Pests of Bees

Kimberly Schofield
Program Specialist-IPM
Texas AgriLife Extension
17360 Coit Road
Dallas, TX 75252
k-schofield@tamu.edu

Parasites of Bees

Varroa Mite

- Found in Texas in 1990s
- Occurs nearly worldwide- *Varroa jacobsoni* and *Varroa destructor*
- *Varroa jacobsoni*, originated in the far east Malaysia-Indonesia
- *Varroa destructor* more common- from Japan and Russia
- External parasite feeds on the hemolymph of adult bees, larvae and pupae

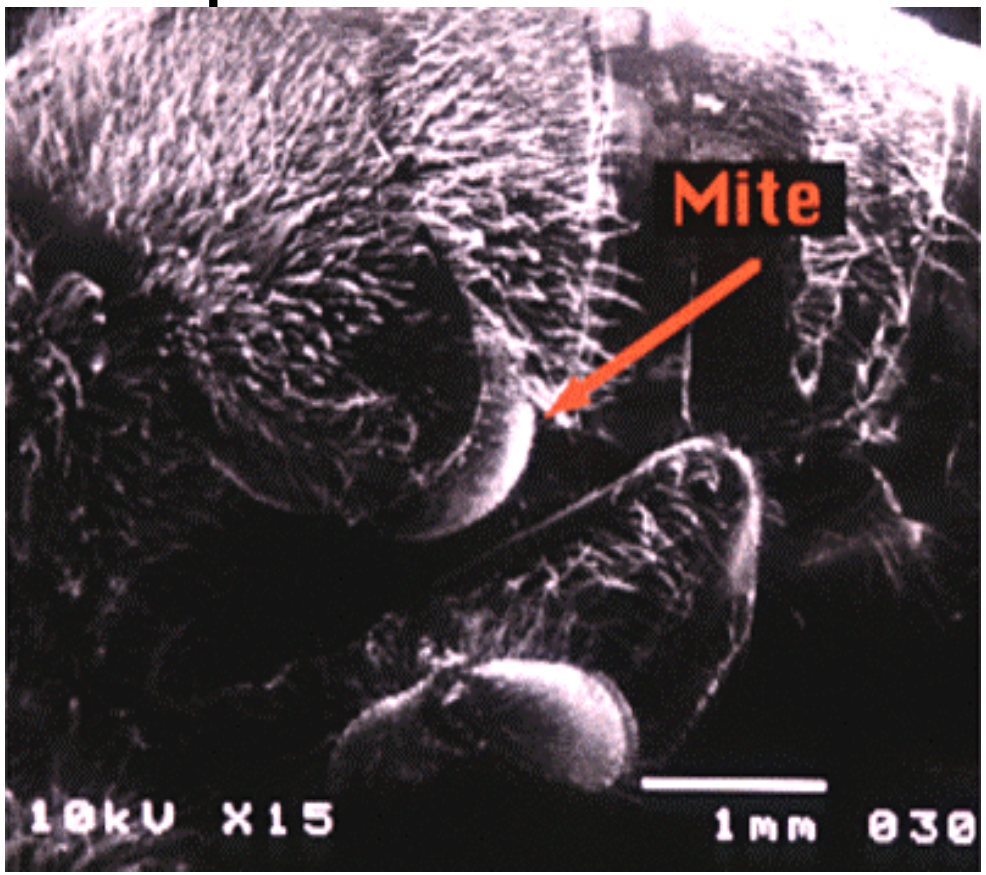
http://maarec.psu.edu/pest&disease/sl10.html

Varroa Mite

http://maarec.psu.edu/pest&disease/sl10.html

- Visible to the naked eye
- Female mite is brown to reddish brown in color
- 1.1 to 1.2 mm in length and 1.5 to 1.6 mm in width (size of a pin-head)
- Flattened shape makes it easy for mite to hold on to the bee
- Males are smaller, 0.7 mm by 0.7 mm and yellow-grayish white in color
- Adult males do not feed and found only in brood cells

