Science Societies

Beneficial arthropods in the Cotton Belt: Predators

By Susan Winsor

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Beneficial Arthropods

This article is the second in a three-part series on beneficial arthropods. It will focus on the predator category of beneficial insects in cotton cropping systems. This article is based upon expertise from Auburn University, Louisiana State University, Texas A&M, and the Universities of Florida, Georgia, Mississippi, Nebraska, and Tennessee.

Insects and spiders have gotten a bad rap: Most of the many arthropod species in cotton are beneficial. There are more than 600 beneficial arthropod predator species in cotton. Some 300 to 350 different species consistently breed in cotton fields, according to California entomologists. The two main insect categories of natural enemies to pests are parasitoids and predators. Parasitoids' prey are often quite species specific, whereas predators typically feed on many insects. Although more than 100 insect families contain predators, about 12 contain the major species that are the workhorses of our "everyday heroes." These predators are found across a wide crop variety through the season. One important group, for example, are lady beetles.

This article will focus on the predator category of beneficial insects in cotton cropping systems.

Order Neuroptera (Lacewings)

Green Lacewing (Chrysopidae Family)

Ronald Smith, Auburn Univ., Bugwood.org.

***Chrysoperla* and *Chrysopa* species** lacewing larvae are important predators of aphids, mites, whiteflies, and eggs and small larvae of bollworms, budworms, armyworms, and loopers, and their eggs. They also feed on other lacewing larvae. Lacewings become very abundant when aphids are present. Like their larvae, adults of *Chrysopa* species also feed on insects while adults of *Chrysoperla* species feed only on honeydew, nectar, and pollen.

Eggs are laid on stalks, either singly or in groups, depending on species, and hatch in three to six days. Larvae feed for two weeks and then spin spherical, white cocoons of tough silk, which are found behind bracts and in plant terminals. Larvae pupate inside the cocoons, and the adults emerge in about two weeks. Adults fly at night and may travel several miles during the first two to three nights after emergence. Females lay their first eggs four to six days after emergence, produce a total of 200–800 eggs, and live for several weeks. *Chrysopa* species tend to overwinter as larvae in cocoons, whereas *Chrysoperla* species tend to overwinter as adults.

ID: Adults are delicate, slender insects ½ to ¾ inches long, green with golden or black eyes and long antennae. Their eggs are easily recognized by their attachment to a long, slender silken stalk, which holds them above the surface of the leaf or stem. The large, elongate, delicate wings are laced with a network of veins (hence the common name of "lacewing") and are held roof-like over the back when at rest. Larvae are alligator-shaped, grayish-brown with long sickle-shaped mandibles projecting from the head. Full-grown larvae are ½ to ⅜ inches long. Adult *Chrysopa* species release a pungent odor when handled.

Brown Lacewing (Hemerobiidae Family)

David Cappaert, Bugwood.org.

***Hemerobius* and *Micromus* species** adults and larvae feed on aphids and whiteflies. Larvae feed on a variety of pest eggs, including bollworms, budworms, loopers, and armyworms. They're found throughout the Cotton Belt.

Unlike the green lacewing, brown lacewing eggs aren't placed on a stalk. Eggs are laid on the underside of leaves and turn from a cream color to pink or purple before hatching. Full-grown larvae pupate inside an elliptical cocoon in concealed locations, such as within bracts. The loosely woven silk cocoon is thin enough to be able to see the pupa

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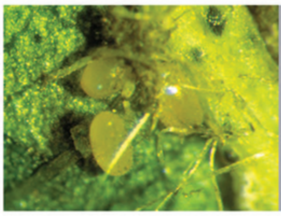
inside. Adults fly during the evening and at night. Brown lacewings tend to be more abundant when weather is cool, rain is frequent, and the plant canopy closes. Most species have two or three generations per year.

ID: Adults resemble the adult green lacewing but are smaller and more compact, brown, and hairy. Larvae are reddish-brown with two to four white spots in the middle of the body. Like green lacewing larvae, they are alligator shaped with long, sickle-like mouthparts that suck juices from their prey. Larvae have a characteristic side-to-side head-wagging behavior, which distinguishes them from green lacewing larvae.

Lady Beetles (Coccinellidae Family)



Scymnus Lady Beetle Eggs

John Ruberson, KSU, Bugwood.org.

***Scymnus* species** lady beetle adults and larvae feed primarily on aphids but may also feed on spider mites in cotton. *Scymnus* species are distributed through the Cotton Belt.

ID: These are very small, dull orange to brown beetles. *Scymnus loewii* has a black center line forming 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 but move more rapidly when disturbed.

