



HONEY BEE PESTS AND DISEASES

THE SECOND LEADING CAUSE
OF BEE DEATH

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OUTLINE

Question #3:
**Why should
I care?**

- I. Why does this matter?
- II. Fundamental principles
- III. IPM (Integrated Pest Management)
- IV. Diseases: What they look like; how to manage them
- V. Pests: What they look like; how to manage them
- VI. Case studies
- VII. Q & A

WHY PEST/DISEASE CONTROL MATTERS

GONE



\$\$ GONE



FUNDAMENTAL PRINCIPLES

Healthy bees are your greatest defense against pest and disease problems

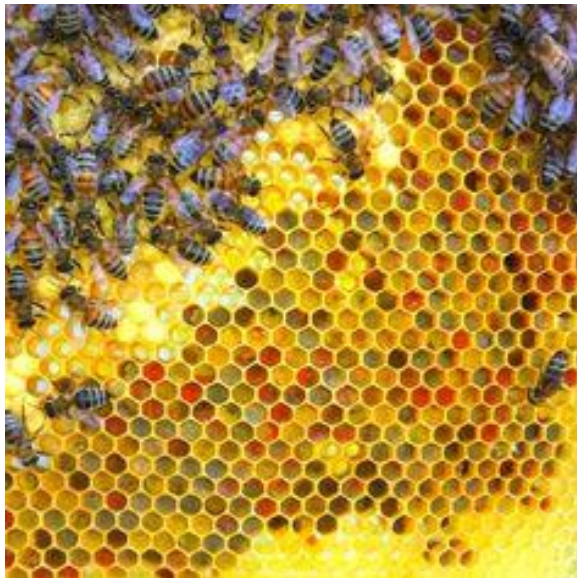
Recipe for healthy bees:

1. Good stock (hygienic, good work ethic)
2. Young, productive queen



FUNDAMENTAL PRINCIPLES: HEALTHY BEES

3. Good nutrition (especially pollen)
4. Basic beekeeping knowledge from reliable sources
5. Think like a bee!



IPM (INTEGRATED PEST MANAGEMENT)

www.clemson.edu/extension/beekeepers/fact-sheets-publications/pest-management-publication.html

www.americanbeejournal.com/integrated-pest-management-of-varroa-in-north-america

www.scientificbeekeeping.com

www.honeybeehealthcoalition.org

MAJOR DISEASES OF THE HONEY BEE

AMERICAN FOULBROOD (AFB)

Bacterial disease

Absolutely the worst
thing that you could
possibly find in your
hive



AMERICAN FOULBROOD (AFB)

Caused by hardy, spore-forming bacteria

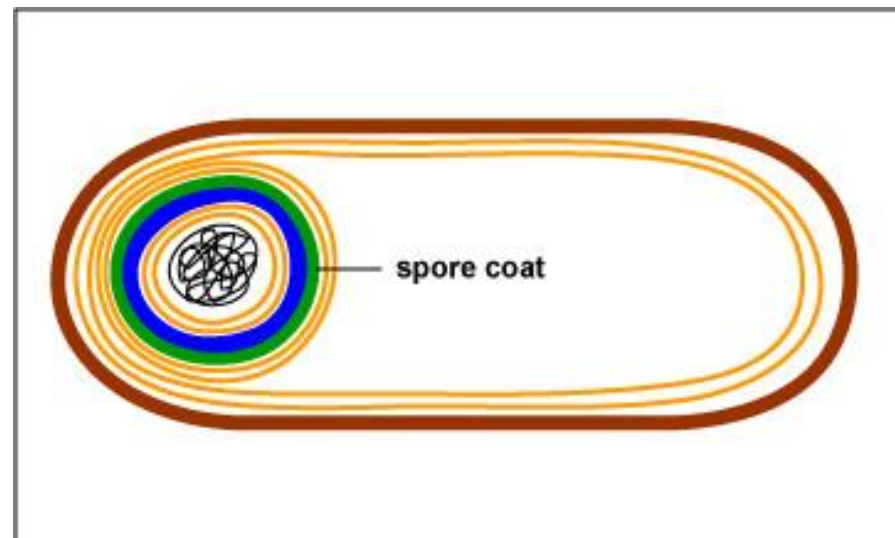
Spores protect the bacteria from most eradication efforts

Starts in larval stage, but diagnosed in pupal stage—
more **ADVANCED** stage than when diagnosing EFB

AWFUL

Virtually always FATAL to hive

Very contagious



AMERICAN FOULBROOD DISEASE (AFB)

Spores resist freezing or chemical eradication

Spores can survive for DECADES without living bees

THIS IS WHY USED EQUIPMENT CAN BE VERY RISKY

AFB spread by robbing bees and/or careless humans

Incidence 1-3% in U.S.

AFB virtually always fatal to hive

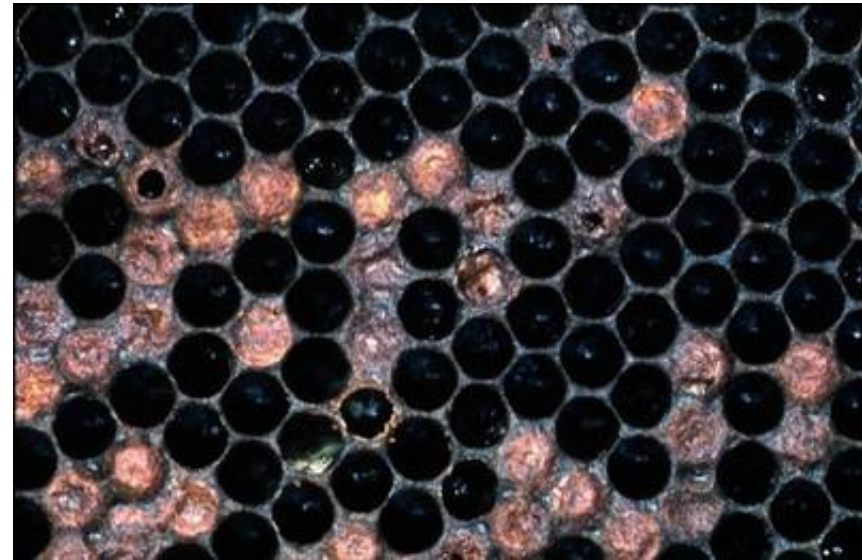
Diagnosis: appearance, aroma, lab tests



HEALTHY BEE BROOD

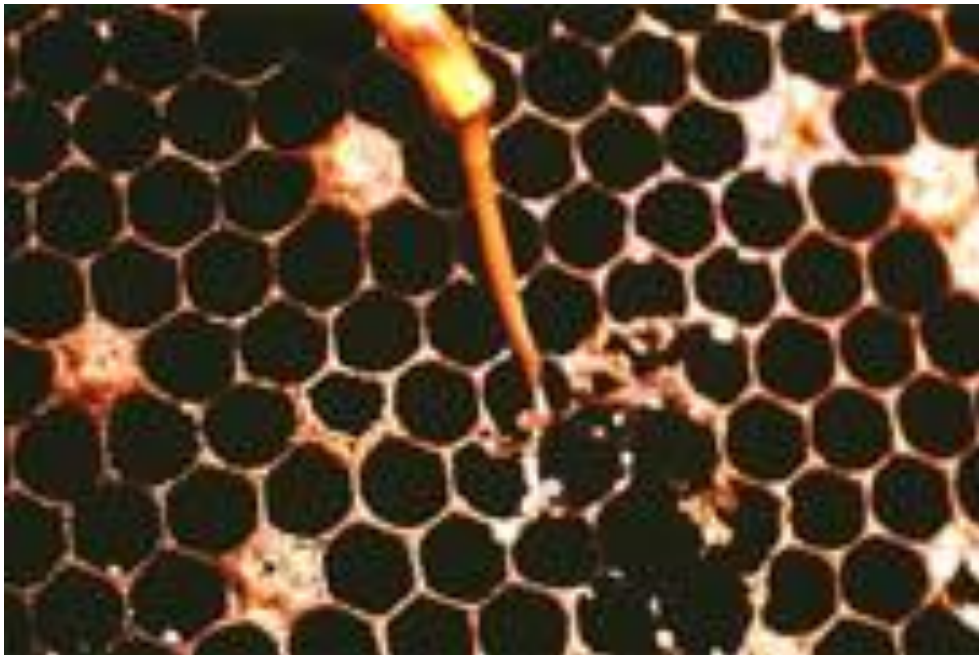


AMERICAN FOULBROOD



AFB ROPE TEST

Usually part of field diagnosis; ropes out $>2\text{cm}$



AMERICAN FOULBROOD DISEASE (AFB): DIAGNOSIS

Diagnosis includes foul odor (putrid)

Chicken houses + dead fish



AMERICAN FOULBROOD: LAB CONFIRMATION

AFB TEST KIT



AMERICAN FOULBROOD DISEASE (AFB): MANAGEMENT

First step is confirming the diagnosis—AFB fatal and contagious → drastic measures must be taken

Infection control ASAP is paramount

Seal off entrance

All bees in symptomatic hive(s) **MUST** be destroyed

(Spread by these bees going out or others coming in)



AMERICAN FOULBROOD DISEASE (AFB): MANAGEMENT

PLEASE CALL YOUR APIARY INSPECTOR!!

