K-STATE
Research and Extension

Pollinators and Beneficial Insects

Pollinators and beneficial insects serve important functions in landscapes and gardens. Pollinators are responsible for ensuring the pollination of plants while beneficial insects regulate insect and mite pest populations below plant-damaging levels. This publication provides information on the common pollinators and beneficial insects of landscapes and gardens, along with ways to conserve and protect pollinators and beneficial insects from pesticides.

Pollinators and Beneficial Insects

The primary pollinators associated with landscapes and gardens are the European honey bee, *Apis mellifera* (Figure 1), and several species of the bumble bee, *Bombus* spp. (Figure 2). Beneficial insects (parasitoids and predators) can be classified as specialists or generalists. Specialists feed on only one type of insect or mite prey, or particular life stage (egg, larva, nymph, or adult) of a given insect or mite prey. In contrast, generalists feed on different life stages of a wide variety of insect and mite prey.

There are many parasitoids in landscapes and gardens, but they are difficult to observe with the naked eye due to their small size (Figure 3). Parasitoids attack insect pests such as caterpillars and aphids. Females insert eggs into aphids using an egg-laying device known as an ovipositor. A larva emerges (ecloses) from the egg inside the aphid and begins feeding on the internal contents of the aphid. Feeding by the larva leads to the formation of parasitized or mummified aphids, which are typically brown and can be observed on leaf undersides (Figure 4). Caterpillars, such as the tobacco or tomato hornworm, *Manduca sexta* or *M. quinquemaculata*, that have been attacked by a parasitoid will have white silken cocoons protruding from the top of their body (Figure 5), which is where adult parasitoids emerge.

Predators of landscapes and gardens include ladybird beetles (Figures 6 and 7), green lacewings (Figure 8), insidious flower bugs (Figure 9), and hover flies (Figure 10). These predators feed on a wide range of insect and mite pests. In general, the larvae or nymphs, and adults are predaceous, but this is not always the case. Adult green lacewings (Figure 11) and hover fly adults (Figure 12) feed on the nectar of flowering plants instead of insects. Spiders (Figure 13) in landscapes and gardens feed on many different insect pests, as well as beneficial insects. However, spiders typically do not consume enough prey to regulate insect pest populations below plant-damaging levels.

Conservation Biological Control

Pollinator and beneficial insect populations in landscapes and gardens can be enhanced by increasing plant diversity using a strategy called conservation biological control. The strategy involves incorporating flowering plants into landscapes and gardens (Figures 14 through 16) to attract or retain pollinators and beneficial insects.

Flowering plants can increase the abundance of pollinators and beneficial insects by providing nectar as a food source for adults, as well as shelter and mating sites for adults. For example, sweet alyssum, *Lobularia maritima*, plants

Figure 1. European honey bee, *Apis mellifera*, feeding on the nectar of a flower. (Photo: Raymond Cloyd)

Figure 2. Bumble bee feeding on nectar in clover flower. (Photo: Raymond Cloyd)

in bloom (Figure 17) provide food for aphid parasitoids and hover fly adults. Flowering plants may vary in their attractiveness to pollinators and beneficial insects. In addition, flowering plants should bloom throughout the growing season so pollinators and beneficial insects have a consistent supply of food. Table 1 lists the flowering plants that attract and provide a food source for pollinators and beneficial insects.

Effect of Pesticides on Pollinators and Beneficial Insects

Pesticides (in this case, insecticides) can harm pollinators and beneficial insects through direct or indirect exposure. Direct exposure to wet sprays or dried residues on leaves and/or flowers may kill pollinators, such as honey bees or bumble bees when foraging, and beneficial insects when searching for prey. Indirect exposure to pesticides may affect movement, behavior, foraging, development, predation, and reproduction of pollinators and beneficial insects. For more information on the effects of pesticides on bees refer to: *Pesticides and Bees*, MF3428, July 2018 (*bookstore.ksre.ksu.edu/pubs/MF3428.pdf*).

