

The background of the slide is a solid brown color with a pattern of stylized, overlapping leaves and branches in a lighter shade of brown. The leaves are scattered across the frame, with some showing detailed vein structures. The overall aesthetic is natural and earthy.

Cool Things Honey Bees Do

And the issues they face

Tim Schuler NJDA

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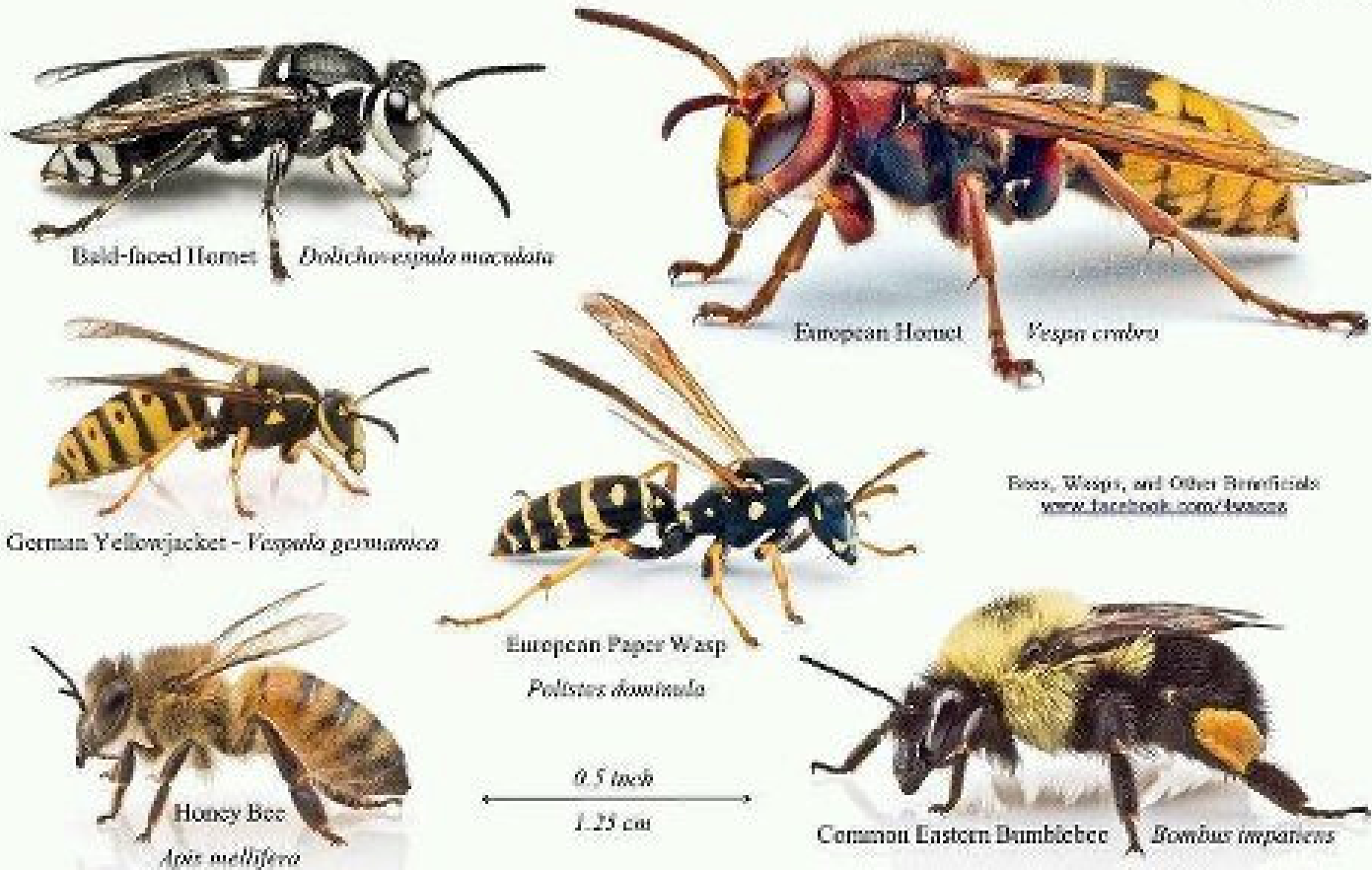


Credentials

- Animal health Technician
- Sideline beekeeper
- Sideline pollinator
- Past President NJBA
- Past President SJBA
- Current NJ State Apiarist
- Instructor for Beginner beekeeping classes – RU
- PTL – Apiculture - RU

Bees to scale

By Alex Sanchez



Why are Honey Bees Important?