Diagnosis confirmation; start investigation

AFB is reportable communicable disease → statistics

All apiaries within two miles must be inspected for AFB disease

Hive registration NOT required in NC, so NCDA & CS apiary inspector needs to find all nearby apiaries



AMERICAN FOULBROOD DISEASE (AFB): MANAGEMENT

Once AFB diagnosis is confirmed, veterinary action needed

Honey Bee Veterinary Consortium

www.hbvc.org

Listing of veterinarians willing to help



www.avma.org/KB/Resources/Pages/Honey-Bees-101-Veterinarians.aspx

AMERICAN FOULBROOD DISEASE (AFB): MANAGEMENT

NC law mandates control of AFB (Bees and Honey Act)

Equipment needs to be disinfected by fire or gas because of AFB's tough spores

ETO STERILIZER



AMERICAN FOULBROOD



LandLearn
NSW

AMERICAN FOULBROOD DISEASE (AFB): MANAGEMENT

Follow-up inspection of all symptomatic apiaries
within 30-60 days of initial inspection/diagnosis



EUROPEAN FOULBROOD (EFB)

Bacterial brood disease, *Melissococcus plutonius* as dominant pathogen

Non-spore-forming-→easier to eradicate than AFB

Usually transmitted by other bees or by less-than-careful humans

Incidence 3-5% in US managed hives

Often revealed after stress (especially food shortage)

Not usually fatal, unless hive is weak to start with

EUROPEAN FOULBROOD DISEASE (EFB)

Infects young honey bee larvae; expressed before being capped

Usually (but not always) accompanied by **foul** odor



EUROPEAN FOULBROOD DISEASE (EFB)

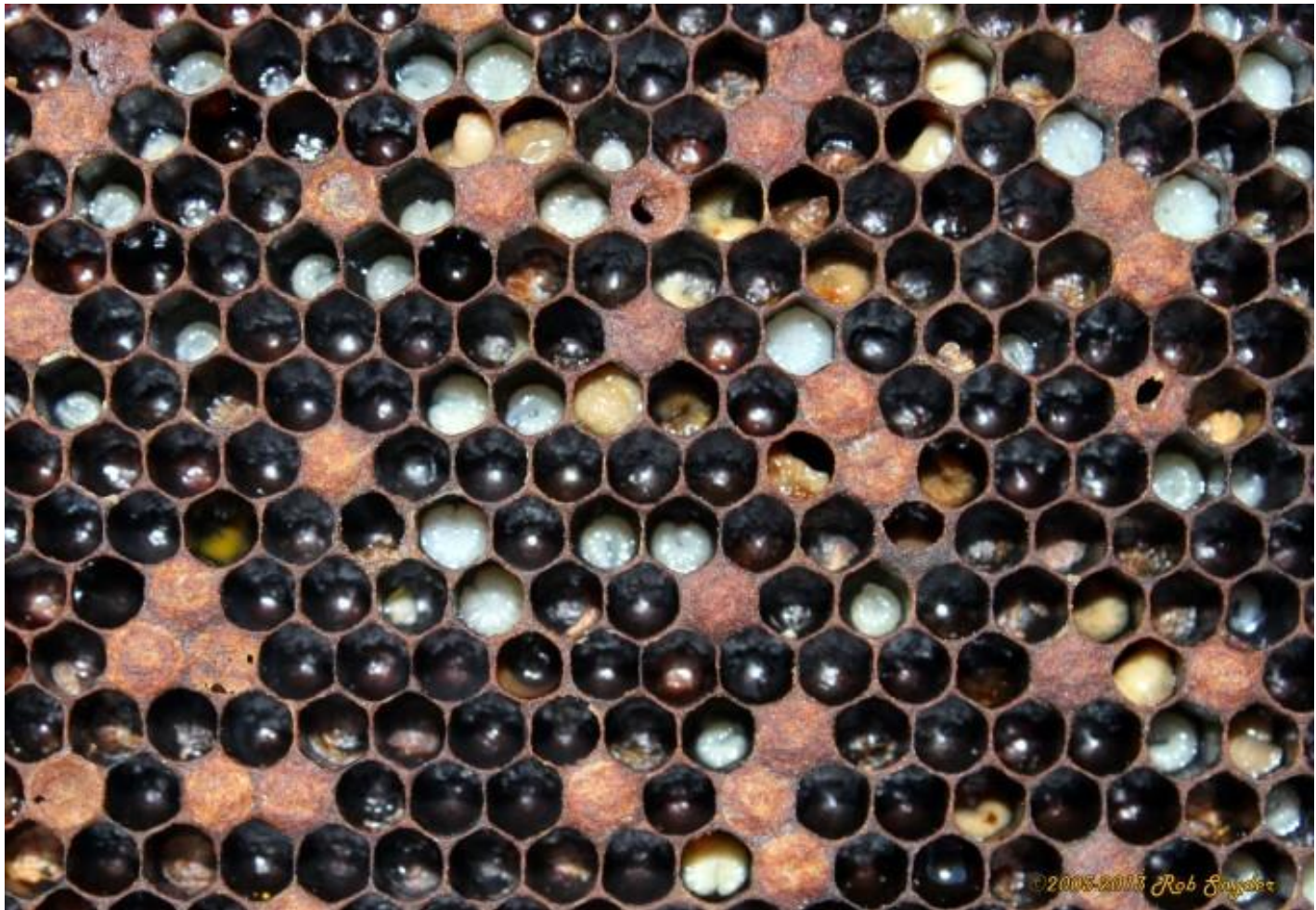
Field diagnosis: appearance; aroma; lab confirmation



