

Lecture notes: Honey bee biology and social organization:

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A beekeepers goal: keep the hive strong and at about 50,000 individuals. Too few, and the colony doesn't make it thru winter. Too many, and the bees swarm – which means they split and half fly away.



The Colony: 1 queen, about 500 drones (males), 30,000-60,000 workers (sterile females).

The colony is social and organized by tasks, similar to the way cells in a body are “organs”.

The goal of a hive or colony seems to be to reproduce and survive.

One female handles the reproductive task – mating, egg laying. The other females support her.

The Queen:

She is originally like her sister bees but is fed more royal jelly while she is developing and this turns her into a super-sized queen bee. The queen does not have pollen baskets on her legs or wax glands that work.

The queen takes a mating flight and mates with a dozen or so drones about a week after she emerges. She is gone only 10-15 minutes. If she can't make the mating flight due to bad weather or something she becomes unable to mate after about 3 weeks. She stores drone's sperm in a spermatheca and starts laying fertile eggs about 2 days after her mating flight. If she lays eggs in a bigger drone cell, she does not release a sperm to fertilize them. These unfertilized eggs become drones.

She lays 1,500 to 2,000 eggs per day! Estimates vary depending on which source you read. She lays more in spring and early summer as the colony is in strengthening mode.

The Queen produces pheromones which communicate information to the rest of the hive. If she is losing strength, her communications (of queen substance – really, no better name?) may drop and then the workers plot to replace (supersede) her.

Workers: **All females** other than the queen handle the other Cooperative labor tasks. They work themselves to death and only live about 6 weeks. Fall reared workers may last longer (6 months) because they don't have to forage. The worker bees change tasks as they mature. Young bees are called "house bees" and they do chores inside the hive. These tasks include:

Nest building/hive cleaning - build beeswax combs, clean and polish cells, remove debris, guard the hive, air condition and ventilate the hive (by fanning wings), generating heat in winter or incubating the brood. They also work with propolis to cement or glue hive parts together and keep out pests.

Replacement/brood related - feed and rear brood (and queen) and "heater" bees, carry out dead or diseased brood (hygienic behavior), groom each other.

House bees also receive and store the nectar and pollen from the older, more experienced foraging workers.

Food related tasks include: foraging, collecting, storing, protecting it from predation. **Field bees** are older workers that fly far away (up to a few miles) and forage for nectar, pollen, water and propolis. House worker bees fan the nectar and convert it to honey. They cap brood and honey.

Communication: Worker bees also release a variety of pheromones and do dances to indicate where food can be found.

To perform all these tasks worker bees have specialized anatomy including glands like brood food glands, scent glands, wax glands and pollen baskets.

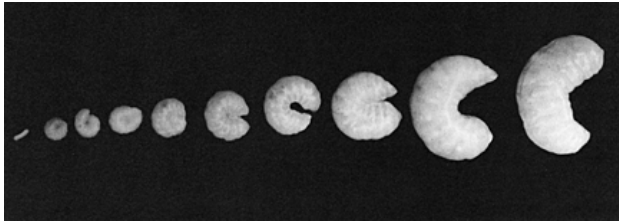
Drones: Only purpose is to fly and mate with the queen. They die immediately after mating. ☹ Drones are usually only around in spring and early summer. No pollen basket, wax glands, or stinger! They can feed themselves but eat 3x as much as workers – a potential drain on the colony. They are kicked out of the hive as winter approaches and are left to starve.

Brood: All bees start out as **eggs**, which are about the size of a rice grain. (Drones emerge from unfertilized eggs). All eggs hatch at about 3 days old. After hatching, bees are called **larvae** and look a lot like little worms. They eat a lot and grow fast and eventually look like white grub worms. The workers are feeding them at this point. The queen is in the larval stage for only about 5.5 days, the workers 6 days, and the drones 6.5 days. After the larvae (grubs) are stretched out and filling up their cell, worker bees will cap their cell and seal them inside. No more feeding at this point.

While sealed in the cell the larvae go through a few pre-pupae stages (molting) then enter the actual **pupae** stage. At this point they look like a white, translucent bee with wings and legs and eyes. Their color deepens, they continue to metamorphosize, and then they spin a cocoon that actually stays in the wax cell after they chew their way out. Queens emerge after 7.5 days in the pupae cell, workers at 12 days, and drones at 14.5 days. After several broods have emerged from the same cell, the wax gets residue layers of brownish cocoon. The older the hive, the darker the brood comb.

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2019-38640-29879 through the North Central Region SARE program under project number ENC19-175. USDA is an equal opportunity employer and service provider. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture

Brood patterns in the frames: Recognize that worker brood cells are relatively flat and in a solid pattern while brood comb cells are slightly raised and more intermittent around the edges of a frame.



The egg is the size of a rice grain and develops into a larva. The larvae are capped by sister workers, they pupae and then emerge.

Right, larvae in the brood comb, uncapped. Below, raised caps indicate drone brood comb. Below, right, worker pupa which will be ready to emerge as what we recognize as bees in 21 days.



Type	Egg	Larva	Cell capped	Pupa	Emergence	Start of Fertility
Queen	until day 3	until day 5½	until day 7½	until day 8	from day 16 on	approx. 23rd day
Worker	until day 3	until day 6	until day 9	until day 12	from day 21 on	N/A
Drone	until day 3	until day 6½	until day 10	until day 14½	from day 24 on	approx. 38th day

*Table source is Wikipedia