- Pollination
- Honey
- Bees Wax
- Environment
- Joy



Honey Bees are Social Insects

1. Cooperate in care of young
 - Females share care of young
2. Reproductive division of labor
 - Some members abandon reproduction to help sisters reproduce (Queen and Workers)
 - Different jobs depending on age
 - Or time of year, and colony conditions
3. Overlapping generations
 - Some offspring remain in the nest to help parents rear more siblings
 - **Honey bees, Termites, Ants**

Colony = individuals or a whole?

Family

- Colony is made up of individuals
- But they cannot survive by them selves
- They need each other to survive
- There is no individual telling the rest what to do. (not a monarchy)
- They do what they do as the needs of the colony change.
- Super organism, (bees like cells in your body)

Goals

- Honey bee colony
 - Reproduce itself
 - Make it through the winter to reproduce again next year.
- They work together selflessly.
- Beekeeper
 - winter healthy colonies
 - Make a honey crop
 - Provide pollination
 - Commercial
 - Backyard

The Colony / Family is more important than the individual

Cool things they do

- Sacrifice themselves for the colony
 - Sick – fly away and die
 - Sting to protect the hive then die.
- Share their food with sisters
- Communicate
 - Nest site location. Decide as a whole which is best for colony
 - Location of food sources

Cool things they do

- Swarm
 - Method of colony reproduction
 - Most vulnerable time in lifecycle, yet gentlest
- Pollinate
 - Manageable
 - Moveable
 - Lots of foragers ~30-40K
 - Hairy

Basic Biology



Nest site

- Honey bees are cavity nesters
 - Dry, dark, cavity
 - They **don't nest in the ground**
 - Will nest in walls of house
 - Hollow tree, overhang (swarm decides collectively the best site)
 - All hive work is done in the dark
 - Winter over as a unit,
 - consume stored provisions (Honey, pollen)
 - Brood rearing Cluster (not hive) temp > 95 degrees

Nest site requirements

- Low interior light
- Prefer cavity of 5-25 gallons in volume
- Ample room for combs
- Prefer small entrance easily defended
- Cavity that smells like bees previously occupied.

