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Entomology

Insect Pollinators and Predators-Goldenrod Soldier Beetle

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Soldier beetles, or leatherwings (Coleoptera: Cantharidae), are a diverse family, with over 470 known species across 23 genera (Arnett and Thomas 2002). One of the genera in this group is *Chauliognathus*. Most species of this genus are found in the United States, Australia, and South America. The goldenrod soldier beetle, or Pennsylvania leatherwing (*Chauliognathus pensylvanicus*) (Fig. 1), is one of the most common *Chauliognathus* species found in Tennessee. It plays a dual ecological role as a beneficial insect, providing pollination as adults and biological control of arthropod pests as both larvae (Fig. 2) and adults. Its presence supports integrated pest and pollinator management strategies in sustainable farming systems. Despite both larvae and adults having prominent mandibles (jaws), neither is likely to bite or bother humans.

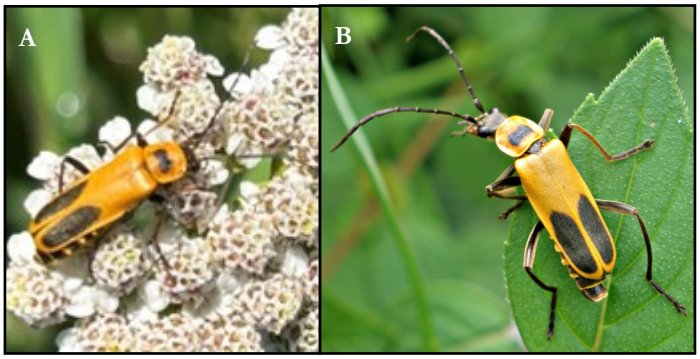

Figure 1: Adults of goldenrod soldier beetle. Photo credit: A. Adhikari, Tennessee State University, Nashville, TN; B. Ansel

Importance as pollinators

Adult goldenrod soldier beetles are commonly observed on flowering plants from early May to mid-September in Tennessee. They feed on nectar and pollen, making them effective pollinators in both natural and agricultural ecosystems. Their activity is often observed on goldenrod, milkweed, sunflower, Queen Anne's lace, wild onion, anise hyssop, *Coreopsis* species, golden marguerite, *Cosmos* species, and other native or non-native plants. They prefer yellow flowers to other colors (Catron, 2021). Goldenrod soldier beetles are typically found in wildflower meadows, agricultural field margins, gardens, and roadsides.

Figure 2: Soldier beetle larva. Photo credit: M. J. Raupp, University of Maryland, College Park, MD.

Importance as predators

Although adults feed primarily on pollen and nectar, they also prey on small insects such as caterpillars, aphids, and arthropod eggs. Larvae are important generalist predators and feed heavily on crop pests, such as aphids and other soft-bodied insects, and their eggs, newly hatched grasshoppers, snails, and slugs. They are important predators of ground-dwelling insects and can also be found on plants, emerging from the ground to hunt for prey in flowers, on fruit, and on foliage. They are active between dusk and dawn; their nocturnal habits make them less conspicuous than other aphid predators. Larvae have chewing mouthparts and are voracious feeders. When disturbed, adults and larvae secrete a white, foul-smelling liquid from abdominal glands (Catron et al. 2019).

Identification and Life Cycle

Goldenrod soldier beetles undergo complete metamorphosis (transformation), and their life cycle includes eggs, larvae, pupae, and adults (Riley, 1892).

Eggs

Eggs are laid in clusters in moist soil or leaf litter, rather than on exposed plant surfaces (Fig. 3). They are less than 0.04 inch long, oval, and typically pearl-white to pale yellow. The eggs hatch in about 10 days.