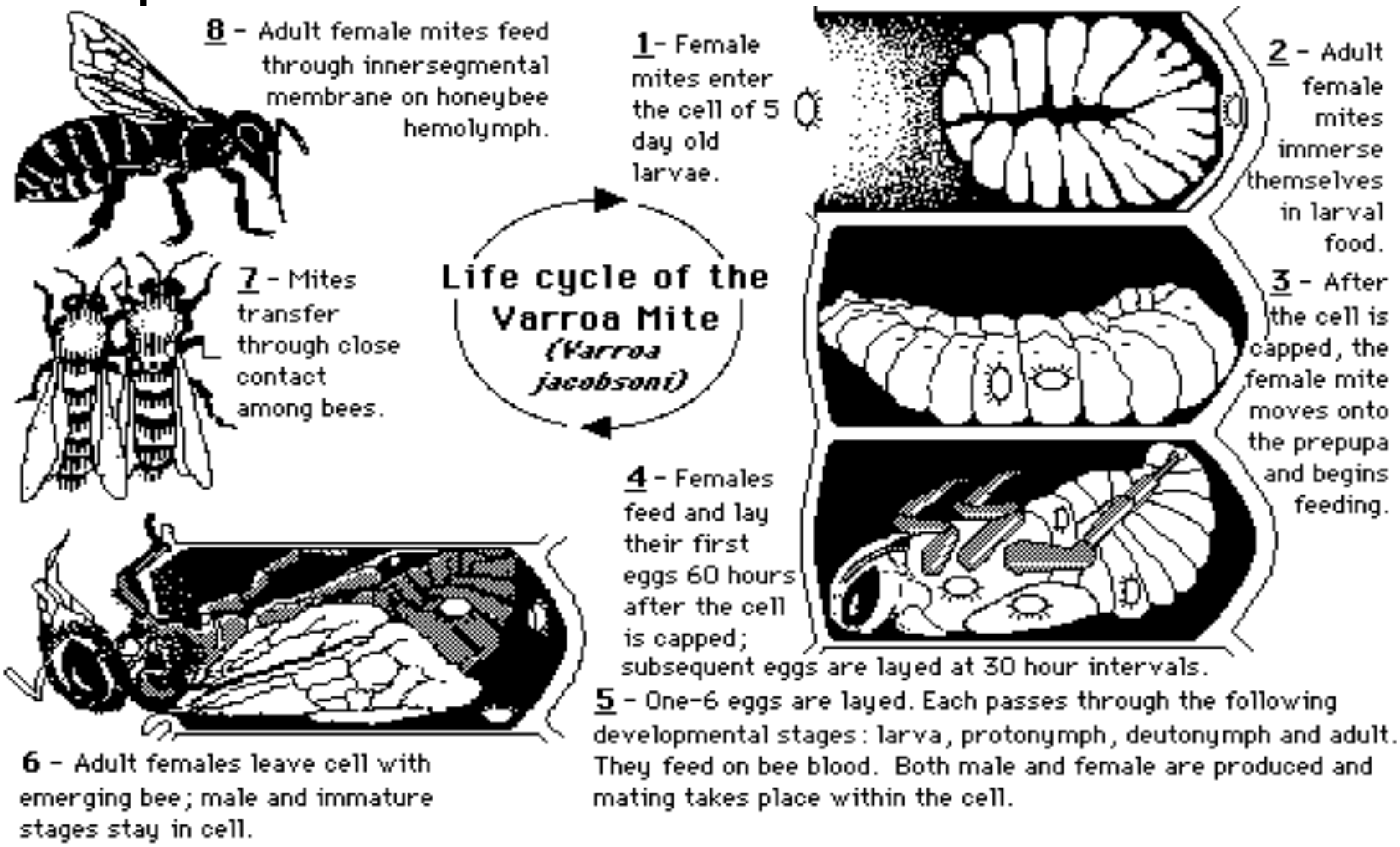
Varroa Mite



http://maarec.psu.edu/pest&disease/sl10.html

- Female mites found on young drone and worker adults
- Found between the head and thorax, between the thorax and abdomen or between overlapping segments of the abdomen
- Places where mites can easily penetrate the exoskeleton with piercing mouthparts- less likely to be removed by grooming

