MANAGING MALADIES: PARASITES, PESTS & PESTICIDES

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Today's Objectives:

- Briefly explain the Virginia Apiary Inspection program
- Go over the main insects and mites that might harm your bees
- Discuss animals that can potentially harm your hive(s) and their contents
- Make you aware of the hazards of pesticides to your investment in bees

Apiary Inspection Pr

- Inspector's duties:
- Examine bees for disease, etc.
- Prohibit movement or sale of diseased hives
- Destroy hives when necessary

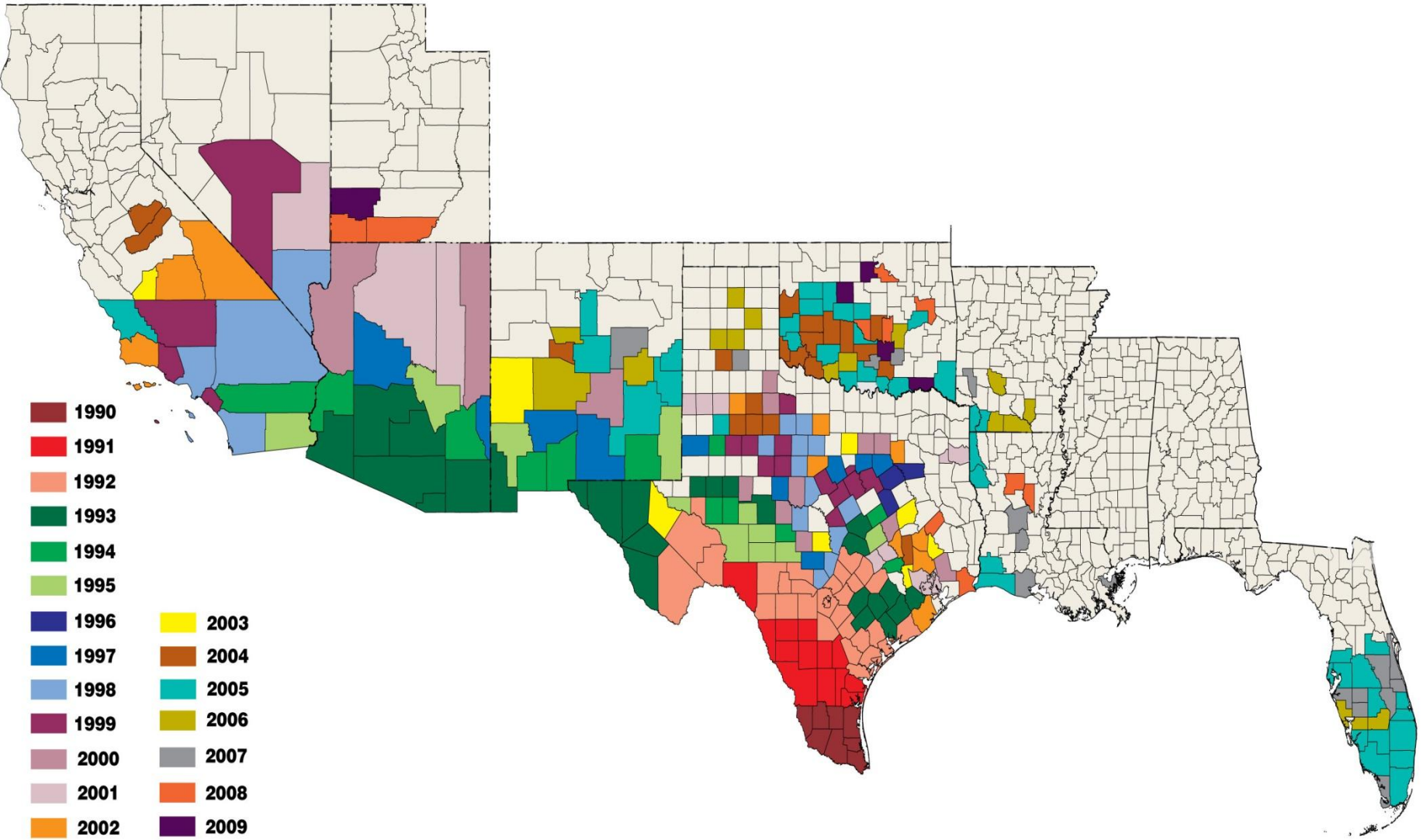
Apiary Inspection Program

- Beekeepers role:
- Provide movable frames
- Tightly close dead hives
- Notify State Apiarist of diseased bees
- Notify State Apiarist of possible Africanized Honeybee

Spread of Africanized honey bees by year, by county

Updated July 2009

First found in southern Texas in 1990, Africanized honey bees are now found in much of the South.



