

Common Beneficial Arthropods Found in Field Crops

There are hundreds of species of insects and spiders that attack arthropod pests found in cotton, corn, soybeans, and other field crops. This publication presents a few common and representative examples. With few exceptions, these beneficial arthropods are native and common in the southern United States. The cumulative value of insect predators and parasitoids should not be underestimated, and this publication does not address important diseases that also attack insect and mite pests. Without biological control, many pest populations would routinely reach epidemic levels in field crops. Insecticide applications typically reduce populations of beneficial insects, often resulting in secondary pest outbreaks. For this reason, you should use insecticides only when pest populations cannot be controlled with natural and biological control agents.

PREDATORY INSECTS AND SPIDERS Assassin Bugs



These insects are a primarily predatory group of Hemiptera (“true bugs”) belonging to the family Reduviidae. Some representative members of this family include thread-legged bugs, ambush bugs, and wheel bugs. Although they are seldom present in large numbers, several species can be important predators of caterpillar pests found in many crops. Wheel bugs can grow to a length of 1½ inch. Assassin bugs are highly susceptible to insecticides, so they are more com-

mon in fields that have not been sprayed for pests. When scouting, be aware that assassin bugs can deliver a painful bite.

Description and Biology

The most common species of assassin bugs found in row crops (e.g., *Zelus* species) are one-half to three-fourths of an inch long and have an elongate head that is often cocked slightly upward. A long beak originates from the front of the head and curves under the body. Most range in color from light brownish-green to dark brown. Periodically, the adult female lays cylindrical brown eggs in clusters. Nymphs are wingless and smaller than adults but otherwise similar in appearance. Assassin bugs can easily be confused with damsel bugs, but damsel bugs are usually smaller.

Prey

Assassin bugs are generalist predators that feed on caterpillar eggs and larvae, plant bugs, and other pests and beneficial insects. Bigger species can tackle the largest insect pests found in cotton and other crops.

Big-eyed Bugs (*Geocoris* spp.)



This is one of the more abundant and easily detected predators. It is an important predator in cotton, corn, and soybeans. These insects are commonly found in pre-blooming cotton or in

young corn or soybean fields after flying in as adults from surrounding vegetation. In the absence of insecticide sprays, they will remain in the field for the remainder of the season. In cotton, populations of 20–40 per 100 sweeps can sometimes be found, especially in fields that have not had many early insecticide treatments. Higher populations of tobacco budworms and bollworms can be tolerated if many big-eyed bugs are present. Despite their distinctive appearance, they are sometimes mistaken for plant bugs. There are several species of big-eyed bugs, so they are sometimes referred to by their genus name, *Geocoris*. *Geocoris punctipes* is the most common species encountered and is the one described here.

Description

Both the nymphs and adults are well described by their common name. The head is as wide as the body, and the eyes are notably large. Adults are about three-sixteenths of an inch long and are dull gray with transparent, shiny wings. The nymphs resemble the adults in general body shape, but they are a distinctive metallic silver-gray. The eggs are white to pink and shaped like hotdogs, but they are only one-twenty-fifth of an inch long. These eggs are often found in cotton terminals and are often mistaken for plant bug eggs. However, plant bug eggs are almost always inserted into plant tissue and are rarely seen by scouts.

Prey

Both the nymphs and adults feed on aphids, whiteflies, mites, and the eggs and larvae of caterpillars, such as tobacco budworms, bollworms, and soybean loopers. They are also predators of plant bugs, especially the younger nymphs. In one laboratory study, big-eyed bug nymphs consumed an average of 151 tobacco budworm eggs or 76 first instar larvae during the 21–31 days required to complete all five nymphal instars. Late instar nymphs consumed approximately 10 eggs per day. Like many predatory insects in this order, big-eyed bugs also feed on nectar and directly on plants, causing little or no damage. In-furrow systemic insecticides may affect their populations.