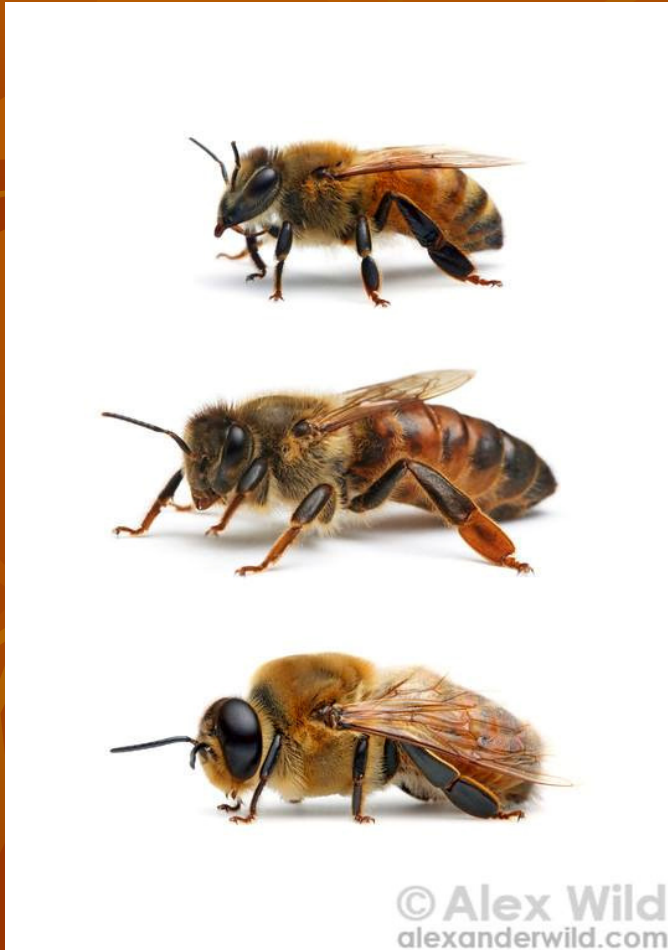
Once site located

- Workers smooth walls + coat with propolis
- Comb production begins
 - Bees wax produced, cell builders
 - Parallel with cells on both sides of a mid rib
 - Cells slope slightly upward – 9-12 degrees
 - Mostly worker size cells (5 cells per inch)
 - Feral colonies 15% cells = drone cells (4/inch)
 - Brace comb between main combs for strength

