Slide 1

The Fundamentals of Queen Honey Bees

Dr. Malcolm T. Sanford
Apis Enterprises
http://www.squidoo.com/apis/

Slide 2

Problem Solving in Beekeeping

- Problems in honey bee colonies and their loss are often unexplainable in simple terms because a complex of reasons is usually at fault.
- Although the reasons are many, one thing that solves many problems simultaneously in a colony is replacing the queen.
- Beekeepers often resort to requeening their colonies with good results.

Slide 3

The Universal Beekeeping Technique!

- Requeen!
- Requeen!
- Requeen!
- Requeen!

Slide 4

Outline of Presentation

- Some queen biology
- Some observations about kinds of queens (bees)
- Some ways to obtain queens
- Some ways to rear queens
- Some aspects of queen breeding
- Conclusions

Slide 5

Queen Biology

- One queen (not always?)
- Reproductive center (fertilized eggs)
- Sperm bank (17 – 20 drone donors)
- Queen development (shortest at 16 days, but longest-lived adult)
- Anatomy
  - Notched mandibles (inter castes)
  - Sting moderately barbed

Slide 6

Queen Biology

- Several mating flights at beginning of life (only once?): 17 -20 Drones.
- Stores all sperm and can lay fertilized/unfertlized eggs at will
- Pheromones (communication)
  - No Nassanov gland (orienting)
  - Queen substance (mandibular glands)
  - Attracts drones
  - Inhibits worker egg-laying

Slide 7

Scientific Naming of Honey Bees

- Genus: *Apis*; Species: *mellifera*
- Subspecies or races of honey bees interbreed, but most have specific names based on ecological and geographical origins - **Ecotype**
- Examples: African Cape honey bee, *Apis mellifera capensis*; Egyptian honey bee *Apis mellifera lamarckii*

Slide 8

Races or Ecotypes of Honey Bees

- Ecotypes interbreed; hybrids always possible; Classification confusing?
- Ecotypes isolated for generations develop certain qualities or traits
- Traits are based on geographic location, and include influences of forage (plants), climate, temperature, rainfall and prevalent diseases/pests

Slide 9

Ecotype Distribution

- Old World: Europe and Africa
- European ecotypes include German, Italian, Caucasian, Carniolan, Spanish (*Apis mellifera iberica*)
- African ecotypes (perhaps 35 in all), including *A. m. adansonii* and *A. m. scutellata*
- New World Ecotypes: None – A super mixture of (8?) Old World Ecotypes – AHB?

Slide 10

German (Black)

- *Apis mellifera mellifera*. First bee in the Americas?, still very prominent in feral populations. Small, dark and mean. Very susceptible to foulbrood, but a survivor bee in many areas affected by Varroa and invasion of Africanized bees.

Slide 11

Italian

- The most commonly available race, *Apis mellifera ligustica* originated on the Italian peninsula, the only European bee with yellow pigmentation. They are short distance foragers, which means they are prone to robbing. They orient on color, so long rows of white colonies lend to drifting. Moderate spring buildup, peak summer populations and slow to shut down in fall can mean lots of winter bees - with the honey stores necessary for that. Low swarming is good, but can be temperamental.

Slide 12

Caucasian

- *Apis mellifera caucasica* evolved in the Caucas mountains near the Black Sea. Predominately dark, with gray or brown spots. Drones have dark hair, and queens are dark, harder to find. They are gentle, quiet on the combs and slow to build in the spring. Little swarming. Produces lots of propolis, but shut down early in the fall. They winter well.

Slide 13

Carniolan

- *Apis mellifera carnica* evolved in Austria and Yugoslavia, and most of Europe. The Yugo bee is of Carniolan decent. Build rapidly in the spring, they are heavy swarmers. Dark, with dark gray hair with some brown. Dark queens shut down in dearths and early in fall. Calm and gentle, they forage in marginal weather. Robbing, drifting minimal.

Slide 14

Buckfast

- A hybrid of several races, selected for gentleness, wintering, production and tracheal mite resistance by Brother Adam (Buckfast Abbey). Variable in appearance, queens tend toward leather color? Moderate fast spring buildup, peak in early summer, good producers. Low swarming.

Slide 15

Starline® and Midnite®

- A hybrid of several stocks, all Italian. Fast spring buildup, lots of brood early means terrific honey production. Very uniform in appearance, they are slow to shut down in fall. Good commercial bee.
- A Carniolan/Caucasian cross. Moderate spring buildup, dark to dark gray, dark queens. Good in marginal weather and extremely gentle. Shuts down early in fall, winters well.
- Not available?