Apiary Inspection Program: Regulations

- No honey in candy for queen cages
- Queen rearing and queen mating apiary inspection
- Inspection certificate for packages
- Inspection prior to bringing hives into Commonwealth
- Certificate for sale of comb, hives, used equipment with comb or appliances

Parasites: Varroa Mite

- *Varroa destructor* Anderson & Trueman
- External parasite of adults…

Parasites: *Varroa* Mite

- …and immatures

Parasites: *Varroa* Mite

Parasites: *Varroa* Mite - Biology

- Female mites crawl into brood cells (especially drone cells) before they are capped
- Feed on bee food first, then on the prepupa
- Lay the first eggs about 60 hours after cell capping, subsequent eggs are laid at 30 hour intervals
- Lay about 4 to 6 eggs total

Parasites: *Varroa* Mite - Biology

- Immature mites develop on the pupal bee, requiring 6-7 days to complete development
- Once sexually mature, males mate with females and die

Parasites: *Varroa* Mite - Biology

- Emerging bees carry female mites.

Parasites: *Varroa* Mite - Biology

- Mites move to other bees from close contact with each other

Parasites: *Varroa* Mite

Mite feeding on bees cause damage and spreads viral diseases

Viruses Transmitted by *Varroa* Mite

- **Acute Bee Paralysis** – kills larvae, pupae, and adults with VM
- **Black Queen Cell Virus** – affects queen pupae
- **Bee Virus X** – reduces life span of bees
- **Bee Virus Y** – associated with *Nosema*
- **Chronic Bee Paralysis** – infected bees tremble, listless crawlers, often hairless, black with greasy

Viruses Transmitted by *Varroa* Mite

- **Cloudy Wing Virus –** wings become opaque
- **Deformed Wing Virus –** deformed wings and shortened life span
- **Kashmir Bee Virus –** harmful if associated with other pathogens
- **Kakugo Virus –** affects brain, increases aggression

Viruses Transmitted by *Varroa* Mite

- **Sac Brood Virus** – sacbrood
- **Slow Bee Paralysis** – kills bee after approximately 12 days, fore leg paralysis
- **Israel Acute Paralysis Virus** – associated with Colony Collapse Disorder

Sampling for *Varroa* Mite:

- Shaking and/or washing method
  - ether/alcohol roll method - kills your bees
  - powdered sugar roll – spares your bees