Figure 3: Soldier beetle eggs (*Chauliognathus basalis*). Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org (5393581)

Larvae

The newly hatched larvae remain inactive for the first day. They have a reddish-brown head capsule and an elongated body with fine bristles, which is initially pale -colored and later darkens (Fig. 4). The dense hairs or bristles give the larva a velvety appearance. The color pattern of larvae depends on the environment and the type of prey. Most larvae are dark grey, with thick, velvety coats of fine hairs. They are predatory and live in soil, feeding on soft-bodied arthropods. Soldier beetle larvae are nocturnal. Occasionally, the larvae will emerge from the soil to feed on soft-bodied insects. Larvae dig small chambers in the soil to overwinter. The developmental time of larvae is 1-3 weeks. Larvae do not form a silken cocoon to pupate; instead, pupation occurs freely within a soil cell or chamber typically constructed just below the soil surface or within moist, organic leaf litter by burrowing into the soil.

Figure 4: Soldier beetle larvae. Photo credit: Joe Boggs, Ohio State University Extension, College of Food, Agricultural, and Environmental Sciences, Columbus, OH.

Pupae

Larvae pupate in soil during warmer months. The pupal stage typically lasts from two weeks to a month. During this stage, the larvae transform, and adults emerge in late July to feed on pollen, nectar, and aphids.

Adults

Adults are 0.5 inch long, slender, and soft-bodied with a forward-projecting head, which is easily seen from above and not concealed by an enlarged pronotum or neck plate in the thorax (Fig. 5). They are yellow-orange in color with two distinct black oval-shaped spots on the bottom half of the forewings (elytra) and a central black mark on the pronotum (area behind the head). Their forewings are soft and leathery, which is the reason they are called leather-wings. The size of the black spots on their front wings can vary across habitats, and this variation may influence their survival and mating success. For instance, over a breeding season, males with medium-sized spots are less common and are less successful at mating (Mclain, 2005). Adults have a distinct head with chewing mouthparts and long, straight antennae. They have soft and flexible front wings that meet in a straight line at the middle, but do not fully cover the tip of the abdomen. On-farm activities such as growing flowering plants, providing pesticide -free zones as habitats, reducing pesticide use during peak blooming periods, and following IPM practices can support adult soldier beetles.

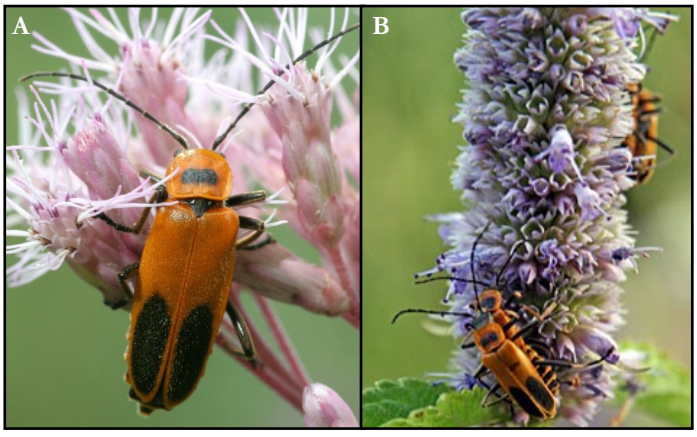

Figure 5: Goldenrod soldier beetle adults. Photo credit: A. David Cappaert, Bugwood.org (UGA2106095); B. Susan Mahr, University of Wisconsin, Madison, WI

Similar-looking insects

Goldenrod soldier beetles are often mistaken for fireflies (lightning bugs) (Coleoptera: Lampyridae) (Fig. 6. C&D). However, they can be distinguished from fireflies by their smaller eyes, clearly visible head, and lack of a light-producing organ at the tip of the abdomen (Catron et al. 2019). Unlike the typically darker fireflies, which have muted brown or black coloring, the goldenrod soldier beetle has a vivid yellow-orange body with striking black markings, especially on the pronotum and elytra. The margined soldier beetle (*Chauliognathus marginatus*) (Fig. 6. A&B) also looks similar. The distinguishing feature lies in the thorax: the goldenrod soldier beetle has a central black spot on the pronotum, while the margined soldier beetle has a black stripe with yellow margins to the left and right instead. The margined soldier beetle has black markings on the elytra ranging from small dots to entirely black elytra, and black "stockings" on the legs. In contrast, goldenrod soldier beetles have solid black legs (Catron et al. 2019).

