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Entomology

Insect Pollinators and Predators-Flower Flies

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Flower flies (Diptera: Syrphidae), also known as syrphid flies (Fig. 1: A & B), are beneficial insects that function as pollinators (adults) and predators (larvae) of arthropod crop pests. A fascinating characteristic of adult flower flies is their unusual flying pattern, which allows them to hover and rapidly change positions. Thus, they are also known as hover flies. They are colorful and prominent insects that mimic other insects to avoid predation. Flower flies have black and yellow stripes that resemble bees and wasps. However, they belong to the insect order Diptera with only one pair of functional wings, while bees and wasps belong to the order Hymenoptera with two pairs of functional wings. Flower flies have prominent heads with large bulbous eyes and short antennae. They have different feeding habits, and overall, their life cycle demonstrates their omnivorous feeding behavior. Flower flies do not harm humans as they do not have stinging organs like bees.

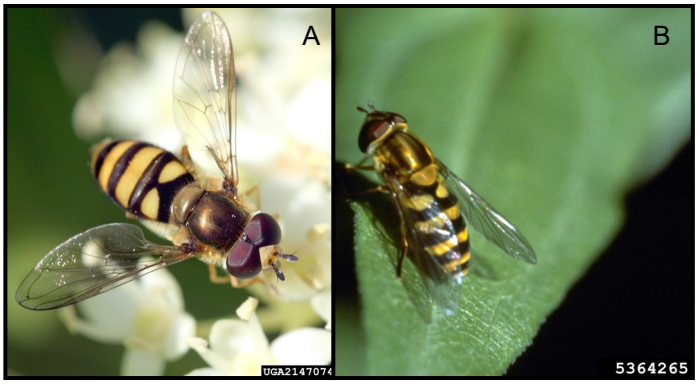

Figure 1: Flower fly adults. Photo credit: A. David Cappaert, Bugwood.org. (UGA2147074), B. Whitney Cranshaw, Colorado State University, Bugwood.org. (5364265)

Predatory nature of flower flies

Flower fly larvae are effective predators, feeding on soft -bodied arthropods, such as aphids, thrips, scales, and lepidopteran caterpillars. Only 40% of the species have predatory larvae. (Fig. 2: A & B). Larvae of over one-third of the flower fly species are aphidophagous (aphid feeding). Females lay their eggs near aphid colonies and often fly around aphid-infested plants. Flower fly larval feeding can reduce aphid populations.

Figure 2: Flower fly larva. Photo credit: A and B. David Cappaert, Bugwood.org. (UGA5371011 and 5490094)

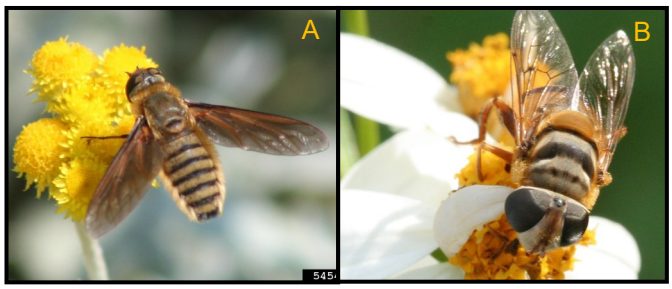

Figure 3: Pollination by adult flower flies. Photo credit: A. Charles Ray, Auburn University Bugwood.org. (5454419), B. David Cappaert, Bugwood.org. (UGA2131037)

Flower flies as pollinators

Adult flower flies are excellent pollinators as they visit many crop flowers, including canola, cotton, berries, melons, tree fruits such as apples, pears, peaches, and vegetables like bell peppers, carrots, and leeks (Fig. 3: A & B). Wings of some flower flies are 0.3-0.4 inch long, and these species can fly long distances. They do not have the hairy bodies or pollen baskets that bees have, but they can carry a similar amount of

pollen as honeybees. Unlike bees, flower flies are not central place foragers, meaning they do not nest, so they can disperse the pollen to greater distances, which makes them efficient pollinators and significant for agriculture. Flower flies are primarily attracted to yellow and white flowers, depending on the species. Both males and females feed on pollen and flower nectar. Flower flies have a mutualistic relationship with flowering plants. While both males and females are pollinators, the pollen that females collect is important for their reproductive maturity. They use flower nectar as a source of energy.