Insidious Flower Bug (*Orius insidiosus*)



This insect is often a very important predator in field crops. However, because of its small size, it is commonly overlooked. *Orius* occurs in all major row crops, and it is present throughout the season. It is an important predator of thrips and often appears in fields shortly after emergence. Quite often, it is the smaller, less noticeable predators that provide the greatest benefit, and this is definitely the case with *Orius*. This is one predator that all scouts need to learn to recognize and appreciate. They often build to relatively high numbers on early-season populations of thrips and mites. When this occurs, they can be of real benefit in “buffering” populations of many caterpillar pests during mid- and late-seasons.

Description

Like the tarnished plant bug and big-eyed bugs, *Orius* is a true bug and belongs to the order Hemiptera. The adults are sometimes mistaken for chinch bugs, but although they resemble chinch bugs superficially, the adults are much smaller (about one-sixteenth of an inch long). The adult *Orius* is black with a white band across its back and a white area over the end of its abdomen. The nymphs are elongate and yellowish or yellow-orange. They are often mistaken for thrips, one of their primary prey items.

Prey

Insidious flower bugs feed primarily on thrips and spider mites, and when these pests are numerous, *Orius* can build to notably high numbers. One reference reports that nymphs are capable of eating an average of 33 mites per day. Eggs of caterpillars, such as bollworms and tobacco

budworms, also are favored prey, along with newly hatched larvae. This predator is common in corn, where it is often found searching for bollworm eggs on the silks, and it has been reported to consume as much as 54 percent of the eggs. It is also an important predator of eggs and small caterpillars in soybeans. In cotton, *Orius* are often found in the blooms, where their primary prey is flower thrips. They will also readily attack the small larvae of various pest species that they encounter. This makes them an important predator of bollworm and fall armyworm larvae.

Damsel Bugs (*Nabis* spp.)



Like the insidious flower bug and the big-eyed bug, damsel bugs belong to the order Hemiptera and are considered true bugs. They are predators with piercing-sucking mouthparts. Damsel bugs are usually much less numerous than insidious flower bugs and big-eyed bugs, but it is not uncommon to find numbers in the range of 2–6 per 100 sweeps in pre-blooming cotton. They also are important predators in corn and soybeans. Damsel bugs are sometimes mistaken for plant bugs, so it's important that scouts know the difference. Damsel bugs belong to the family Nabidae and are also referred to as Nabids.

Description

There are several species of damsel bugs that can be found in cotton. Most adults are gray to light brown and are about three-eighths to one-half of an inch long. Adult damsel bugs resemble plant bugs somewhat in general body shape, but their bodies and legs are longer and more slender. Also, the wings are flat over the entire length of the abdomen; this distinguishes them from tarnished plant bug adults, which have wings that

angle downward at the back third of the abdomen. Nymphs resemble adults, except for the lack of wings.

Prey

Both the nymphs and adults are predatory and feed on a variety of prey. Almost any insect that is smaller or slower is subject to attack, including other predators. In addition to aphids and whiteflies, they commonly feed on eggs and larvae of caterpillar pests such as tobacco budworms and bollworms. They will also attack plant bug nymphs. They occasionally bite scouts as well.

Spined Soldier Bug (*Podisus maculiventris*)



The spined soldier bug is a predatory stink bug that is sometimes found in cotton, soybeans, and other crops. These predators can easily be confused with plant-feeding stink bugs, such as the brown stink bug. So it is important that scouts learn to recognize this as a beneficial insect rather than a pest.

Description

Adult spined soldier bugs are medium-sized (three-sixteenths to one-half of an inch long) and brown. They are shield-shaped with a prominent spine extending outward from each "shoulder." Unlike plant-feeding species, the tips of the wings extend past the tip of the abdomen, and there is often a dark line at the wing tips when they overlap. These predators have a strong, stout beak compared to plant-feeding stink bugs, which have more slender beaks. The beak is kept folded under the body unless feeding. The eggs of

spined soldier bugs are laid in a loose mass of 17–70 eggs. Each egg has a characteristic crown of “spines” that rings its top. Immature (nymphal) stages are more rounded. On a small nymph, the head and thorax are black and the abdomen is red. Larger nymphs vary in color considerably as they grow; the abdomen may be tan to reddish-orange with red, white, and/or black markings.