Sampling for *Varroa* Mite: Drones

Remove drone larvae or pupae from cells with cappings scratcher

Take action if 10% or more of drone brood infested

Sampling for *Varroa* Mite: Sticky Boards

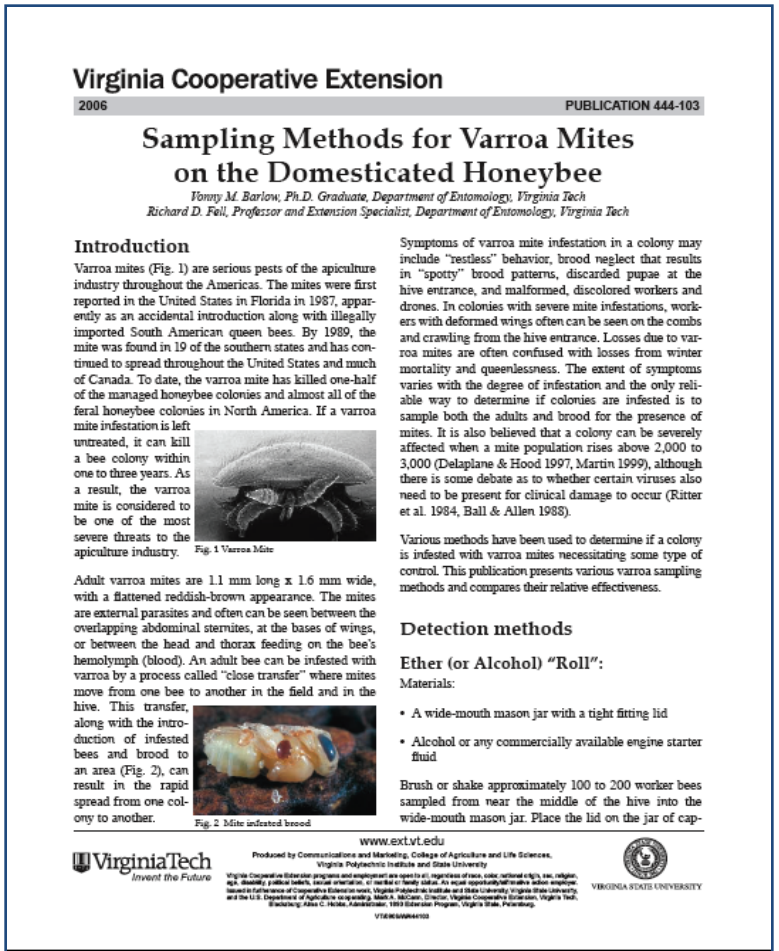
Sampling for *Varroa* Mite: Sticky Boards

- Use natural mite fall
- Can purchase sticky boards or make your own with white cardboard and petroleum jelly or spray cooking oil
- Economic threshold: 50-60 mites/day for Virginia


IPM Varroa Monitoring Board
Dewill Varroa M
DEWILL INC.

For further help in sampling for *Varroa* mites

- **http://pubs.ext.vt.edu/444/444-103/444-103.html**



Virginia Cooperative Extension

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Sampling Methods for Varroa Mites on the Domesticated Honeybee

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Introduction

Varroa mites (Fig. 1) are serious pests of the apiculture industry throughout the Americas. The mites were first reported in the United States in Florida in 1987, apparently as an accidental introduction along with illegally imported South American queen bees. By 1989, the mite was found in 19 of the southern states and has continued to spread throughout the United States and much of Canada. To date, the varroa mite has killed one-half of the managed honeybee colonies and almost all of the feral honeybee colonies in North America. If a varroa mite infestation is left untreated, it can kill a bee colony within one to three years. As a result, the varroa mite is considered to be one of the most severe threats to the apiculture industry.

Fig. 1 Varroa Mite

Adult varroa mites are 1.1 mm long x 1.6 mm wide, with a flattened reddish-brown appearance. The mites are external parasites and often can be seen between the overlapping abdominal sternites, at the bases of wings, or between the head and thorax feeding on the bee's hemolymph (blood). An adult bee can be infested with varroa by a process called "close transfer" where mites move from one bee to another in the field and in the hive. This transfer, along with the introduction of infested bees and brood to an area (Fig. 2), can result in the rapid spread from one colony to another.

Fig. 2 Mite infested brood

Symptoms of varroa mite infestation in a colony may include "restless" behavior, brood neglect that results in "spotty" brood patterns, discarded pupae at the hive entrance, and malformed, discolored workers and drones. In colonies with severe mite infestations, workers with deformed wings often can be seen on the combs and crawling from the hive entrance. Losses due to varroa mites are often confused with losses from winter mortality and queenlessness. The extent of symptoms varies with the degree of infestation and the only reliable way to determine if colonies are infested is to sample both the adults and brood for the presence of mites. It is also believed that a colony can be severely affected when a mite population rises above 2,000 to 3,000 (Delaplane & Hood 1997, Martin 1999), although there is some debate as to whether certain viruses also need to be present for clinical damage to occur (Ritter et al. 1984, Ball & Allen 1988).

Various methods have been used to determine if a colony is infested with varroa mites necessitating some type of control. This publication presents various varroa sampling methods and compares their relative effectiveness.

