

***Study Outline – Qualified Beekeeper Level***

The following outline provides a list of topics with which one should be familiar before taking the written and practical exams for the Qualified level. Most of the topics will be covered in a basic beekeeping course and are reviewed in most basic beekeeping texts.

**Honey Bee Biology:**

A. Occupants of the hive

- What three types of individuals are found in the honey bee colony? How can they be distinguished? How many of each type might you expect to find in a colony? Do the numbers change during the year?
- What are the two castes found in the colony and what are their major roles (functions). What is the development cycle of each (stages and times) and how do the conditions under which they are reared differ?
- What is the function of males and what are their development stages and times.
- How is sex determined in honey bees?

B. Anatomy and Physiology

Workers:

- What are the three main body sections of the adult bee and how are they specialized in terms of function?
- What are the major sensory structures of the adult bee and where are they found? What organs are used for smell, taste, and touch. What visual organs do honey bees have? Are they all capable of seeing images? Can honey bees hear sound?
- What do bees eat and what food do they collect?
- How do honey bees carry nectar and water?
- How are honey bees specialized for the collection and transport of pollen? How do they carry propolis?
- Where are the wax glands located?
- How do honey bees produce brood food?
- What is the basic structure and function of the sting? What happens when a bee stings?
- How long does a bee live?

Queens:

- Why are queens larger than workers and why does queen size change during the year?
- Where are the ovaries located and how do queens store sperm from mating?
- When does a queen mate and with how many drones?
- Where do queens mate?
- How many eggs does a queen lay in a day? Does the number vary? How does a queen know whether to lay a fertilized or an unfertilized egg?
- What are the main functions of a queen, other than egg laying?

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- Does a queen ever leave the colony after mating?
- Can there be more than one queen in a colony?
- Under what conditions are new queens reared?

## Drones:

- How does a drone differ from a worker in appearance?
- Why don't drones have a sting?
- How many days after emergence does a drone reach sexual maturity and initiate mating flights?
- How many times does a drone mate? Why?
- What two senses do drones use to locate queens for mating?
- When are drones reared?

## C. Colony Organization

### Social System:

- What are the basic labor activities performed by workers (ie. nurse activities and brood care, attending queen, nest construction, cleaning, guarding, etc.)
- How is the labor system organized and how do tasks change as a function of age?
- When (age) do workers forage and what four things do bees collect? What is the function of each?
- What is a pheromone and why are they important to colony functioning? Which bee produces the pheromones most important to normal colony functioning?
- What are the basic functions of the bee dances?

### Natural Nest:

- Where do honey bees naturally nest? What does a natural nest look like?
- What materials are used to construct the nest?
- What is the basic structure of the comb (cell shape and structure)?
- Is there a natural pattern to comb utilization in the nest? For example, where is brood reared and pollen stored? Where do they store honey? How do we take advantage of this natural organization in our management?

### Colony Life Cycle:

- What does a honey bee colony do in the winter? Spring? Summer?, Fall?
- How does a colony population change during the year?
- When do colonies reproduce? How?

## **Beekeeping Equipment and Assembly**

### A. Hive Types

- What is the most widely used type of hive?

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- What are the main features of a Langstroth hive?
- What is a nuc, or nucleus colony?

## B. Components of the Langstroth hive

### Basic components:

- What is bee space and why is it important in the design of a modern hive?
- What is the purpose of a hive stand?
- What is a landing board?
- Describe the advantages and disadvantages of a solid and screen bottom board.
- What are the dimensions of a deep, medium, and shallow hive box?
- Which hive box(es) may be used as a brood chamber? honey supers?
- Describe the parts and proper method for nailing a frame together.
- What are the dimensions of a frame for a deep and medium hive box?
- When should crimped wire foundation be used? thin surplus foundation?, Duragilt foundation?, and Pierco foundation?
- Describe how to wire a frame, include any specialized equipment for this procedure.
- Why is an inner cover used in a beehive?
- What are the basic types of outer covers?
- What materials are used to construct a hive? frame?

### Additional hive parts:

- What is a queen excluder and how is it used?
- Describe three (3) types of sugar syrup feeders and list advantages and disadvantages of each.
- What is a fume board?
- What are the reasons for using an entrance reducer?
- When would a ventilated inner cover be used?
- What is the function of a frame spacer?
- What is a drone trap? beetle trap?

## C. Safety equipment

- What color clothing is best for working in and around an apiary?
- Name three (3) types of veils.
- Why are most veils dark color?
- What is a hive tool?
- List the advantages and disadvantages of canvas, leather, and plastic coated gloves.
- What is the function of a smoker?
- What materials may be used for fuel in a smoker?

## **Yearly Management Cycle**

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## A. Spring

- Describe the general annual growth cycle of a bee colony.
- What are the main objectives in spring management?
- Describe a good brood pattern.
- What are the characteristics of a good apiary site?
- What are signs that a queen is present in a hive?
- What are indications in the hive of a failing queen?

### Swarming

- What is swarming and why is it a concern?
- Describe two management techniques that can be used to prevent swarming.
- What are signs that a hive is ready to swarm? has swarmed?

