Honey Bees 101
(Intro Biology and Behavior)

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Disclaimer

- If you ask 10 beekeepers the same question you will get 11 different answers!!!!

Honey Bees 101

- Biology
- Pests & Diseases
- Why should we care?
- Parts of the hive

Honey Bee Biology (*Apis mellifera)*

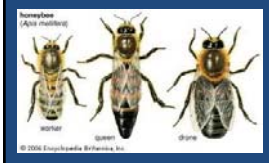
- Kingdom – Animalia
- Phylum – Arthropoda (Insects, Arachnids, Crustaceans)
- Class – Insecta (3 body segments, 3 pairs of legs, compound eyes, 1 pair of antennae)
- Order – Hymenoptera (Wasps, Bees, Ants)
- Family – Apidae (bumblebees, orchid bees, carpenter bees, stingless bees)
- Genus – Apis (Latin for “bee”)
- Species – Mellifera (Latin *melli-* "honey" and *ferre* "to bear“)

Honey Bee Biology (*Apis mellifera)*

- The Honey Bee is <u>not</u> native to North America.
- In the early 16th century, the Spanish brought the first honey bee colonies to North America.
- English colonists did the same and soon honey bees had escaped into the wild and were *buzzing* all over North America.
- The honey bees traveled in advance of the European settlers. The Native American tribes referred to them as "white man's flies."

Honey Bee Biology - Castes

- Workers – Up to 80,000 individuals
- Drones – up to a few thousand depending on the time of year.
- Queen - One

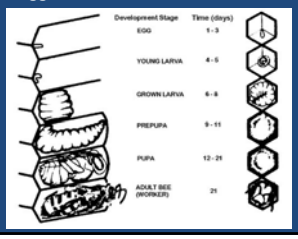


Honey Bee Biology - Workers

- Workers are females that are infertile.
- Egg – hatches after 3 days
- Larvae are fed Royal Jelly for three days.
- Royal Jelly is secreted from the salivary glands of worker bees.

Honey Bee Biology - Workers

- After 3 days workers are fed "bee bread"
- Bee Bread is a mixture of Pollen, Nectar and Saliva. Fermented – Increases Nutritional Value and Preserves.
- 21 days from egg to adult worker.



Honey Bee Biology - Workers

Honey Bee Biology – Workers (duties)

- Duties change as the Bee Ages.
- First 2 Days – Cell Cleaning
- Days 3-10 – Queen Care, Nursing, Wax Work
- Days 15-20 – Wax Work, Nectar Processing, Guarding, Undertaking
- Days 21-35 – Foraging (nectar, water, pollen, propolis), Colony Defense
- Life Span – 6 weeks in Summer, 4-9 months in Winter.

Honey Bee Biology - Workers

- They Sting!!!!!!
- Honey Bees Sting as a Defense Mechanism.

Honey Bee Biology - Drones

- Males
- From Unfertilized Eggs!!!!
- 24 days From Egg to Adult.
- The Drones Purpose is to mate with the Queen. They do not share the hive duties.

Honey Bee Biology - Drones

Honey Bee Biology - Drones

- Large Eyes
- Stout Bodies, Strong Flyers
- Cannot Sting!!!!
- Are Expelled from the Hive in the Fall.

Honey Bee Biology - Queens

- One per Hive/Colony.
- From Fertilized Egg – Fed Exclusively Royal Jelly
- 16 Days from Egg to Adult.
- Can Lay up to 2000 Eggs per Day.
- Can Live up to Five Years.

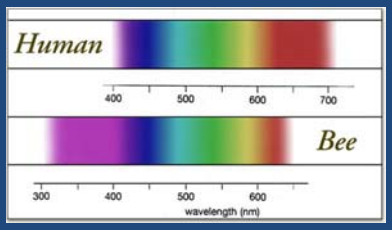
Honey Bee Biology - Queens

- Will Leave the Hive to Mate with 10-20 Drones.
- May Never Leave Again.

