Life Cycle of the Honeybee Apis mellifera

Written by Brian P. Dennis **as lecture notes for beginners.**

A colony of honeybees at the height of the summer contains <50,000 bees. There is one **queen** (female) capable of laying <2,000 eggs per day, several hundred **drones** (males), and **workers** (sterile females).

Both the **workers** and the **queen** develop from fertilised eggs (egg + sperm) and have 32 chromosomes. The queen is reared in a queen cell and receives a richer and more plentiful diet (royal jelly or brood food). The workers are all potential queens - it is the feeding that makes the difference (workers have rudimentary ovaries and may become **laying workers** producing drones).

The **drones** develop from unfertilised eggs and have 16 chromosomes. A drone has a mother but does not have a father - but he does have a grandmother & a grandfather!

Stages in Life Cycle

	Worker	**Queen**	**Drone**
Open Cell:			
Egg	3 days	3 days	3 days
Larva (4 moults)	5 days	5 days	7 days
Sealed Cell:			
Larva/Pro-pupa (1 moult)	3 days	2 days	4 days
Pupa (1 moult)	10 days	6 days	10 days
From egg to emergence:			
	21 days	16 days	24 days
After emergence:			
Summer bee	6 weeks	c. 3 years	c. 4 months*
Winter bee	c. 6 months	ditto	----------*

*Drones that mate die - drones are killed by the workers in the autumn.

Day 1. Queen measures size of cell to determine whether it is a drone or a worker cell. Egg vertical, parallel to cell walls.

Day 2. Egg at 45 deg.

Day 3. Egg horizontal, laying on the bottom of the cell - hatches.

Day 4 - 8. Larva fed by workers, grows, moults every 24 hours, eventually fills cell - cell sealed.

Day 8 - 21. Excretes. Stretches head outwards and spins a cocoon - pupa develops after 5th moult (3 days after sealing) - colour slowly changes from white. 6th moult occurs just before emergence.

Functions of the worker

Day 1 - 3. Cell cleaning & brood incubation.

Day 4 - 6. Feeding older larvae (honey + pollen).

Day 7 - 12. Feeding young larvae (brood food).

Day 13 - 18. Processing nectar into honey (water evaporation), wax making, pollen packing.

Day 19 - 21. Guarding and orientation flights.

Day 21 - 6th week. Foraging for nectar, pollen, water & propolis.

Bees often do nothing! Duties depend on the maturity of the brood glands, wax glands (day 12) & sting gland (day 18) - bees can revert to earlier duties if required. Other duties included ventilation, humidity and temperature control.

Functions of the drone

<c. day 12. Confined to hive except for cleansing & orientation flights on fine days.

Day 12 - 14. Sexually mature. Drones meet (>20 deg./afternoon) in congregation areas - drone assemblies. Drones are attracted to virgin queens by pheromones.

Autumn. Massacre of the drones. The drone's sole function is to mate with virgin queens (from which act he dies). Drones still alive in the autumn are no longer required and are killed.

Functions of the queen

Day 1. On hatching, may kill sealed queens (may swarm).

Day 3 - 5. Orientation flights.

Week 1 - 3. Mating flights.

Year 3 - 5. Starts laying 2 - 4 days after mating. Produces pheromones (chemical messengers) that inform the colony of her presence & inhibits queen raising. If the queen dies (or is removed) or is old, the workers can produce queens from fertilised eggs. Queens are produced when the colony swarms.

The colony through the year

During the winter the colony clusters and becomes inactive - egg laying ceases and food consumption is low. In the spring, as it gets warmer and day length increases, the queen starts laying - the cluster breaks and stores are consumed. The bees take cleansing flights and seek water and pollen from early flowers (crocus etc.). The population decreases as the old bees die. The decrease in population and stores needs to be balanced by new bees and incoming pollen and nectar. Disease, poor weather, lack of forage and too few bees can cause a delay in development. Colonies need to be strong enough to take advantage of oil seed rape in April.

As the season progresses, drones are produced in readiness for swarming. The population increases until the brood box is full and extra space has to be provided - supers are added. The colony is held together by the queen's pheromones, which are passed around the hive by grooming and food sharing. When the population is large, the effect of the pheromones is diluted and the inhibition to produce queens is reduced - the colony may swarm (usually April, May, June). Swarming is reproduction - and survival. The old queen leaves with half the colony. A virgin queen hatches from one of several queen cells prepared before swarming. She kills the other queens in their cells or swarms with half of the remaining colony - this can occur several times unless the beekeeper takes action. The swarm finds a new location (or is hived). The virgin queen in the original colony mates on the wing (30'-90' above the ground) with several drones and returns to the hive to commence her egg laying. Egg laying is often erratic when the queen starts laying and more than one egg per cell occurs - this phenomenon soon disappears. Supersedure is the replacement of the queen without swarming – both mother and daughter may co-exist for a time.

The mated queen can lay an egg, which becomes a drone, or add sperm to the egg to produce a worker - if the fertilised egg is reared in a queen cell and fed copiously, a queen is produced. The queen determines the type of cell by measuring with her front legs - worker cells are smaller than drone cells. The workers decide if a queen cell is required. The balance of drones and workers is determined by colony needs. If the queen dies or is failing (old age or insufficient mating), the workers can produce a replacement queen if they have fertilised eggs present.

If a queen and her pheromones are not present, the workers rudimentary ovaries may function producing drone laying workers. Since workers have not mated, they can only lay unfertilised eggs producing drones. Laying workers produce small drones in worker cells (raised domes) in a haphazard pattern - the queen lays in a compact & orderly pattern - usually more than one egg per cell.

Bees produced in the summer work for 3 weeks in the hive and then work themselves to death during the next 3 weeks collecting nectar, pollen, water and propolis. Sufficient honey has to be produced for their daily needs and for winter stores - in a good year there will be a surplus for the beekeeper. In a bad year it may be necessary to feed a colony. Winter bees have fat layers and will survive through the winter. In the autumn the drones are evicted, and the colony gradually forms a cluster and the cycle continues.

There are 20,000 species of bees in the world. Only honeybees survive the winter as a colony - wasps and bumblebees rear queens to overwinter and the colonies die. The survival & progress of the colony depends on several factors: climate/forage, disease, genetics (i.e. native bees v. foreign strains such as the Italian bee) - and management. Varroa destructor a parasitic infestation, is now endemic and must be monitored - leave alone management is no longer an option. Bees have survived for 50 million years - homo sapiens a mere 5 million years. Their organization is highly organized for the benefit of the whole colony not the individual. Keeping bees in hives is for the benefit of the beekeeper not the bees. Always try to be in tune with their needs - not yours.

Brian P. Dennis