

Life Cycle

During nuptial flight, the queen receives spermatophores from drone and store in its spermatheca. The queen walks over the combs deciphering the cell size (largest of queen, smallest of worker and in between of drone) and depositing one egg in bottom of each cell. The eggs are small, oblong and bluish white. The eggs may be fertilized to produce females or unfertilized to produce drone parthenogenetically, and these are accordingly deposited in the cells of required size. The period of development of larvae and pupa differs amongst the different castes is given in table.

The transformation of 3 castes depends upon the amount of 'Brood food' or 'Royal jelly' produced by pharyngeal salivary glands of worker fed to larvae. The cells of queen, worker and drone are sealed, i.e. capped with wax on 8, 9, 10 day of emergence, respectively. The cap of drone cell is convex with a central hole, and those of worker, queen, honey and pollen are flat.

Social behaviour

The various behavioural features of bees within the hive and in the field are important for the smooth functioning of the colony as a unit.

Swarming and Colony Reproduction

Swarming is a method of reproduction. A part of the colony migrates to a new site to reproduce a new colony. When food is available in plenty, the worker bees take up activities that result in colony reproduction. They build drone cells in which the queen lays unfertilized eggs. These hatch into drones. After this, the bees construct queen cells and fertilized eggs are laid in these cells. The worker bees feed the larvae in the queen cells with royal jelly, larvae develop into fertile females, viz. queen bee. Before a virgin queen emerges from the sealed queen cells, the mother queen leaves the hive with a part of the worker bees as a prime swarm. Then the virgin queen emerges and after a while rushes out of the hive

with another batch of worker bees to form after swarm that establishes itself into a colony at a new nesting site. The swarm settles in a selected nesting site. Worker bees begin to construct combs, forage and gather food, and to rear the brood. As the new worker bees emerge, the hive develops into a full-fledged colony.

Nest Site Selection and Nest Construction

Several factors are considered by bees in selecting the nest site, viz. the availability of food source nearby, distance of water source and adequate space to accommodate the nest. Other factors are temperature, humidity, and availability of sunlight, ventilation, and protection from rain, predators and enemies. Among the honeybees, rock bees prefer associations in the nest site, while other species build their nest in independent sites in isolation.

Following selection of nest site, worker bees produce beeswax by consuming nectar or honey. Wax is secreted by the 4 pairs wax glands located on 3rd – 6th abdominal sterna. The wax is secreted in liquid form and hardens into thin flakes or scales. The wax scales are removed from there with the help of legs, kneaded into required shapes by the spatulate mandibles and stuck to the top of nesting cavity and extended downwards bit by bit. Several bees hang like a string to do this job of nest construction. Beeswax is also used to seal the cells with wax cap.

Temperature Regulation

Temperature in the nest is an important factor. It controls hatching of eggs, ripening of honey and other activities of bees. Bees regulate nest temperature to the required level. In hot summer, temperature is brought down to the normal level by setting up wind currents and evaporating water inside the nest. Water or dilute nectar is collected for this purpose. In severe winter, they cluster close

together so that the nest temperature does not fall down, and the heat generated by their metabolism is conserved.

Nursing and Food Sharing

Young worker bees normally attend to the duties of nursing and feeding. They can detect the young or old larvae, and feed them accordingly with royal jelly or with beebread (a mixture of pollen and honey). Bees consume pollen and nectar or honey, which helps in secretion of a special highly protein and hormone rich food, called royal jelly. Royal jelly is fed to young larvae till the third day after hatching. Worker larvae are fed thereafter with beebread. Bees feed the larvae, as well as other adult bees including the queen and drones. They exchange nectar or honey with other workers.

Pheromones: The distinctive colony odour resulting from these chemicals helps in recognition of hive mates, and locating their nest on return from forage flights. The chemicals are called pheromones and control the functions and behaviour of other individuals. The queen bee pheromones regulate the smooth functioning of the colony. It inhibits development of ovaries in worker bees, and prevents them from rising into new queen bees. When a virgin queen goes out on a mating flight, its pheromones help the drones to locate and reach her. The brood pheromones induce worker bees to feed the brood, and gather food from outside. Similarly, alarm pheromones induce them to attack the enemy or intruder in the colony. There are several such pheromones produced by the three castes that selectively control the behaviour of the inmates of the hive.