Eggs are tiny, barrel-shaped, and golden and laid singly in tight spots on the plant, such as at the base of cotton leaves where the hairs are dense. Eggs hatch in three to four days, and larvae develop in 14 to 17 days. Pupae resemble larvae, covered with wax, but unlike larvae, do not move. Adults emerge from pupae after five to eight days and live three to six weeks. There are typically two or three generations per year in cotton, and numbers are greatest when aphids are present. The wax covering may provide *Scymnus* larvae some protection from fire ants as they are not attacked by ants as readily as other aphid predators.

Stethorus Lady Beetle Adult

F.C. Schweissing, Bugwood.org.

***Stethorus* species** adults and larvae feed on spider mites and their eggs. *Stethorus* lady beetles appear in cotton when spider mites are present and lay eggs in spider-mite colonies.

ID: The adult is jet black and very small, about the size of a pinhead, and commonly seen in spider mite colonies. The adults run rapidly when disturbed. Larvae are dark brown to black and covered with fine hairs.

Collops Beetles (Melyridae Family)

Collops vittatus Adult

KS Dep. of Agric., Bugwood.org.

Collops quadrimaculatus*, *Collops vittatus*, *Collops balteatus, and ***Collops marginellus*** are active, soft-bodied beetles. In California and Arizona, *C. marginellus* and *C. vittatus* are important species in cotton.

Adults feed on moth eggs and small caterpillars, whiteflies (eggs, nymphs, and adults), aphids, stink bug eggs, soft-bodied insects including armyworms,

Photo courtesy of Adobe Stock/mehmetkrc.

lygus bug nymphs, aphids, mites, and lepidopteran eggs. *Collops quadrimaculatus* commonly feeds on bollworm eggs and larvae. In Arizona, *C. vittatus* feeds on whiteflies in cotton. These beetles overwinter as adults.

ID: They are dark blue (often metallic) with orange spots or stripes. *Collops quadrimaculatus* is often called the "red cross" beetle because of the orange-red cross on its back. *Collops vittatus* is dark blue with an orange stripe on each side. The front section of these beetles' thorax is often orange and may or may not have a central dark spot. Larvae have a pincher-like structure at the tip of the abdomen and are rarely seen.

Eggs are yellow to pinkish-orange and spindle shaped. Most eggs are laid in clusters on soil debris but sometimes are found in the plant terminal. Larvae are pink to brownish-red and feed on soil insects.

Convergent Lady Beetle (Coccinellidae Family)

Hippodamia convergens Larva

Louis Tedders, USDA, Bugwood.org.

Hippodamia convergens is an important natural biological control agent for aphid pests on cotton and is found throughout the U.S. Adults and larvae feed primarily on aphids, and adults also feed on nectar and pollen. When aphids are not available, adults feed on bollworm and budworm eggs and small larvae. Convergent lady beetles and larvae become very abundant when aphids are present.

Females lay 200 to 1,000 eggs during a one- to three-month life span. Eggs hatch in three to four days, and larvae feed for two to three weeks and then enter the pupal stage. Pupae are shaped like bike helmets and are immobile and attached to stems and leaves. Adults emerge from the pupae in about a week. There are several generations per year. Adults congregate in sheltered sites to overwinter.

ID: Besides the two white lines on the pronotum (plate behind the head) that, if extended, would converge, the pronotal margin is also lined with white. The number of black dots on adults range from only a few up to 13. The adult is rounded and elongate-oval, averaging ⅓ inches long for females and ¼ inches long for males. Adults are easily recognized by their bright red or orange elytra (hardened forewings), which usually have 12 black spots (six on each elytron). The legs, head, and underside are black. The legs are short with three-segmented tarsi, and the antennae are short and clubbed. Larvae are alligator shaped and black with parallel rows of orange spots. Eggs are bright yellow, football shaped, and laid in clusters of 10 or more on plants or on debris on the soil. Pupae are immobile, attached to the plant. You may find adults clustered under tree branches and rocks in reproductive diapause when temperatures are too high or low and when food sources are insufficient for reproduction.

Seven-Spotted Lady Beetle or "C-7" (Coccinellidae Family)

Coccinella septempunctata

Mary C Legg, Bugwood.org.

Coccinella septempunctata is found throughout the eastern U.S. west to Oklahoma and Texas. Both adults and larvae feed primarily on aphids but also on eggs and caterpillars of various moth pests.

Photo by Louis Tedders, Bubwood.org.

Like the convergent lady beetle, the seven-spotted lady beetle is most abundant in cotton when aphids are present. Adults can survive on pollen and nectar when aphids are absent. This species was introduced into the U.S. from Europe. This beetle is often the largest lady beetle in crop fields.