Some feral nests

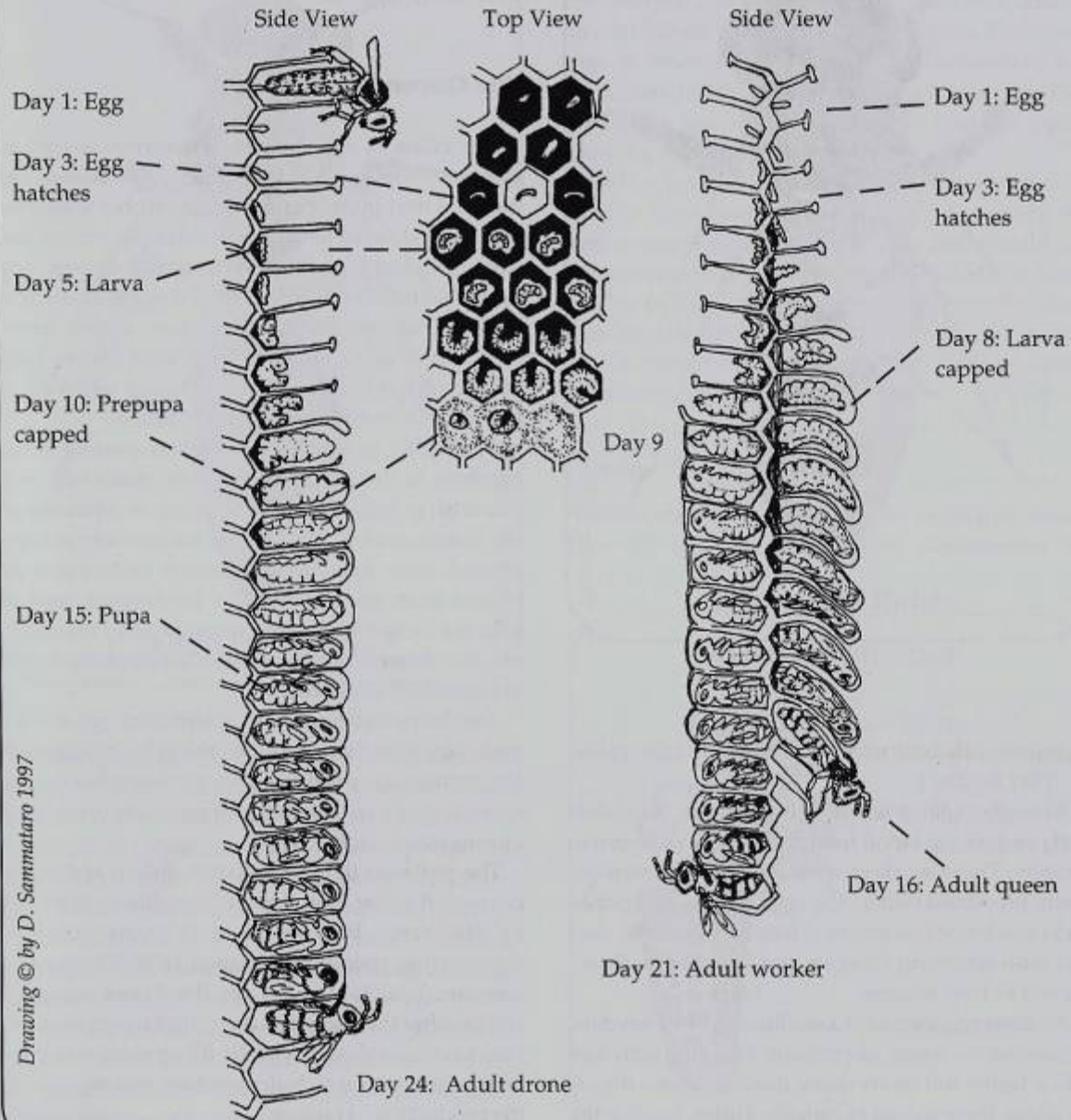


Members of the hive



- Worker ~50K
 - Do all work
- Queen – 1
 - Holds the genetics for the colony.
 - Egg laying machine
- Drone - ~1-4K
 - Do no work
 - Kept as needed for Mating with virgins

Developmental Stages of Honey Bees



Things members have in common

- Head, Thorax, Abdomen, 4 wings
- Engage in Complete Metamorphosis
 - Egg, Larva, pupa, adult

Antennae

- Touch and Smell Receptors are located here.
- Guide the bee inside and outside the hive
- Can sense
 - Hive odors
 - Floral odors
 - Pheromone odors
- If antennae are removed bee will soon die

Bee Vision

- Bees have 5 eyes
 - 3 simple and 2 compound
- With compound eyes bees see
 - Color
 - Light and direction from Sun UV rays
- Color range = Violet, blue, blue green, yellow, orange
- Their eye allows them to know where the sun is even on a cloudy day

Worker Bees

- Vast majority of bees in hive
- Female not fully developed reproductive system
- Differ from queen
 - Smaller size
 - Pollen baskets
 - Inability to produce queen pheromones

Worker duties

Worker < 21 days old (Hive bee)

- Cell cleaning
- Comb building
- Queen Feeding
- Ventilation Fanning
- Propolizing
- Nectar storage

Worker duty – wax production

- 12 doa, 4 pairs of wax glands are ready
- Wax produced as needed,
 - Honey flow capping ripe honey (new wax - light)
 - Comb building (swarm)
 - Capping brood
 - Old and new wax darker color



Wax production

- Exits glands as a liquid, hardens in air
- Hard oval “scales”
- To build comb the scales are worked in mouth with added saliva heated to 109 degrees and formed into combs

Worker bees – guarding behavior

- Day 18 guarding begins
- Guard any hole/entrance in hive
 - Keeping equipment in good repair
- Guard smells every bee that enters (antenna)
 - Challenge those that don't smell right
 - In some times of year will welcome strangers
 - Other times will kill strangers

Worker duties

Worker < 21 days old (House bee)

Guard Duty – protect colony from threats



Scenting – attracts bees to colony



Worker bee > 21 days = foragers

- Nectar – weak sugary liquid secreted from flowering plants (Carbohydrate)
- Pollen – Male element of plant reproduction (protein)
- Water – necessary for consumption and cooling
- Propolis – Resin from woody plants,

Foragers

- Hazardous
 - Eaten, starved, lost, weather
- Field bee lives 10 – 21 days
- Foraging is hard on the bees but necessary
 - Tattered wings
 - Winter live longer not foraging
- Flexibility in hive as to job duties
 - Manipulation, opportunity

Foragers

- Some specialize
 - Pollen, water, propolis, nectar
- Will try to recruit sisters
- Forage 3 mile radius = 28 square miles
- Fly 12 miles per hour
- Wing stroke 11,400 times per minute
- 1 will make 1/12 of a teaspoon of honey
- 1 hive must fly 55,000 miles to make 1 Lb

Deaths

- Workers die through out the year
- Some while foraging
- Some at night or non fly days
- When flight resumes dead bodies carried off
 - Smell
 - Fertilizer
- Some bees specialize as undertakers