Slide 16

Russian Bees

- Carniolan in origin, but not a specific race. Rather a "survivor" bee that has been introduced into the U.S. because it has tolerated Varroa infestations in Russia (Primorski).
- Calls for shift in management?
- http://en.wikipedia.org/wiki/Russian_honeybee

Slide 17

Others

- Minnesota Hygienics (Dr. Spivak)
- New World Carniolan (Sue Cobey)
- SMR/VSH – Varroa tolerance
- Australian – No Varroa?
- Hawaiian – No Varroa?
- Others! Where is the data?
- http://www.squidoo.com/queen_production

Slide 18

Africanized Bees

- Hybrids of *Apis mellifera scutellata* have taken up residence in the southern reaches of Texas, Arizona, New Mexico, California and Florida. Undesirable bees because of their defensiveness and are not raised for sale? Often called AHB
- http://www.squidoo.com/American_Bee_Journal/

Slide 19

Ways to Obtain Queens

- Buy mated queens (already fertilized in a cage)
- With packages with/without attendants
- Ripe queen cells (must emerge and then mate locally – risky - AHB)
- From splits or nuclei (requeen using nuclei)
- From brood (1 to 3- day-old larvae) – classic "emergency" situation

Slide 20

Rearing Queens

- Emergency/supersedure: The way the bees do it; old queen dies or is missing; bees raise a new one from larvae 1-3 days old.
- Splitting a colony
- Swarming: The way the bees do it; crowd colony to encourage "swarming impulse"; the origin of the "starter" box.
- Selecting larvae: Let the bees do it?

Slide 21

Rearing Queens

- Humans select larvae via "grafting," or transferring 12-24-hour-old larvae to cups. "Doolittle method"
- Larvae are fed by the bees (accepted) or not. Why? Why not?
- Prepare comb (Alley method) or let bees build their own comb via foundation (Miller method)

Slide 22

C.C. Miller – 50 Years AB

- Take from a colony having your best queen a frame
- Replace it by putting in the center of the nest another with foundation
- A week later, take out the comb and trim away the edge to expose eggs
- Put this prepared frame in the center of any strong colony with queen removed
- Ten days later, cut out the ripe cells to be used where needed

Slide 23

Queen Quality

- Purchased Queens: What is the measure of quality? Well-fed, large cells (candling); good looking?, good egg-layer? Color?
- Mating success? Breeding results (sperm donors not always desirable - AHB – paternity matters!)
- The bottom line: Price?

Slide 24

Queen Breeding/Producing

- Producing vs Breeding models
- Most “breeders” are simply producers doing some selection
- Many exchange queens among selves, meaning that quantity is all important
- Price is the important consideration; the beekeeping community is used to inexpensive queens.

Slide 25

Consequences of the Producer Model

- Inexpensive queens have been the "norm" and many producers have come to expect this
- Reliance on antibiotics/pesticides takes the place of innate protection mechanisms that exist in honey bees
- Innate protection not only compromised, but the responsible genes may be ultimately lost in the process

Slide 26

Consequences of the Breeder Model

- Need a trained geneticist in the mix like any animal breeding
- Must reading: "Necessary Links in the Chain of Honey-bee Stock Improvement," published as two installments in the 1980 edition of *American Bee Journal* (Vol. 120, pp. 223-5, 304-305)
- More work and more expense to produce quality queens

Slide 27

Challenges of the Bee Breeder

- **Finding** the appropriate genes – mostly by behavior at present, perhaps in the future by looking at genes themselves (genetically engineered or GMO bees), for example:
- Testing for hygienic behavior and SMR characteristics, non-swarming strains, and "survivor populations"
- Communicating with customers (producers)

Slide 28

Challenges of the Bee Breeder

- **Retaining** the genes
- Haplo-diploid sexual system can result in "diploid drones," which are destroyed by colonies (have to be replaced leading to reduced population ("inbreeding depression")
- Inbreeding may lead to expression of undesirable genes (hairless black syndrome in bees; hemofilia in humans)

Slide 29

Challenges of the Bee Breeder

- Drone management certainly as important as queen production
- "Closed breeding population" to keep genetic diversity high
- Drone saturation to ensure breeding with appropriate drones (one queen mates with 17 – 20 drones)
- Haplo-diploid system designed to encourage genetic variability (diversity)

Slide 30

Conclusions:

- **Queen production is like wine production**
- **Anyone can encourage honey bees to make new queens just like anyone can encourage yeast to make a passable wine**
- **Producing quality queens that are disease / pest resistant is like producing a fine wine vintage**
- **Where's the proof (data)? Ask for this from queen producers (breeders?) to ensure you're getting a quality product, but expect to pay for it**