Prey

Spined soldier bugs are generalist predators but are most commonly observed in fields where caterpillar and leaf beetle larvae are present. Both the nymphs and adults feed on pests such as tobacco budworms, bollworms, soybean loopers, fall armyworms, and beet armyworms. This species will feed on other predatory insects and is also cannibalistic.

Reference: University of Florida, Department of Entomology and Plant Pathology, Featured Creatures (http://creatures.ifas.ufl.edu/beneficial/podisus_maculiventris.htm)

Lady or Ladybird Beetles



There are several genera of lady beetles that may be commonly found in cotton. Lady beetles are the first beneficial insects that most people learn to recognize. There are hundreds of different lady beetle species, but practically all species share the trait of being predacious as both larvae and adults. One exception is the Mexican bean beetle, an important pest of soybeans in some regions of the country.

One species of lady beetle, the Asian lady beetle, is considered a pest by many homeowners. This is an introduced species that prefers to for-

age in trees, although it can be found in row crops as well. This predator has become well-established throughout the United States. It seems to be especially helpful in controlling aphids in pecans. The problem for homeowners is that overwintering Asian lady beetles often accumulate in homes in extremely large numbers.

Description

Adults of the more common species are yellow to red, oval in overall body shape, and often have dark spots on the wing covers. These are the species that everyone recognizes as lady beetles. However, fewer people recognize the larval stage. The larvae are soft-bodied and elongate and are sometime described as “alligator-shaped.” Their bodies are usually dark in color with yellow, red, orange, or purple markings. Lady beetles lay cylindrical, yellowish eggs in clusters.

One common group of lady beetles does not fit the above description as either adults or larvae. These are the *Scymnus* lady beetles. The adults are shaped like other lady beetles, but they are about one-fifth as large and are dark-colored with lighter brown markings. Scouts often encounter these when checking terminals but don’t realize they are lady beetles. *Scymnus* larvae are covered with fuzzy white filaments of waxy material and resemble mealy bugs. Larvae, as well as adults, are often seen in association with aphid colonies.

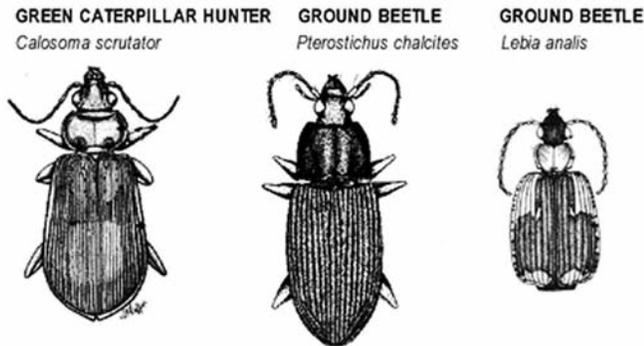
Prey

Lady beetles are heavy feeders as both larvae and adults. Most lady beetles seem to feed preferentially on aphids when these are present, but they also will feed on caterpillar eggs and small larvae as well as mites and whiteflies. However, when an aphid population crashes because of an outbreak of fungal disease, the lady beetles are forced to pursue other food, such as caterpillar eggs and small larvae. In cotton fields where this occurs, lady beetles may aid in suppressing tobacco budworm and bollworm populations for a week or two after the aphid population crashes. Adults may then leave in search of better food sources, but the wingless larvae do not have this option.

In a laboratory study, adult females of one common species were reported to consume an average of 357 bollworm and/or tobacco bud-

worm eggs or 80 first instar larvae in a 48-hour period. Adults also feed on pollen and nectar. Lady beetle larvae and adults are abundant in most cotton fields, and they are one factor that helps slow the overall population growth of cotton aphids.

Ground Beetles



From: *Insect Pest Management in Arkansas Cotton*, Allan & Rouse, 1978

Many different species of ground beetles may be found in row crops. Although these beetles are common, they often are not recognized as predators. One reason for this is that they tend to be more active at night and hide under crop debris and in cracks in the soil during the day. Most species have relatively long life cycles and complete only one or two generations per year. Adults of some species may live several years. For this reason, their populations are slow to rebound if disrupted by insecticides. This is one group of predators we may see and appreciate more in no-till fields and after making management changes that reduce total insecticide use, such as eradicating boll weevils and/or planting transgenic Bt cotton.