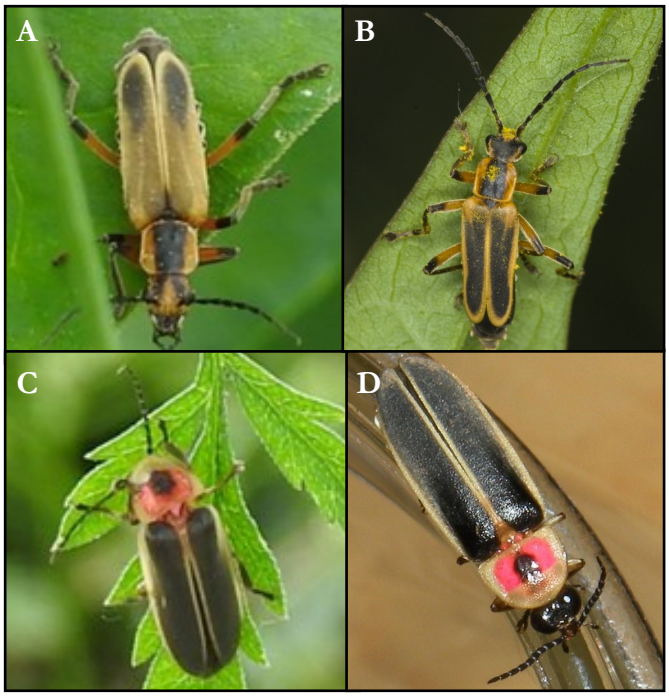

Figure 6: A-D. Similar insects: Margined soldier beetle (A&B) and common eastern firefly (C&D). Photo credit: A. Adhikari (A&C), Tennessee State University, Nashville, TN; David Cappaert, Bugwood.org (UGA5255040) (B); Jessica Louque, Smithers Viscient, Bugwood.org. (2423814) (D).

Sensitivity to insecticides

Goldenrod soldier beetles can be highly susceptible to insecticide exposure in agricultural systems. Research has shown that both conventional insecticides (such as neonicotinoids) and some organic products (including azadirachtin- and pyrethrin-based sprays) can cause high mortality in adults (Catron, 2021). Because of their sensitivity to insecticides, it is important to minimize unnecessary insecticide applications and the use of broad-spectrum insecticides. Using selective, reduced-risk insecticides only when needed, spot applications, and following IPM practices, such as pest monitoring to identify the lowest population densities at which control measures should begin (economic threshold levels/action thresholds) can reduce adult exposure.

Conservation

On-farm activities such as growing flowering plants, providing pesticide-free zones as habitats, reducing pesticide use during peak blooming periods, and following IPM practices can support adult soldier beetles. Reducing tillage, systemic pesticides, and soil fumigants can support larvae. They prefer areas with higher plant cover and humidity to bare ground. Areas of constant plant cover, planted with cover crops or permanent plantings, benefit larvae and their movement to nearby crops. Flowering plants such as goldenrod, *Coreopsis*, *Zinnia*, marigold, golden marguerite, *Cosmos*, and sunflower can attract adult goldenrod soldier beetles to cropping systems.

References

1. Arnett, R. H., and M. C. Thomas. 2002. American Beetles; Scarabaeoidea through Curculionoidea, CRC Press. CRC Press LLC, Boca Raton.

2.Catron, K. A., C. Philips, E. Fread, and T. Kuhar. 2019. Soldier beetles (Letherwings) *Chauliognathus marginatus* and *Chauliognathus pensylvanicus* (Coleoptera: Cantharidae). Virginia Cooperative Extension. Virginia Tech, Department of Entomology, Blacksburg, VA.

3.Catron, K. A. (2021). Biology of *Chauliognathus* spp. (Hentz) (Coleoptera: Cantharidae) in Virginia agroecosystems (Doctoral dissertation). Virginia Polytechnic Institute and State University. https://vtechworks.lib.vt.edu/handle/10919/102914

4. McClain, D. K. (2005). Female soldier beetles display a flexible preference for selectively favored male phenotypes. Evolution, 59(5), 1085-1095.

5. Riley, C. V. 1892. The margined soldier-beetle. Canadian Entomologist. 24: 186–187.

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