HEALTHY BEE LARVAE

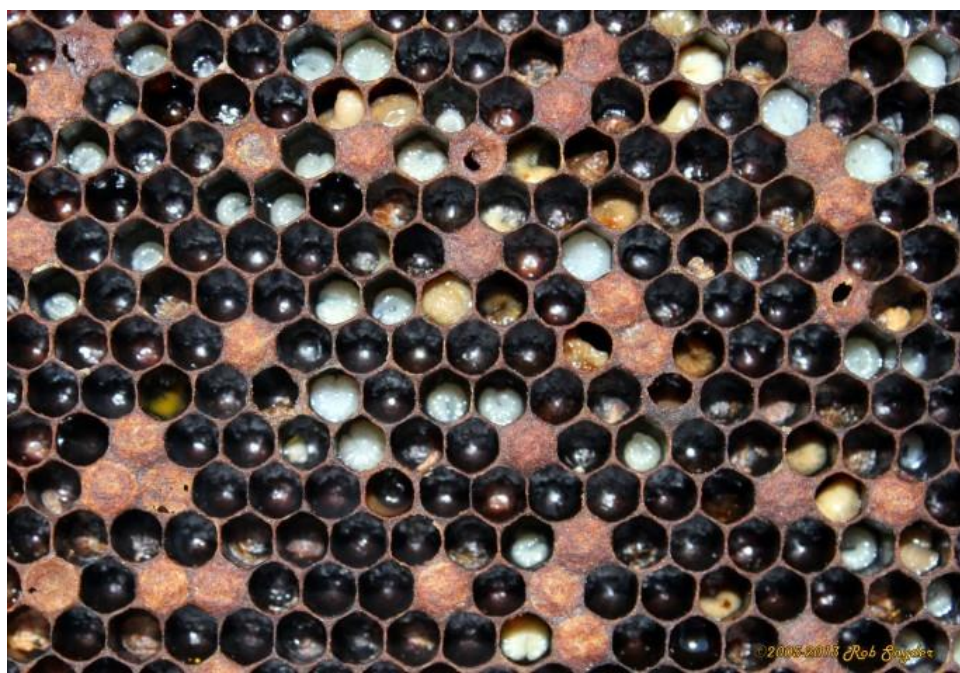


IMAGE OF EFB



DISEASE

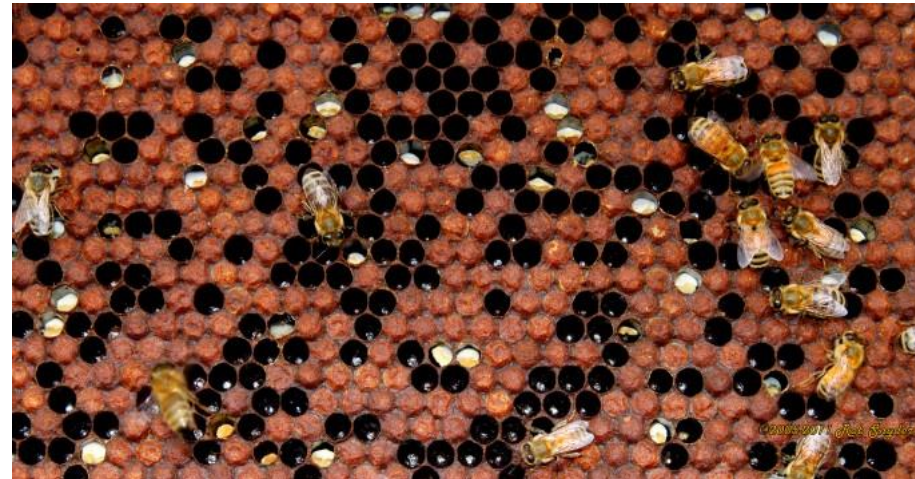
EFB



PMS



CHALKBROOD



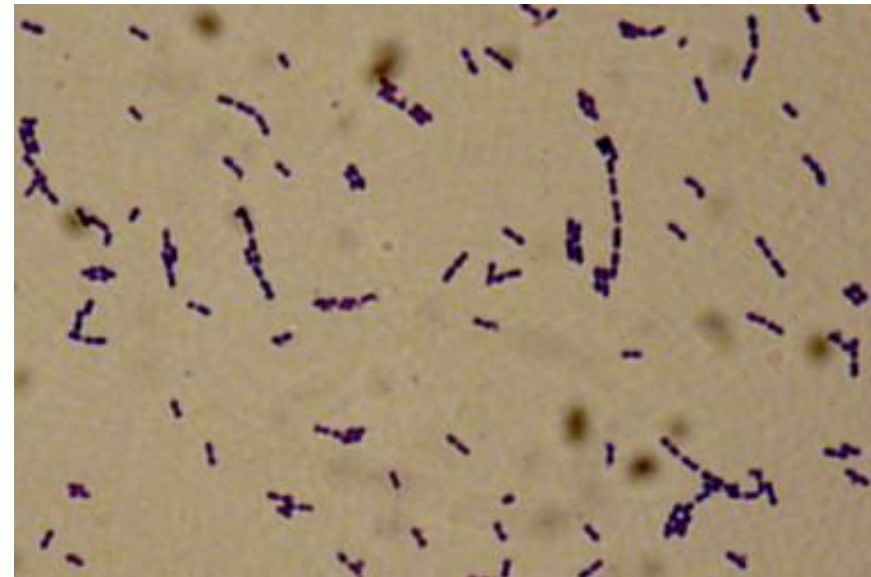
EUROPEAN FOULBROOD DISEASE (EFB): AROMA

Healthy larvae have smell like baker's yeast rising

EFB-sickened larvae have sour smell

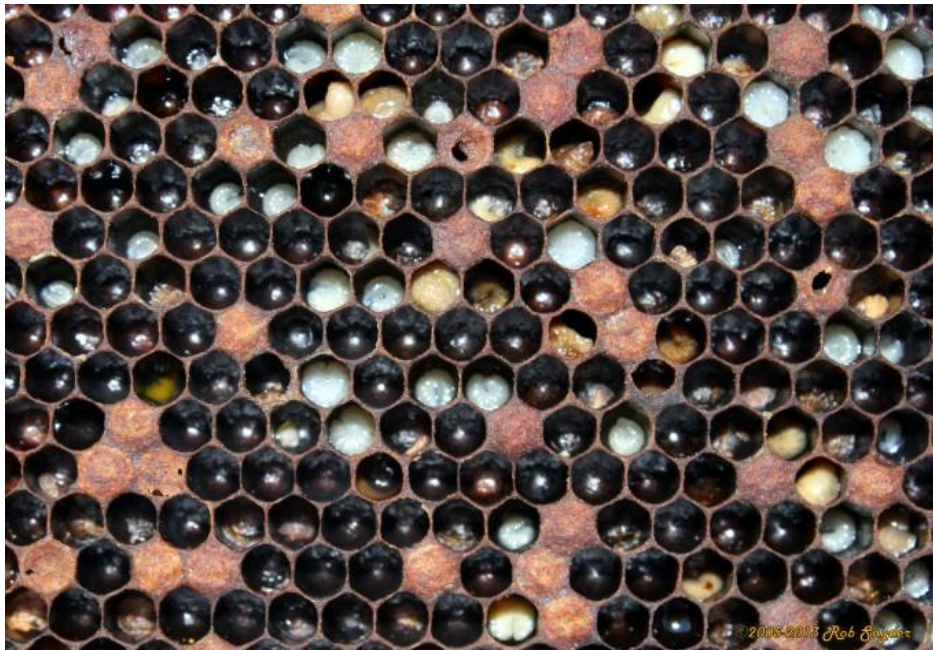


EUROPEAN FOULBROOD DISEASE (EFB): CONFIRMATION



EUROPEAN FOULBROOD DISEASE (EFB): MANAGEMENT

Bees—especially hygienic stock—will often clean it up themselves



EUROPEAN FOULBROOD DISEASE (EFB): MANAGEMENT

Sometimes bees not hygienic or strong enough to clear EFB alone

Feeding carbohydrates (1:1 sugar water) helps if food-stressed

Antibiotics may be indicated

Oxytetracycline HCl (terramycin) only approved drug for EFB

Acquired via VFD (**V**eterinary **F**eed **D**irective)



EUROPEAN FOULBROOD DISEASE (EFB): MANAGEMENT

Requeen colony: Many experts say that advanced EFB
= poor genetics



Beekeeper caution: prevent spread

OTHER BROOD DISEASES

Sacbrood (viral)



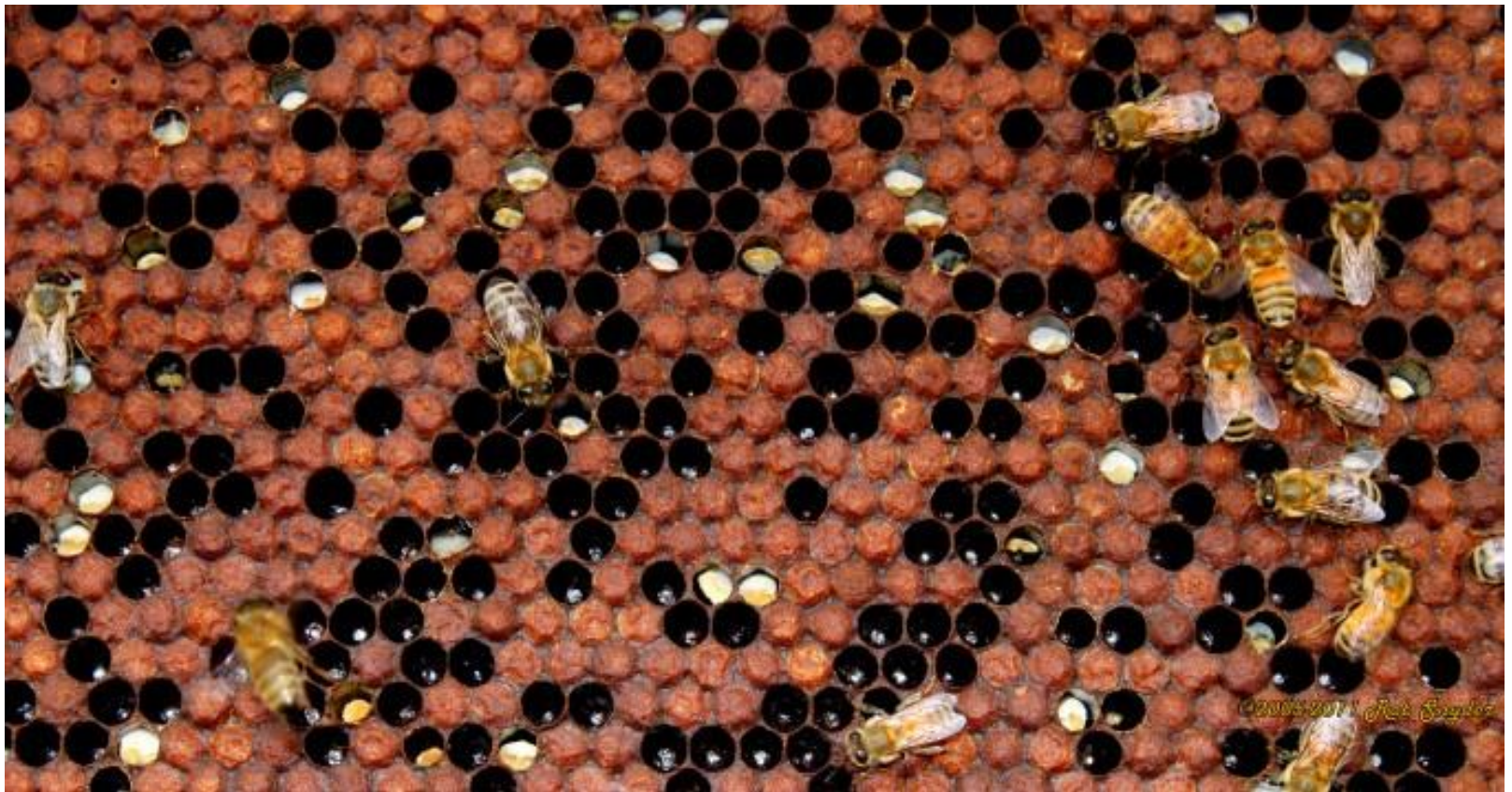
OTHER BROOD DISEASES

Healthy brood



OTHER BROOD DISEASES

Chalkbrood (fungal)



OTHER BROOD DISEASES

Chalkbrood Mummies



OTHER BROOD DISEASES

Parasitic
mite
syndrome (viral)
(PMS)

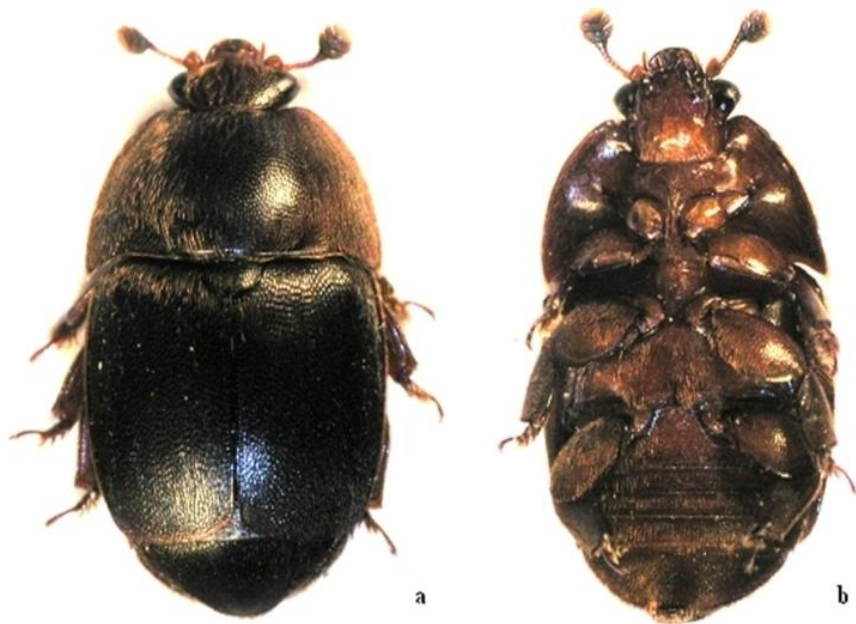


There are actually more, but let's stop!!



MAJOR PESTS OF THE HONEY BEE

Small hive beetles



Varroa mites



SMALL HIVE BEETLES (SHB)

Introduced to U.S. in 1990s

SHB larvae are more destructive than adults to honey bees

Can decimate a hive within 7-14 days

Most likely in areas of shade, higher humidity, and sandy soil; can fly for miles, targeting weak hives



IMAGES OF SHB

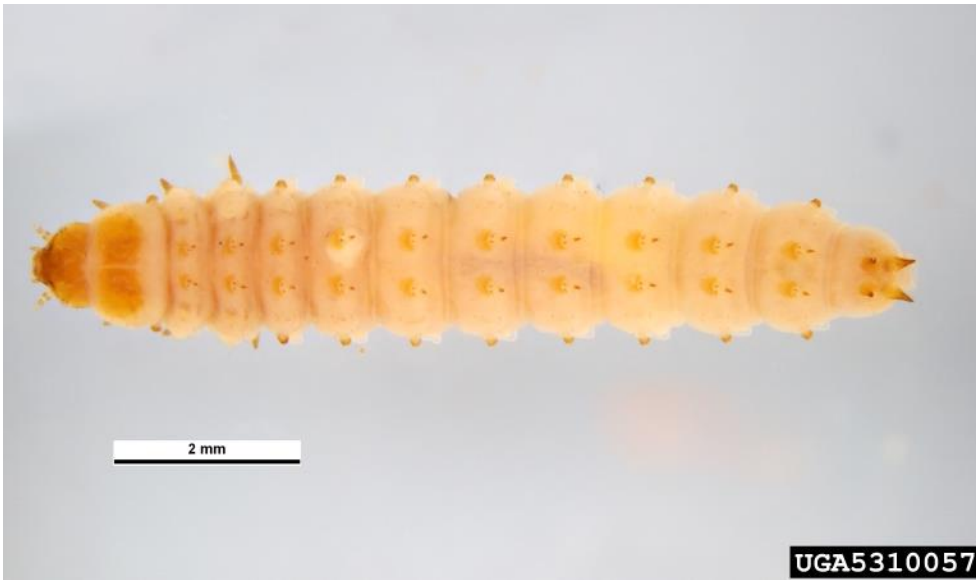




IMAGES OF WAX MOTHS



HIVE BEETLES OR WAX MOTHS?