Description

The accompanying drawings show three of the more common species of ground beetles that occur in our major row crops. Adults range from one-fourth of an inch in length for many of the *Lebia* species up to 1½ inch for some of the “caterpillar hunters.” The adults are long-legged, quick moving beetles that have broad, hard wing covers. The head is narrower than the thorax, and the mandibles are strong and easily seen. Some of the caterpillar hunters are metallic green or blue, but most species of ground beetles are a drab color. The *Lebia* species are commonly seen in the

sweep net when sampling soybeans or when sweeping cotton for plant bugs. The larvae are more “worm-like” but have conspicuous legs and mandibles and are also quick moving.

Prey

Both adults and larvae are predatory, although the larvae of some species are parasitic and are considered general predators. Caterpillars are favored prey. Small tobacco budworm and bollworm larvae are probably at greatest risk of being attacked when moving between feeding sites. Mature larvae are particularly vulnerable to the caterpillar hunters and other larger ground beetle species when they move to the ground to pupate. One species of caterpillar hunter was reported to consume an average of 41 large gypsy moth larvae during its 14-day larval feeding period. As the name implies, many species are primarily ground foragers, but some species, particularly the *Lebia* species and some of the caterpillar hunters, also forage in the plant canopy. Because they occur in higher numbers and have a tendency to forage on the plants, the *Lebia* are one of the more important groups of ground beetles.

Lacewings



Both brown and green lacewings are sometimes common in cotton fields during the summer, especially at times when aphids are, or were recently, numerous. As with lady beetles, these beneficials can aid in controlling budworm/bollworm egg lays that occur after an aphid population has crashed due to an outbreak of the aphid fungus *Neozygites fresenii*.

Description

Adult green lacewings, which include several green-colored species, are slender green insects with golden eyes, long antennae, and large, transparent wings. They are about five-eighths of an inch long. Brown lacewings are similar in general body shape but are smaller and brown with wings that are less transparent because they are covered with small brown hairs. The larvae of brown and green lacewings are similar. They are elongate, "alligator-shaped" creatures that taper at both ends and reach a size of about three-eighths of an inch long. The stout, sickle-like mandibles are easily seen projecting from the front of the head. Larvae are gray to brown with yellow markings along the edges of the body. Green lacewings deposit their eggs on a small hair-like stalk, but brown lacewings do not. Both species pupate beneath a thin, transparent webbing. Scouts often encounter lacewing pupae when searching inside bracts of squares, blooms, or bolls. The cocoon of the green lacewing is a round, pea-sized structure that is often mistaken for the egg case of a spider. Brown lacewing cocoons are more oval in shape and more loosely woven so that the developing pupa can be seen through the silk.

Prey

Larvae of both species feed heavily on aphids and whiteflies as well as on moth eggs and small caterpillars. They are capable of consuming extremely large numbers of prey when availability is not a limiting factor. In one report from a laboratory study, third instar green lacewing larvae consumed an average of 191 budworm/bollworm eggs or 124 first instar larvae when given free access to prey in a petri dish. In a study where third instar green lacewing larvae were caged on cotton terminals infested with either 25 eggs or 25 first instar larvae, the lacewings were able to find and consume approximately 75 percent of the prey within 48 hours. Brown lacewing adults also are predatory, but green lacewing adults are not. In fields where aphid populations have crashed and lacewing numbers remain high, their presence and numbers should be considered when making treatment decisions for tobacco budworms and bollworms.

Syrphid Flies (or Flower Flies)



The larvae of some syrphid flies are specialized predators of aphids, including the cotton aphid. Although these larvae are usually not present in sufficient numbers to control aphid populations by themselves, they are a component of the natural enemy complex that helps keep pest populations below damaging levels.