Honey Bee Biology - Queens

- Queens are often "Marked"
- Makes Finding Queen Easier
- White – Years Ending 1 or 6
- Yellow – Years Ending 2 or 7
- Red – Years Ending 3 or 8
- Green – Years Ending 4 or 9
- Blue – Years Ending 5 or 0

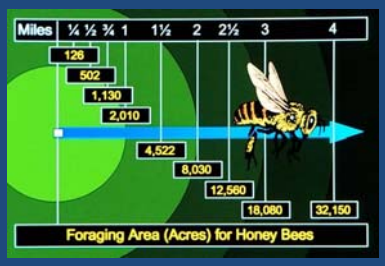
Honey Bee Biology – Vision



Honey Bee Biology - Vision



Honey Bee Biology - Foraging

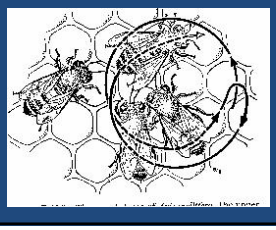


Honey Bee Biology – Dance Language

- 5-25% of foragers are Scouts.
- Scouts "Dance" upon returning to the Hive
- Used to "Recruit" more foragers to the best food sources.
- Honey Bees exhibit Flower Fidelity (Constancy)
- Optimization of Resources.

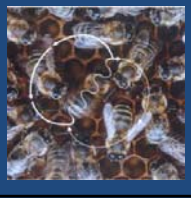
Honey Bee Biology – Dance Language

- Round Dance – Nectar/Pollen Sources
  - Up to 100 Yards from Hive
  - Does not indicate direction (???)



Honey Bee Biology – Dance Language

- Waggle Dance
  - Waggle Phase
  - Return Phase
  - Gives information on Distance and Direction

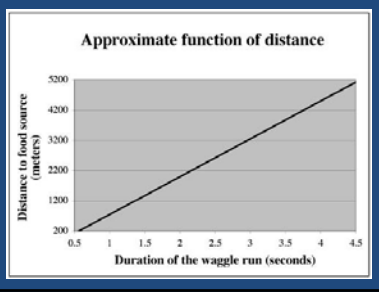



Honey Bee Biology – Dance Language

- Waggle Dance (Continued)

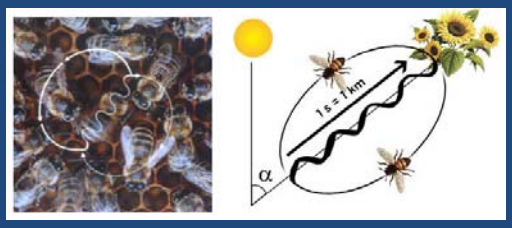
Honey Bee Biology – Dance Language

- Waggle Dance (Continued)



Honey Bee Biology – Dance Language

- Waggle Dance (Continued)



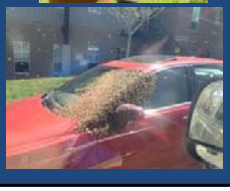
Honey Bee Biology – Dance Language

- Waggle Dance (Continued)
- But…..What about Distance?????
  - Energy Expenditure?
  - Optic Flow?

Honey Bee Biology - Swarming

- Swarming is for reproduction!

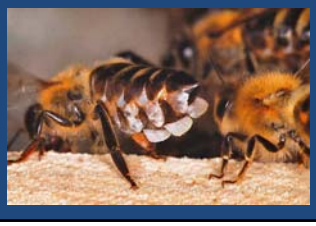
Honey Bee Biology - Swarming



Honey Bee Biology - Swarming

Honey Bee Biology – Wax & Comb

- Wax is produced from 8 glands on the underside of the abdomen.
- Metabolic Cost – 8 pounds of Honey for every 1 pound of Wax.



Honey Bee Biology – Wax & Comb

- Cells are Hexagonal
- Cells are sloped "up" 9-14%

Honey Bee Biology – Propolis

- A resinous mixture bees collect from tree buds, sap flows, or other botanical sources.
- Used as a Sealant within the hive.

Honey Bee Biology – Propolis

- Inhibits fungal and bacterial growth.
- "Mummify" animals too large to remove from hive.

Honey Bee Biology - Honey

- Honey Bees add enzymes to nectar to "invert" sucrose to form glucose and fructose.
- Reduce the water content of nectar from 40-50% to 17-18%

Honey Bee Biology - Honey

- National Average – 56 pounds/hive (2012)
- 2,000,000 flowers visited to make 1 pound of honey.
- 55,000 miles to produce 1 pound of honey.
- Average worker bee will produce 1/12 teaspoon of honey in her lifetime.