Detection methods

Ether (or Alcohol) "Roll":

Materials:

- A wide-mouth mason jar with a tight fitting lid
- Alcohol or any commercially available engine starter fluid

Brush or shake approximately 100 to 200 worker bees sampled from near the middle of the hive into the wide-mouth mason jar. Place the lid on the jar of cap-

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Produced by Communications and Marketing, College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University

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Integrated Pest Management (IPM) of *Varroa* Mite

Cultural

Physical or Mechanical

Biological

Chemical

Cultural Contol of *Varroa*

- Mite Reducing Queens
  - Russian Stock (ARS Primorsky stock)
  - Varroa-sensitive Hygienic

e.g. Minnesota Hygienics

Physical Control of *Varroa*

- Screen Bottom Boards
  - Sticky Paper insert optional
- Drone Brood Trapping
- Heat (104-110 F for 4 hrs)

Biological Control

- **Under Development**

- **Fungus looks promising**
- **Possibly a pseudoscorpion**

Biopesticide Control of *Varroa*

formic acid (Mite Away II)

- Pads placed on spacer sticks over top of frames of brood nest; spacer rim placed on hive body and cover placed on top. Holes and cracks must be sealed.
- Use one pad for 21 days with temperat between 50 to 79 F
- Cannot be used above 80 F
- Remove all honey supers before treatm and **not** during nectar flow.

Biopesticide Control of *Varroa*

Thymol (Apiguard)

Two packets per colony

Open tray and place on top of brood frames gel side up

Keep free space of ¼ inch between top of tray and cover board

Daytime temperature must be above 60 F but less than 105 F

Add second tray after two weeks

Do not use during honey flow

Works best in late Summer after honey harvest

Causes problems with brood rearing – bees don't like thymol.

Biopesticide Control of *Varroa*

Thymol + eucalyptus oil + menthol + camphor (Api-Life VAR)

- Break tablet into quarters, enclose in pieces of 8-mesh screen and place on the top corners of hive body
- Reapply two additional times (remove old pieces) at 7 to 10 day intervals.
- Leave last tablet on for 12 days then remove all material
- Remove honey supers 30 days before use and cannot be used within five months of honey harvest.
- Causes problems with brood rearing – bees don't like thymol
- Don't use when temperatures above 90 F or below 55 F

Biopesticide Control of *Varroa*

Sucrose octanoate (Sucrocide)

- Remove and spray frames (and bees) with rate of 1.5 oz. per frame.
- Spray three times at 7 to 10 day interva
- 75 to 91% effective, but will kill brood if it contacts them

Chemical Control of Varroa

fluvalinate (Apistan)

- two strips per hive body
- leave in hive six to eight weeks
- honey supers must be removed before treatment; allow two weeks before replacing
- DO NOT use within four weeks of honey flow
- resistance a problem

Chemical Control of Varroa

coumaphos (Checkmite +)

- Use one strip per five combs close to bee cluster
- Apply in Spring two months before putting on honey supers (allowing two weeks before adding supers) or in Fall after supers removed
- Leave strips in 42 to 45 days max.
- Effects bee reproductive abilities , especially if rearing queens or wanting drones

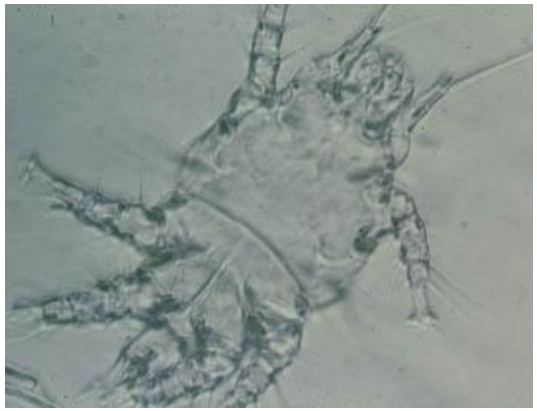
Chemical Control of *Varroa*

With any registered product for control, READ and FOLLOW the LABEL

It's the Law.

