

I. Honey bee biology

A. Anatomy and development

- What are the four stages of honey bee development? How are they different? What is the purpose of each stage?
- What are the three main body structures of an adult bee? What are their respective functions? What primary organs are contained in each?
- What are the different sensory structures of adult bees? Which of the five senses does each use? What is the primary mode that honey bees use to communicate?
- What are the two sexes in the colony? What are the **three** castes? What is the development cycle of each? What is different about them?

B. Social system

- What is the primary function of drone bees? How do they accomplish this?
- What is the primary function of the queen bee? What is her relationship to the other members of a colony? What are her distinguishing characteristics?
- What do the worker bees do within a nest? How do their tasks change as a function of age? What do worker bees do outside the nest?

C. Life cycle

- Where do honey bees live? What materials do they use to construct their nests? Why are their combs built the way they are?
- What does a typical honey bee colony in **Alberta** do in the Winter? Spring? Summer? Autumn? How might this idealized life cycle change in a different place (e.g., **U.S.A.**)?
- What foods do bees collect? Where are the food stores kept in the colony? And the developing brood? Is there any pattern to their relative positions?
- What do honey bees eat? How do they forage for these various food items?
- What is the mating system of honey bees? How do queens accomplish this? When does mating take place? Where?
- When does a colony produce new queens? How are new colonies formed? What is the purpose of forming a new colony?

II. Honey bee management

A. Hive equipment and beekeeping tools

- What are the components of the modern hive? What is the purpose of each?
- What is a bee space? How big is it? Why is this an important measurement when constructing hive equipment?
- How does one obtain bees? What are some of the common bee stocks?
- What are the most common items used to manage bees? What is the primary function of each?
- How do honey extractors work? How does one go about harvesting honey?

B. Basic hive manipulation

- What is the proper technique to opening a hive of bees? What are some behaviors that should always be done? What are some behaviors that should be minimized? (In other words, what do honey bees like and dislike when we work them?)
- How should the frames be manipulated? Where should they be placed if removed from the hive?
- Why would a colony need to be requeened? What is the basic procedure of requeening a colony? What schedule of events should or must take place? What are the difficulties that must be overcome? How might they be resolved? What are the pros and cons of both spring and fall requeening?
- What is the proper technique to putting a colony back together?
- What are some things that can be done to minimize burr comb?

C. Establishing a bee yard

- What are some characteristics of a location that is favorable to keep bees? What is unfavorable?
- How should the hive be facing in the yard? What is the benefit of orienting the hives in this way?
- What are some things that can be done within a yard to protect your hives from pests and predators, such as ants, bears, and other bees?

D. Disease

1. Varroa mites

- What does the varroa mite parasitize in the colony? How does it accomplish this? What happens if they go untreated?
- What are the symptoms of a varroa infestation?
- What are some of the treatments for varroa? How are they used properly?

2. Tracheal mites

- How does this mite infect bees? What happens if it goes untreated?
- What are the symptoms of tracheal mite infestation?
- What are some treatments for tracheal mites? How are they administered? When?

3. American foulbrood

- What causes AFB? What does it infect?
- What are the symptoms of AFB? How are they different from other infections?
- What is the only legal treatment of AFB? In what ways can it be administered?

4. European foulbrood

- What causes EFB? What does it infect?
- What are the symptoms of EFB? How are they different from other infections?
- What is the only legal treatment of EFB? In what ways can it be administered?

5. Small hive beetle

- Where did the SHB come from? What does it attack in a hive?
- How do you know if you have a SHB problem? What can be done about it?

6. Chalkbrood

- What causes chalkbrood? What does it infect?
- What are the symptoms of chalkbrood? Are there any treatments for this disease? What can be done about it?

7. Sacbrood

- What causes sacbrood disease? What does it infect?
- What are the symptoms? How are they different from other infections?

8. Nosema

- What causes nosema? What does it infect?
- How can you tell if a colony has nosema? What is the treatment for it? How is it administered?

9. Wax moth

- What does the wax moth infect in a hive? How can it be distinguished from the SHB larvae?
- What can be done to prevent wax moths?

E. Non-disease disorders

- How can you tell if brood has died from chilling rather than disease? What can you do to reduce the chances that the brood gets too cold?
- What are the symptoms of a pesticide poisoning of a colony? What can be done to reduce the risks of exposing your bees to pesticide spraying?
- What are the symptoms of a queenless colony? How do you go about requeening it? Is the process different from requeening a queenright colony?
- How can you tell if a colony has laying workers? What can you do with a laying worker colony?
- What are the signs that the bees are trying to supersede their queen? What should you do?