Lifecycle of Varroa Mite



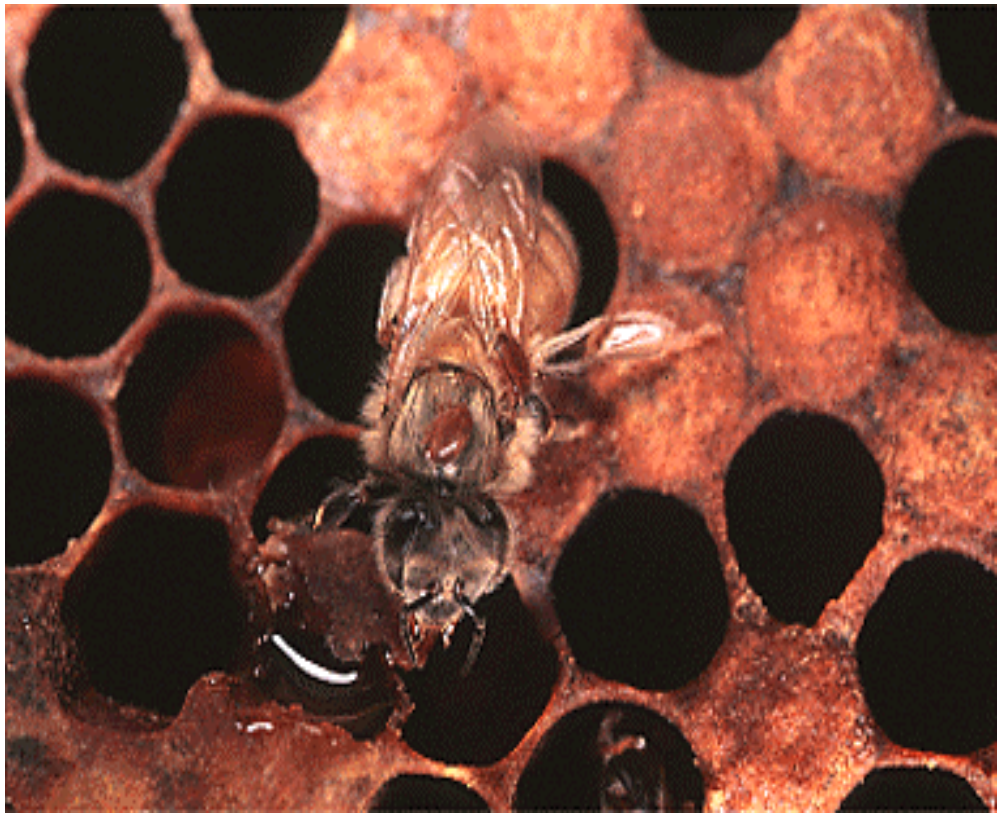
http://maarec.psu.edu/pest&disease/sl10.html

Varroa Mites

http://maarec.psu.edu/pest&disease/sl10.html

- The mite life cycle : egg, two eight-legged nymphal stages (protonymph and deutonymph), adult
- 6-7 days for the female
- 5-6 days for the male

Varroa Mite: Reproduction



http://maarec.psu.edu/pest&disease/sl10.html

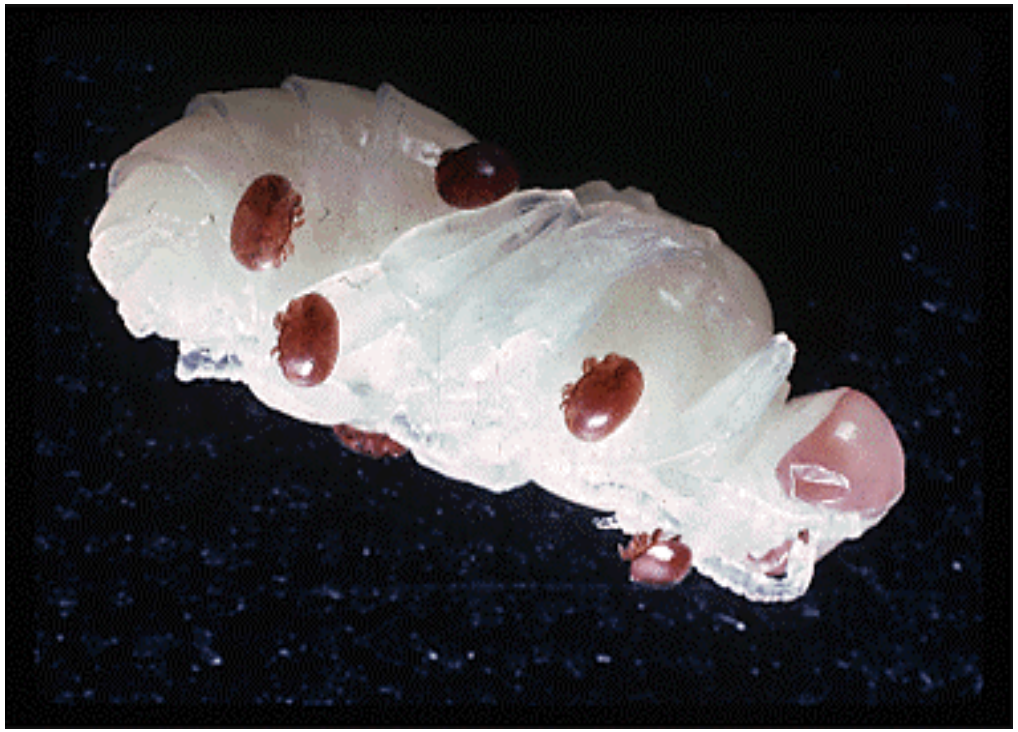
- Mating occurs in the brood cells
- Adult males die after copulation- their mouthparts are modified for sperm transfer rather than feeding
- The old female and newly fertilized female offspring remain in the brood cell until the young bee emerges
- The adult bee serves as an intermediate host and a means of transport for these female mites

