

Beginning Beekeeping

Module 1

Bee Biology

Northwest Arkansas
Beekeepers Association
www.nwabeekeepers.com

What your goals should be as a first year beekeeper

- Obtain needed equipment and bees
- Determine location for your bee hives
 - Can your location sustain bee hives?
- Successfully install bees and queen
- Feed your bees
- Promote a healthy hive(s)
- Obtain a mentor (experienced beekeeper) for questions and emergencies
- Keep learning the art
- Have your bees produce honey
 - Do not plan on removing honey during your first season. The bees will need it to survive winter

Bee Biology

- A beehive is a superorganism
 - Collection of individual bees acting as a unit
 - One queen bee (female)
 - Several hundred drones (males)
 - Tens of thousands of workers (females)
 - Queen and drones are involved in reproduction

Bee Biology

– Workers

- Collect food and resources
- Defend the hive
- Care for bee brood and new bees
- Build honeycomb and repair inside of hive
- Perform all other needed functions

Bee Biology

- Hives display a degree of intelligence
 - Socially dependent on hive for survival
 - Use consensus decision-making
 - Will recognize their beekeeper
 - Each hive has a distinctive personality

Bee Biology

- Bees are not domesticated livestock
 - They come and go as they please
 - Take care of their own needs
 - They are highly efficient in what they do

Bee Biology

- Our objective is to be managers of the hives
 - We provide them with hives
 - We take a portion of surplus honey and other products
- We need to work with the bees to help them accomplish what their instincts guide them to do

Bee Biology

- A couple of definitions
 - What is royal jelly?
 - Secretion from glands in the heads of worker bees
 - Fed to all larvae for first three days and to the queen throughout her development
 - Made up of water, protein, amino acids, sugars, and fatty acids. Royalactin is the key protein.
 - What is bee bread?
 - What is fed to larvae and workers after first 3 days
 - Pollen ball packed into a pellet with added nectar and salivary secretions

Bee Biology

- Queen bee
 - Reproductive female
 - Only one per hive/colony at a time
 - Mother of all workers and drones
 - May lay in excess of 1,000 eggs per day (depending on time of years and conditions)
 - Must eat many times her body weight per day
 - Eats only royal jelly
 - Longest living bee (may live up to 5 years, usually has best productivity for first 2 or 3 years)

Bee Biology

- Workers
 - Non-reproductive females
 - May range up to 60,000 in a hive at peak times
 - Perform all hive tasks
 - House cleaning
 - Tending to brood
 - Tending to queen
 - Building honeycomb
 - Regulating hive temperature
 - Pollination of flowering plants
 - Gathering nectar
 - Making honey
 - Defending hive (these girls do sting)
 - Communicating locations of food sources to other workers
 - Finding new potential hive locations
 - The real decision-makers in the hive

Bee Biology

- Drones
 - Reproductive males
 - Several hundred may be in a hive during spring and summer
 - Do not do any work inside of the hive
 - Cannot sting
 - Their one purpose is to mate with a queen and then die
 - Around October, the drones will be forcefully ejected from the hive by the workers so they do not consume hive resources needed for winter (honey)

Bee Biology

Bee Lifecycle:

| Process | Queen | Worker | Drone |
|---|---------------|---|--------------|
| Period as an egg | Day 1 to 3 | Day 1 to 3 | Day 1 to 3 |
| Period as larvae feeding | Day 4 to 9 | Day 4 to 9 | Day 4 to 9 |
| Larvae in cocoon and transforming in a closed cell (pupating) | Day 10 to 15 | Day 10 to 20 | Day 10 to 23 |
| Bee emerges from cell | Day 16 | Day 21 | Day 24 |
| Lifespan | Up to 5 years | 4 to 6 weeks in summer 4 to 6 months in winter | One season |

Bee Biology

- All bee larvae from 0 to 3 days old are fed royal jelly
- After Day 3, drones and workers are fed bee bread
- When workers continue to feed a female larvae royal jelly, it will develop into a queen
- Queen bee larvae have distinct, elongated, vertical cells