Description

Of the predatory syrphid flies found in cotton, the adults are often mistaken for some kind of small wasp or bee because they have alternating stripes of yellow and black across the abdomen. Also like bees, adults are often observed hovering about flowers. However, flies have only one pair of wings, unlike wasps and bees, and cannot sting. *Allograpta* species are common, and adults are about one-fourth of an inch long. The larvae are legless maggots seen on the undersides of leaves or other places where aphids are found. They are tapered toward the head and may be light brown to green. They can reach a length of about one-third of an inch. Larvae complete their development in as little as 2 weeks, depending upon the temperature, and may eat as many as 400 aphids each. In some species, the pupae are found on plants, but in others, larvae leave the plant to pupate in the soil.

Prey

As noted, the larvae of these flies feed primarily on aphids, but they also will feed on thrips, whiteflies, small caterpillars, and other small insects.

Spiders



Many different species of spiders are found in fields of cotton, corn, soybeans, and other crops. All spiders are predatory, and they may be more abundant than any other predatory arthropods found in row crops. The hunting and feeding habits of spiders vary greatly among the different species. Many are generalist and may feed upon a wide range of crop pests. However, they may also feed indiscriminately on other invertebrates, including beneficial insects.

Description

Spiders are not insects. Rather, they are arachnids belonging to the order Araneae. Although some species are venomous, such as the black widow, most are harmless. The body of the spider is divided into two parts: the cephalothorax (with mouthparts, legs, and eyes) and the abdomen. Unlike insects, which have three pairs of legs, spiders have eight legs. Immature and adult spiders are similar in these characteristics. Adults typically range in size from one-eighth of an inch to 1½ inch in length, depending upon the species. Common representatives seen in cotton include jumping spiders, crab spiders, lynx spiders, and orb weavers.

Prey

The prey of spiders varies greatly depending upon the species and their size, with small species or immature spiders feeding on smaller prey. Most spiders feed upon other arthropods such as insects and other spiders. Some species feed upon insects that become entangled in silken webs. Other species are hunting spiders, actively seeking and ambushing their prey. It is not entirely clear just how important spiders are in pre-

venting pest outbreaks, but what we do know is that they are very common in row crop fields and will feed on a wide variety of pests, including plant bugs and various caterpillar pests.

INSECT PARASITOIDS

***Cardiochiles* Wasp (Tobacco Budworm Parasitoid)**

Most of these small parasitic insects do not have common names, and we are forced to use scientific names. However, this little wasp is commonly referred to as “the red-tailed wasp” by scouts. In general, boll weevil eradication and Bt cotton have had a positive effect on the populations of most beneficial insects, but this is not true for *Cardiochiles nigriceps*. The primary host of this parasitic wasp is the tobacco budworm. Because most of the state’s cotton acreage is now planted to Bt varieties, and because tobacco budworm does not survive on Bt cotton, this is one beneficial insect that we see less of than in the past.

Description

Although most species of parasitic wasps are small and inconspicuous, this is not true of *Cardiochiles*. The adult wasp is larger than most other parasitic wasps—approximately one-fourth of an inch long—and has black wings and a red abdomen. The wasps are commonly seen flying at terminal height searching for larvae along the rows. These wasps are frequently observed in non-Bt cotton fields during mid- and late summer when their hosts are more common. If you take the time to observe them, you will be impressed by their searching ability. If you see the wasp change course, land, and begin searching a terminal, the odds are good that it has, or at least had, a larva present.

Prey (Hosts)

Cardiochiles is an important biological control agent of tobacco budworms. The primary hosts of this parasitoid are the tobacco budworm (*Heliothis virescens*) and a related species (*H. subflexa*) that is found mostly on ground cherries. If eggs are laid in bollworm larvae, they will not hatch because the bollworm has a defense mechanism that causes the eggs to become encapsulated. Extremely high populations of these wasps are often observed when tobacco budworms are common.

Biology

Adult wasps will “sting,” or lay eggs in, tobacco budworm larvae of all sizes, but they prefer newly hatched larvae. Older larvae are better able to fight off the wasp and keep her from successfully laying eggs. (Try tickling a large budworm on the back with a blade of grass and see how it reacts.) The wasp larva hatches inside the caterpillar and begins feeding, but the wasp larva grows slowly until the budworm larva enters the ground to pupate. The wasp larva then begins to develop more rapidly, consuming much of its host in the process. Parasitized caterpillar larvae grow more slowly and cause less damage than normal. *Cardiochiles* wasps overwinter as pupae in a pupal cell inside their host. The wasp’s overall development rate closely matches that of the tobacco budworm, so that generations of wasps and hosts coincide.