Egg and Larvae



Egg

- Workers and Queens – Fertilized Egg
- Drone = unfertilized egg
- The egg temp range = 91.4 – 96.8
- Gradual laying down of the egg
- The egg hatches not by rupturing the cell but by gradual dissolution of the eggs membrane.
 - This is unique to honey bees*

Larvae/ Pupa

- White grub (6 days)
- Increases 1500 times its size during feeding
- Visited 10,000 times for feeding and cleaning inspection, and capping of cell.
- Pupa = 12 days
- Transforms from grub to adult
- Eats way out of cell
- Complete Metamorphosis

Open Brood (larva)



Pupae Capped Brood



Adult Honey Bee

- Chew through cap
- Coated with white fuzz
- Wings soft
- Start adult activities



Queen Bee

- 1 per colony
- Egg Layer up to 2000 eggs per day
- Mother of all bees in the hive
- Mates 1 x with up to 20 drones
- Controls whether egg is fertilized or not (measures cell size)
- Attendants feed and clean her, distribute queen pheromone
- If the workers sense problem they will replace her
- 16 days to develop (Royal Jelly sole food)
- Cell orientation different from worker or drone
 - Vertical Peanut like

Swarming

- Natural method of colony reproduction
- May – June strong nectar flow
- Colony gets crowded
- Queen Pheromone gets diluted
- Workers start to make queen cells
- Old queen leaves with $\frac{1}{2}$ work force



Swarm



Dance Language

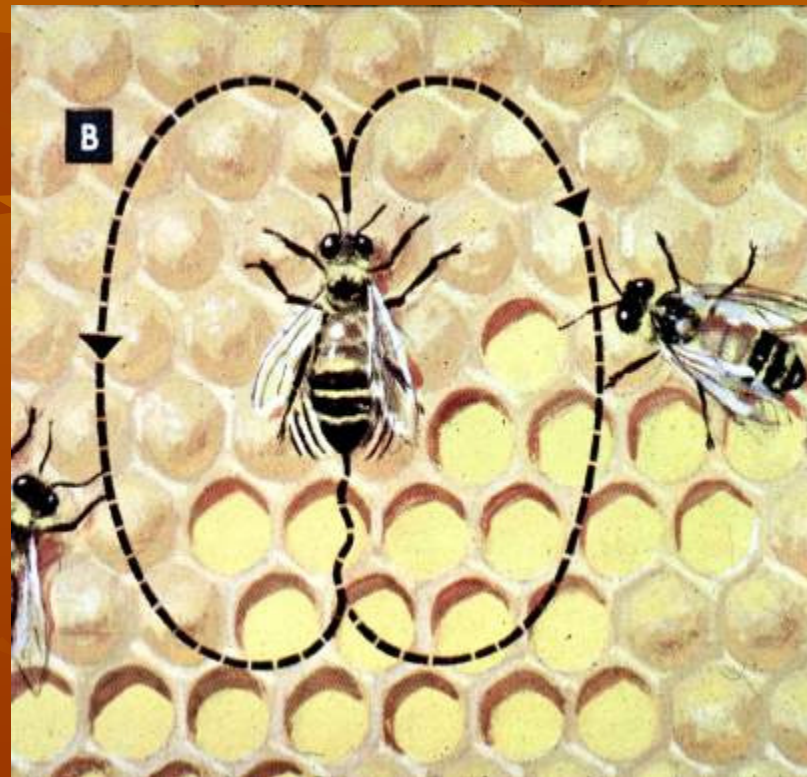
- Uses gathered nectar and pollen in a repeated pattern of movement to recruit sisters to join foraging that food.
- Communicate to hive mates location of water, food, and propolis.
- Can communicate distance, taste, and direction
- Karl von Frisch – interpreted dance language
 - 2 Types of Dances
 - Round
 - Wagtail