Hive beetle larva



Wax moth larva

HIVE BEETLES OR WAX MOTHS?



CONTROL OF HIVE BEETLES

PAY ATTENTION!!

Strong, healthy hive

Limit shade



**Are You
Paying
Attention?**



CONTROL OF HIVE BEETLES

Apply pressure, with hive tool or finger



In-hive traps---upper or lower part of hive

Ground drench around hive for persistent cases

Chemicals in hive (coumaphos) as last resort

BEETLE TRAPS

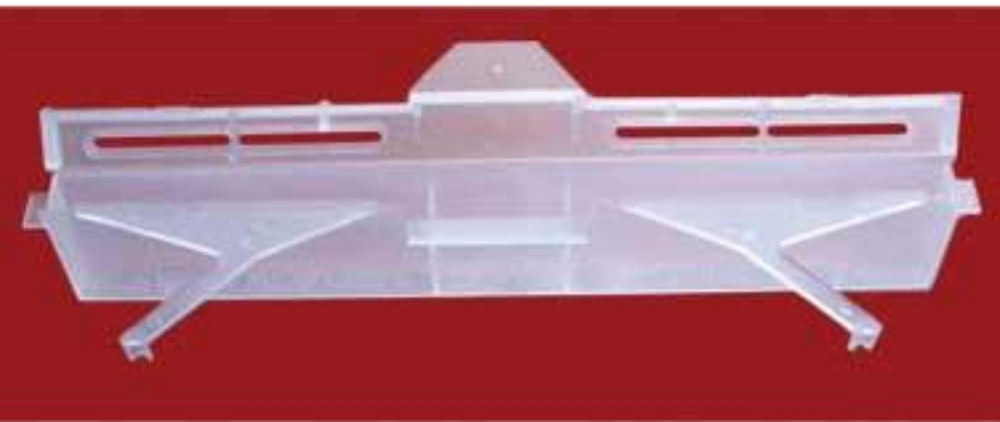


BEETLE TRAPS

Between-frame traps: as they try to escape bees chasing them, beetles fall through holes in top



BEETLE TRAPS



BEETLE TRAPS

What's wrong with this picture?



BEETLE TRAPS



HIVE BEETLE CONTROL



HIVE BEETLE CONTROL



VARROA MITE

(VARROA DESTRUCTOR)



VARROA MITE (CONT.)

Parasitic mite, introduced to the U.S. in 1980s

Multiple damaging effects on bees:

1. Transmit viruses, maybe bacteria
2. Weaken bees by draining them of nutrients
3. Cause early bee death by damaging forming bees

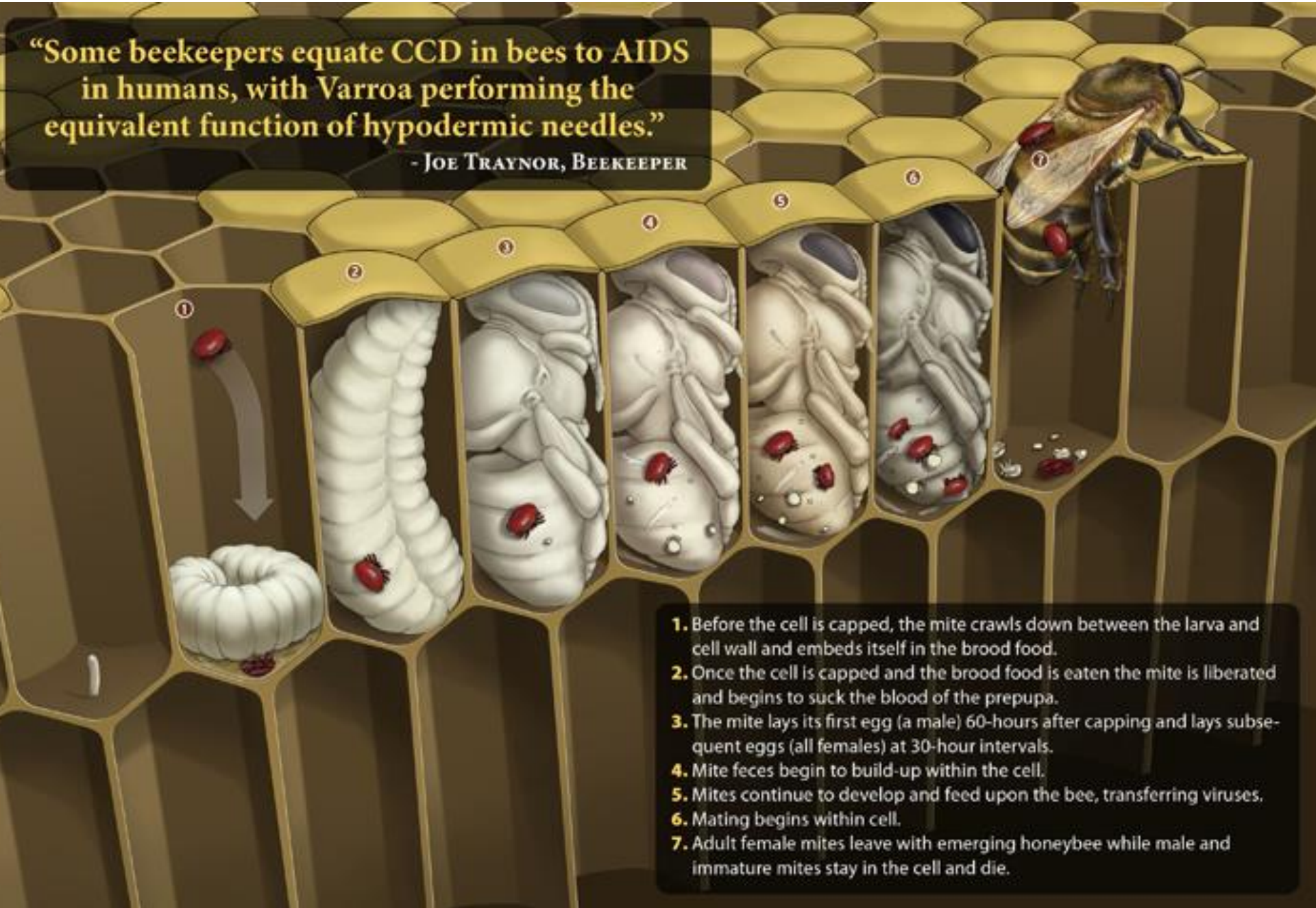


MORE UGLY PICTURES....



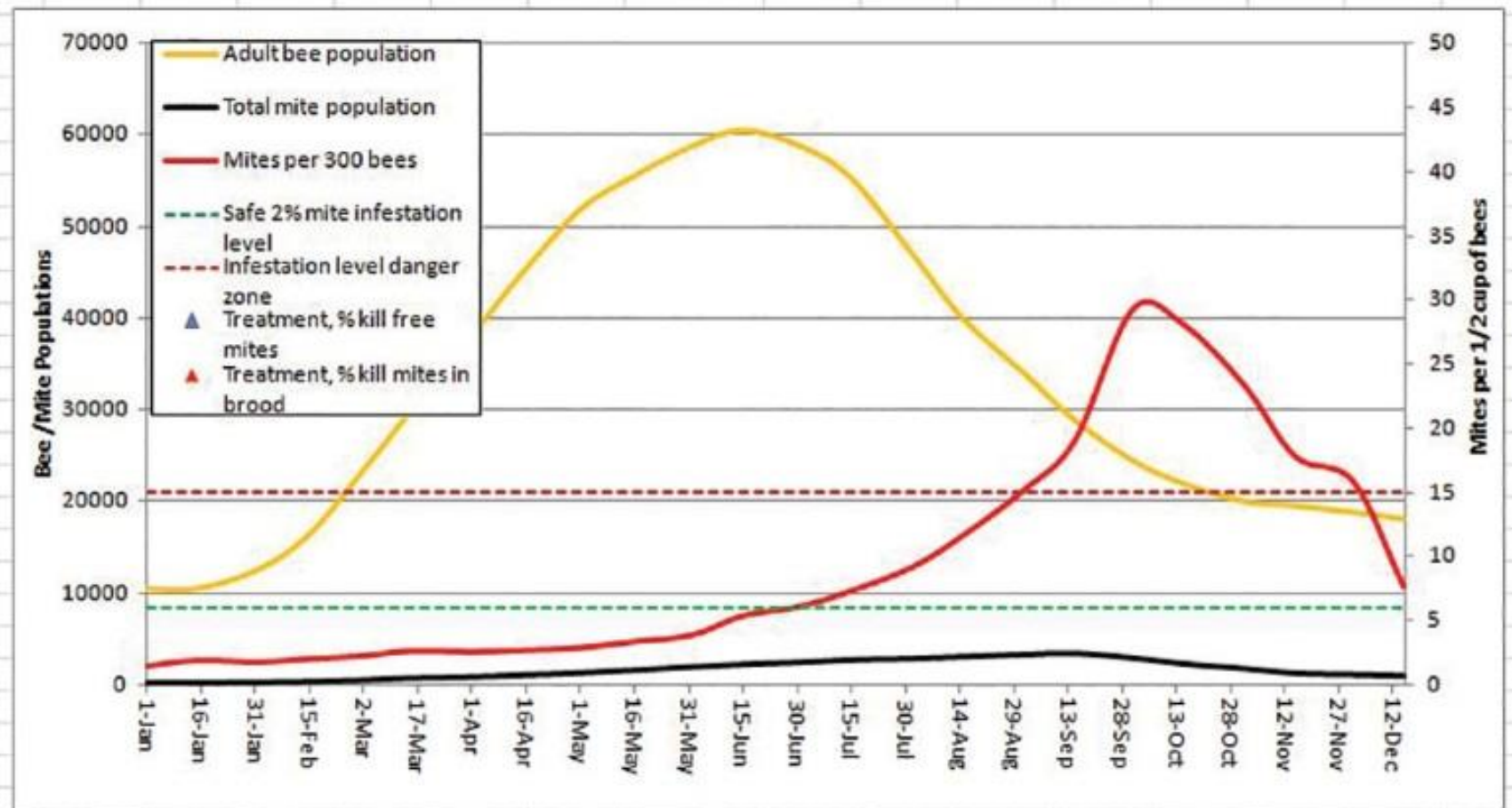
"Some beekeepers equate CCD in bees to AIDS in humans, with Varroa performing the equivalent function of hypodermic needles."

