

## **A Suggested CURRICULUM For Advanced Beekeeper Classes**

The purpose of this curriculum/class topic content, is to provide a basic structure for anyone coordinating an advanced class, or possibly to serve as a study guide for individuals.. Resource References are available on a separate document.

This outline of content for this document is arranged so that the overall time would be approximately 16 to 18 hours.

The time shown to the right of the session is a suggestion, not a mandate.

Each course administrator would have to analyze their resources, needs, and time available. Chapters may find that one or more topics would be of interest to the membership as an educational program for a chapter meeting.

More or Less time can be spent on each item by either expanding or reducing the amount of time allotted.

This was set up for a six session in-depth review for members considering taking their Journeyman or Master exams.

The NCSBA Master Beekeeper Program is a means by which the state association sets about identifying and acknowledging those amongst us that have exhibited knowledge and achievements in beekeeping.

For this reason, this curriculum is intended as a guide. It is not intended to be the only source of knowledge that a candidate is tested upon.

The various topics, categories, specific questions, service credits, and sub-specialties are chosen by the MBP Committee as a gauge of a candidate's overall ability.

The course outline presented here has been used by various committee and other NCSBA members over the past year.

Certainly, this outline can be presented in a formal classroom experience. However, we have found that if the course participants are given the reading material ahead of each session, then the class itself is more of a discussion among beekeepers who already have some experience. The class coordinator, or presenter, then serves more as the moderator of an organized discussion. This allows for individual participants to share their relative experiences and more freely voice their questions without peer-pressure stigmas. This takes into consideration that many participants have been away from any formal schooling atmosphere for some time. A relaxed atmosphere might possibly increase better retention of materials covered. Keeping on-topic within the time allowed can be a challenge, and parameters need to be established ahead of time to ensure that course goals are met.

While every attempt has been made to present a curriculum that addresses beekeeping throughout all of North Carolina, regional interests can also be included as the class administrator feels pertinent.

## A Suggested CURRICULUM

### For Advanced Beekeeper Classes

NOTE: The History of Beekeeping is part of the MBP, so when a topic is covered, it is wise to include segments on the people, who may have been noted for their contributions to those topics.

Likewise, understanding when, and how pests, or diseases began to impact apiculture in the US or NC is also important. Therefore, when talking about those topics it is wise to include a bit of a timeline to help keep things in perspective as to why we are doing something today, based on what has already transpired.

Concerning the topics of Pesticides, and/or Chemical “treatments”. We have heard that some members of the NCSBA do not want to participate in the MBP because it is felt the MBP *promotes* the use of chemicals. Nothing could be further from the truth.

The MBP does require candidates to be informed about pesticides and ‘chemical’ treatments. You must know the scientific facts about them so that when you discuss this with others, you are able to explain your decision about management techniques based on facts, not solely on opinion.

Regardless of how you choose to manage pests and/or diseases, the MBP expects Journeyman, and especially Master and Craftsman level candidates to know about them, what they are expected to do, the effects on the target as well as the colony. This includes pesticides that are used in the environment (agricultural and urban) so that an informed beekeeper can react appropriately to protect their colonies; knowing the level of threat (or not) to the bee colonies.

#### SESSION ONE: (2 hours)

##### COMMUNICATIONS:

**SOUNDS:** (15 minutes )

Johnston Organ

Queen Piping : tooting / quacking / when , why, and how / Charles Butler

**PHEROMONES:** (60 minutes)

explain difference between pheromones and hormones

(external vs internal and how those differences effect colony vs individual behaviors)

**Queen:** Queen Mandibular Pheromone (QMP) / 9-ODA / Tergal / Tarsal / Dufour /

Koschevnikov/ Effects on Mating, Worker Development, Fecal,

Worker: Mandibular, Hypopharyngeal, ( royal vs worker jelly ) ,Tarsal , Sting , Nasanov, Alarm

Effects on Colony Behavior, Foraging Behavior, Juvenile Hormone & Brood Esther Pheromone

**Drone:** Tarsal, Sting,

**DANCES:** (45 minutes)

Karl Von Frisch

Round, Sickle, (varies between sub-species )

Waggle Tail ( Wag Tail)

Joy, DVAV, Grooming, Massage, Begging, “Buzz Run”

## **SESSION TWO: ( 2 hours )**

### **SYSTEMS: ( 20 minutes each)**

The use of a diagram to explain the positioning, of organs and their functions is helpful.