Wagtail dance

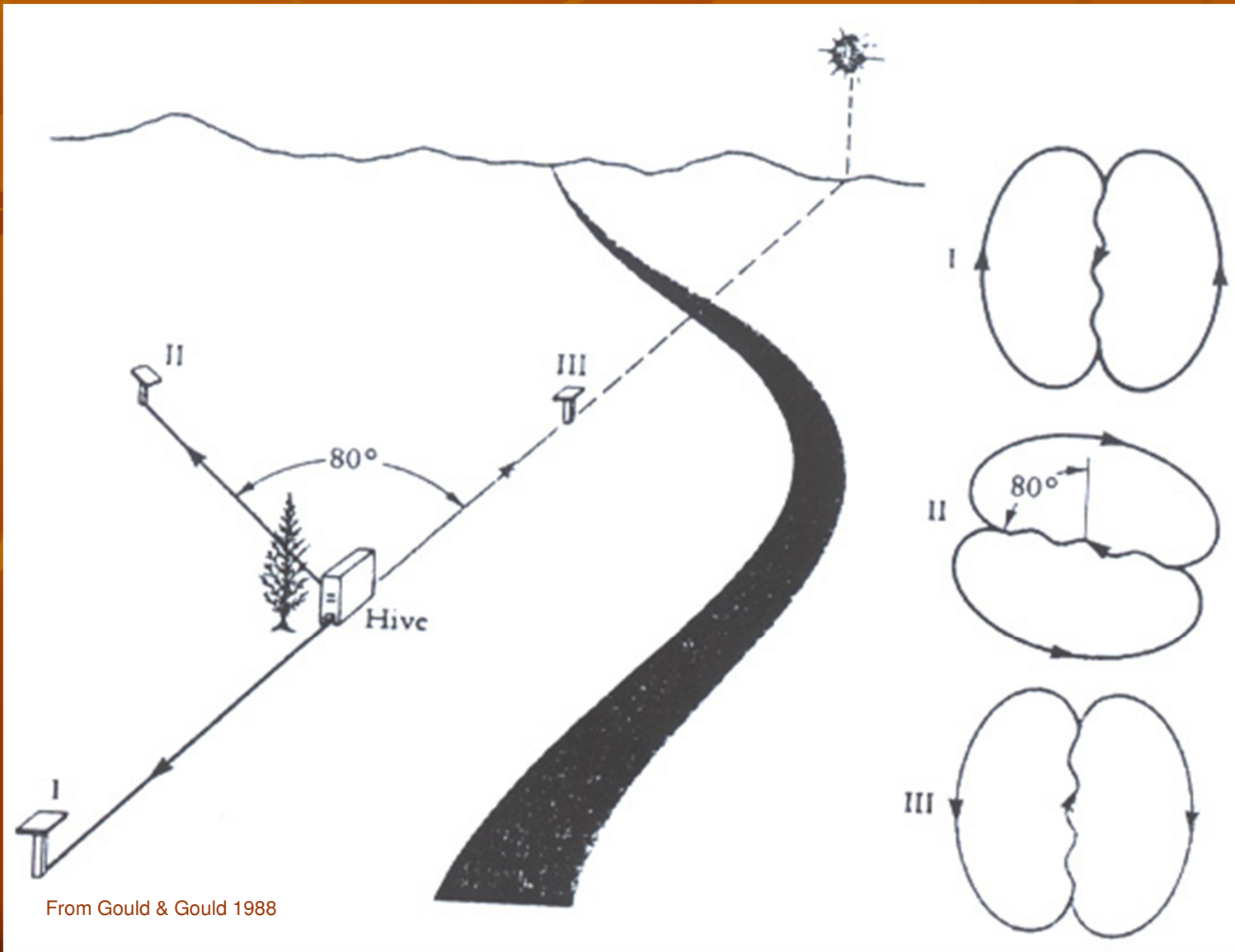
- Communicates the following:
 - Source is > 88 yards
 - Distance to food
 - Direction to food
 - Smell and taste of food
 - Profitability of Source

Wagtail Dance

- Alternating half circles
 - Straight line is consistent
 - Direction is of straight is in relation to the sun
 - Vigorous side to side (waggle) movement of abdomen = (richness of food)
 - Sound production
 - Correlation between sound production time and distance



Wagtail Dance



From Gould & Gould 1988

Wagtail Dance

- Bees use sun for compass
- Bees detect polarized light – to accurately fix sun position.
- Adjusts through out day, dance shifts as sun moves.
- Inside the hive they use gravity as a reference point, cannot see sun

Taste and Smell

- During dancing – potential recruit bees are able to smell the flower fragrance.
- Tastes are given to let recruit's know richness of source
- The most and sweetest get liveliest dances
- Foragers shift through out day, this the most profitable resources are exploited.