Adults

Adults range from 0.2 - 1.0 inch in length and have a robust and slender body that varies in size, shape and color among species. Their bodies are black with bands of yellow, orange, or white, resembling those of bees and wasps. The shape of their mouthparts is closely related to the shape of flowers they visit and can be narrow, round, or tubular. Flower fly wings have a characteristic streak of discoloration in the third and fourth veins. This discoloration area is often mistaken for a vein and is called a spurious vein or false vein (Fig. 4). Apart from pollen and nectar provided by flower resources, aphids' honeydew is also a valuable resource for adults. Feeding on honeydews can reduce adult foraging time and energy, and can be used as a substitute for nectar when flowers are scarce.

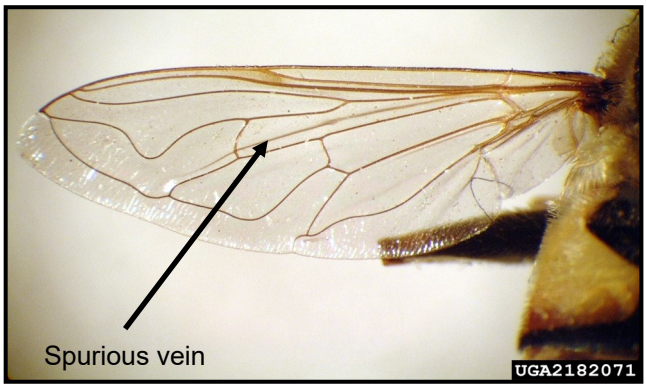

Figure 4: Flower fly spurious vein. Photo credit: Darren Blackford, USDA Forest Service, Bugwood.org. (UGA2182071)

Eggs

Adult females lay their eggs singly on the underside of leaves or shoots of plants near floral resources or aphid colonies (Fig. 5: A & B). Eggs are oblong and slightly curved and gray to white. They are 1/25 inch (1 mm) or less in length. The eggs have flattened undersides, whereas the top and sides are convex. Generally, eggs hatch in 2 - 3 days, depending on the environmental temperature.

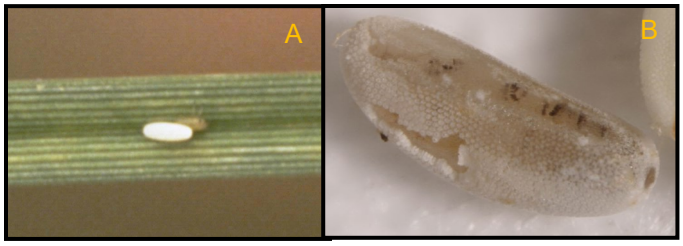

Figure 5: Egg of flower fly. Photo credit: A. Whitney Cranshaw, Colorado State University, Bugwood.org. (5364271), B. Charles Olsen, Charles Olsen Insect Collection, USDA APHIS PPQ, Bugwood.org (UGA5167002)

Larvae

Larvae are important, as they feed heavily on crop pests, such as aphids and other soft-bodied insects (Fig. 6: A & B). The color pattern of larvae depends on the environment and type of prey. Most larvae are brown, greenish, pink, or whitish in color. They are active between dusk and dawn; their nocturnal habits make them less conspicuous than other aphid predators. Larvae have sucking mouthparts and are voracious feeders. They often lift the aphid prey from the plant surface while feeding. The developmental time of larvae is 1-3 weeks.

Figure 6: Flower fly larva. Photo credit: A. Merle Shepard, Gerald R. Carner, and P.A.C Ooi, Insects and their Natural Enemies Associated with Vegetables and Soybean in Southeast Asia, Bugwood.org(5368152), B. Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org. (UGA1435171)

Pupae

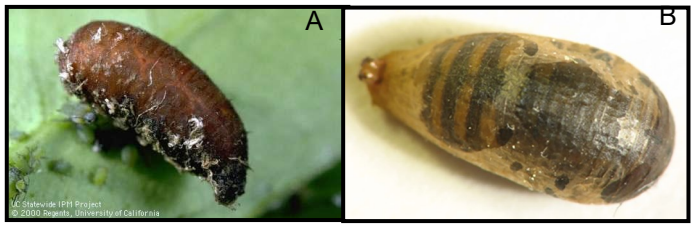

Figure 7: Flower fly pupa. Photo credit: A. UC Statewide IPM Project @2000 Regents, University of California. B. Beatriz Moisset, Bugguide.net

Pupation occurs within a hard outer cover called an integument, which hardens and becomes a teardrop shape in most species (Fig. 7: A & B). Pupation mainly occurs in litter or topsoil because it requires damp

or high humidity conditions. In the final larval stage, the larvae move down several inches into loosened soil to pupate. It takes 1-2 weeks for the pupae to develop into adults.