Bee Biology

- Workers will not raise new queen bees in a hive with a healthy, laying queen (queen right)
- New queens are reared under certain conditions:
 - If the queen is perceived to be poor quality, the workers will replace her by supercedure
 - If a hive is overcrowded, the workers will rear new queens in preparation for swarming
 - If the queen disappears or dies suddenly, workers will immediately begin rearing emergency queens from suitable young larvae (0 to 3 days old)
 - The first queen to emerge will eliminate her competition by stinging the other queen cells

Bee Biology

- **Marked Queens**
- Queen breeders sell marked queens (you can buy marked or unmarked queens) in which the queen has a dab of paint on her back to indicate what year in which she was born

| Year Ends with | Color Code | Example Year |
|----------------|------------|--------------|
| 1 or 6 | White | 2016 |
| 2 or 7 | Yellow | 2017 |
| 3 or 8 | Red | 2018 |
| 4 or 9 | Green | 2019 |
| 5 or 0 | Blue | 2020 |

Bee Biology

- Beekeepers can manipulate hive conditions to force workers to produce queens
 - Create a colony which has:
 - No queen
 - Lots of food (pollen and honey)
 - Many young nurse bees
 - Eggs or larvae 1 to 3 days old. These may be taken from another colony with desirable traits
 - Workers will rear new queens from young larvae

Bee Biology - Mating and reproduction

- Drones spend their afternoons visiting drone congregating areas
- A new queen takes a series of nuptial flights for fertilization
- The new queen mates with 20 plus drones over several days

Bee Biology - Mating and reproduction

- Semen from all matings is stored in the queen's spermatheca
- When the queen lays an egg, she can choose to release sperm to fertilize the egg as it is deposited
 - A fertilized egg develops into a female bee (queen or worker)
 - An unfertilized egg develops into a male bee (drone)
 - Drones have no fathers – but do have a grandfather

Bee Biology - Mating and reproduction

- After mating, the queen returns to the hive and begins laying eggs
- The queen spends the rest of her life producing and laying eggs
- The queen never leaves the hive again unless the colony swarms
- Drones die soon after mating
- Most drones are expelled from the hive before winter

Bee Biology

- **Workers' lifecycle (approximate):**

| Days | Function |
|------------------|--|
| Days 1 to 2 | Cleaning cells and keeping brood warm |
| Days 3 to 5 | Feeding older larvae |
| Days 6 to 11 | Feeding younger larvae |
| Days 12 to 17 | Producing wax, building comb, transporting food within the hive |
| Days 18 to 21 | Guarding hive entrance |
| Days 22 to death | Visiting flowers; pollenating flowers; collecting pollen, nectar, resin, and water |
| | Note that as the worker ages, the job becomes more risky. |

Bee Biology - Hive Temperature Control

- During winter, bees cluster around the queen and rotate from the center to the outer part of the cluster
- Workers vibrate their wings to generate heat
- With no brood present, the cluster stays around 80° F
- The brood nest stays around 92° F

Bee Biology - Hive Temperature Control

- Bees fan their wings to create air currents within the hive
 - Workers spread water around the hive to cool it
 - Workers evaporate water from honey
- When outside temperatures are 50° F to 55° F, workers will start flying outside the hive
 - Workers do not defecate inside the hive unless sick and perform cleansing flights to relieve themselves
 - Workers will also forage, even if no food is available

Bee Biology - Hive Temperature Control

- When temperatures are hot, you may observe bees clustering on the landing board and front of hive
- This is bearding and is not necessarily the sign of bees beginning to swarm
- It may be too hot inside of the hive and bees are outside to cool off
- Try propping the hive cover with a stick to allow air to flow through the hive

Bee Biology - Pheromones – the bee's chemical language

- Bees use scents to communicate with each other and to identify that the queen is present
 - It is dark inside of the hive so sight is of limited use
 - A hive will quickly start to disintegrate without the queen scent present
- Scents are emitted by the Nasonov gland located towards the end of the bee's abdomen

Bee Biology - Pheromones – the bee's chemical language

- Bees generate scents or pheromones through the Nasanov Gland

[Pic of nasanov gland]