Sting - Defense mechanism

- Barbed sting
- Reasons honey bees sting
 - Defend hive
 - Defend self
- Reaction
 - Swelling
 - Burning
- Remove sting by scraping
- Quicker done, lesser dose
- Bee Dies



Food Transmission Behavior

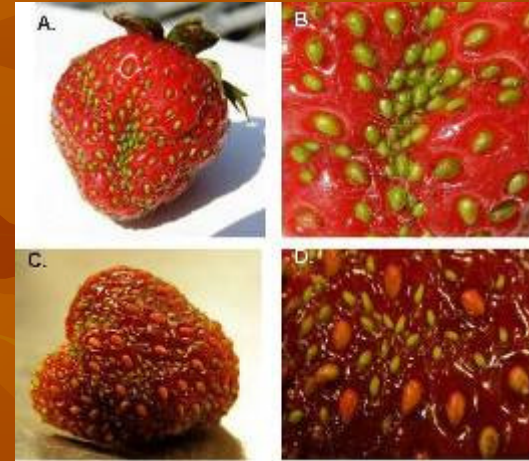
- Starving colony all die very close at 1 time
- Food transmission ensures that all get some food
- English experiment
 - 20 Ml radioactive sugar syrup fed to 6 bees
 - After 5 hrs over $\frac{1}{2}$ of the foragers were “hot”
 - After 24 hrs $\frac{1}{2}$ colony was “hot”
 - 48 hrs later 85% of larvae were “hot”
- Honey bees like to share

NJ Crops that use honey bees

- Blueberries ~ 15000 colonies
- Cranberries ~ 6000
- Apples
- Cucumbers / Pickles
- Squash
- Melons
- Pumpkins
- 2011 Value of those crops in NJ ~200 million

Strawberry

- Ample pollen transfer
- More uniform the berry
- Larger size of the berry



Cucumbers

- Straight even are most desirable.
- Curved uneven are pretty much worthless



Pollination

- Farmers hire beekeepers to bring hives.
- Hives are moved at night
- Beekeeper paid for service
- Range per hive = \$70.00 - \$150.00
- Depends on crop
- Almonds $\frac{1}{2}$ all US colonies go there for pollination

Issues facing the beekeeping industry

- Death loss
- Parasites
- Viruses
- Loss of forage
- Pesticides

NJ Winter death loss

| Year | Total DL | No treatment DL | Treated DL |
|-----------|----------|-----------------|------------|
| 2007-2008 | 16% | 26% | 12% |
| 2008-2009 | 35% | 41% | 30% |
| 2009-2010 | 34% | 50% | 29% |
| 2010-2011 | 33% | 65% | 18% |
| 2011-2012 | 21% | 44% | 17% |
| 2012-2013 | 31% | 48% | 29% |
| Avg | 28% | 46% | 23% |

Varroa = Beekeeper Enemy #1



Varroa Mite



- External Parasite
- Feeds on hemolymph
- Reproduces on Pupae
- Prefers Drone Pupae
 - Longer development = more baby mites