Two consequences of pesticide use on beneficial insects are secondary pest outbreaks and pest resurgence. Secondary pest outbreaks may occur following the suppression of major insect pest (e.g., aphids) populations by routine insecticide applications, leading to an increase in the population of what was previously a minor or secondary insect or mite pest (e.g., twospotted spider mite, *Tetranychus urticae*). The secondary pest then becomes the primary pest, requiring additional pesticide applications (in this case, a miticide). Secondary pest outbreaks also occur as a result of killing beneficial insects (parasitoids or predators) associated with a secondary pest. Consequently, the secondary pest becomes the primary pest and the initial primary pest becomes secondary.

Pest resurgence occurs when an insect or mite pest population, after having been suppressed by applications of a pesticide, increases or rebounds to higher numbers than before the pesticide application. The reason for the pest population increase is that the beneficial insects that were providing regulation of the insect or mite pest population have been killed by the pesticide application. In addition, beneficial insect populations take longer to reach levels sufficient to suppress the insect or mite pest population before the pesticide application.

Conclusion

Pollinators and beneficial insects help pollinate plants and provide natural regulation of insect and mite pest populations in landscapes and gardens. Pollinator and beneficial insect populations can be increased and retained in landscapes and gardens by incorporating flowering plants that provide a food source. In addition, pollinators and beneficial insects can be preserved by minimizing the application of pesticides in landscapes and gardens.

Figure 3. Parasitoid or parasitic wasp on leaf. (Photo: Raymond Cloyd)

Figure 5. Tomato hornworm caterpillar with white silken cocoons on the body where adult parasitoids emerge. (Photo: Raymond Cloyd)

Figure 4. Parasitized or mummified aphids on leaf underside. (Photo: Raymond Cloyd)

Figure 6. Ladybird beetle adults. (Photo: Raymond Cloyd)

Figure 7. Ladybird beetle larva. (Photo: Raymond Cloyd)

Figure 11. Green lacewing adult. (Photo: Raymond Cloyd)

Figure 8. Green lacewing larva on leaf underside. (Photo: Raymond Cloyd)

Figure 12. Hover fly adult. (Photo: Raymond Cloyd)

Figure 9. Insidious flower bug adult. (Photo: Raymond Cloyd)

Figure 13. Spiders are generalist predators that feed on many different types of prey. (Photo: Raymond Cloyd)

Figure 10. Hover fly larva on leaf underside feeding on aphids. (Photo: Raymond Cloyd)

Figure 14. Flowering plants in landscapes and gardens will attract pollinators, beneficial insects, and butterflies. (Photo: Raymond Cloyd)

Figure 15. Flowering plants in landscape and gardens will attract pollinators, beneficial insects, and butterflies. (Photo: Raymond Cloyd)

Figure 16. Flowering plants can attract beneficial insects such as goldenrod soldier beetle, *Chauliognathus pennsylvanicus*, adults. (Photo: Raymond Cloyd)

Figure 17. Sweet alyssum flowers provide food for aphid parasitoids and hover fly adults. (Photo: Raymond Cloyd)

Table 1. Common and scientific name of flowering plants that attract and provide food (e.g., nectar) for pollinators and beneficial insects.

Common Name	Scientific Name
Queen Anne's lace	*Daucus carota*
Common yarrow	*Achillea millefolium*
Sweet clover	*Melilotus spp.*
Sweet alyssum	*Lobularia maritima*
Buckwheat	*Fagopyrum esculentum*
Dill	*Anethum graveolens*
Fennel	*Foeniculum vulgare*
Coneflower	*Echinacea spp.*
Coreopsis	*Coreopsis spp.*
Rosemary	*Rosmarinus officinalis*
Garlic chive	*Allium tuberosum*
Aster	*Aster spp.*
Sage	*Salvia spp.*
Black-eyed Susan	*Rudbeckia hirta*
English lavender	*Lavandula angustifolia*
Cornflower	*Centaurea cyanus*
Common vetch	*Vicia sativa*
Candytuft	*Iberis amara*
Marjoram	*Origanum vulgare*

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