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Pest Management and Insect Identification Series



Apis mellifera, Western Honeybee (Hymenoptera: Apidae)

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Description

The western honeybee, *Apis mellifera*, also known as the European honeybee, is one of several species in the genus *Apis*. It is the most widely distributed and well-known domesticated species of insect in the world. Western honeybees have distinct caste-specific physical features, but they are generally reddish brown to yellow in color, with black bands and orange-yellow rings on their abdomens. They have two pairs of wings and a slender waist. Thoraxes and abdomens are covered with forked or frayed hairs, though less so on the abdomen. Western honeybee colonies consist of a queen, overlapping generations of workers, reproductive males called drones, and offspring, collectively called brood. Workers are females that, in the presence of a queen and brood, are sterile. They range between 2/5 to 3/5 of an inch (1.0 to 1.5 cm) in length. The queen is the only reproductive female in a colony. She ranges between 4/5 to 1 inch (2.0 to 2.5 cm) in length.

As with all stinging Hymenoptera, only female honeybees (workers and queens) possess stingers, which are modified egg laying organs (ovipositors). Workers and queens possess stingers spiked with venom coming from abdominal glands. The stinger is barbed in workers and tears away from their bodies after stinging. The queen's stinger is smooth.

Female bees possess a distinctive structure on the hind legs that serves as a pollen collecting basket (corbicula), and foraging workers are often seen heavily laden with pollen surrounding their hind legs. Drones are male and are larger than workers and smaller than queens in terms of length, and have much larger compound eyes. Drones are also wider than workers and queens, with stouter abdomens. As with all male members of the order, drones do not possess a stinger.

The brood consists of eggs, larvae and pupae. Eggs are white, have a rice grain-like shape, and range between 1/25 to 3/50 of an inch (1.0 to 1.5 mm) in length. Larvae are pearly white, legless and grub-like in shape. They vary widely in length depending on the growth stage, but are



A western honeybee forager collecting pollen from flower (David Cappaert, Bugwood.org).

always larger than eggs. Pupae range in shape and color from white and similar to larvae, to yellow then brown and similar to adults as transformation progresses.

Many subspecies of western honeybee are recognized. Each has evolved adaptations to local environments as a result of the introduction of western honeybees to different parts of the world. The most abundant subspecies in Louisiana are the Italian honeybee (*Apis mellifera ligustica*), the Carniolan honeybee (*A. mellifera carnica*), and the German honeybee (*A. mellifera mellifera*). All are identical in appearance. So called Africanized honeybees are hybrids

of an African subspecies with various European subspecies. They are more aggressive in defending colonies and present a significant health risk to beekeepers and the general public where they occur. They are not currently a problem in Louisiana and are more prevalent in southwestern states. Beekeepers and apiculture researchers monitor for possible Africanized colonies throughout southern U.S. Molecular analysis and/or comparing measurements of various body parts are necessary to positively identify Africanized bees.



Honeybee in hive with larval cells (Florida Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Bugwood.org).

Life Cycle

The life histories of all western honeybee subspecies are similar. The queen undertakes a mating flight, attracting drones that follow her pheromones. The queen then mates with one or several males and stores their semen for the remainder of her life. Once fertilized and conditions are favorable, the queen starts laying eggs, each in a separate hexagonal cell in wax combs built by workers. After hatching, larvae can grow 1,500 times larger than their original size before reaching the pupal stage. Upon entering the pupal stage, workers cap the cells so that pupae can further develop and undergo transformation before leaving as adult bees.

Honeybee hives are complex social insect systems. Egg laying is performed exclusively by the queen. She can control whether to fertilize eggs or not. Fertilized eggs become workers, unfertilized eggs become drones. The latter are produced seasonally prior to mating swarms. Workers carry out a number of tasks in an age-dependent manner such as housekeeping, caring for the brood and the queen, building combs, storing food and foraging.



Honeybee workers tending queen (Florida Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Bugwood.org).