Parasites: Tracheal mites

- *Acarapis woodi* (Rennie)
- Infect the respiratory system of adult honey bees

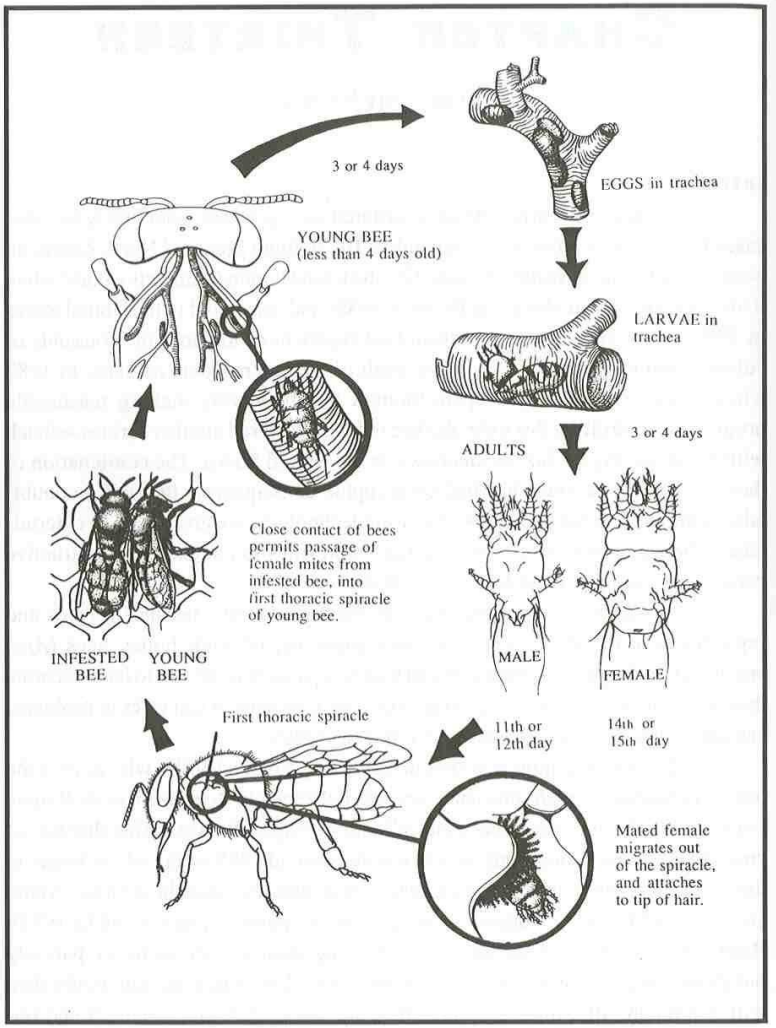


Tracheal Mite Biology

Mites infest the respiratory trachea or breathing tubes of the adult bee

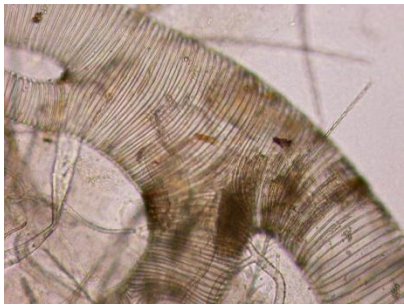
Mites are transferred by direct contact; female mites may move to a new host after mating.

Eggs are laid in the trachea and immature mites require approximately 2+ weeks to complete development.



Tracheal Mite Biology

- Mites feed by puncturing the walls of the trache and feeding on body fluids.
- Feeding activity may lead to discoloration of trachea (brown staining), which can be used for identification of mite presence after bee dissection.



- Mites infestation stresses the bees, feeding may lead to damage of flight muscles and the presence of “crawlers” and K-wing. Heavy infestations in winter lead to colony death.