Pests & Diseases

- American Foulbrood – Spore Forming Bacteria

Pests & Diseases

- Wax Worms

Pests & Diseases

- Skunks

Pests & Diseases

- Bears

Pests & Diseases

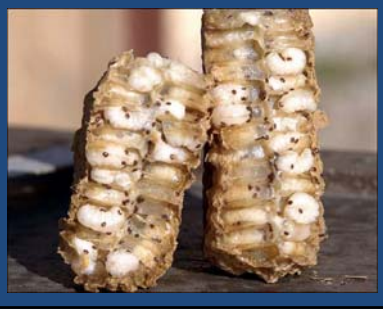
- Varroa Mite (*Varroa destructor*)

Pests & Diseases

- Varroa Mite - Found in U.S. in 1987

Pests & Diseases

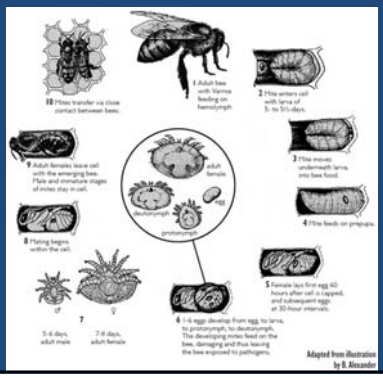
- Most Often Observed on Drone Brood



Pests & Diseases

- Varroa Mite on Adult

Pests & Diseases



Pests & Diseases

- Varroa Mites – Carrier of Deformed Wing Virus

Pests & Diseases

- Varroa Mites also linked to other Viruses
  - Acute Bee Paralysis Virus (ABPV)
  - Israeli Acute Paralysis Virus (IAPV)
  - Kashmir Bee Virus (KBV)
  - Black Queen Cell Virus (BQCV
  - Cloudy Wing Virus (CWV)
  - CCD???????

Why should We Care?

- 1/3 of the food we eat is the result of pollination.
- 70-80% of plants worldwide require pollination (mostly by insects).
- In Michigan, 60 plus crops require insect pollination.
- Cherries, apples, blueberries, cranberries, cucumbers, squash, melons, brambles, strawberries, tomatoes.

Why Should We Care?

- Currently there are approximately 2.6 million colonies in the U.S. (75-150 thousand in MI)
- Down from a high of 5.9 million colonies in 1947.

Why Should We Care?

- U.S. estimated pollination value is $15 billion per year.
- Michigan estimated pollination value is $1 billion per year.

Why Should We Care?

- Almonds, Almonds, Almonds!!!!!!
- The U.S. produces 75-80% of the world supply.
- All U.S. production from California (Sacramento & San Joaquin Valleys)
- Valued at approximately $4-5 billion annually.

California Almond Acreage, Production and Value, 1995-2014

Year	Bearing	Non-Bearing	Yield Per Acre	Production	Price Per Pound	Value of Production
	Acres		Pounds	Million Pounds	Dollars	1,000 Dollars
1995	418,000	65,700	890	370	2.48	880,896
1996	428,000	72,400	1,190	510	2.08	1,018,368
1997	442,000	83,000	1,720	759	1.56	1,168,640
1998	460,000	120,000	1,130	520	1.41	703,590
1999	485,000	115,000	1,720	833	0.86	687,742
2000	510,000	100,000	1,380	703	0.97	666,467
2001	530,000	75,000	1,570	830	0.91	740,012
2002	545,000	65,000	2,000	1,090	1.11	1,200,687
2003	550,000	60,000	1,890	1,040	1.57	1,600,144
2004	570,000	70,000	1,760	1,005	2.21	2,189,005
2005	590,000	110,000	1,550	915	2.81	2,525,909
2006	610,000	145,000	1,840	1,120	2.06	2,258,790
2007	640,000	125,000	2,170	1,390	1.75	2,401,875
2008	710,000	115,000	2,300	1,630	1.45	2,343,200
2009	750,000	90,000	1,880	1,410	1.65	2,293,500
2010	770,000	85,000	2,130	1,640	1.79	2,903,380
2011	800,000	75,000	2,540	2,030	1.99	4,007,860
2012	820,000	110,000	2,300	1,890	2.58	4,816,860
2013 a/	840,000	100,000	2,380	2,000	—	—
2014 b/	860,000	—	—	—	—	—

a/ For 2013, production is based on the Almond Board of California receipts from handlers. Price and value of production for 2013 will be available in the Annual Noncitrus Fruits & Nuts publication, released on July 17, 2014.
b/ Preliminary estimate of bearing acres. The subjective production forecast for 2014 will be released on May 1, 2014.
SOURCE: USDA/NASS, Pacific Regional Office

Parts of the Hive

Parts of the Hive

Parts of the Hive

Other Tools

Resources

- Michigan Beekeepers Association
- Beesource.com
- The Hive and the Honey Bee
- ABC and XYC of Bee Culture
- Beekeeping for Dummies
- American Bee Journal
- Bee Culture

Thank You!