**RESPIRATORY:** Spiracles, Trachea, What this system “carries” throughout the bee,

**CIRCULATORY:** location of the heart and aorta, what this system carries for the bee

**ALIMENTARY (digestion and excretory):**

Mandibles, proboscis, esophagus , honey stomach, proventricular valve, Ventriculus,

Rectal, Malpighian tubes, length of time from ingestion to excrement (nectar vs pollen)

What this system carries and how it benefits the individual bee., Larval excrement

**MATING:** Queen and Drone reproductive systems , spermatheca, ovaries, age of maturity at which mating begins, duration of mating period (both in age and individual mating sessions) , DCA locations, times of day (sub-species influenced), how the differing flights discourage in-breeding, endophalus, testes, amount of sperm retained, , effect of QMP and Tergal glands, antennae, and eyes. Eclose vs ‘hatch’. THE mating sign.

### **GENETICS: a very brief overview ( 30 minutes)**

Haploid and Diploid, chromosomes, Diploid Drones

Super sisters, Half Sisters, Full Sisters—effects on packaged bees

Effect of queen rearing locally , need to control drone genetic influence , Miller and Doolittle Methods

Breeding for specific traits: influence on pest resistance, temperament, swarming behavior etc.. Testing for hygienic behavior

Artificial Insemination and Henry Laidlaw

### **AHB ( Africanized Honey Bee ) ( 15 minutes)**

The developmental differences (length of time) compared to European Honey Bee; Cells per Square Inch, Swarming habits, Honey Production, Stinging (note.. Many beekeepers think that an Africanized Honey Bee can sting more than once— which is obviously incorrect, but needs explaining and reinforcement of why it is incorrect during an advanced review)

How AHB takes over an area including usurpation and sublimation

How AHB is identified

The North Carolina PLAN , consulting with NCDA&CS Apiary Inspectors, the NC Travel Corridor, Quarantine areas around sea ports, incidents of AHB in NC, Where AHB entered USA and when, Progression known at this time

What to do if you are asked by a reporter about AHB

What to do if you suspect AHB in your apiary or area

CAPENSIS CALMAITY in Africa / THELYTOKY

## **Session Three : (2-1/2 hours)**

### **Pests and Diseases: Life Cycles, Causes, Effects , & Management, since when (timeline)**

#### **IPM (Integrated Pest Management)**

Know the definition, understand the principle (threshold, does not exclude “chemicals”)

#### **SHB ( Small Hive Beetle) ( 20 minutes)**

Life Cycle, Stages of Development , Damage to the colony—how, Reproduction , where they spend over-winter

Pupation in soil—depth, why bees can't defend as well as against other pests, yeast damage to honey , mgmt.

Soil drench (pros and mostly CONS); beetle traps, where and what to bait with

#### **GWM ( Greater Wax Moth ) ( 20 minutes)**

Life Cycle, Mating, Difference in appearance of larva (compare to SHB), Difference in damage done,

Weak Colonies effected most, Freezing vs. PDB vs. Light, Wax Moth Traps, 40° activity

#### **TRACHEAL MITES ( 20 minutes)**

Where they 'enter the bee', effects on individuals and colony, potential management techniques. K Wing

#### **VARROA MITES ( 45 minutes)**

Life Cycle, Phoretic Mites, entering the pre-pupal cells, feeding on lipids in hemolymph, reproduction, male varroa doesn't leave cell, vectoring viruses, DWV, snotty brood, CBPV, How using the bees colony brood-less periods, re-queening, in combination with the needs of the varroa's life cycle can be used as management techniques.

MUST KNOW all various treatments (see [www.honeybeehealthy.org](http://www.honeybeehealthy.org)) Treatments MUST be administered following instructions especially concerning temperatures; honey supers; and knowledge of the effect each has on queen reproduction and colony health.

#### **NOSEMA ( 10 minutes )**

Cause, apis vs ceranae, symptoms, K Wing, management techniques, adults only, underdeveloped hypopharyngeal and the effects on brood rearing

#### **FOULBROOD ( 10 minutes)**

**AFB** differentiate between EFB & AFB, spores, NC rules, Contact apiary inspector, New law abt. antibiotics

**EFB** open cell vs AFB closed cell (mostly), treatment/management, non-spore forming, spring

**Sacbrood, Stonebrood, Chalkbrood**—briefly review causes, symptoms & management

#### **Parasitic Mite Syndromes & Viruses ( 20 minutes)**

**Paralysis, Snotty Brood, Deformed Wing Virus,**

**CCD** : Facts, history (1866, 1965), current reports/incidents,

**Others:** bracula, Tropilaelaps claracae, black bear, opossum , raccoon, Zombie Flies,

Florida “bee killer”( 5 minutes)

## **Session Four: ( 2 hours)**

### **PLANTS / POLLINATION / BEE NUTRITION**

#### **PARTS of a FLOWER ( 20 minutes)**

It is recommended that a diagram of the “reproductive parts” of a flower is used during this session.