Young workers are in charge of hive maintenance, climate control and brood care. Brood are provided with a mixture of honey and pollen (bee bread) and/or a high nutrition substance called royal jelly. Brood destined as new queens are raised on royal jelly and are cared for differently than regular worker brood. Older workers become forager bees, collect pollen and imbibe nectar for conversion to honey and bee bread. Back at the hive, foragers exchange information about availability of nectar and pollen by performing a series of complex body movements known as the waggle dance that indicate the direction and distance to food resources. Austrian scientist Karl von Frisch received a Nobel Prize during 1973 for his discovery of the waggle dance and other contributions to the knowledge of honeybee biology and social structure.

Queen bees eventually age out and this prompts a portion of the colony to leave, along with the old queen. These swarms typically happen during spring in Louisiana, and the swarms either establish new, feral hives or are recovered by beekeepers to become managed hives. New queens are produced in the source hives, with multiple queens killing each other until only one remains. Feral honeybee hives are established in sheltered places such as hollow trees, abandoned buildings, and notoriously, often void spaces between walls in occupied structures. Hives are perennial and can exist continuously for many years.

Ecological Significance

A large body of literature exists dealing with honeybee husbandry (apiculture). This article does not discuss the technical aspects of beekeeping but focuses on honeybee biology and the impact on the environment. The western honeybee is the most commonly managed and economically valuable pollinator in the world. It is native to Europe, Asia (including the Middle East) and Africa, and has been introduced to all other continents except Antarctica. In their native range, western honeybees

provide an indispensable service to the ecosystem as pollinators. Their proficiency as pollinators has been exploited commercially wherever they have been introduced via mobile pollinator services and stationary commercial or hobbyist beekeeping operations. Pollination is critical for production of some fruit and vegetable crops and contributes to food security. According to the U.S. Department of Agriculture-National Agricultural Statistics Service (USDA-NASS), pollination services by honeybees contributed approximately \$269 million to the U.S. economy in 2021. Western honeybees are also a source of honey, as well as beeswax, propolis and royal jelly. According to the USDA-NASS, honey sales generated a gross revenue of \$321 million at the national level and \$5.37 million in Louisiana alone in 2021. In the same USDA-NASS report, sales of other bee and beekeeping products such as queens, queen cells, beeswax and propolis contributed \$102 million to the U.S. economy.

Honeybee operations face multiple threats from various hive and internal parasites, emerging diseases and stress from management practices. The latter often exacerbates the negative effects of other threats. Mitigating damage often involves use of genetically resistant strains of bees and attention to best management strategies. Honeybees may also suffer from non-target impacts from pesticides sprayed for mosquito control and agricultural pests. Avoiding non-target effects requires coordination among local authorities and growers. Recently, honeybees in the U.S. suffered significant decline due to a newly recognized disorder called colony collapse disorder (CCD). Worker bees suffering from the phenomenon abandon the colony and die, leaving the remaining workers and brood abandoned, often resulting in the death of the colony. Bee losses due to CCD have been lower in recent years and the cause or causes of the disorder remain unknown.

The success and abundance of honeybees also impact ecosystems and wild plant reproduction wherever they are established, especially when large numbers of feral hives occur in natural landscapes. Honeybees tend to favor non-native weedy species of plants that originated in their native Eurasia, thus promoting reproduction and spread of these weed species. For example, in Louisiana and other areas across southern U.S. one of the main spring nectar sources is the invasive Chinese tallow tree



Honeybee feral colony in tree (Dennis Riggs, Denrig, Inc., Bugwood.org).

(*Triadica sebifera*), which is one of the worst invasive plants in forested wetlands across the South. This has led to a conflict between conservation biologists and the beekeeping community. Biological control efforts against tallow monocultures are opposed by some in the beekeeping industry that regard tallow as a valuable nectar source for mobile pollinating operations.

Feral populations of western honeybees are increasingly being viewed as invasive, and potentially detrimental to native pollinators, particularly native bees that are in direct competition. Results of some research have indicated that honeybees are associated with a decrease in native bee species richness in agricultural areas, where they compete for pollination sources, especially for bees that are closer in size and foraging behavior to honeybees. Other research has had mixed results and the overall impacts of honeybees on biodiversity in their introduced ranges is still unclear and is an area of active research.

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