Control of Tracheal Mite

- Mites numbers are highest in late winter and this is time when the mites are most destructive to the bees
- Preventative treatments are best in late summer (August or early September) when the colony is rearing ‘winter bees’
- Do we need to treat colonies for tracheal mites in Virginia? **Probably not!**

Treatment of Tracheal Mite

- Material: menthol (crystalline alcohol from oil of peppermint)

- Dosage: 50 grams (1.8 ounces)

- Treatment: Use plastic screen bag (7” x 7”)

Treatment of Tracheal Mite

- Effective on two or less deep hive bodies with entrance reducer and no honey supers
- Place menthol bag on top bars of frames (if daytime temperature over 80 F, place on bottom board)
- Treatment period is 15-20 days, treat in early Fall

Treatment of Tracheal Mite

Grease patties:

- 1 part vegetable shortening
- 2 parts granulated sugar

Place on top of frames

in early Spring and

again in Fall

Treatment of Tracheal Mite

- Formic acid (Mite-Away II pads) can be used for the control of tracheal mites
- Primarly used for *Varroa*
- Problem with delivery
  - If temperature over 80 F ***DO NOT USE***.

Parasitic Mite Syndrome

- Colony infested with both tracheal and *Varroa* mites

Spotty brood pattern and symptoms indicating disease, although no specific disease has been associated with PMS

Brood frame from a colony with PMS

Insect pests: Wax Moths

Great Wax Moth: *Galleria mellonella* (Linnaeus)

Lesser Wax Moth: *Achroia grisella* (Fabricius)

Greater wax moth

GWM eggs

Lesser wax moth

Wax Moth Caterpillar

Insect pests: Wax Moths

- Wax moth caterpillars are a serious pest of wax comb and cause over $5 million of damage every year in the U.S.A.

Insect pests: Wax Moths

- Greater wax moth much more common
- Moths lay 300 to 600 eggs on or near wax combs each day
- Caterpillars hatch three to five days later and tunnel through the wax combs, feeding on pollen, cast skins and cocoons, leaving webbing and frass behind
- Caterpillars move out of comb to pupate, taking four weeks to several months to become adults
- Adults emerge and mate away from hives

Insect pests: Wax Moths

- Wax moths do not kill colonies, primarily a pest of stored equipment and weak colonies
- Control: stored comb must be prote
  - ✓ Fumigation
    - paradichlorobenzene crystals
    - Aluminum phosphide fumigation
  - ✓ Non-chemical control
    - Exposure to freezing temperatures
    - Storing equipment in lighted areas

Insect Pests: Small Hive Beetle

- *Aethina tumida* Murray
- Small sap beetle introduced from Africa
- Both adults and larvae pests of honey bee colonies

Small Hive Beetle Life Cycle

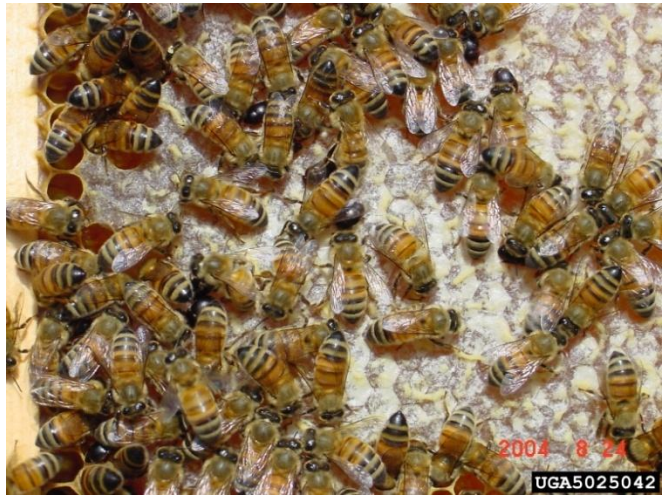
- Eggs - similar in appearance to honey bee eggs, but 2/3 as long, deposited in irregular masses in crevices or cavities, hatch in 2 to 3 days
- Larvae - white colored 'worms' that grow to 3/8 inch (10 mm). Larvae feed on pollen and honey damaging combs; larvae require 10 - 16 days to develop
- Pupae - larvae leave hive and burrow into soil to pupate; pupation requires 3 - 4 weeks
- Adult - reddish brown to black beetles depending on age; about 3/16 inch (5 mm) long. Live up to 6 months

Small Hive Beetle: Damage

- Larvae tunnel through comb with stored honey or pollen, damaging or destroying cappings and comb
- Larvae defecate in honey and the honey becomes discolored from the feces
- Activity of the larvae causes fermentation and a frothiness in the honey with a characteristic odor of decaying oranges