***Copidosoma floridanum* (Looper Parasitoid)**

This tiny parasitic wasp has no common name. It can be referred to generally as “the looper egg-larval parasite,” but in this publication we will refer to it simply as *Copidosoma*. This is one of the more common parasites of both cabbage and soybean loopers, and it certainly has one of the most interesting life histories of any of the beneficial insects. Science fiction writers get a lot of their wilder ideas from reading about parasitic insects such as this one. This parasitoid belongs to the family of wasps known as Encyrtidae. It is listed in the literature both as *Copidosoma floridanum* and as *C. truncatellum*.

Biology

Copidosoma is referred to as an egg-larval parasite because its eggs are deposited in newly laid looper eggs, but it does not complete its development until the host is in the larval stage. Looper moths deposit eggs individually, usually on the undersides of leaves. Female *Copidosoma* wasps search for these eggs and deposit either one or two eggs inside each looper egg they find. Sometime after the looper larva emerges and begins to feed, the *Copidosoma* egg begins to divide into additional eggs, 2, 4, 8, 16, 32, and so on. Eventually a parasitized looper contains around 1,000 of these *Copidosoma* eggs, all of which may have developed from a single origi-

nal egg and all of which are genetically identical. Thus, if only one *Copidosoma* egg was initially placed in the looper egg, all of the *Copidosoma* eggs will be either male or female. When two *Copidosoma* eggs are placed in the same looper egg, they usually are of opposite sexes.

Once the parasitized looper larva reaches its fifth larval instar, changes in the growth hormones of the looper trigger the *Copidosoma* eggs to hatch and begin feeding within the body of the host caterpillar. Strangely, this also stimulates the host larva to delay its pupation and have additional larval instars, resulting in a larger larva that provides more food resources for the parasites developing within its body. The looper larva remains alive until after it has formed its pupal cocoon on the underside of a leaf, but it dies before it has a chance to pupate because of the feeding of the *Copidosoma* larvae. By this time, the body of the looper caterpillar is completely filled with the bodies of the *Copidosoma* parasites, which by this time have also pupated. The resulting looper mummies are initially tan to gray and have a grainy appearance because of the large number of *Copidosoma* pupae that can be seen through the “skin” of the looper. If you collected one of these mummified loopers and placed it in an enclosed container, it would “hatch” within a few days into hundreds of very small, gnat-like *Copidosoma* adults. In one Louisiana study, the average number of *Copidosoma* to develop from parasitized soybean loopers was 992, but as many as 2,500 to 3,000 parasites have been recorded from individual larva.

Prey (Hosts)

As mentioned previously, *Copidosoma* attacks both cabbage loopers and soybean loopers, and it attacks other loopers as well. In a report from Louisiana, approximately 9 percent of all soybean loopers collected were parasitized by this wasp. However, levels of parasitism often are considerably higher than this during the latter part of the season. Because parasitized loopers are killed before they emerge as moths and have a chance to reproduce, *Copidosoma* does help reduce overall looper populations. But this is one parasite that can actually contribute to increased levels of crop injury. Because parasitized loopers often have additional larval instars and grow larger, they actually eat more than they would if they were

not parasitized. In another Louisiana study, parasitized soybean loopers weighed 50 percent more and consumed 40 percent more leaf area than nonparasitized larvae.

Cotesia marginiventris (Armyworm Parasitoid)



This small parasitic wasp has no common name, but it often plays an important role in helping suppress beet armyworm populations. In several studies from Georgia to Mississippi, the percentage of beet armyworm larvae collected from cotton fields that were parasitized by *Cotesia* ranged from 17 to 83 percent. These levels of parasitism can have a tremendous impact on the overall population development of a pest like the beet armyworm.