- JOE TRAYNOR, BEEKEEPER



1. Before the cell is capped, the mite crawls down between the larva and cell wall and embeds itself in the brood food.
2. Once the cell is capped and the brood food is eaten the mite is liberated and begins to suck the blood of the prepupa.
3. The mite lays its first egg (a male) 60-hours after capping and lays subsequent eggs (all females) at 30-hour intervals.
4. Mite feces begin to build-up within the cell.
5. Mites continue to develop and feed upon the bee, transferring viruses.
6. Mating begins within cell.
7. Adult female mites leave with emerging honeybee while male and immature mites stay in the cell and die.

LIFE CYCLES: MITES & BEES



VARROA MITE EFFECTS



VARROA MITE EFFECTS



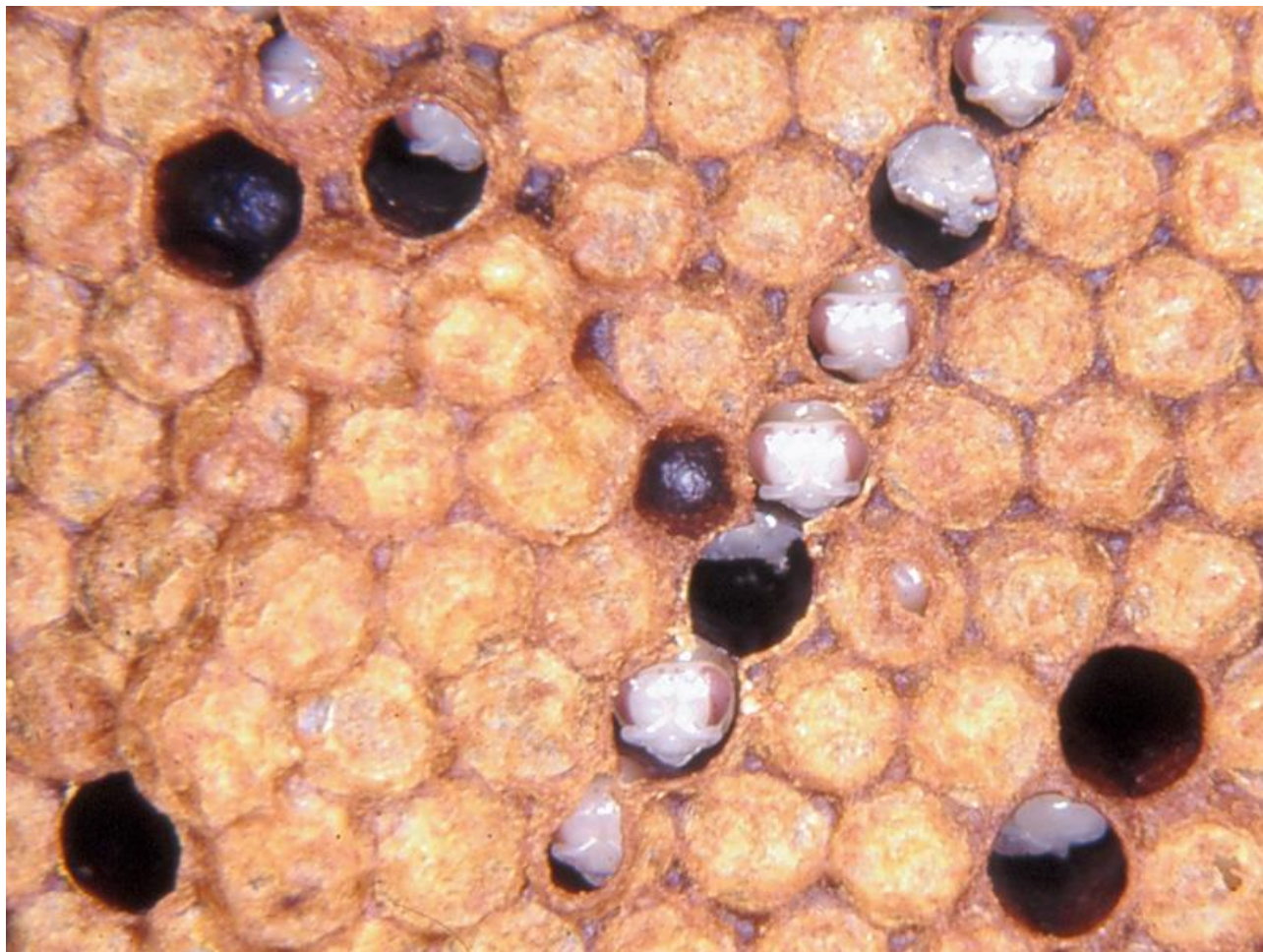
VARROA MITE EFFECTS



VARROA MITE EFFECTS



VARROA MITE EFFECTS?



“BALD BROOD”



VARROA MITE EFFECTS



CONTROL OF VARROA MITES

LEARN ALL YOU CAN---KNOW THE ENEMY!!

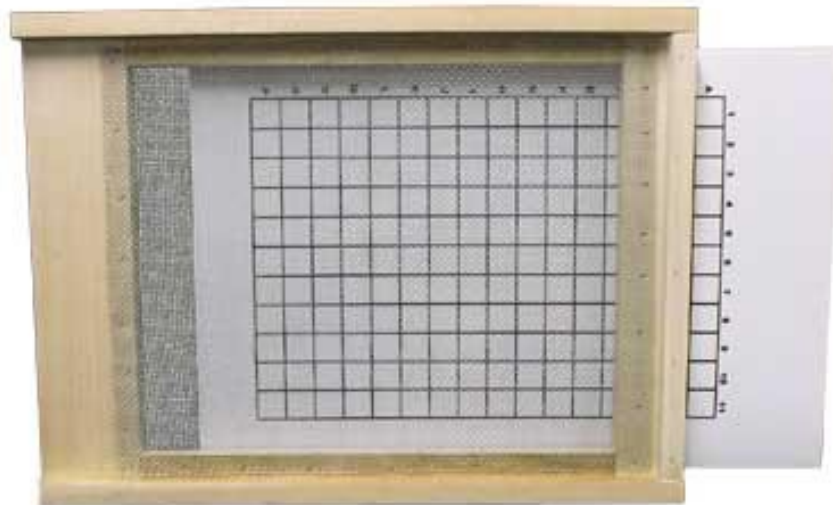
HEALTHIER BEES CAN WITHSTAND SOME OF VARROA'S EFFECTS → KEEP BEES HEALTHY

ACCURATE ASSESSMENT OF THE VARROA: IT'S NOT IF, BUT HOW MANY

STICKY BOARD SUGAR ROLL ALCOHOL WASH
UNCAPPING DRONE PUPAE ETHER ROLL

ASSESSING VARROA MITE LEVELS

STICKY BOARD (AKA IPM BOARD)



ASSESSING VARROA MITE LEVELS



ASSESSING VARROA MITE LEVELS



VARROA MITE ASSESSMENT

Sugar roll/sugar shake testing,

Alcohol wash:

www.honeybeehealthcoalition.org

<https://www.youtube.com/watch?v=48vomY-lf2Q>

CONTROL OF VARROA



CONTROL OF VARROA (CONT.)

Resistant/tolerant stock

Hygienic stock (VSH)

Drone comb in hive

Replace comb every 3-5 years

Materials placed in hive

www.honeybeehealthcoalition.org

****GENETICS (DNA + RNA)****



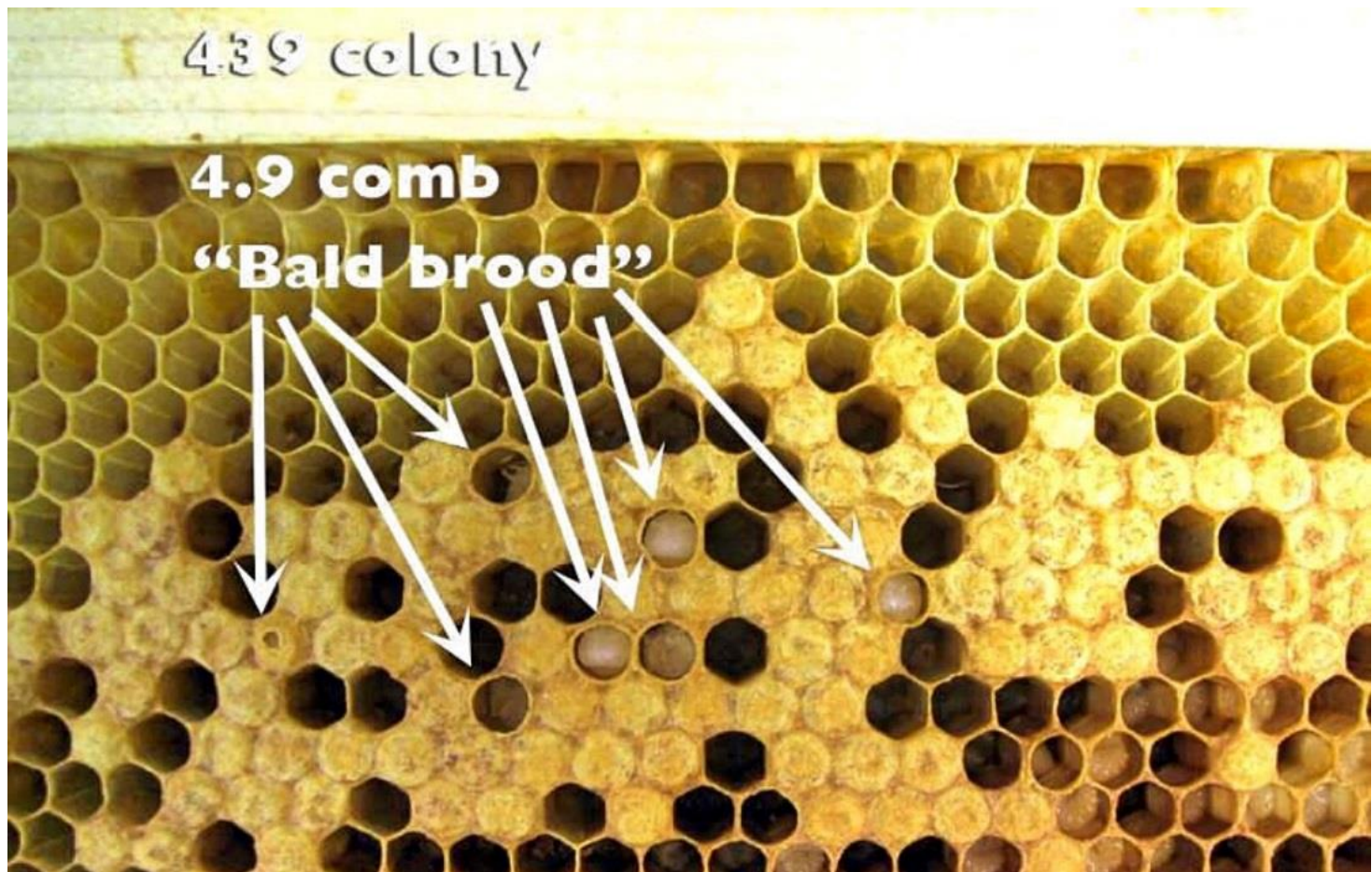
CONTROL OF VARROA (CONT.)