F. Seasonal management

1. Winter

- How does one prepare their hives for winter? What are the critical variables in predicting a colony's ability to survive the winter?
- What types of activities should a beekeeper perform during the winter in preparation for the following spring? How often should one check on their colonies?

2. Spring

- How does one prepare colonies for the spring? Why? What is the main difficulty for this time of year?
- Describe the difference between swarm deterrence and swarm prevention. What are some different techniques of each? What are their benefits and drawbacks?
- When should the first inspection be performed in the spring? What should you look for during this inspection? What should be done about them if found?
- How often should bee colonies be checked through the spring? What should you look for during these inspections?

3. Summer

- What should be done to the hives to prepare them for the honey flow? How many honey supers should you add? How do you add them?
- When should the honey supers be removed from a hive? How are they removed?
- What measures can be taken to minimize robbing behavior of bees in a bee yard?
- Why is it necessary to make sure that your bees have access to a clean source of water during the summer? If there is no natural source of water, what can be done to provide them one?

4. Fall

- What should you look for during hive inspections during the fall? What should be done if found?
- Why is sampling for varroa mites important during this time of year? What is the threshold number of mites for treatment in this part of the country?
- How should you arrange the nest/hive structure to promote winter survival?

III. Honey bee industry

A. History of beekeeping

- How long have honey bees been domesticated by humans? What are some various ways that they kept bees?
- Who was L. L. Langstroth? What was his contribution to beekeeping?

B. Plants, crops, and pollination

- What is the value of honey bees to agriculture? What are the benefits of apiculture to agriculture?
- What crops are dependent on honey bees for pollination? What crops benefit from bee pollination but do not require them to set fruit? What crops do not require bees at all?
- Approximately how many colonies are managed in **Alberta**? In the **Canada**? In the **US**? Are they geographically concentrated? Why? What do many larger commercial bee operations do throughout the year?

C. Honey production

- What is the current price of honey? How has this changed over time? What are some of the variables that affect honey prices? Is it temporally stable?
- What are some different types of honey? What varies among them?
- What are the extracting, packing, and storage procedures of honey?

D. Other hive products

- What are the various products harvested from bee hives other than honey? What are each of them used for?
- How does one extract these various products from their hives?
- What benefits may be gained from using these products?

Suggested readings and references

NCSU Beekeeping Notes

“The importance of honey bees to North Carolina”, Beekeeping Note 3.02, NC State University, Cooperative Extension Service.

“Africanized ‘killer’ bees?”, Beekeeping Note 1.01, NC State University, Cooperative Extension Service.

“Honey plants of North Carolina”, Beekeeping Note 1.04, NC State University, Cooperative Extension Service.

“The small hive beetle (*Aethina tumida*): a new bee pest in N.C.”, Beekeeping Note 2.05, NC State University, Cooperative Extension Service.

The Hive and the Honey Bee Chapters

Winston, M. L. (1992). Chapter 3. “The honey bee colony: life history.” In: *The Hive and the Honey Bee*, Dadant & Sons, Inc. pp. 73-102.

Avitabile, A. (1992). Chapter 13. “For the beginner.” In: *The Hive and the Honey Bee*, Dadant & Sons, Inc. pp. 575-601.

Hoopengarner, R. A. & G. D. Waller. (1992). Chapter 23. “Crop pollination.” In: *The Hive and the Honey Bee*, Dadant & Sons, Inc. pp. 1057-1077.

Other readings

Blackiston, H. (2002). *Beekeeping for Dummies*. Chapter 7, “Knowing what to look for”, Hungry Minds, Inc., New York. pp. 111-126.

Caron, D. M. (1999). *Honey Bee Biology and Beekeeping*. Chapter 2, "What's in a name?"

Wicwas Press, Cheshire. pp. 11-24.

Morse, R. A. (1994). *The New Complete Guide to Beekeeping*. Countryman Press, Woodstock. pp. 39-82; 129-158.

Delaplane, K. S. (1996). *Honey Bees and Beekeeping: a Year in the Life of an Apiary*. The University of Georgia Cooperative Extension Service. pp. 65-77; 103-120.

Dadant, M. G., J. C. Dadant, G. H. Cale, Jr., & H. Veatch. (1990). *First Lessons in Beekeeping*. Dadant & Sons, Hamilton. pp. 17-32.