Of course, *Cotesia* is not the only beneficial insect that is important in suppressing beet armyworms. It is mortality caused by a complex of predators and parasites that helps to maintain beet armyworm populations below damaging levels. For this reason, the intensive use of broad-spectrum insecticides may trigger outbreaks of this pest.

Description

The adult wasp is so small and inconspicuous that scouts rarely notice it. It is about one-eighth of an inch long and has a dark-colored body. The female wasp inserts her eggs inside the body of the caterpillar using her stinger-like ovipositor. The white, maggot-like larvae also are seldom seen because they spend their life inside the body of the caterpillar host. This larval period lasts approximately 6 days. Occasionally a scout will encounter a mature larva after it has exited the caterpillar and before it has pupated. It is the pupal stage of this parasite

that is most often seen by scouts. *Cotesia* pupates in an oval-shaped white silken cocoon (pictured at left) that is approximately one-eighth of an inch long. These often are found near an area where the host larva was feeding.

Prey (Hosts)

In addition to beet armyworms, *Cotesia* also attacks a wide range of other caterpillars such as yellowstriped armyworms, fall armyworms, tobacco budworms, and bollworms. However, beet armyworms seem to be the most favored host, possibly because their habit of remaining clustered together for several days after hatching makes them easy targets.

Lysiphlebus testaceipes (Aphid Parasitoid)



This small parasitic wasp does not have a common name, but it is often referred to as the “aphid wasp.” Next to the “aphid fungus” (*Neozygites fresenii*), it is probably the most important biological control agent of cotton aphids. Levels of parasitism can exceed 70 percent in some situations. It is likely that this parasite would play an even greater role in aphid population suppression if it weren’t for the fungal disease eliminating aphids first. On the other hand, there are indications that the parasite helps spread the fungal spores from one aphid to another, hastening the development of the disease epizootic.

Description/Biology

The adult is a very small black wasp, approximately the size of a winged cotton aphid but more slender. Females can be seen crawling about on the undersurface of cotton leaves in search of

aphids to parasitize. When a suitable aphid is found, the wasp curls its abdomen forward between its legs and “stings,” or lays an egg in, the unfortunate host. An individual adult can parasitize up to 100 aphids during its brief life. Eggs hatch in 2 to 3 days, and the larval parasite begins feeding inside its aphid host before ultimately killing it. The larval stage lasts about a week, and the pupal stage, which takes place inside the body of the host aphid, takes an additional 4 to 5 days. Thus, the complete life cycle takes roughly 2 weeks.

During the early stages of parasitism, parasitized aphids appear normal. As the developing parasitic larva grows larger, it eventually kills the aphid, causing it to swell and turn beige to tan. These “aphid mummies” are readily recognized and provide an easily observed indication of parasite activity. However, it is important to keep in mind that the actual level of parasitism is considerably higher than would be indicated by counting the percent of aphid mummies. Once the percentage of mummified aphids reaches 10 to 20 percent, it’s a good bet that most of the aphids present on a leaf have been parasitized. Upon reaching the adult stage, the wasp cuts a small, circular hole near the back end of the aphid, emerges, and begins searching for aphids into which to lay its eggs. *Lysiphlebus* overwinters inside its aphid host as a larva or pupa, and mummified aphids can be found throughout the year.

Prey (Hosts)

For a parasitoid, *Lysiphlebus* has a relatively wide host range, attacking a number of economically important aphid species. Cotton aphids and greenbugs, important pests of wheat and sorghum, are two of the more important aphids parasitized by this wasp, but it can be found attacking many other aphids.

Stink Bug Egg Parasitoids

If it weren’t for egg parasitoids, stink bug populations would be a lot higher than they are each year. Stink bugs lay their eggs in masses, and there are several species of very small parasitic wasps that take advantage of this by searching for stink bug egg masses and laying their own eggs inside the individual stink bug eggs. These wasps are so small that they usually go undetect-

ed, but if you approach a newly deposited stink bug egg mass carefully and look closely, you often can see a very small, gnat-like wasp lurking nearby. These wasps belong to Scelionidae, a family that contains many species of parasitic wasps. Members of this family also attack the eggs of many caterpillar pests and other insects. There are several different species of these stink bug egg parasites. Some are quite host specific, attacking only one species of stink bug or a few closely related species. Others may have a most favored species, but will also attack others. Collectively, these stink bug egg parasites are probably the most important natural enemies of stink bugs. In one Louisiana study, levels of egg parasitism often were as high as 30 to 50 percent, and one California study reported parasitism levels as high as 87 percent.