## B. Summer

- What is the difference in top and bottom supering and when would each be appropriate?
- Why is it important to keep the queen separated from honey supers?
- Describe the configuration of a hive for production of extracted honey.
- List two (2) indications that a honey flow is in progress.
- What characteristics of the hive are used to evaluate queen quality?
- When should a queen be replaced?

### Honey removal

- What is a bee escape?
- List two (2) bee repellants.
- Describe how bee repellants are used to remove honey supers.
- What are other methods for removing bees from honey supers?

### Extraction

- What are the two (2) main types of extractors?
- How are cappings removed?
- How is a capping scratcher used?
- Be able to describe the general steps you would use to clean and bottle honey
- How should honey be properly stored to prevent crystallization?
- What is the appropriate range of water concentration in honey?

## C. Fall

- List the main hive preparations for winter.
- What colony population (bee numbers) is recommended for good winter survival?
- What is Fumidil-B and how is it applied in a bee hive?

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- Describe the proper configuration for preparing a hive for winter.
- How much honey should a colony have going into winter?
- What concentration of sugar water is used to increase honey stores?

## D. Winter

- What adaptations do honey bees have that allow them to survive winter?
- What is/are the primary cause/s for winter losses?
- When should a hive be checked in winter and why?

## Major Bee Pests

### A. Diseases

- What is the disease of major concern for beekeepers?
- What stage in the life cycle does it attack?
- How is it spread?
- Who should you contact if you think your colony might be diseased?
- Name two other common brood diseases of honey bees
- What is Nosema and why is it important?

### B. Honey bee pests

- What is the major mite pest of the honey bee?
- How does one determine if they have a mite problem?
- What is done in the way of treatment for these mites?
- What is a wax moth and what damage does it cause?
- How can one avoid problems with wax moths?
- What is the Africanized honey bee?
- Why is it a concern?
- If someone discovers a very aggressive hive, what should be done?

## Practical Hive Inspection – What is involved?

- A knowledge of how to light and use a smoker.
- Be properly dressed and have proper equipment for a hive inspection.
- Be able to show how to open a hive.
- Demonstrate proper techniques for hive inspection.
- Be able to recognize different stages of brood (eggs, larvae, pupae) and the cells for workers, drone and queens (including queen cups).
- Be able to differentiate emergency, swarming and supersedure queen cells.
- Be able to recognize cells with pollen, honey and discuss the normal arrangement of brood, pollen and honey on a comb and in the hive.

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- Be able to give an overall evaluation of colony condition (is the hive, strong or weak, does it need feeding, does the colony appear healthy).
- Is the queen present and is she doing an acceptable job?
- How much brood and honey is in the hive?
- Is there any management needed?
- Be able to discuss and demonstrate two methods for feeding a colony
- How would you evaluate the site where the hives are located? What factors should be considered in locating an apiary site? In an urban area?

### References:

There are many beekeeping books and manuals that cover basic information that beekeepers should know. A list of references is provided, however, this is only a partial list and is not meant to be inclusive. There are literally thousands of references on beekeeping, some very good and some less useful. The annotated list given below provides references for the new or less experienced beekeeper. Most of the references are available from the bee supply companies or they can be ordered from most book dealers. The Beekeeping Basic manual from MAAREC is available on-line.

Avitabile, A., D. Sammataro, and R. A. Morse. 2006. *The Beekeeper's Handbook*, 3<sup>rd</sup> Edition, Cornell University Press, Ithaca, NY. 190 pp. (Good basic introduction to beekeeping and management practices, easy to read)

Caron, Dewey M. 1999. *Honey Bee Biology and Beekeeping*, Wicwas Press, Cheshire CT, 355 pp. (Good overview of biology and beekeeping, written as an introductory college text)

Flottum, Kim. 2005. *The Backyard Beekeeper, An Absolute Beginner's Guide to Keeping Bees in Your Yard and Garden*, Quarry Books, 168 pp. (Very basic and designed for the beginner, lots of pictures)

Morse, Roger A. 1994. *The New Complete Guide to Beekeeping*, The Countryman Press, Woodstock, VT. 207 pp. (A basic beekeeping text, easy to read)

Tew, James E. *Beekeeping Principles, A Manual for the Beginner, A Guide for the Gardener*, Great River Printing Co., Hamilton, IL. 245 pp. (A good overview of basic beekeeping practices, written for a general audience)

Winston, Mark L. 1987. *The Biology of the Honey Bee*, Harvard University Press, Cambridge, MA, 281 pp. (Excellent summary of honey bee biology, although somewhat dated. Well written but at a somewhat more advanced level)

\_\_\_\_\_. 2006. *ABC & XYZ of Bee Culture*, 41<sup>st</sup> Edition, Ed. by H. Shimanuki, and K. Flottum, A.I Root Company, Medina, OH.

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1992. *The Hive and the Honey Bee*, Ed by J. M. Graham. Dadant & Sons, Hamilton, IL, 1324 pp. (Comprehensive reference on all aspects of beekeeping, not a beginner's guide, but a good reference for any serious beekeeper)

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Beekeeping Basics, manual put out by Mid Atlantic Apiculture Research and Extension Consortium and Penn State College of Agriculture, Cooperative Extension, 98 pp. (Can be order from the Penn State Publication Distribution Center or down-loaded as a PDF at no cost. MAAREC website is [http//maarec.cas.psu.edu](http://maarec.cas.psu.edu))