ID: Wing covers are red or orange and always have seven black spots, the seventh spanning the top of both wing covers at the forward edges. It's a large (⅓ inch long), orange-red lady beetle with seven, distinct dark spots on the back. The shield behind the head (pronotum) is black with a white mark on each side. Larvae are alligator shaped and black with an orange-white strip down the middle of the thorax (central body region where legs attach). Full-grown larvae are about ½ inch long. Eggs are yellow-orange, football shaped, and laid on end in groups of 10 to 30. Each female can deposit up to 1,000 eggs during a six- to eight-week period and hatch in 7 to 10 days. Larvae are fully grown in 10 to 50 days, depending on temperature and food availability. Pupae are black with yellow spots. Pupae are shaped like bike helmets and are immobile and attached to stems and leaves.

Adults emerge in 3 to 10 days. The life cycle is completed in about two to three weeks, and there are several generations each year. Small groups of adult beetles gather in protected areas to overwinter.

Harmonia or Asian Lady Beetle (Coccinellidae Family)

Harmonia axyridis Adult

Spakes Richter, UFL, Bugwood.org.

Harmonia axyridis is found throughout North America. Adults and larvae feed primarily on aphids but also on armyworm eggs and small caterpillars. The *Harmonia* lady beetle was introduced into the U.S. to control aphids on pecan trees. It commonly moves into cotton when cotton aphids are abundant. Eggs hatch in four days, and larvae feed for about two weeks and then enter the pupal stage. After about six days, the adult emerges. Females begin laying eggs 7 to 12 days later, and each 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.

ID: Adults occur in a variety of color forms but most commonly in the U.S. are a bright yellow-orange to reddish-orange to red with 0 to 20 spots. 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 "eyes." Larvae are alligator shaped, black, with an orange jagged streak or blaze on each side of the abdomen. Pupae are shaped like bike helmets and are immobile and attached to stems and leaves. Eggs are yellow, football shaped, and laid in masses of 10 to 30 on leaves.

Photo by Mary C Legg , Bubwood.org.

Pink Spotted Lady Beetle (Coccinellidae Family)

Whitney Cranshaw, CSU, Bugwood.org.

Coleomegilla maculata is found throughout the eastern half of the U.S. to east Texas and along the southern border of west Texas, New Mexico, Arizona, and California. Adults and larvae feed primarily on aphids; also on eggs and small caterpillars. Unlike most lady beetles, plant pollen may constitute up to 50% of their diet; they may be abundant when cotton is blooming. Adults emerge from overwintering sites in the spring and lay egg masses on leaves often near aphid colonies. Females lay several hundred eggs during a two- to three-month period. Larvae feed for several weeks and then molt to the pupal stage. The pupa is attached to a leaf or stem and does not move. The adult beetle emerges from the pupa in about a week. There are several generations each year, and adults overwinter in protected sites.

ID: The oblong, flattened, slender, pink beetle has six very large black spots on each forewing. The spots sometimes join. The two large triangular black marks on the area just behind the head are dark and alligator like with three pairs of prominent legs, 5 to 6 mm long. Eggs are spindle shaped and about 1 mm long. Larvae are alligator shaped and black with cream or yellow spots. Eggs are small, spindle shaped, yellow, and laid on end in masses of 10 to 30.

Ground Beetles (Carabidae Family)

A. Steven Munson, USFS, Bugwood.org.

Ground beetle adults and larvae (such as *Calosoma* species) typically hunt caterpillars, including cutworms and bollworms, that drop to the soil, as well as various soil insects. Large beetles can subdue large caterpillars. Some species in the genus *Lebia* climb the cotton plant in search of caterpillars. Tiger beetles tend to be more prevalent in sandy soils with open canopies.

ID: Dark and shiny (sometimes metallic colors) with long, slender legs and antennae and prominent eyes. They run quickly, but many species are not commonly seen because they are most active at night. Immatures are worm-like predators with well-developed legs and jaws. Both stages are active on the soil surface or may climb into the plant canopy in search of prey.

Hooded Beetle

KS Dep. of Agric., Bugwood.org.

Notoxus monodon **(Corylophidae Family)** feeding habits in cotton are not well known. Adults feed on nectar, and under laboratory

Photo by Jeremy Lee, Bugwood.org.

conditions, readily feed on budworm and bollworm eggs and small larvae. Adults are often found hidden behind bracts on squares or nestled in terminals. Larvae live in sandy soil. They are believed to complete several generations a year and overwinter as adults.

ID: When viewed from the side with a hand lens, the hooded beetle is easily recognized by the horn-like projection extending over its head, creating a hood. These small, ant-like beetles are tan or reddish with black patches, often forming zig-zag patterns on the back (elytra).

Joseph Berger, Bugwood.org.

Rove beetle (Staphylinidae Family) adults and larvae feed on a variety of small, soft-bodied insects and insect eggs. Some species feed on aphids and others on caterpillars or spiders. Little is known about the species present in cotton. Larvae commonly live in the soil, and larvae of some species are parasites of insects.

ID: Adults are tiny to small, black to brown, slender beetles that run and fly rapidly. The wings are very small, leaving much of the abdomen exposed. The tip of the abdomen may be curled forward, much like a scorpion, when the beetles are disturbed although the beetles have no stinger. Larvae are elongate with well developed legs.