Biology

Adults of these stink bug egg parasites can live from 2 to 6 weeks and may parasitize from 30 to 300 stink bug eggs. Parasitized eggs turn black within a few days, and depending on species and temperature, the adult parasites emerge within 8 to 20 days. Normally, only one parasitoid develops within each parasitized egg.

Prey (Hosts)

The eggs of all of the common species of stink bugs are subject to attack by at least one species of these stink bug egg parasites. The major parasite of the southern green stink bug is *Trissolcus basalus*, but this parasite will attack the eggs of other stink bugs when southern green stink bug eggs are lacking. *Telenomus podisi* is the most common egg parasite of brown stink bugs, but there are other species that also attack brown stink bugs. It is not uncommon to collect stink bug egg masses that have been attacked by more than one kind of parasitoid.

There are several different species that attack the eggs of the beneficial spined soldier bug. One of these, *Telenomus calvus*, has a rather unusual behavior. In order to assure that it is present when the spined soldier bug female lays her eggs, this small wasp actually searches a female soldier bug and then simply rides on its back until the eggs are laid. Then it hops off and parasitizes the newly laid soldier bug eggs. At least one species of tropical stink bug has adopted the habit of sit-

ting on its egg mass until it hatches in order to protect the eggs from being parasitized. Eggs around the outer edge of the mass still get parasitized, but this behavior does help protect the eggs located on the inside of the mass.

Trichopoda pennipes **(Stink Bug Parasitoid)**



Trichopoda pennipes is an important parasitoid of stink bug nymphs and adults. Levels of parasitism can be 90 percent or greater, but this is highly variable.

Description/Biology

T. pennipes is a large, showy tachinid fly (family Tachinidae). It is somewhat larger than a housefly and has a bright orange abdomen and a velvety black head and thorax. The legs have a feathery appearance due to a fringe of large hairs. Its eggs are laid on the back of the host, and it is not uncommon to see the dirty white, elongate eggs attached to stink bugs. The hatching maggots bore into the parasitized bug and feed internally. The larvae then exit the stink bug and burrow into the ground to pupate. The parasitized bugs are not killed until the maggots exit, but their egg-laying ability often is severely reduced due to damage to their reproductive organs.

Prey (Hosts)

This parasitoid attacks stink bugs, especially the southern green stink bug, and several other bugs, including the common squash bug.

Classification of Represented Insect Predators and Parasitoids

Order Hemiptera Family:	Anthocoridae (minute pirate bugs, including <i>Orius</i>) Lygaeidae (seed bugs, including <i>Geocoris</i>) Nabidae (damselfly bugs, including <i>Nabis</i>) Pentatomidae (stink bugs, including <i>Podisus</i>) Reduviidae (assassin and ambush bugs, including <i>Zelus</i>)
Order Coleoptera Family:	Carabidae (ground beetles, including <i>Calosoma</i> , <i>Lebia</i> , and <i>Pterostichus</i>) Coccinellidae (ladybird beetles including <i>Hippodamia</i> , <i>Coccinella</i> , <i>Harmonia</i> , and <i>Scymnus</i>)
Order Neuroptera Family:	Chrysopidae (common lacewings, including <i>Chrysopa</i> and <i>Chrysoperla</i>) Hemerobiidae (brown lacewings, including <i>Hemerobius</i>)
Order Hymenoptera Family:	Aphidiidae (including <i>Testaceipes</i>) Braconidae (including <i>Cardiochiles</i> and <i>Cotesia</i>) Encyrtidae (including <i>Copidosoma</i>) Scelionidae (including <i>Telenomus</i> and <i>Trissoclus</i>)
Order Diptera Family:	Syrphidae (syrphid or flower flies, including <i>Allograpta</i>) Tachinidae (including <i>Trichopoda</i>)