Small Hive Beetle: Damage

- Damage and fermentation cause honey to run out of combs, creating a mess in hives or extracting rooms
- Heavy infestations may cause bees to abscond; some beekeepers have reported the rapid collapse of even strong colonies



Small Hive Beetle: Control

- coumaphos (Checkmite +)
  - Coumaphos strips, placed in hive, will control both small hive beetles and *Varroa* mites
  - Can cut strip in half, staple to 4x4” corrugated cardboard square and place on bottom board.
- permethrin (Gardstar 40EC)
  - Treat soil 18 to 24 inches in front of hive, using sprinkler can, at 5 ml per gallon water for six hives (larvae crawl from hive and pupate in soil) once bees are inactive during the late evening. Reapply after 30 to 45 days
  - **Caution: permethrin is highly toxic to bees**

Insect pests: Bee Louse

- *Braula coeca*
- Wingless, ectoparasitic fly
- Workers usually with one, Queens with several
- Steal nectar directly from mouths of bees
- Lay eggs on cappings of honey storage cells, May through July

Insect pests: Bee Louse

- Upon hatching, larvae burrow into cappe cells, lengthening and broadening as they grow, feeding on wax and pollen
- Pupate inside tunnel, hatch out and craw onto bee
- Damage to colony is minimal, unless harvesting comb honey, because of appearance
- Rarely found in Virginia

Insect pests: Ants, Yellow Jackets, Hornets and Wasps

- Usually not serious pes
  of hives
- May indicate weak colonies
- Keep bottom boards raised off ground

Vertebrate pests: Mice

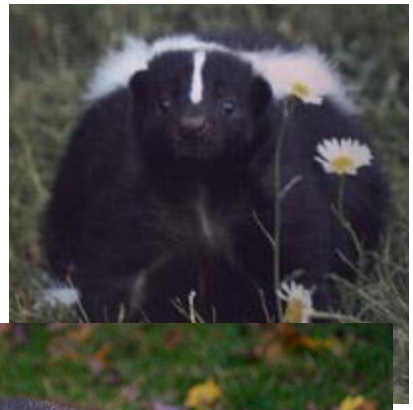
- Nest in hives and destroy combs
- Primarily a problem in Fall and Winter, with hives located near woodlots or fields
- Build nests in corners away from the bee cluster (they don't like to be stung)
- Bees won't clean out mouse urine, which they find repellant

Mouse Control

- Reduce the lower hive entrance in Fall
- Chase away mice already in hive
- Destroy nests
- Replace chewed frames so bees won't replace worker cells with drone cells
- Take care to exclude mice from stored frames and hives as well.

Vertebrate Pests: Skunks, Raccoons, and Opposums

- Feed at beehive entrances at night, when they are less likely to be stung
- Primarily a problem in Spring
- Scratch at entrance where they eat the defending bees
- Known to feed for an hour or more
- Cause bees to become more defensive



