

## Complete Beekeeping Short Course

### Part 4

## Honey Bee Biology & Behavior



## honey bee biology

- bee colony is a “superorganism”
  - collection of individuals that act as one unit
  - collect food/resources
  - self-defense
  - reproduction
- socially dependent animals – need each other
- do not behave like domesticated livestock
  - come and go as they please
  - take care of their own needs
    - we can manage them in hives we provide
    - we can take part of their surplus stored honey
- bees are highly efficient at what they do
- successful beekeepers learn to work with the bees to help them accomplish instinctive goals*



## honey bee biology

### queen



- reproductive female
- one per colony
- the mother of all the workers & drones
- can lay more than 1000 eggs per day
- must eat many times her own body weight
- eats only royal jelly
- longest living bee
  - up to 5 years

### worker



- non-reproductive females
- do all tasks in hive:
  - house cleaning
  - tend brood
  - tend queen
  - build combs
  - regulate temperature
  - pollinate
  - gather nectar
  - make honey
  - defend hive

### drone

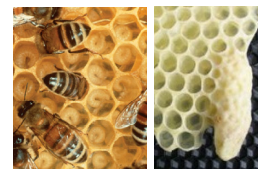


- (potentially) reproductive males
- don't do any work inside the hive:
  - care for brood/queen
  - produce wax
  - forage & pollinate
  - make honey
- can't sting
- one purpose:
  - mate with a queen bee
    - then die
- unmated drones ejected

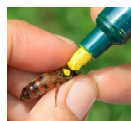
## honey bee biology

### the queen bee

- all bee larvae 0-3 days old are fed **royal jelly**
  - a highly nutritious substance produced by young worker bees
- after day 3, drones and workers are fed **bee bread**
- if workers continue to feed a female with larva royal jelly, it will develop into a queen
  - queen bees are reared in distinct, elongated vertical queen cells



## marking a queen bee



| queen marking |        |
|---------------|--------|
| year          | code   |
| ends          | code   |
| with          |        |
| 2 or 7        | yellow |
| 3 or 8        | red    |
| 4 or 9        | green  |
| 5 or 0        | blue   |

## honey bee biology

### raising queen bees

- workers will not raise new queen bees in a colony with a healthy, egg-laying queen
- new queens will only be reared under certain conditions
  - if the queen is perceived to be poor-quality, the workers will replace her by **supersedure**
  - if a hive becomes overcrowded, the bees 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 (0-3 days old)



# Complete Beekeeping Short Course

## honey bee biology

### raising queen bees

- beekeepers can manipulate colony conditions to make workers produce queens
- create a colony that has...
  - no queen
  - lots of food (pollen and honey)
  - many young nurse bees
  - eggs or young larvae (1-3 days old)
- bees will rear new queens from the young larvae



## Raising Queen Bees ( MP - 518 )

[uaex.uada.edu/publications/PDF/MP518.pdf](http://uaex.uada.edu/publications/PDF/MP518.pdf)

(download for free!)



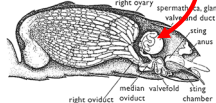
¡También en español!

<https://www.uaex.uada.edu/publications/PDF/MP518SP.pdf>

## honey bee biology

- mating & reproduction
  - drones spend their afternoons visiting DCAs
  - a new queen bee takes a series of nuptial flights
  - she mates with numerous drones over several days
    - semen from all matings is stored in spermatheca
  - when queen lays an egg, she can choose to release sperm to fertilize it as it is deposited
    - a fertilized egg develops into a female bee
    - an unfertilized egg develops into a male bee

drones have no father – but do have a grandfather!