Bee Biology - Pheromones – the bee's chemical language

- Alarm pheromone
 - Released when a bee feels threatened or feels the hive is at risk
 - Excites and alarms other bees to danger
 - Released when a bee stings an intruder
 - Tags the intruder as a specific threat so that other guard bees may attack the intruder
 - Smells similar to bananas

Bee Biology - Pheromones – the bee's chemical language

- Queen pheromone

- Each queen has a unique scent which identifies her to her hive
- Gives an identity to the whole colony
- Pheromone passed through trophallaxis (mouth to mouth feeding)
- A sufficient level of pheromone keeps the colony from swarming
- A sufficient level prevents supersedure
- A sufficient level inhibits worker's ovaries from developing

Bee Biology - Pheromones – the bee's chemical language

- Brood pheromone
 - Enables workers to determine the age and caste of each larvae
 - Attracts parasitic mites to their hosts

Bee Biology - Pheromones – the bee's chemical language

- Nasonov pheromone
 - The scent is an aggregation signal
 - Attracts lost bees back to the hive
 - Attracts bees to congregate into a swarm
 - Recruits and signals foraging bees
 - To a water source
 - To food which doesn't have a characteristic scent

Bee Biology - Pheromones – the bee's chemical language

- Footprint pheromone
 - Builds up at the hive entrance
 - Marks flowers being visited by foraging bees

Bee Biology - Body language

- Bees also communicate by behaviors
- Housekeeping bees unload foraging bees
 - Priority given to different foragers conveys the needs of the hive
 - Foragers are obtaining pollen, nectar, water, resin

Bee Biology - Body language

- Waggle Dance
- The waggle dance conveys specific and precise directions to resources
 - Direction
 - Distance
 - Quality
- Bees also dance the location of potential home sites
 - A consensus is developed based on the dances of multiple scout bees

Bee Biology - Foraging

- A single bee may fly up to three miles from the hive looking for food and water
- Remember the area of a circle:
 - $\pi \times \text{radius}^2$
 - 2 mile radius = 12.6 sq. miles or more than 8,000 acres
 - 3 mile radius = 28.3 sq. miles or more than 18,000 acres

The beekeeper has no control over what plants the bees are foraging within that area

This is why there is almost no certified organic honey produced in the U.S.

Bee Biology – Defensive behavior

- Bees are generally docile creatures except when they are defending their hive
- Their defense is to sting
- Only the female workers sting
- Drones do not have stingers

Bee Biology – Defensive behavior

- If you keep bees, at some point you will be stung, probably a lot
- This is why we use protective clothing and smokers

Bee Biology – Defensive behavior

- When a bee stings, the stinger is barbed and stays in the target
- A venom sack is pulled out with the stinger
- The venom sack continues to pump venom after the stinger and sack is pulled out
- The bee subsequently dies

Bee Biology – Defensive behavior

- About .1 mg of venom is dispensed in a sting
- The venom is call Apitoxin
 - Mixture of proteins
 - Neurotoxin
 - Causes inflammation and decreased blood pressure
 - Acts as an anti-coagulant
 - Has anti-inflammatory chemicals
 - Dilates capillaries
 - Creates an allergic response
 - Increases pulse rate

Bee Biology – Defensive behavior

- Human response to apitoxin will run from
 - Burning and itching at the sting site
 - To localized swelling
 - To widespread swelling and difficulty breathing
 - To sudden death
- Reaction depends on the sensitivity of the person stung and the level of their allergic response
- A person's reaction may vary from one sting to the next
- People who are allergic to bee stings and have bad reactions should not keep bees

Bee Biology – Defensive behavior

- Good idea to have an Epi-Pen in stock
 - Come in sets of two pens
 - Keep them together
 - The first is to get the person past the initial adverse reaction
 - The second is to keep the person alive long enough to get medical treatment

Bee Biology – Defensive behavior

- When you get stung, remove the stinger as quickly as possible to reduce amount of apitoxin you receive
- Scrape the stinger sideways with your fingernail, a credit card, or your hive tool to tear it out of your skin
- Do NOT grab the venom sack, you will pump more venom into you