Varroa Mites

- Bees with one or two mites usually are normal in appearance
- May suffer from malnutrition, blood loss or disease
- Individuals heavily infested with more than five mites become visibly crippled or die in their cells without emerging

http://maarec.psu.edu/pest&disease/sl10.html

Mites on Drones



http://maarec.psu.edu/pest&disease/sl10.html

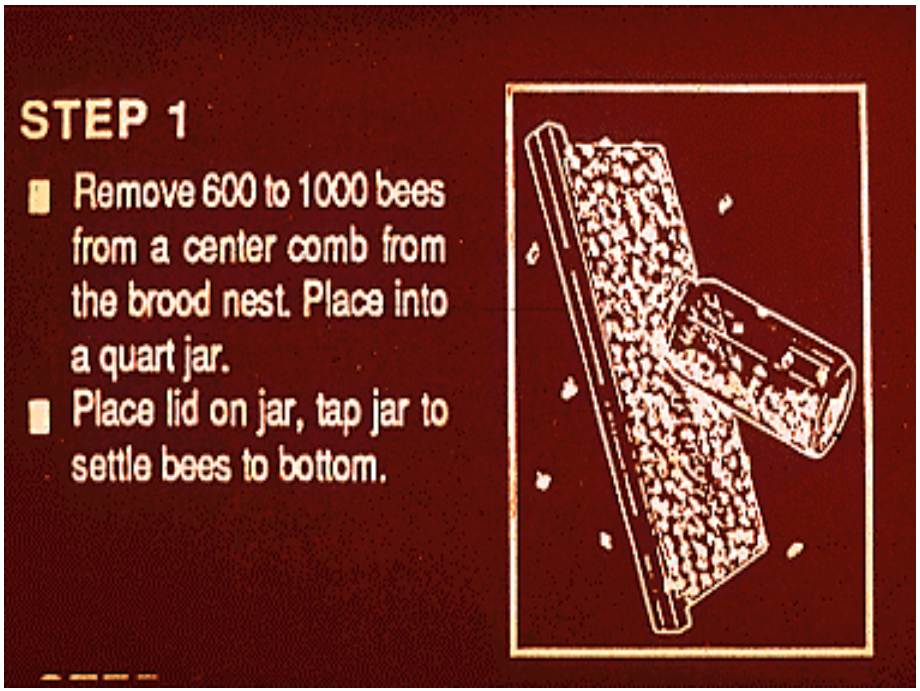
- Preference for drone brood
- Workers and especially queen brood are utilized only in cases of heavy infestation
- Female mites produced in the summer live 2-3 months and in the fall 5-8 months
- Without bees and brood the mites can survive for five days
- Can live in a comb with sealed brood at 68º F up to 30 days

