fringe or crown of hairs around the top. Immature stink bugs or nymphs remain clustered around the egg mass before dispersing. Time from egg to adult is about 3 weeks.



Adult *E. floridanus*.
Credit: W.L. Tedders



Adult *S. anchorago*.
Credit: W.L. Tedders

Syrphid fly

Allograpta obliqua (Say)

Metasyrphus americanus (Wiedemann)

Characteristics: The larva is a green to brown slug-like maggot with no legs and no obvious head. The head is located at the small end of the tapered body. Although the larvae have no legs, they move well, stretching out their bodies in a looping action. Full grown larvae are about 1/4 to 1/2 inch long. Adults vary in size from 1/4 to 1/2 inch and are striped with bright yellow and black. When at rest the wings are held out at an angle from the body. Adults fly quickly and can often be seen hovering near plants and flowers, hence their common name, hover fly.

Prey: Hover or syrphid fly maggots pierce their prey and suck out body fluids. They feed mostly on aphids but may consume insect eggs and small caterpillars. The adults feed only on nectar and honeydew.

General Biology: Eggs are white, sculptured and elongate, and are laid on leaves near aphid colonies. Larvae feed for 2 to 3 weeks, and large larvae eat as many as 50 aphids per day. The pupa is pear-shaped and will be fastened to leaves, stems or ground debris. The winter is spent in the pupal stage.



Adult *A. obliqua*.
Credit: W.L. Tedders



Larva or maggot of *A. obliqua*.
Credit: W.L. Tedders



Larva or maggot of *M. americanus*.
Credit: W.L. Tedders

Wasps

Vespula spp.

Polistes spp.

Several species of paper wasps can be found nesting in and around pecan orchards. These wasps construct multicelled nests that hang upside down under limbs and building structures. These wasps are generally considered beneficial because they feed on many species of pest caterpillars and other insects. As long as a nest does not pose a threat to orchard workers the nest should be left alone.



Polistes Adult.
Credit: B. Ree



Vespula Adult.
Credit: B. Ree

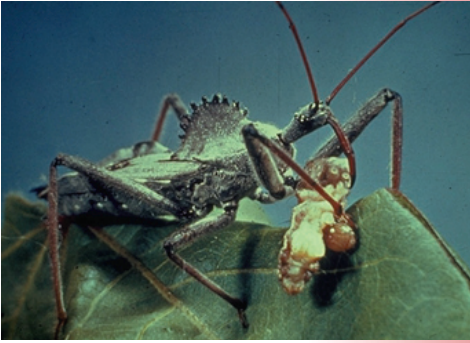
Wheel bug

Arilus cristatus (L.)

Characteristics: This large assassin bug gets its common name from the cog-shaped structure on the thorax.

Prey: Wheel bug nymphs and adults feed primarily on insects which are soft bodied and easily punctured by the proboscis or mouth part. The wheel bug has 5 instars and the first two instars feed almost entirely on aphids and small insects. The 3rd and 4th instars continue to feed on aphids but will also feed on small caterpillars. During the fourth and last instar the nymphs will feed on large caterpillars such as walnut caterpillar and fall webworm.

Biology: This species overwinters in the egg stage. Eggs are deposited in clusters of 50 to 60 but as few as 6 have been observed. The length of each instar depends on the availability of food. Nymphs have a black thorax, red swollen abdomen and long slender legs. Wing pads begin to develop during the 3rd instar. Adult wheel bugs obtain a length of 33 to 35 mm or approximately 1 1/2 inches. If handled carelessly adults and nymphs can inflict a very painful bite. There is one generation per year.



Adult
wheel
bug.
Credit:
W.L.
Teddars



Wheel bug
nymph.
Credit: B. Ree



Wheel bug egg
mass.
Credit: W.L.
Teddars

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