The participants will be expected to identify these during a practical exam.

Understanding the difference between Pollination and Propagation.

Know what is meant by cross-pollination, understand that there are differences due to sub-species (varieties),

Know what is meant concerning monoecious and dioecious plants

(at least be able to discern this on a multiple choice question, as it does have an effect on crop production)

#### **FORAGING HABITS (30 minutes)**

Flower Fidelity aka Flower Constancy, Footprint pheromone, Dances, Trophallaxis, Bee Vision

Temperature, other weather effects

Distances

#### **SPECIFIC PLANTS & ISSUES (50 minutes)**

We find that if the class participants are given a “Honey Bee Plant Fact Sheet” the week before the class, and are asked to each work on information for a specific plant, is a worthwhile exercise in helping beekeepers recognize the value or difficulties of specific plants that bees may forage upon.

Specific Plants of Concern: Corn, Cucumbers, Tomatoes, Soy Beans, Canola, Sage—various, Clovers—various types, Titi—one of the three common to this area is toxic ( and can cause “purple brood”), Carolina Jessamine, Rhododendron, Azalea, Berchemia, Buckwheat, Dandelion, Tobacco, Sunflowers, Tulip Poplar, Sourwood

#### **OTHER POLLINATORS & STINGING INSECTS (20 minutes)**

A Slide Show of various other stinging insects is recommended.

Wasps: Paper, Mud-Dauber, Golden Digger, Yellow Jacket, Bald-Faced Hornet, Cicada Killer, Flightless Ant aka Cow Killer aka Velvet Ant; European HORNET (different than a wasp)

Other Bees: Bumble, Carpenter, Blue-Orchard Mason

What their ‘nests’ look like; what they eat; how they feed their young

What hazards do they pose to a bee colony ( especially yellow jackets, and when )

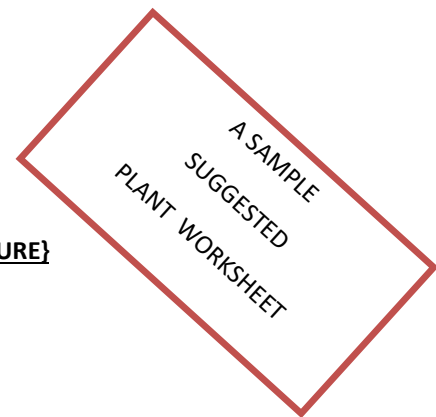
The differences between honey bees and bumble bees and mason (blue orchard bees)

**DIFFERENCES in POLLINATION EFFECTIVENESS & WHY**—an important MBP Topic

Colony structure, manageability, distance of forage, nutritional needs (what they forage upon), hairs

—especially plumose, flower fidelity, greenhouse use or not—why or why not

North Carolina Honey Bee Plant – Plant Sheet



**Region: (Mountain / Piedmont / Coastal Plains )**

**further describe location: mid-region; elevation; county; other )**

**Plant Name: Genus / Species / Cultivar , Variety. or Hybrid { MANDATORY NOMENCLATURE}**

Common Name:

Botanical Name:

Plant Type: Tree / Shrub / Vine / Groundcover /

Further Describe plant type or usage:

Agricultural usage / Herb / Weed / Vegetable / Ornamental / Shade / Fruit / Nut

Mature Height Overall:

Mature Width Overall:

Deciduous or Evergreen?

Annual

Perennial

Bi-Annual

Flower Color:

Flower shape (type):

Flower Size:

Fragrant:

Pollination is primarily wind driven or by pollinator?

**Bees Forage on this plant for: pollen / nectar / resin for propolis / honeydew / apparently moisture**

If Nectar, describe sugars to moisture ratio

If Pollen: describe nutritional value of amino acids, lipids etc.

If pollen: what color is the pollen?

Other pollen characteristics :

**Bloom Period in this region: (start to end date approximate)**

Is this plant toxic to humans? The plant itself / The honey obtained from it (in quantity)

Is this plant toxic to bees?

Honey Characteristics from this plant, for example: color / taste / tendency to crystallize / fragrance etc.