Varroa damage



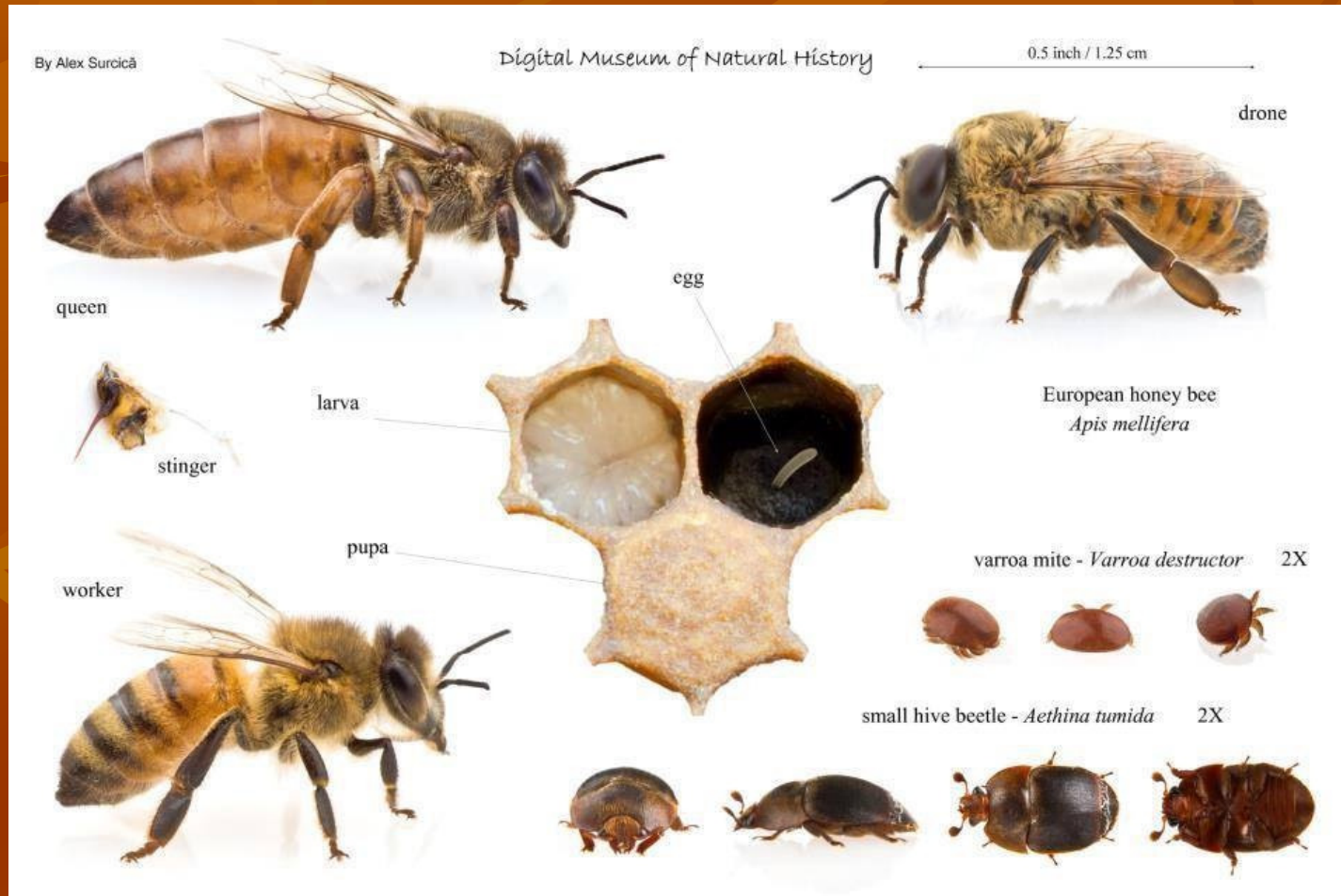
Varroa in pupa



Varroa on Honey bees



Puts things in perspective



Viruses

- Researchers have found ~ 8 viruses
- Some are vectored by Varroa Mite
- Some by plants
- Not much is really known yet
- Some believe the virulence is increasing

Loss of Forage

- “You can’t preserve pollinators unless you preserve Plants”
- Pollinators need floral sources all season to stay healthy
- They like meadows, ditches, pastures, woody plants
- Hedge rows with a variety of blooming plants

Pollinators don't like

- Weed less lawns
- Grass hay fields
- Corn and soy (usually)
- Monoculture
- Golf courses



Pesticides

- 2008 Penn State Research on stored pollen
- 180 different pesticides found in samples
- All classes found
 - Pyrethroids
 - Growth regulators
 - 20 fungicides
 - 14 systemic pesticides
- Honey bees are collecting and storing contaminated pollen.
- Contributes to Honey bee decline?