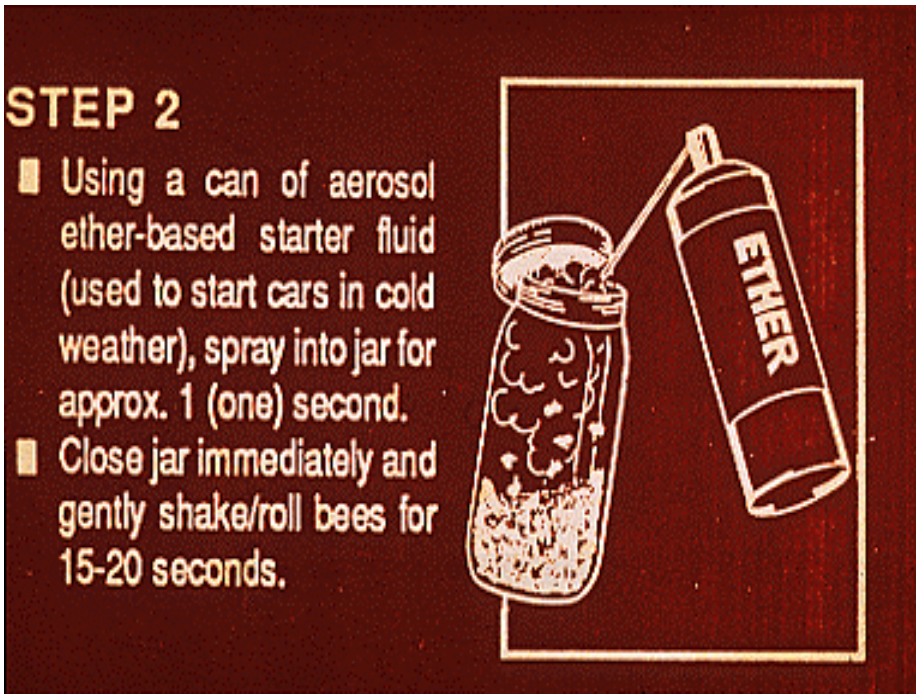
Affected Workers

- Low level infestations are difficult to detect
- Medium to high infestations result in the appearance of spotty brood pattern and malformed worker and drone adults with deformed wings and small abdomens
  - Usually seen crawling and unable to fly
  - Colonies become severely debilitated at extremely high levels

