

# Bee Harmony



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## Honey Bee Caste, Life Cycle and Duties

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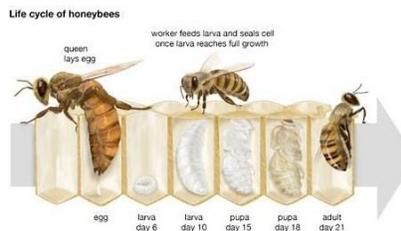
The Merriam-Webster Dictionary defines Caste as: "a specialized form (such as the worker of an ant or bee) of a polymorphic social insect that carries out a particular function in the colony" It also defines Polymorphic as: "existence of a species in several forms independent of the variations of sex." Which, as you will see, is very true regarding the Honey Bee.



Worker, Drone and Queen

### Life Cycle

The life cycle of the Honey Bee involves four distinct life cycle phases: egg, larva, pupa, and adult. The total development time varies a bit among the three castes of bees, but the basic miraculous process is the same: 24 days for drones, 21 days for worker bees, and 16 days for queens.



Life Cycle of a Honey Bee

### Egg

The honey bee metamorphosis begins when the queen lays an egg. The Worker Bees build the cells for

the queen. In most of the cells, she lays a fertilized egg that will develop into a worker bee. In cells that are slightly larger than the worker cells, she lays unfertilized eggs that will grow into drones. The egg stage of development lasts only three days.



Honey Bee Egg

The queen lays a single egg in a cell built by worker bees. The cell must be spotless, or the queen moves on to another cell. The queen positions the egg in an upright position (standing on end) at the bottom of a cell.



*Queen Bee depositing egg*

### Larva

After three days, the egg hatches into a white, worm-like grub, called a larva, curled up in the bottom of the wax cell. The worker bees feed the larva royal jelly for the first few days and then switch to a mixture of honey (carbohydrate) and pollen (protein). This mixture of honey and pollen is referred to as bee bread. If the hive needs a new queen, the larva will be fed a diet of only royal jelly. Each larva is fed approximately 1,300 meals a day by the worker bees. Within a five day period, the larva grows 1,500 times larger than its original size. At this point, worker bees cap the cell with tan colored porous wax and the larva spins a cocoon around their bodies.

The larval stage lasts about six days for a worker bee. Five days for a queens and just over six days for drones. The larva is now officially a pupa (the plural is pupae).



*Honey Bee Larva*

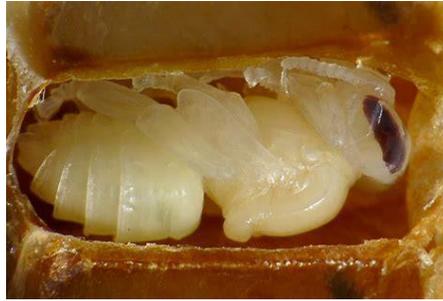
### Pupa

In the pupa stage, the larva begins to transform into an adult bee, developing eyes, wings and legs. At

the last stage of development the bee grows hairs that cover its body.

The Pupa stage lasts 12.5 days for a worker bee; 8 days for a queen and 14.5 days for a drone.

Once fully developed the bee chews its way out of the cell. At this point the bee is born fully grown as an adult bee and knows exactly what their job is.



*Honey Bee Pupae*

### Queen

The queen bee can live 3-4 years, but her biological clock develops quickly. Just a week after emerging from her queen cell, the new queen flies from the hive to mate. If she doesn't do so within 20 days, it's too late; she loses her ability to mate. If successful, however, she never needs to mate again.



*Queen Cells*

She stores millions of sperm in her spermatheca and uses it to fertilize eggs throughout her life. Just 48 hours after mating, the queen begins her lifelong task of laying eggs and is capable of producing up to 2,000 eggs in a single day. She is able to produce the equivalent of her own body weight in a single day. In order to accomplish this feat, worker bees

take care of all her needs, including feeding and grooming her.

The queen is the only fertile female in the colony and is the only bee capable of laying fertilized eggs. She continually emits a pheromone called 'bee perfume' that only the bees in the hive can smell.. This pheromone assures the bees in the hive of that hives identity.



*Queen Bee*

### Drone

Drones, the male bees, have a very large and thick body. As a matriarchal society they are used for the single purpose of mating with a virgin queen so she may fertilize eggs. He flies around at an altitude of 40 - 200 feet in search of virgin queen bees on their maiden flights. His odds of finding one are slim, but if he is fortunate to meet and mate in flight, the virgin queen retains his endophallus (storing it inside her body for future use) and he falls to the ground and dies.



*Drone Cells*

They cannot sting to help defend the hive nor does he have the necessary body structure to collect pollen or nectar to contribute and feed the

hive. They cannot even feed themselves. A drone is hatched from an unfertilized egg. This process is called arrhenotokous parthenogenesis. Thus a drone has only one parent and a single set of genes, that means he has only one set of chromosomes from the mother. So, a drone has no father but a grandfather from his mother's side!