Habitat and importance

Flower flies are found near flowering plants, crop fields, hedges, and meadows, and in some areas near water (Fig. 8). Males are typically found beneath trees. During mating periods, they hover around the food or ovipositing areas. Females are found near flowers or the site of their emergence. The dual nature of flower flies as both pollinators and predators of crop pests is of great importance for organic agriculture and some conventional farming practices that follow integrated pest management (IPM) concepts.

Figure 8: Syrphid fly covered in pollen. Photo credit: David Cappaert, Bugwood.org. (UGA5381066)

Flower fly species in Tennessee

Eupeodes americanus, the American hover fly (Fig. 9A), is found in Tennessee and throughout North America and inhabits meadows and fields with flowers and foliage. *Allograpta obliqua*, the common oblique syrphid fly/oblique streaktail (Fig. 9B), is also a North American flower fly species in Tennessee. *Toxomerus jussiaeae* (Fig. 9C) is found generally in the Midwest-Southeast area, including Tennessee and eastern North America. *Toxomerus geminatus*, the eastern calligrapher or margined calligrapher (Fig. 9D), is found in Tennessee. *Spilomyia longicornis*, one of the best yellowjacket mimics (Fig. 9E), occurs in North America, east of the Rocky Mountains, and is also found in Tennessee.

Flowering plants

Growing flowering plants such as buckwheat, zinnia, sweet alyssum, phacelia, golden marguerite, crimson thyme, English lavender, coriander, and mint on crop borders, in surrounding areas, and within crop fields can attract flower flies.

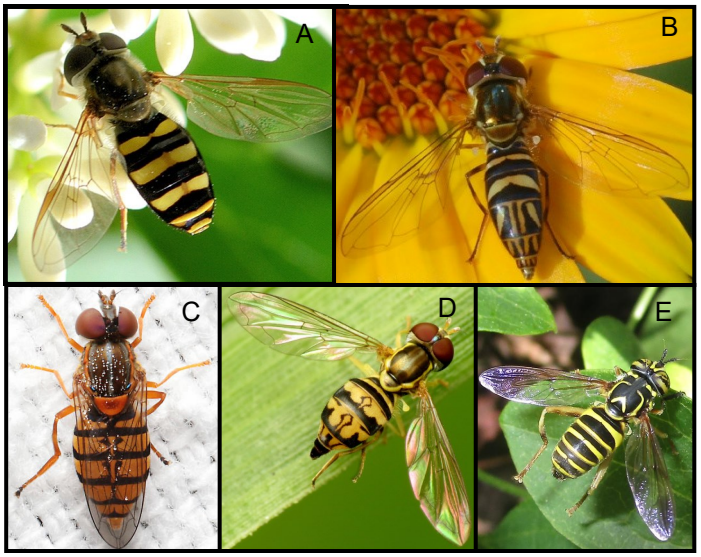

Figure 9: Flower flies in Tennessee. Photo credit: A. American hover fly *Eupeodes americanus*. Rich Kelly, Bugguide.net. B. *Allograpta obliqua*, the common oblique syrphid fly/oblique streaktail, Ron Hemberger, Fullerton Arboretum, Fullerton, CA. C. *Toxomerus jussiaeae*. Ken Childs, Buggide.net. D. *Toxomerus geminatus*, the Eastern Calligrapher or Margined Calligrapher, Ashley Bradford, Marylandbiodiversity.com, E. *Spilomyia longicornis* (the best yellowjacket mimic), Ken Wolgemuth, bugguide.net

Sensitivity to insecticides

Broad-spectrum contact and systemic insecticides used in crop fields can disrupt populations of flower flies by disrupting their foraging ability, affecting reproduction, and causing mortality. Larvae are affected by the neonicotinoid insecticides (e.g., imidacloprid and thiamethoxam), pyrethroids (e.g., cyfluthrin, and cypermethrin.), organophosphates (e.g., phosalon) and carbamates (e.g., pirimicarb). These impacts can result from direct exposure to insecticides or indirectly through the loss of food resources or alterations in their habitat. Using IPM practices and reserving insecticides as a last resort when controlling crop pests is important.

References

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