Limit hive's exposure to shade

Break the brood cycle



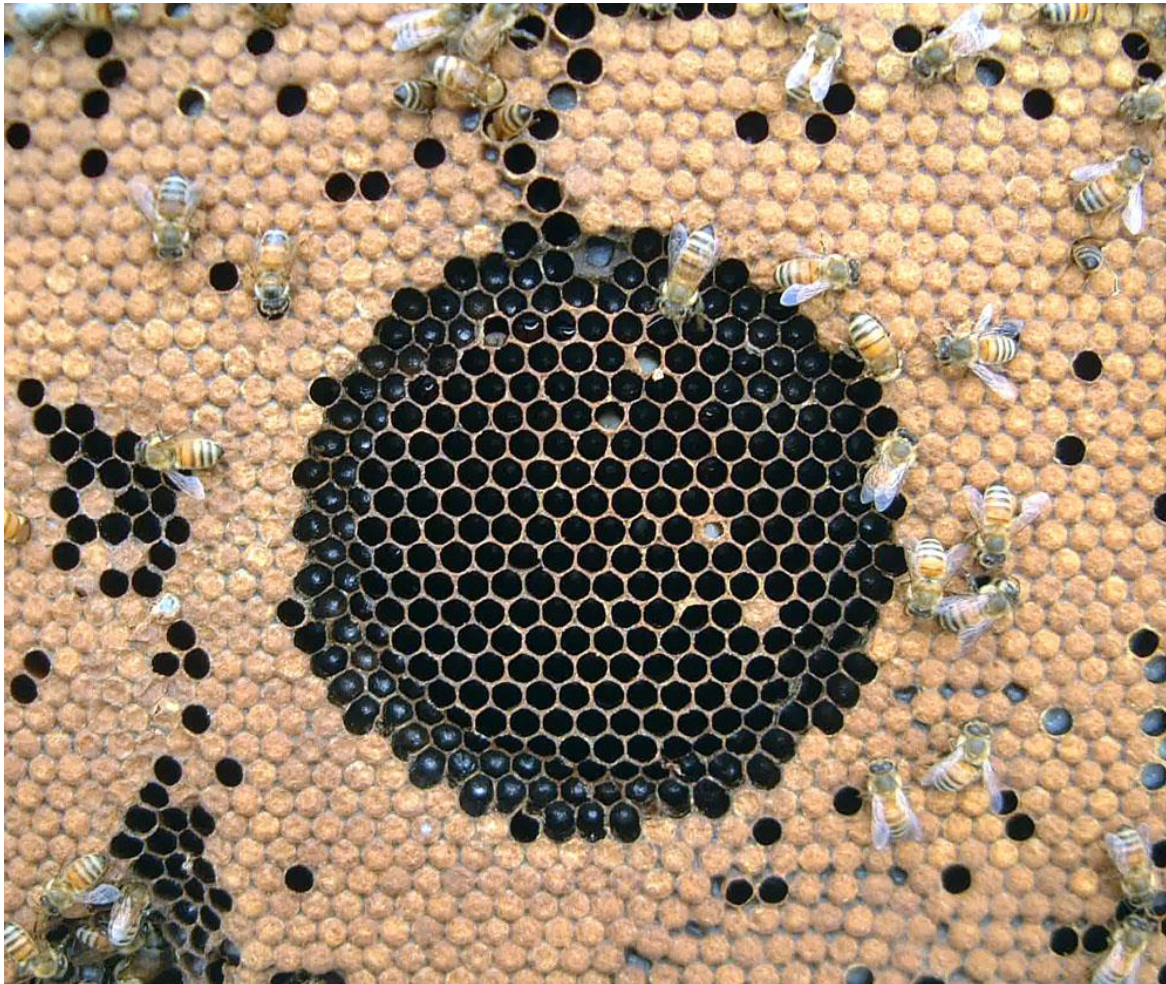
HYGIENIC BEHAVIOR



HYGIENIC BEHAVIOR



TESTING HYGIENIC BEHAVIOR

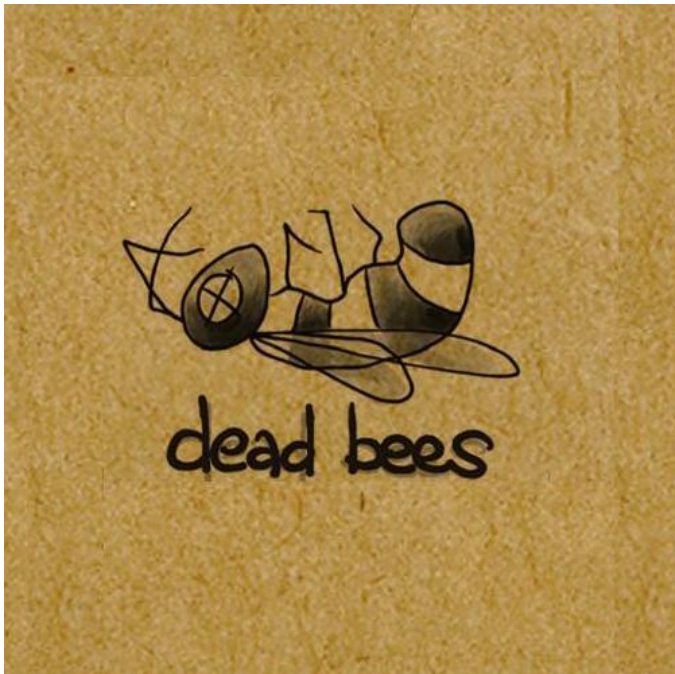


TESTING HYGIENIC BEHAVIOR



CONTROL OF VARROA (CONT.)

“Live and let die”—do nothing; NOT = natural beekeeping



VARROA MITE CONTROL

This is one area of hive pest management where IPM pays off BIG-TIME!

IPM example for this:

Drone comb + break in brood cycle + limiting shade
on hive + effective control of other nearby hives =
fewer varroa problems, possibly without chemicals

CONTROL OF VARROA (CONT.)

Be VERY cautious about
homemade recipes!!

(Better yet: don't use them)



© 2011 by Bohnenhase

VARROA MITE CONTROL

www.honeybeehealthcoalition.org

Fogging? (Using food-grade mineral oil in insect fogger)

Shop towels? (Using variable recipes, usually includes thymol +/- other ingredients in vegetable/mineral oil)



VARROA MITE CONTROL

FAILURE TO ADDRESS VARROA MITES:



VARROA MITE CONTROL

Api Life VAR

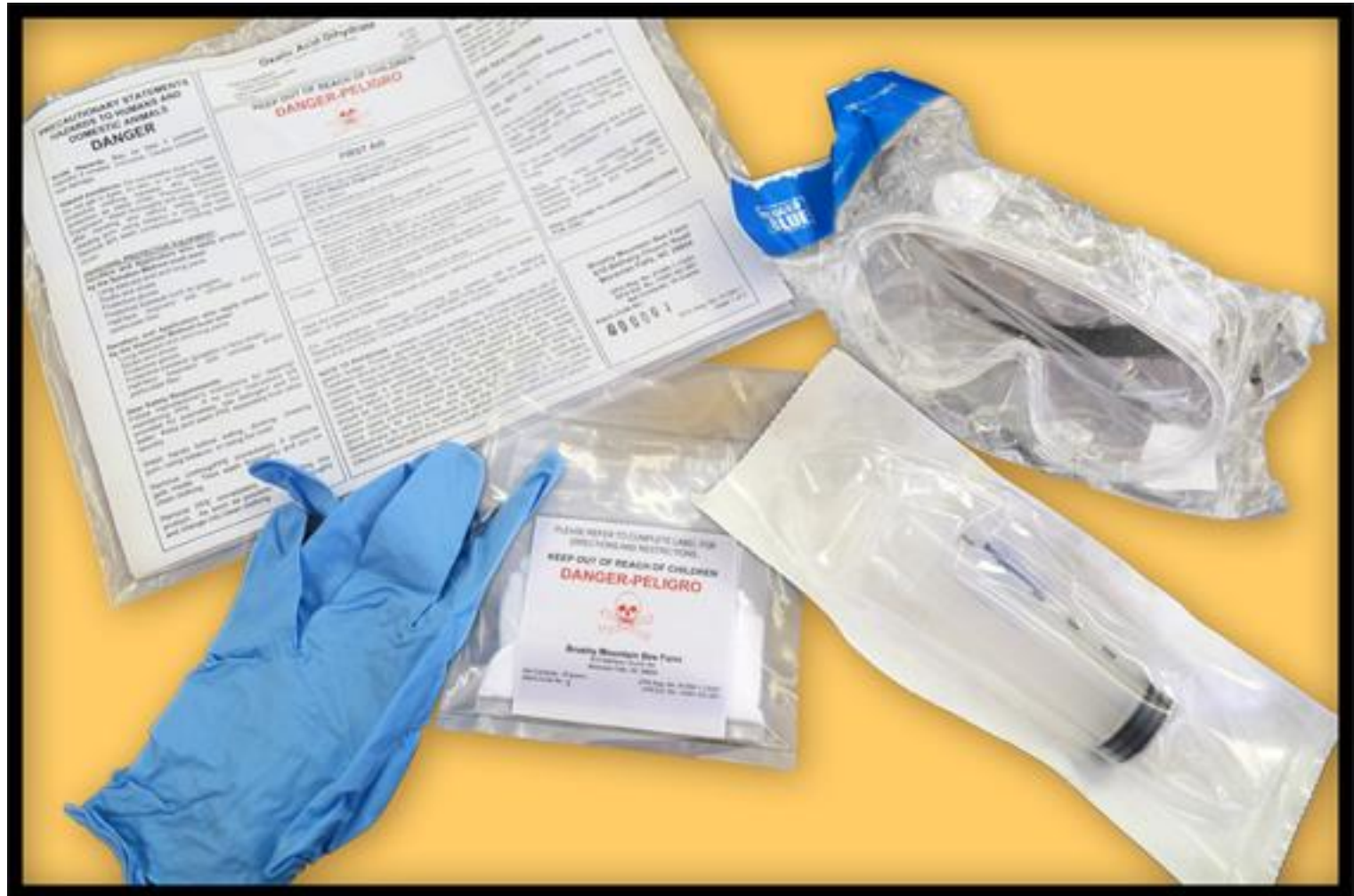


Apivar

VARROA MITE CONTROL



VARROA MITE CONTROL



**PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND
DOMESTIC ANIMALS
DANGER**

Acute Hazards: May be fatal if swallowed. Harmful if inhaled. Corrosive. Causes irreversible eye damage.

Hazard avoidance: Do not breathe dust or fumes. Do not get in eyes, on skin, or on clothing. Wear protective clothing, eyewear, and respiratory protection as listed under "Personal Protective Equipment." Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse.

PERSONAL PROTECTIVE EQUIPMENT:

Handlers and Applicators who apply product by the Solution Method must wear:

- Long-sleeved shirt and long pants
- Socks and shoes
- Protective gloves
- Protective eyewear such as goggles
- Half-face respirator with cartridge and/or particulate filter

Handlers and Applicators who apply product by the Vaporizer Method must wear:

- Long-sleeved shirt and long pants
- Socks and shoes
- Protective gloves
- Protective eyewear (goggles or face shield)
- Half-face respirator with cartridge and/or particulate filter

User Safety Requirements:

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions are provided for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.

Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

Remove PPE immediately after handling this product. As soon as possible, wash thoroughly and change into clean clothing.

Oxalic Acid Dihydrate

For Varroa mite control on bees

Active Ingredient: Oxalic Acid Dihydrate..... 97.0%
Inert Ingredients: 3.0%
TOTAL..... 100.0%

KEEP OUT OF REACH OF CHILDREN

DANGER-PELIGRO



FIRST AID

If swallowed	-Call a poison control center or doctor immediately for treatment advice. -Have person sip a glass of water if able to swallow. - DO NOT INDUCE VOMITING unless told to by the poison control center or doctor. -Do not give anything to an unconscious person.
If on skin or clothing	-Take off contaminated clothing. -Rinse skin immediately with plenty of water for 15-20 minutes. - Call a poison control center or doctor for advice.
If inhaled	-Move person to fresh air. -If person is not breathing, call 911 or an ambulance, then give artificial respiration, if possible. DO NOT use mouth-to-mouth method if victim ingested or inhaled the substance, use respiratory medical device. -Call a poison control center or doctor for advice.
If in eyes	-Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. -Call a poison control center or doctor for advice.

Have the product container or label with you when calling a poison control center, doctor, or going for treatment.

For non-emergency information concerning this product, call the National Pesticides Information Center (NPIC) at 1-800-858-7378 seven days a week, 6:30 am to 4:30 pm Pacific Time (NPIC Website: www.npic.orst.edu).

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage. Provide general supportive measures and treat symptomatically. Treatment should be rapidly instituted by giving a dilute solution of calcium lactate, limewater, finely pulverized chalk, plaster, and/or milk to supply large amounts of calcium to inactivate oxalate by forming an insoluble calcium salt in the stomach. Gastric lavage is controversial, since this may compound an already severe corrosive lesion in the esophagus or stomach. However, if used, gastric lavage should be done with limewater (calcium hydroxide). Intravenous gluconate or calcium chloride solutions should be given to prevent hypocalcemic tetany; in severe cases parathyroid extract also has been given. Additionally, acute renal failure should be anticipated, and careful fluid management is necessary. Metabolically its toxicity is believed to be due to the capacity of oxalic acid to immobilize calcium and thus upset the calcium-potassium ratio in critical tissues. Effective therapy against burns from oxalic acid involves replacement of calcium.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

READ THIS LABEL: Read the entire label. This product must be used strictly in accordance with this label's precautionary statements and use directions, as well as with all applicable State and Federal laws and regulations.

USE RESTRICTIONS:

Oxalic Acid Dihydrate applications are for outdoor use only.

DO NOT use in enclosed overwintering areas.

Use only in late fall or early spring when little or no brood is present. Oxalic Acid Dihydrate might damage bee brood. Oxalic Acid Dihydrate will not control Varroa mites in capped brood.

Do not use when honey supers are in place to prevent contamination of marketable honey.

Apply only when monitoring indicates treatment is required. Consult state guidelines and local extension experts for monitoring protocols and thresholds for treatment.

(See next page for additional DIRECTIONS FOR USE)

**Brushy Mountain Bee Farm
610 Bethany Church Road
Moravian Falls, NC 28654**

EPA Reg. No. 91266-1-73291

EPA Est. No. 73291-NC-001

Net Contents: _____

Batch Code No.: _____

EPA Reg. No. 91266-1

page 1 of 2

DIRECTIONS FOR USE, continued

APPLICATION DIRECTIONS:

Oxalic acid is used to treat colonies during low brood periods, packages, or swarms. This product can also be used as a "clean up" Varroa treatment following the application of a different acaricide where Varroa infestations continue to be problematic.

SOLUTION METHOD:

NOTE: To completely dissolve Oxalic Acid Dihydrate, use warm syrup.

Dissolve 35 g of Oxalic Acid Dihydrate in 1 liter of 1:1 sugar: water (weight:volume). Smoke bees down from the top bars. With a syringe or an applicator, trickle 5 ml of this solution directly onto the bees in each occupied bee space in each brood box. The maximum dose is 50 ml per colony whether bees are in nucs, single, or multiple brood chambers. Under certain unfavorable conditions (e.g., weak colonies, unfavorable overwintering conditions), this application methods may cause some bee mortality or overwintering bee loss.

VAPORIZER METHOD:

Apply only to outdoor colonies with a restricted lower hive entrance. Seal all upper hive entrances and cracks with tape to avoid escape of Oxalic Acid vapor. Smoke bees up from the bottom board. Place 1.0 g Oxalic Acid Dihydrate powder into vaporizer. Follow the vaporizer manufacturer's directions for use. Insert the vaporizer apparatus through the bottom entrance. Apply heat until all Oxalic Acid has sublimated.

SPRAYING PACKAGE BEES

Ensure bees are clustered before applying oxalic acid (for example store in cool dark location 24 hours before application).

Spray broodless package bees with a 1:1 sugar:water solution at least 2 hours before spraying with oxalic acid. This allows bees to fill honey stomachs with sugar water reducing ingestion of oxalic acid.

Mix a 2.8% oxalic acid solution by dissolving 35 g of Oxalic Acid Dihydrate in 1 liter of 1:1 sugar: water (weight:volume). Evenly apply 3.0 mL of 2.8% oxalic acid solution per 1,000 bees using a pump sprayer or battery powered sprayer (for example, a typical 2 lb package contains approximately 7,000 bees which requires 21 mL of solution). Apply solution evenly on both sides of the package.

Store bees in a cool darkened room for 72 hours before hiving.

RESISTANCE MANAGEMENT: Oxalic acid's mechanism of action is unknown at this time. Any Varroa mite population has the potential to become resistant to acaricides. Resistance development is affected by both the frequency of application and rate/dose of application. Continued reliance on a single class of miticide or single miticide with the same mode of action will select for resistant individuals which may dominate the mite population in subsequent generations. In order to prevent resistance development and to maintain the usefulness of individual insecticides it is important to adopt appropriate resistant management strategies.

To delay resistance:

- When possible, rotate the use of miticides to reduce selection pressure as compared to repeatedly using the same product, mode of action or chemical class. If multiple applications are required, use a different mode of action each time before returning to a previously-used one.
- Base miticide use on Integrated Pest Management (IPM). This includes proper pest identification, monitoring for locality specific economic threshold and economic injury levels, record keeping, and utilizing all available control practices (cultural, biological and chemical).
- Maximize efficacy by following all label instructions including dosage and timing of application.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

PESTICIDE STORAGE: Store only in original container, in a dry place inaccessible to children, pets, and domestic animals.

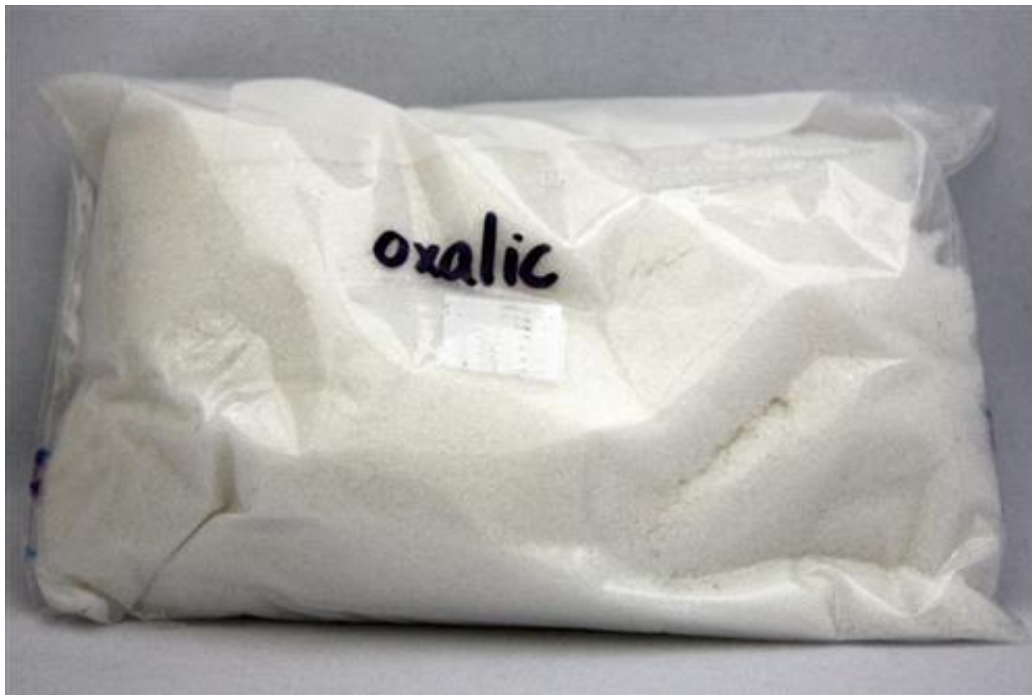
PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER HANDLING: Nonrefillable container. Do not reuse or refill this container.