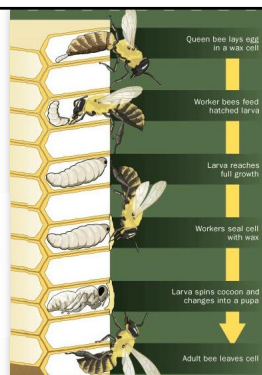
## honey bee biology

- after mating, the queen returns to the hive
  - spends the rest of her life producing eggs
  - never leaves the hive (unless the colony swarms)
- drones die soon after mating
  - most drones are expelled from hive before winter



## honey bee biology

- worker bees
  - egg: 3 days
  - larva: 6 days
  - pupa: 12 days
  - adult
    - lives 4 to 6 weeks (summer)
    - lives 4 to 6 months (winter)
- 21 days to maturity
- drones
  - pupa: 15 days; total 24 days
  - lives one season
- queen
  - pupa: 7 days; total 16 days
  - lives up to 5 years



## honey bee biology

- workers perform different tasks according to age

2-10 days

11-20 days

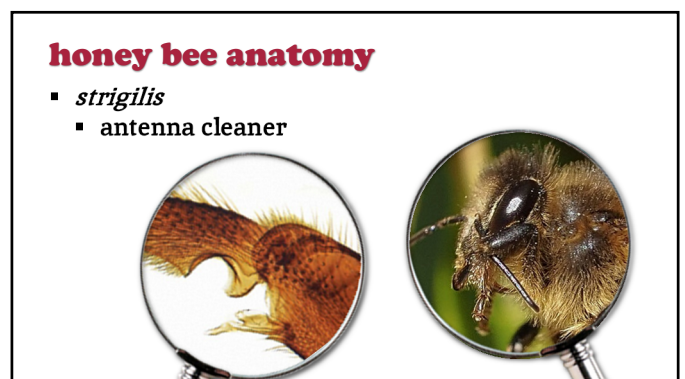
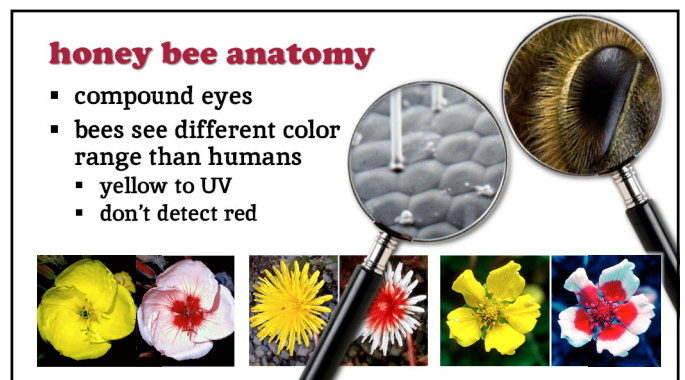
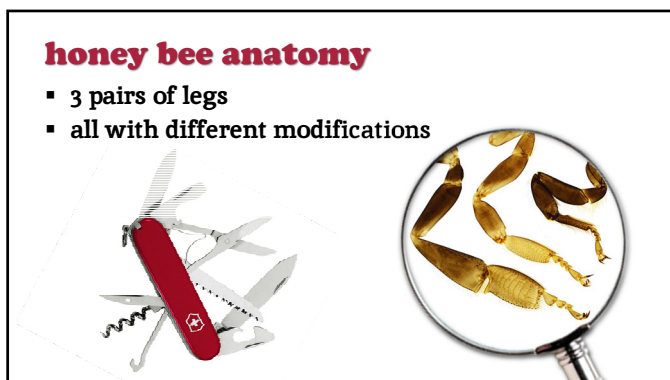
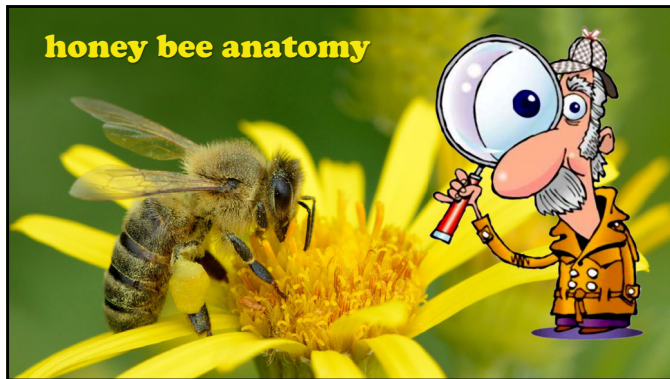
21-25 days



"nurse bees"

"house bees"

"field bees"





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### honey bee anatomy

- beeswax is produced from wax glands



### honey bee anatomy

- mandibles (jaws)