Queen's Retinue

A group of house bees form a circle around the queen and attends its feeding, cleaning and assists her in egg laying. Bees in this retinue constantly lick the queen's pheromones and share this substance with other house bees. The

individuals in the retinue regularly are changed, as they leave the retinue to attend to other house duties and new individuals take their place.

Supersedure and Emergency queen

Supersedure is queen replacement without colony division. A failing queen who is unable to lay as many eggs as required, or who begins to run out of spermatozoa and lay a high proportion of male eggs will need to be superseded by supersedure queen. The worker bees are induced to build supersedure cells which are 2 or 3 large queen cells in the middle of the nest, unlike a dozen of comparatively small queen cells build at edges of nest during the swarming period.

In absence of queen substance due to death of queen, the workers are stimulated to get set for producing an emergency queen. The eggs or larvae less than two and half day old in worker cells, which are still being fed on abundance of brood food, are selected. Their cells are enlarged and extended downwards and the larvae are fed in the same way as in queen cells to develop into emergency queen.

Absconding and Migration

Complete desertion of a hive is known as absconding. It may occur due to lack of water, food store, overheating due to poor insulation and ventilation of nest, constant attack of pest and even by excessive interference of beekeeper. Prior to absconding, the bees drink whatever honey their nest has and then migrate leaving behind empty combs. Absconding can be prevented by providing water or sugar solution near the hive particularly in summer. The experienced beekeepers always take this precaution, since absconding is complete loss to him.

Guarding and Defence

Bees have defence mechanisms against enemies and predators. Use of propolis is one of them. Dammar bees use propolis also to regulate nest entrance.

Dwarf bees use glue like special propolis to guard their nest from ants. Bees developed stinging behaviour to face threats to the nest from enemies and predators. A batch of old house bees guards the entrance of the hive. They warn the hive mates of an impending danger to the nest, by releasing alarm pheromones. When a guard bee stings or bites an enemy, alarm pheromones are released that alert and instigate other workers to mount a collective attack on the enemy.

Flying and Foraging

Initial flight of bee is restricted to the surroundings of the nest, and is called orientation or play flight. Bees use the play flights also to void themselves of faeces and other waste products of their metabolism. Bees exhibit highly efficient methods of collecting food, learning the intricate patterns of the flowers and of reaching the food. They are excellent navigators and can reach their nest after foraging at long distances. Nectar foragers suck nectar with their proboscis. The nectar gets into the honey stomach, where it gets mixed with bee's digestive enzymes. When adequate quantity of nectar is collected, the bee returns to the hive. Here, it regurgitates the nectar and gives it to nectar soliciting house bees. Both nectar and water are carried by separate bees. Pollen foragers manipulate anthers of flowers to dislodge the pollens. Bees walk quickly or fly over the flowers, getting the pollen on their body parts. Pollen grains on any part of the body are gathered and packed together into pellets with the help of legs that have undergone extensive modification. The tibia of mid legs bears a spine at inner end, which is used to remove wax-flakes from the abdominal sterna bearing wax glands. The tibia of hind legs is broadened with concave outer surface fringed with long curved spines, the lower one of which acting as pollen rakes. The outer concave surface of tibia acts as a pollen basket. The basitarsus has pollen brushes. The pollens collected off the body the fore- and mid- legs are placed in pollen

basket. Pollen baskets hold the pellets. When the pellets are big enough, the forager returns to the hive and deposits them in a pollen store cell.

Communication

Bees have a unique language (bee dance) to communicate among themselves about the distance and direction of food source. Experienced forager bees function as scout bees. They search vegetation in surroundings for food source. On locating a good source, the scout bee performs a dance on the surface of the comb. Through this dance, the scout bee communicates with potential foragers in the hive the information about the location in respect to Sun, the quality and amount of food.

Bee dance is of two types: Round dance and Tail-wagging dance. The communication dance is a sequence of elaborate movements of the posterior abdomen and of the bee in circles or other patterns. The vigour of dances and the frequency patterns of movements depend upon the quality, quantity, and distance of the food source.