Order Diptera

Hover or Syrphid Fly

Shepard, Carner & Ooi, Bugwood.org.

Hover fly (Syrphidae Family) larvae pierce their prey (aphids, small worms, and their eggs) and suck out the body fluids. The adult flies feed only on nectar and honeydew. Large larvae can eat as many as 50 aphids per day. Hover flies are most abundant when aphid numbers are high and overwinter as pupae.

ID: The larva is a green to brown slug-like maggot with no legs. The tiny head is at the small end of the tapered body. Although they have no legs, larvae can move well, stretching out their bodies in a looping action. Full-grown larvae and adults are about ¼ to ½ inches long. Adults are striped with bright yellow and black, like a small bee. Some species have a slender, striped body while others have a broad, striped abdomen. At rest, the wings are held out at an angle from the body, unlike bees and wasps, which fold their wings over their backs. Adults fly quickly and often hover near plants and flowers.

Eggs are white, sculptured, and elongated and are laid singly on leaves near aphid colonies. Larvae swing their heads from side to side until they touch and seize an aphid.

The larva then lifts the aphid into the air and holds it while sucking it dry. Larvae feed for two to three weeks at night and rest near aphid colonies during the day. The pupa is pear-shaped and fastened to leaves, stems, or ground debris.

Long-Legged Fly (Dolichopodidae Family)

Russ Ottens, UGA, Bugwood.org.

Adult flies and larvae feed on small, soft-bodied insects, such as whiteflies and aphids. Long-legged flies are not known to be an important predator of any cotton pest but are often noted in the field. Very little is known about this insect family. Adults are predaceous on other small insects, and the larvae are also assumed to be predaceous. The adult flies can be very abundant, particularly from mid-season to harvest.

ID: These are small (⅛ inch), slender flies with long, stilt-like legs. They are metallic blue, red, yellow, or green and often rest on leaves in the sunlight. They move rapidly on and among leaves, running and flying quickly. The wings are typically held out from the body at about a 45-degree angle.

Order Hymenoptera

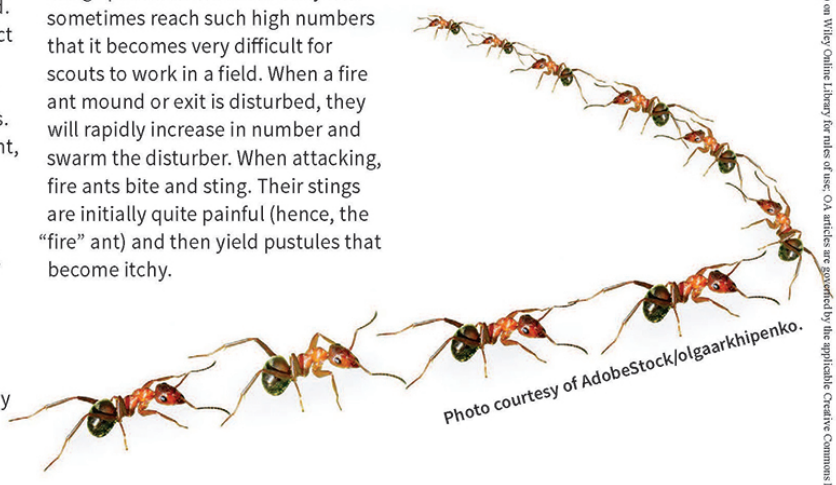
Red Imported Fire Ant (Formicidae Family)

John Ruberson, KSU, Bugwood.org.

Solenopsis invicta can be the single most important arthropod predator in many cotton fields, unless aphids or whiteflies are present. It is an exotic ant now established throughout the Cotton Belt. This aggressive species can consume a wide range of cotton pests, most notably caterpillar pests. They can reach very high numbers in cotton fields, especially where conservation tillage practices are used. They can sometimes reach such high numbers that it becomes very difficult for scouts to work in a field. When a fire ant mound or exit is disturbed, they will rapidly increase in number and swarm the disturber. When attacking, fire ants bite and sting. Their stings are initially quite painful (hence, the "fire" ant) and then yield pustules that become itchy.

Ants will remove arthropods and their eggs from plants and return them to the colony to eat them. The ants also feed on nectar and can often be found feeding at floral and extrafloral nectaries on cotton plants. When these latter species are present, fire ants will defend them from other predators, such as lady beetles and lacewings, so they can feed on the sugary honeydew that the aphids and whiteflies produce. When this occurs, biological control can break down, and other pests, such as caterpillars, can emerge.

ID: Red imported fire ants are typically dark red, and workers can exhibit a wide range of sizes. Colonies of 100,000 to 500,000 workers are underground with numerous exit points from which ants exit and into which they enter.



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