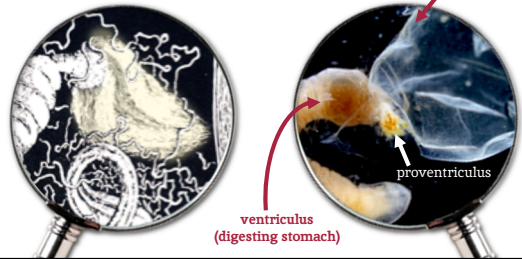
### honey bee anatomy

- proboscis (tongue)



### honey bee anatomy

- honey crop (honey stomach)



### honey bee anatomy

- trophallaxis
- sharing food
- processing nectar



### honey bee anatomy


- ripening honey and capping cells





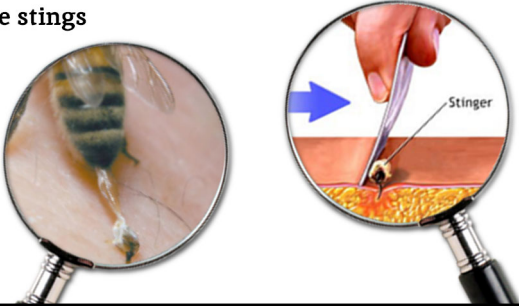
**honey bee anatomy**

- warning colors
- honey bee stinger



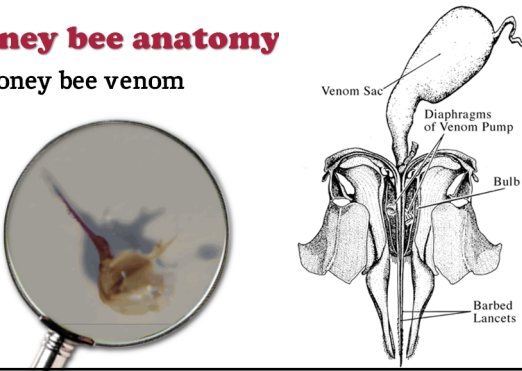
**honey bee anatomy**

- bee stings




**honey bee anatomy**

- honey bee venom




**honey bee anatomy**

- branched body hairs ("plumose setae")

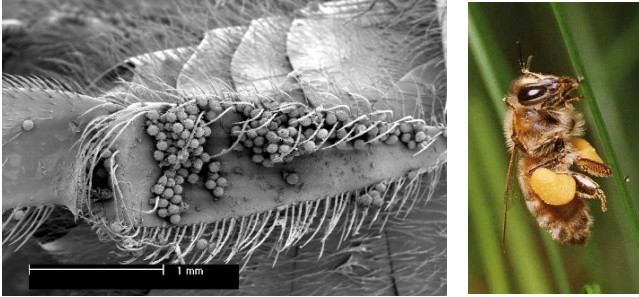


**honey bee anatomy**

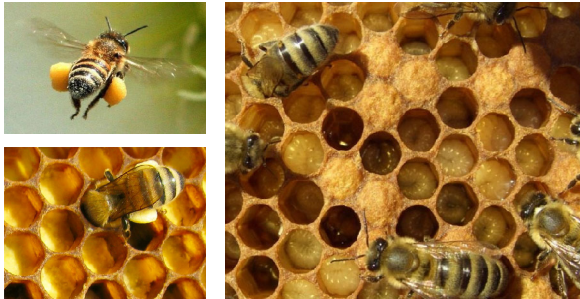
- pollen combs
- pollen basket



**honey bee biology**

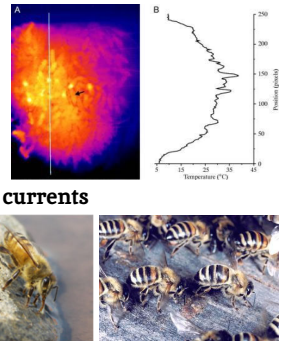


## honey bee biology



## thermoregulation

- bees maintain a constant temperature in their hive
  - in winter, no brood present, cluster stays around 80°F
  - brood nest stays about 92°F
  - bees fan wings to create air currents
    - spread water drops around hive to cool
    - evaporate water from the honey



## honey bee communication

- pheromones – chemical language
  - alarm pheromone
    - released when a bee feels threatened
    - excites & alarms other bees to danger
    - released with bite/sting
    - tag intruder as specific threat