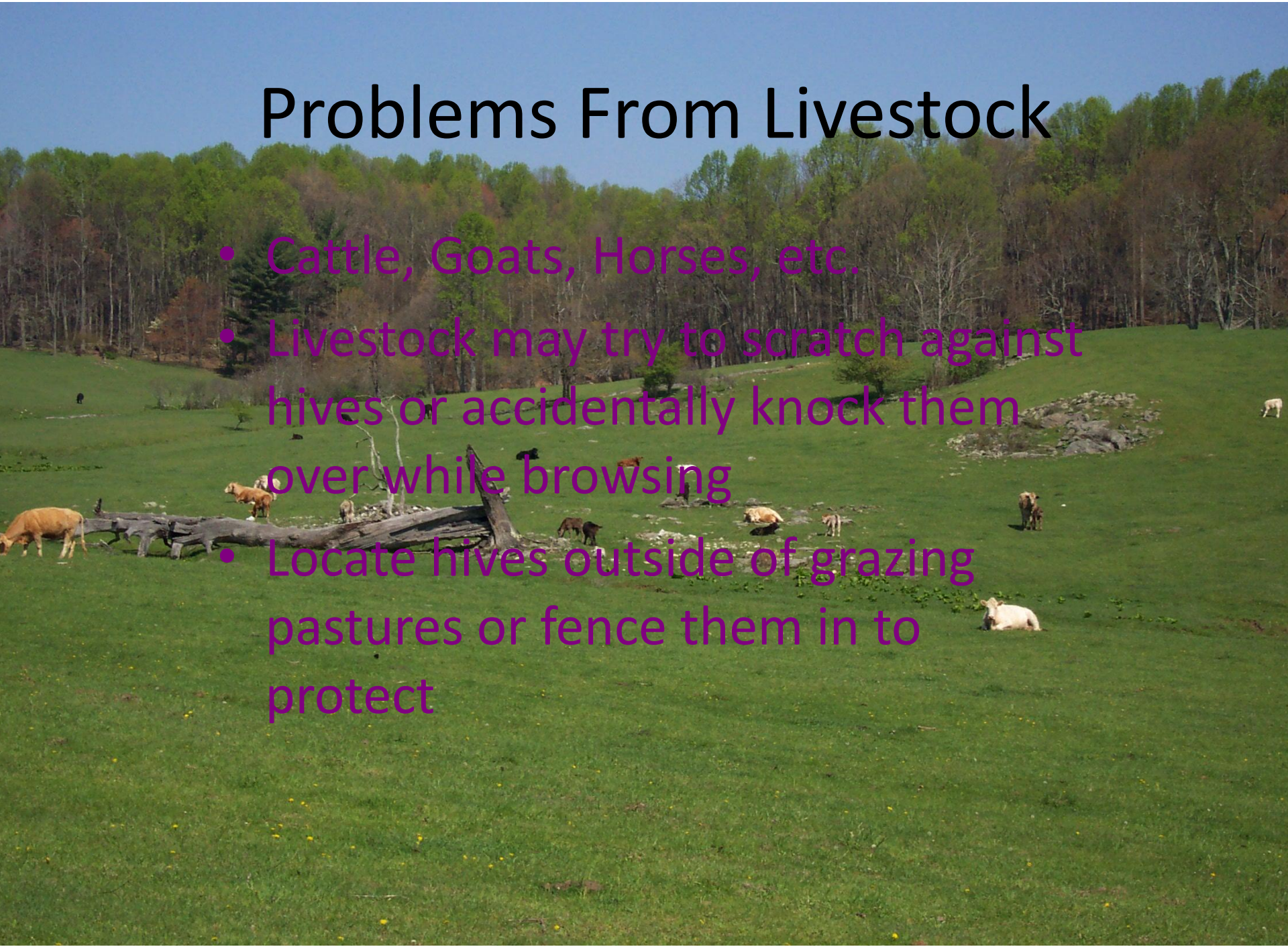
Vertebrate Pests: Skunks, Raccoons, and Opposums

- Look for animal scat and bee parts near hive
- Staple chicken wire to bottom board and stretch in front of hive to discourage
- Add an upper entrance
- Install a fence around bee yar
- Keep colonies on stands more than 18 inches high

Vertebrate Pests: Black Bears

- Bears eat bees, brood and honey
- Bears destroy hives and are hard to control
- Select apiary site to avoid home range of bears and away from trees
- Install baited, electric fence (at least 2,000 volts) around bee yard

Problems From Livestock



- Cattle, Goats, Horses, etc.
- Livestock may try to scratch against hives or accidentally knock them over while browsing
- Locate hives outside of grazing pastures or fence them in to protect

Miscellaneous Pests

- Insectivorous birds
- Toads, frogs, lizards and snakes
- Spiders
- Praying Mantis
- Dragonflies

Protecting Honey Bees from Pesticides

- More of a problem in intensive agricultural crop producing areas e.g. orchards, sweet corn
- Some pesticides are highly toxic to bees
- Field bees are most affected, but can bring back to hive
- Talk with your neighbors about the hazards of pesticides to your bees and ask them to spray after 4:00 P.M.

Thank You

- Dr. Richard Fell, Virginia Tech
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- www.insectimages.org
- Whomever I forgot.
- You

Questions?