PENNSTATE

College of Agricultural Sciences
Cooperative Extension

Pennsylvania Pollinator Series

2. Pollinators and Their Threats

Worldwide, more than 200,000 species of pollinators (NRC, 2007)play a role in the reproduction process for about 75% of all flowering plant species (NRC, 2007) (USFWS, 2009). Most pollinators visit flowers only for nectar, a sugar solution, while exploiting other protein resources. In their nectar quest, these pollinators unknowingly but efficiently vector pollen from flower to flower. This step, known as pollination, is critical to the sexual reproduction of flowering plants.

The following are the major groups of pollinators in the Northeastern United States:

Bees In the United States there are more than 3,550

species of native bees (NRC, 2007), which are the only group of pollinators specialized in collecting pollen and nectar. Most bees have hairy bodies and pollen-collecting mechanisms. They make their nests from mud, leaves, plant fibers, resin, or sand. Flowers attractive to bees are generally aromatically scented, and petals are often brightly colored yellow or blue.

Beetles One of the largest and oldest groups of polli-

nators are the beetles, but because in many species both larvae and adult stages feed on flowers, their role as pollinators is often underestimated. Even though estimates indicate that in the U.S. and Canada 52 plant species are pollinated by beetles (NRC, 2007), the full extent of pollination services provided by beetles has yet to be assessed. Typically, plant species that are pollinated by beetles have flowers with a strong fruity smell, moderate nectar amounts, and are white, to dull white or green.

Butterflies In general, butterfly adults will pollinate a

wide range of flowers, but as larvae they require specific plant food sources. A good example is the monarch butterfly, which will lay eggs only on milkweeds. Butterflies are frequently associated with plants with red, yellow, and orange brightly colored flowers with large amounts of nectar that is deeply hidden.

Birds The most representative group of bird pollinators are the hummingbirds, with 18 species in United States (NRC, 2007). Few overwinter here, and most species are dependent on nectar corridors for the southward migration. Hummingbirds will pollinate brightly colored, tubular flowers that contain more diluted nectar than do flowers pollinated by bees.

Flies After bees, flies are considered the most important pollinators, and contribute to the pollination of many fruit and vegetable crops. According to the fossil record, flies might have been one of the first groups of pollinators (NRC, 2007). The flowers pollinated by flies are in general dark brown or purple and frequently have an unpleasant, carrion-like smell. Most pollinating flies can mimic bees and are not a nuisance to humans; these flies can be quite beautiful, and fascinating to watch.

Moths Because most of their activity occurs at night, moths are often overlooked as pollinators. In order to be pollinated by moths, a plant will usually have nocturnal white flowers, with strong perfume and lots of nectar. However, some moths are active early morning or evening; some even look like hummingbirds in size, and feed on phlox or other tubular flowers.

Other Pollinators Any animal seeking nectar or visiting flowers for other reasons has the potential of being a pollinator. With some exceptions, the more dependent the animal is on the flower's rewards, the more important its role as a pollinator. Some species of bats, opossums, ants, wasps, and thrips are also significant pollinators.

Today, there is strong evidence for a decline in pollinator abundance and diversity, especially of bees, butterflies, bats, and hummingbirds. The intensity of this phenomenon varies for each species according to the particular challenges it faces, but the problem is frequently attributed to habitat destruction, invasive plant species, pesticide misuse, and climate change. Worldwide, more than 23 insect pollinator species have recently become extinct (NRC, 2007), and more than 34 pollinator species are endangered in the U.S. alone (USFWS, 2007).

Habitat destruction, resulting from industrialized agriculture, and urban and suburban sprawl, takes a heavy toll on pollinator species. Today's agriculture industry claims millions of acres for monocrop production systems. The challenges pollinators face as a result of these cropping methods include the lack of "weeds", soil cultivation (70% of bee species nest in the ground), and pesticide misuse. Furthermore, urban and suburban sprawl has replaced native habitats with landscapes containing lawns and non-native plant species that are not conducive to pollinator survival.

The extensive use and misuse of **pesticides** in agriculture and households weakens and kills pollinators, such as bees. Pesticide contamination can be a primary honeybee stressor, and it

may play a role in Colony Collapse Disorder syndrome. Research at Penn State University has identified more than 70 different types of pesticides and metabolites of those pesticides in pollen and bees, with an average of six per pollen sample, and a record number of 31 in one pollen sample (Messer, 2008). The sublethal effect of pesticides may impair bees' ability to learn, navigate, and defend themselves from pathogens. Far less is known about impact of pesticides on other pollinators.

Invasive plant species can take over pollinator habitats, displacing the native plant populations. Most invasive plants are opportunistic non-native plant species that have escaped cultivation. Most were deliberately introduced, either as a food and fodder source, or by gardeners in search of exotic, pest-free, and fast-growing plants. Due to a high reproduction, dispersal, and growth rate, the most notorious noxious plants (e.g. kudzu) escape cultivation and become established in the wild and in disturbed sites. Once established, these invasive plants can outcompete the existent plant population, forming monocultures that do not provide pollinator food sources throughout season. Currently, billions of dollars are spent on removing invasive plant species.

Many **hybridized plant cultivars** produce little or no nectar and/or pollen, thus little or no food for pollinators. The plant breeder's goal is to fashion plant cultivars more appealing to the consumer, not pollinators. Depending on the type of industry and demand, plants are bred for having less or no pollen, longer blooming season, more abundant and showier flowers, certain pest/pathogen resistance, or better yields. These changes can decrease the amount of rewards put forth by plants, having negative consequences on the pollinator's diet.

With unpredictable shifts in temperature and precipitation, **climate change** disrupts the timing of plant-pollinator relationships. Having equally devastating effects, elevated intensities of ultraviolet-B radiation and high levels of carbon dioxide can force some plant species to have delayed and/or shorter blooming periods (NRC, 2007). Other environmental alterations, such as pollution, may negatively affect pollinators' ability to locate rewarding plants (Eilperin, 2008).

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