PLASTIC CONTAINER DISPOSAL: Triple rinse container (or equivalent) promptly after use. Offer for recycling, if available. Otherwise, puncture and dispose of in a sanitary landfill, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

VARROA MITE CONTROL

Make sure your choice has directions for beehive use



VARROA MITE CONTROL

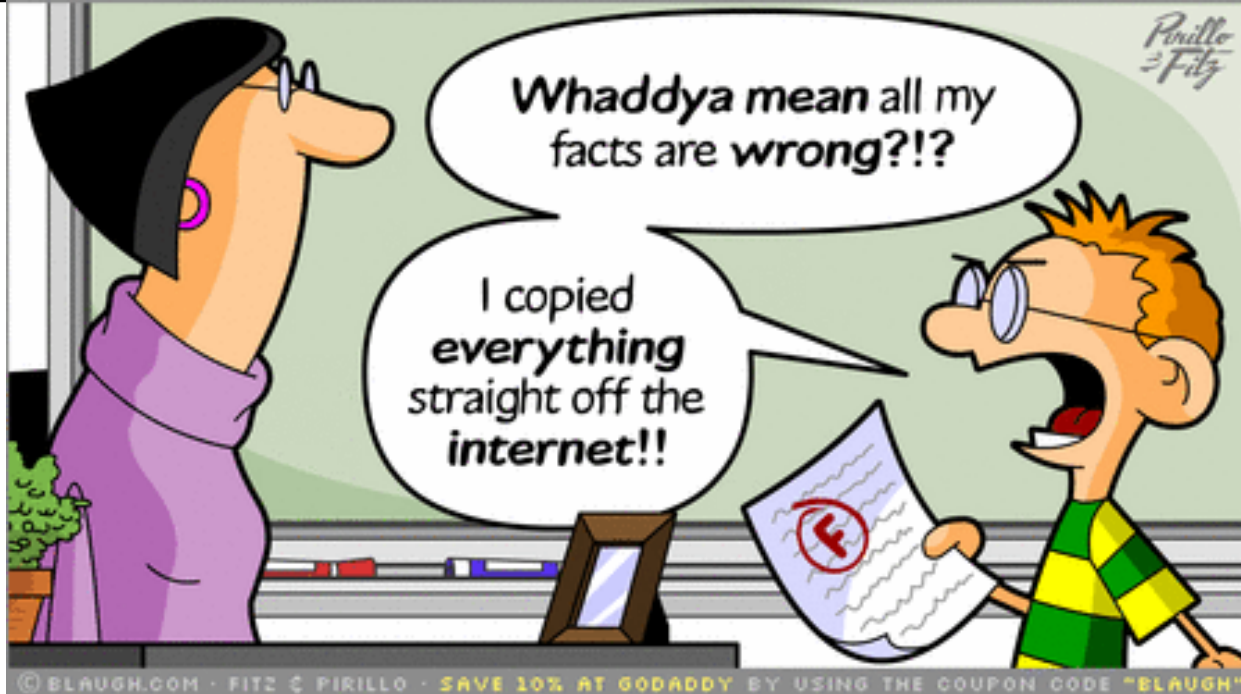


VARROA MITE CONTROL



VARROA MITE CONTROL

**BEST RESULTS ARE ACHIEVED WHEN PROVEN
METHODS ARE USED—NOT SOME HOMEMADE
WITCHES' BREW!**



OTHER HIVE PESTS

Hornets, yellow jackets

Wax moths (always a secondary problem)

Bears

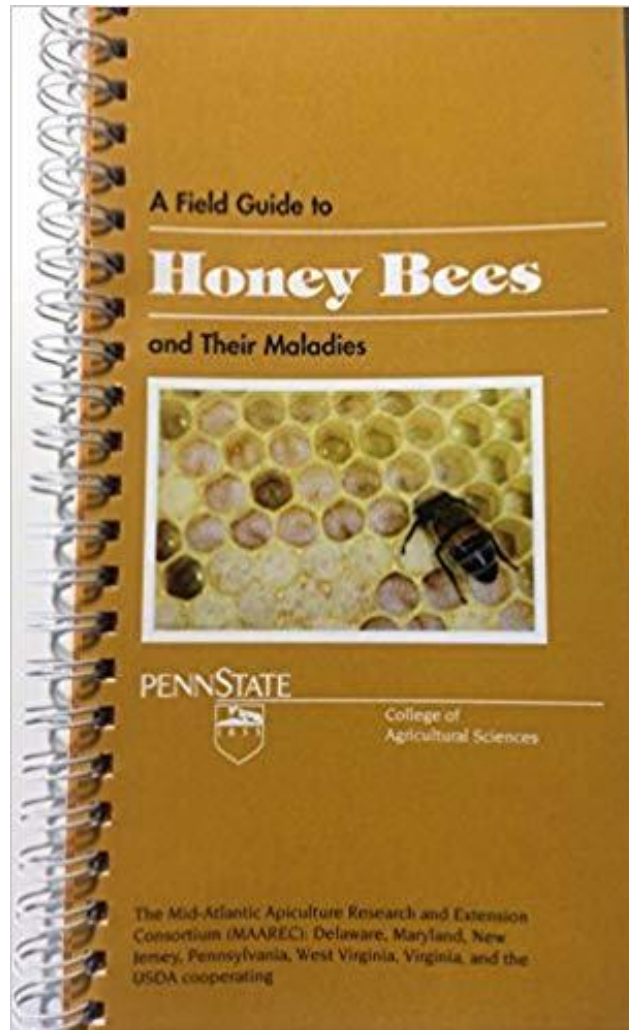
Skunks

Tracheal mites

Nosema (not as significant a problem for most beekeepers as many think)

These pests are well-covered in the *Field guide to honey bees and their maladies* reference (Penn. St. Univ.)

PEST/PARASITE MANAGEMENT: A FIELD GUIDE TO HONEY BEES...



RESOURCES

A field guide to honey bees and their maladies. University Park, PA: Penn State University, 2011. (Can be downloaded for **free** at

<http://pubs.cas.psu.edu/FreePubs/PDFs/AGRS116.pdf>)

www.ipm.ucdavis.edu Includes a printable page called “What is IPM?”

[HBHC-Guide Varroa-Interactive-PDF.pdf](#) Current guide, updated, developed by experts, free download

www.scientificbeekeeping.com Good general info

McFawn, D. (2018) Southeast U.S. *varroa* treatment decisions. *Bee culture* 146(1), 88-89.

CASE STUDIES/APPLICATION

Joe: 2nd year with bees. Works full-time, new dad.

Started first two hives Spring 2018 with packages.

Put hives under oak trees in back yard—has small lot, and old-timer beekeeper suggested that bees needed shade to keep from overheating.

Fed bees well for 3 weeks after installing packages, then bees found plenty of local nectar/pollen.

Bees seemed to do well through spring and summer, filling two hive bodies and making two supers of honey.

CASE STUDIES: JOE (CONT.)

Assessments: June → both busy, looked great.

August → one still very busy, other not so much, per front entrance view. Opened hives, found this:

Busiest hive → still looked good, no mites seen on bodies of bees. Saw about 12 black bugs, not sure what they were. (See pics next slide.)

Not-so-busy hive → bees had left the hive, and “maggots” had taken over. (See pics next slide.)

PICS FROM JOE'S HIVES



CASE STUDY: JOE (CONT.)

What's going on, and what factors might be present?

Small hive beetles in both hives, badly infesting one.

Bees often leave hive when overrun by beetle larvae.

- What can Joe do now?

Vigilant (weekly) monitoring and SMASHING

beetles in still-existing hive.

Try to find less shady location for this hive.

Freeze or burn affected frames from decimated hive.

- What about varroa mites? (How did Joe assess this?)

CASE STUDY: KAREN

First-year beekeeper. Works PT, 2 toddlers at home.

Husband supportive but works FT and “don’t wanna be near all those stinging insects.”

Started two hives Spring 2018: one nuc, one package.

Placed hives in sunny spot near garden in her yard.

Fed both hives intermittently for first 3 weeks.

Noticed in late May that nuc was doing well, but package struggling. (What are possible reasons for this?)

- What might Karen do to help package bees?

CASE STUDY: KAREN

Both hives busy by early August, seemingly healthy.

Karen looked very closely at the bees on the frames, and noticed “only” one or two bees in each hive with a visible mite on the body of those bees.

Wanting to manage her hives as “naturally” as possible, she decided not to intervene any further regarding varroa mites. She said that the few mites that she saw implied no significant problem, and she had also read on the internet (SOAT*) that varroa don’t need treatment during the hive’s first year.

*SOAT=Source of All Truth

CASE STUDY: KAREN (CONT.)

On examining the hives in late August, this is part of what Karen saw:



CASE STUDY: KAREN (CONT.)

Karen decided to further assess, via sticky board:



CASE STUDY: KAREN (CONT.)

What, if anything, does Karen need to do now? (Hint: she wants her bees to survive the winter.)

By all indications, she has a serious varroa infestation and needs to take aggressive measures to keep her bees alive. Bees infested with varroa mites in the late summer or fall almost never survive the winter without intervention! Also, if intervention is delayed for too long, even the correct action might not save the hive.



QUESTIONS?



THANK
YOU