*Drone Honey Bee*

### Worker Bees

Worker bees constitute the largest population in the colony and are all females. They are unable to produce fertilized eggs, however if there is no queen, they sometimes lay unfertilized eggs, which become male drones. Each worker bee, guided by a biological clock, assumes different responsibilities and performs specific duties as she reaches a certain age. All worker bees are capable of producing Royal Jelly, a milky concentration secreted from the food glands in their heads. Royal Jelly is an important component of the worker bees diet during the larva state. Below are the different roles of worker bees. The life span of an adult worker bee varies with the time of the year. When the colony is active in spring and summer, worker bees may live as long as 5-6 weeks. During the inactive period in winter, a worker bee lives five months or more.



*Honey Bee – Worker/Forager*

### Cleaners

Days 1-2: The first worker bees spend their time cleaning and polishing empty brood cells, starting with the one they were born in, making the cells ready to receive new eggs and store nectar and pollen. The queen inspects the cells and if they are not clean, the cleaners will have to repeat the cleaning.



*Worker Bee cleaning cell*

### Nurses

Days 3-5: Worker bees become Brood care bees and assume the role of incubating and caring for the developing larvae.

Days 6-11: They feed the youngest larvae. The future worker bees and drones are fed a mixture of pollen, honey and royal jelly. To produce a queen bee, the larva are fed pure royal jelly.

"Wet" brood—young larvae floating on abundant royal jelly indicates that this colony is enjoying a rich protein intake, and is thus well nourished.

Practical Tip: Well-fed nurse bees will keep the young larvae "swimming" in jelly. Lack of "wet" brood is a sign that the colony is short on protein, and might benefit from being given a pollen supplement.



*Worker Bee Feeding Brood*

### Builders, Undertakers and Temperature Controllers

From days 12-17: Worker bees are mature enough to begin secreting and producing beeswax, the material for the construction of honey comb. The wax flakes they produce help with the building of new wax comb and in the capping of ripened honey and cells containing developing pupae. The bee must consume large amounts of food (honey and nectar) to produce these wax flakes. In 1999, Thomas Hales produced a 19-page mathematical proof that of all the possible structures such as rectangles, squares or triangles, honeycombs use the least amount of wax and are the most efficient and practical structures in nature. As Charles Darwin put it, the honeycomb is a masterpiece of engineering and is "absolutely wax."



*Honey Bee Making Wax*

Worker bees also take nectar and pollen from foraging bees and deposit them into them cells as food for the colony. At some point, as a means of transforming nectar (which is 70 percent water) into honey (which is 17 percent water), worker bees fan their wings at top speed. As the air circulates, the moisture evaporates. Honey must be dried to 17-18% moisture and then sealed. If there are not enough worker bees on hand to take in the nectar from foraging bees, they will perform a special dance, called the "tremble dance," to encourage other worker bees to help out with this job. Nectar

is passed between 200 honey bees which add an enzyme to it. The enzyme helps ripen the honey. Pollen must be taken from the foraging bees and packed tightly to prevent it from going rancid.



*Bees Exchanging Nectar*

When the worker bees are a little older, they are charged with removing dead bees and disposal of the corpses. Diseased or dead brood are also quickly removed by the undertakers before becoming a health threat to the colony.



*Honey Bee removing dead bee*

Worker bees also control the temperature and humidity within the hive. In hot weather, these bees obtain water within a short distance from the hive and bring it back to spread on the backs of fanning bees. These bees ventilate the hive by fanning their wings, increasing airflow in the hive and which brings down the temperature with evaporation. When the weather turns cold, the bees congregate in a cluster to keep themselves warm



*Honey Bee Fanning*

### Guards

Days 18-21: Guarding the hive is the last task of a worker bee before venturing out to the fields. The guards inspect every bee that returns to the hive for a familiar scent. Only members of the hive are allowed to enter. Bees from other hives are occasionally allowed in when they bribe the guards with nectar. These "foreigners" steal some honey and pollen and leave. The guard bee also looks out for any crack through which a robber bee or intruder might enter the hive. These worker bees also defend their colony against other insects. When their stingers are used to attack the intruders, they tear their abdomen and die as a result. They also emit an alarm pheromone from a gland near their stingers to alert other bees of impending danger.



*Guard Bee*

### Foragers

Days 22 – X: When they are about twenty-two days old, the worker bees leave the hive box at sunrise as foragers and visit the flowers within a two to three mile radius from the hive in search of nectar, water, pollen and

propolis. If food resources are not readily available within that distance, they will fly five to ten miles from the hive. They can make about ten trips a day, each one lasting about an hour and return to their hive at sunset. At the age of six to eight weeks, most worker bees will die in the field. The farther bees have to fly, the more physical stress on their already short lifespan. During the winter, bees stop flying, hibernate in their hives and live on stored honey from fall to the next spring.



*Foraging Honey Bee*

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