## honey bee communication

- pheromones – chemical language
  - queen pheromone
    - each queen has a unique scent
      - imparts identity to whole colony
    - passed through trophallaxis
    - absence causes queen rearing
    - sufficient level keeps colony from swarming
    - prevents supersedure
    - inhibits development of workers' ovaries



## honey bee communication

- pheromones – chemical language
  - brood pheromone
    - workers can tell the age and caste of each larva
    - attracts parasitic mites to their hosts



## honey bee communication

- pheromones – chemical language
  - nasanov pheromone
    - aggregation signal
      - attract lost bees to a hive
      - attract bees to a swarm
      - recruit foragers to water source

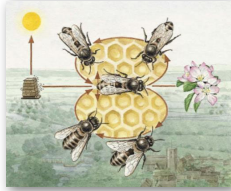




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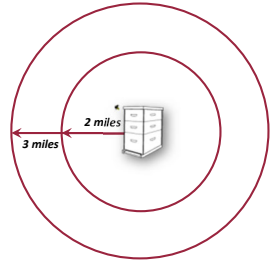
## honey bee communication

- bees also communicate by dancing
    - conveys specific, precise directions to resources
  - direction
  - distance
  - quality
- also dance the location of potential home sites



## foraging bee-havior

- a  $\frac{3}{4}$ -inch honey bee forages several miles from home!
- a bee colony covers an enormous territory
- remember:  $\pi \times r^2$
- 2 mile radius = 12.6 mi<sup>2</sup>
  - > 8000 acres
- 3 mile radius = 28.3 mi<sup>2</sup>
  - > 18,000 acres
- this is why there is very little certified organic honey produced in the U.S.



## a proportional comparison...



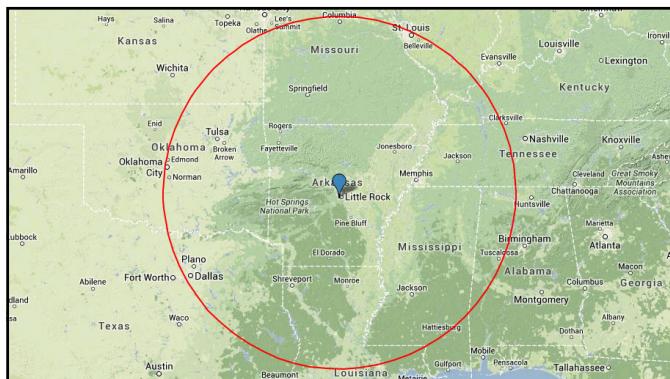
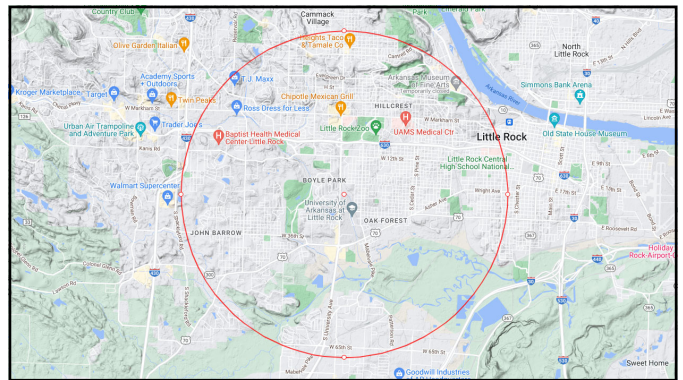
Honey Bee

vs.

Superman



- |                                     |  |
|-------------------------------------|--|
| ▪ $\frac{3}{4}$ " long              | ▪ 6' 3" tall (75")                     |
| ▪ forages 3 miles away              | ▪ patrols 300 mile radius              |
| ▪ can fly 15 mph                    | ▪ must fly 1,500 mph                   |
| ▪ 3 miles in 12 minutes             | ▪ mach 2 = 1,540 mph                   |
| ▪ territory of 28.3 mi <sup>2</sup> | ▪ territory of 282,743 mi <sup>2</sup> |
|                                     | ▪ Texas = 266,874 mi <sup>2</sup>      |



Whew!

**AMAZING  
BEES!**