PLANTING:

Hardiness Zone:

Soil needs or prep needed to plant

Moisture needs:

Best time to plant:

Other planting tips:

Plant Difficulties Comments: ( for examples " hurricane resistance" /" prone to a specific pest or disease"/ "sprawling nature – needs constant pruning" / "root system not good in urban environment"/ "dirty" in that it drops leaves or fruit)

Additional comments relative to the use of this plant by honeybees:

For example: Nectar gathered from Asters in the fall, tend to make a poor over-winter honey for the bees because it lacks moisture and can crystalize in the hive / cucumbers tend to produce little nectar and the pollen is sticky and unattractive to the honey bees – especially a fall crop can be problematic for necessary fall brood build-up for a healthy over-wintering colony)

Is this plant on any "invasive species" list?

Photo of plant ( overall ) and/or (blossom) included?

Other Pollinators Known to forage on this plant: \_\_\_\_\_

Is this competition with the honey bee? Or does the honey bee NOT forage on this plant?

INFORMATION RESOURCES: MANDATORY

## **Session Five: ( 2 hours )**

### **HONEY and WAX**

#### **Basics of Honey** (45 minutes)

How it is made by the bees

Moisture

Temperatures

Fermentation

Crystallization

Storage

#### **HONEY JUDGING** (30 minutes)

Score card & why

Polariscope

Refractometer

Color (charts such as Pfund Grader )

#### **HONEY LABELING** (20 minutes)

Laws, rules, recommendations and sources thereof

#### **OTHER POINTS OF INTEREST ABOUT HONEY:** (10 minutes)

Include : cooking, baking, medicinal, allergy, infants, diabetics)

#### **WAX:** (15 minutes)

Refining Wax (solar melters, double boilers, straining, cleaning)

Lipids & Hydrocarbons, Human Consumption/Nutritional Value / How Bees Make Wax (8 glands) /

How bees use wax (hairs act as plumb-bobs during cell construction) / Age at which adult bees make wax /

Top Uses for Wax / Where we beekeepers get it from / How to store until refined /

TEMPERATURES: 90° Softens / 144° - 147° melting point / 185° discolors /400° flashpoint

Other vocabulary to know: "slum gum", "Bloom", "Priming a wick- for candle making"

## **Session Six (2 hours)**

### **Miscellaneous / Wrap-up / Allow some time for Q&A**

#### **HISTORY (people, inventions, introduction to and about problems) (15 minutes)**

You probably covered a lot of this topic throughout the course, but a quick review with a list of names can be a source of recall: In no particular order and not exclusive: Charles Butler, Dyce, Demaree, Laidlaw, Miller, Doolittle, Langstroth, Root, Dadant, Seeley, Tarpy, Delaplane, Jamie Ellis, Randy Oliver, Debbie Delaney, James Tew, Dewey Caron, Larry Connor, Kim Flottam, Joe Graham, C. Collison, Karl Von Frisch, Michael Bush, Wyatt Mangum, 1922 US Congress Honey Act, 1977 NC Honey Act, 1670 Honeybees in NC, 2009 Bee Garden at NC Zoo, When ( and where ) pests, diseases, and AHB entered the US and current impacts.

#### **NCSBA PROGRAMS (15 minutes) Review Yellow Book and Website—should be able to list at least 6 programs**

KNOW YOUR REGIONAL DIRECTOR'S NAME

#### **NCSBA ( three divisions ) (30 minutes)**

##### **(apiary inspection, food & drug protection & pesticides)**

Know regional apiary inspector; Know what laws Food & Drug oversee, Know DriftWatch, Bee Check, Aerial Registration, reporting pesticide violations / impacts

#### **NCSU: (5 minutes) Be aware of NCSU apiculture program**

#### **PESTICIDE LABELS (25 minutes)**

##### **How to Read a Pesticide Label**

##### **Protecting Bees**

##### **The Importance of Record Keeping**

#### **VENOM: (15 minutes) : Read Chapter 29 in the 2015 The Hive & The Honey Bee**

##### **Facts vs Myths**

##### **Apitherapy**

##### **Allergic Reactions understood**

Especially understand the difference between a large local reaction and a systemic reaction.

#### **MISC. EQUIPMENT, SEASONAL MANAGEMENT TECHNIQUES (15 minutes)**

Preparing for Winter (starts a long time before cold weather sets in )

Vitellogenin and “fat winter bees” - negative effects of pollen feeding in the fall

Feeding carbohydrates: various methods—pros and cons ( feeder types, fondant vs syrup vs corn syrup)

Ventilation and wind-blocks, wrapping or not and why, Mouse Guards, Screened vs Solid,

Spring: Swarm Prevention Methods (including Demaree), Splits, Varroa management, Swarm capture

Summer: festooning, bearding, cooling, evaporation, lack of forage resources, water resources

Equipment: queen excluders, escape boards, slatted bottom boards, hive scales