

MATING BIOLOGY OF HONEY BEES

(UNIVERSITY OF FLORIDA RESEARCH)

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Female larvae remain bipotent (can become either queens or workers) up to 48 hours after emerging from their diploid eggs.

It takes a queen about 16 days to develop from egg to adulthood.

Queen reaches sexual maturation around 22 days after being laid as an egg.

Drones mature from a haploid egg to adult in about 24 days.

Drones have a grandfather but no father.

Drones take about 36 days to go from egg to sexual maturity.

Worker bees are the primary regulators of the number of drones in a colony.

Only about 5% of the bees in the nest during re-production season are drones.

When drones are about two weeks old, they will remain out of their colonies 25 minutes or longer, looking for queens with which to mate.

Drones that fail to mate will live, on average, about three to five weeks, though some have been shown to live 50 days.

The typical colony will produce 1-2 adult virgin queens for every 2,500 or so sexually mature drones per season.

Approximately 6 - 26.5% of queens are lost on mating flights.

A new queen is ready to take her first mating flight when she is 6 to 10 days old.

Most queen mating flights occur between 2:30 –4:00 pm.

Queens will spend about 30 minutes per day for 1-2 days on mating flights.

Regardless, the total flight period for potential queen mating flights at any given location is about 1.5 hours.

Drones begin their search for mates when they are about 12 days old.

Drones leave the colony about 1:00 pm with peak drone flight between 2:00 – 5:00 pm.

Drones will make about six mating flights per day in search of a queen about the last two weeks of their adult lives.

Weather conditions are the main factors influencing the mating flights of both sexes.

Queens prefer to fly when temperatures are above 68°F (around 20°C) and when the skies are clear or partly cloudy.

Drones will begin flying at about 64°F (about 18°C) but otherwise prefer similar flight conditions to those preferred by queens.

Queens can begin their mating flights as late as three or four weeks after emerging from their cells.

Queens waiting too long to take their mating flights may fail to mate because they miss their window of opportunity and after about 30-40 days will begin to lay unfertilized eggs.

Queens and drones both go to areas known as drone congregation areas (DCAs).

DCAs are found where valley hill sides seem to form a V (depletions of horizon) or flat lands near forest edges or other similar areas showing significant geographical changes.

DCAs occur about 30 – 80 feet in the air and with around 15,000 drones (9,000 – 26,000 have been found).

There can be multiple DCAs in an area, drones typically prefer to go to the DCA that is closest to their hive. In contrast, queens usually prefer to visit DCAs further away from the hive, likely in an effort to avoid inbreeding.

Young queens flying through DCAs attract a large number of drone suitors. This cloud of drones is called a drone comet.

The entire copulation procedure from catching and mounting the queen to drone release to the ground takes less than two seconds!

Drones wait in a que to mate with a virgin queen, even while she is copulating actively with another drone.

The next drone in que with which the queen mates is the one responsible for removing the mating sign of the previous drone.

Subsequent drones cue into the mating signs left by previous drones in order to mate with the queen more successfully!

The typical queen has been shown to mate with an average of 11 – 17 drones, with a high of 59 being reported.

Queens appear to “count” the number of mates to determine when it’s time to cease their mating flights, this being how she monitors her own mating success.

This all occurs during one or two mating flights and over the course of only a few minutes.

While mating with multiple drones, the queen will receive 70-100 million sperm into her median and lateral oviducts where it’s mixed using abdominal muscle contractions.

The spermatheca can only hold about 5-7 million sperm.

A single drone can provide 5-7 million sperm to fill the spermatheca.

The queen fills her spermatheca before discarding the excess sperm within one to two days of her final mating flight in preparation for egg laying.

Research has shown that despite the number of drones with which a queen mates, only about 8 drones are responsible for siring most of the workers in the nest.

Queen bees are able to keep the sperm they receive alive during their reproductive lives.

Workers produced by a queen that is two years old are being sired by fathers who have been dead for two years!

The quality of a queen relies, in part, on the weather at the time she needs to be mated and the quality of the drones with which she mates.

Drones with good, viable sperm are important for the production of high-quality queens.

The number of sperm produced per drone varies from 3-10 million sperm/drone.

Drones being parasitized by Varroa can have reduced sperm loads.

Pesticides also may impact sperm loads in drones.

Investing in drone quality must be emphasized as much as one invests in queen quality if quality mated queens are to be produced.

If the queen was successful on her mating flight(s), she will begin to lay her first eggs 12-15 days after emerging from her queen cell.

Fortunately, the majority of queens mate successfully and, thanks to their drone partners, continue on to lead productive colonies of their own.