http://maarec.psu.edu/pest&disease/sl10.html

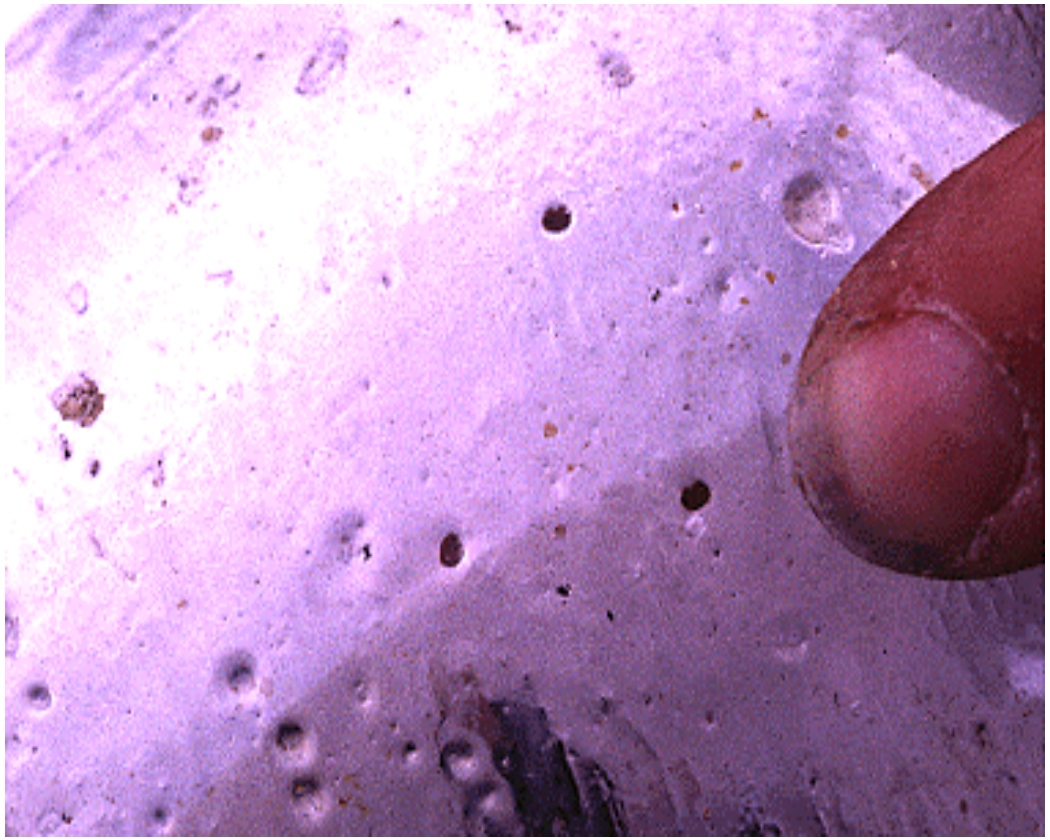
Detecting Varroa Mites





http://maarec.psu.edu/pest&disease/sl10.html

Detecting Varroa Mites



http://maarec.psu.edu/pest&disease/sl10.html

- Mites will adhere to the sticky film left on the sides of the jar
- Light infestations may be missed by this method
  - Include drones to increase the chances of detecting mites

Detecting Varroa Mites

http://maarec.psu.edu/pest&disease/sl10.html

- Another technique is to examine brood for the presence of mites
- Uncap and examine sealed brood, especially drone brood
- Individual pupae can be removed with forceps to permit visual inspection
- A faster technique is to use an uncapping fork to easily remove many drone pupae at once for close examination
- 10x hand lens can help considerably

Varroa Mites Spreading

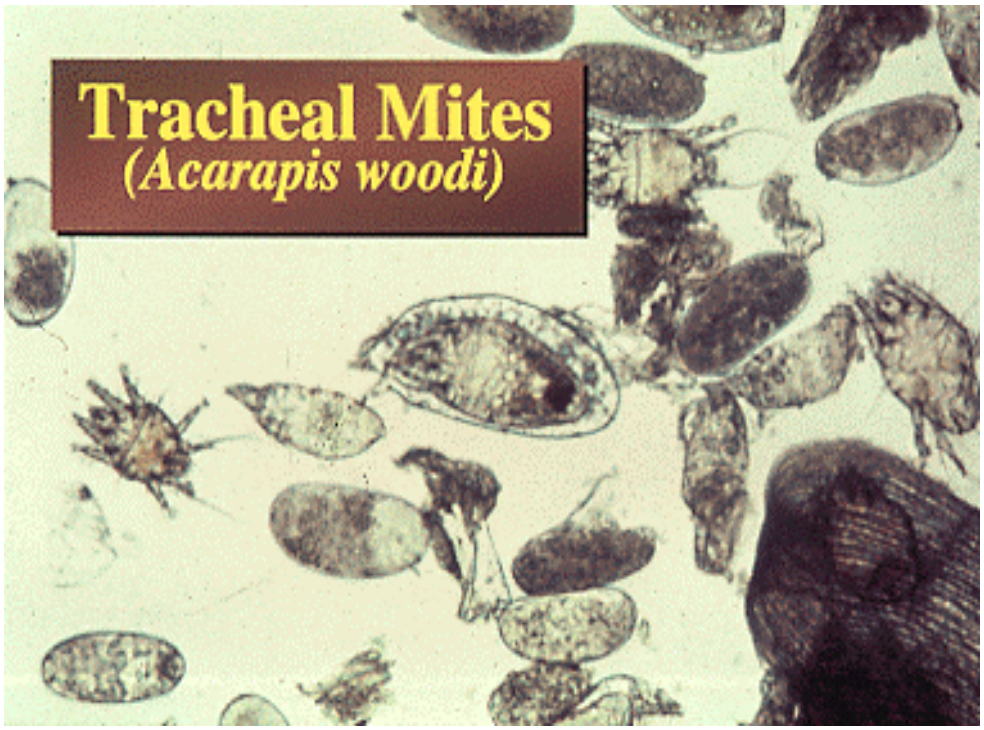
- Mites can be spread by the movement of honey bee colonies- migratory beekeeping, the shipment of queens and package bees, and movement of colonies for pollination rentals
- Beekeepers probably spread infestations through normal apiary manipulations
- Also spread as a result of drifting and swarming bees

Plastic Strips

- Plastic strip impregnated with the chemical pesticide coumaphos (Check-Mite) and fluvalinate (Apistan)
- Strips are hung vertically inside the brood nest
- Honey left in the hive during treatment must be used as bee food or destroyed
- Strips left on colonies for a minimum of six weeks and a maximum of eight weeks
- Number of strips placed on a colony is dependent on the number of frames in each colony- often applied in the fall, 1" by 8" strips placed 1 per 5 frames of bees

http://maarec.psu.edu/pest&disease/sl10.html

Honey Bee Tracheal Mite (Acarapis woodi)

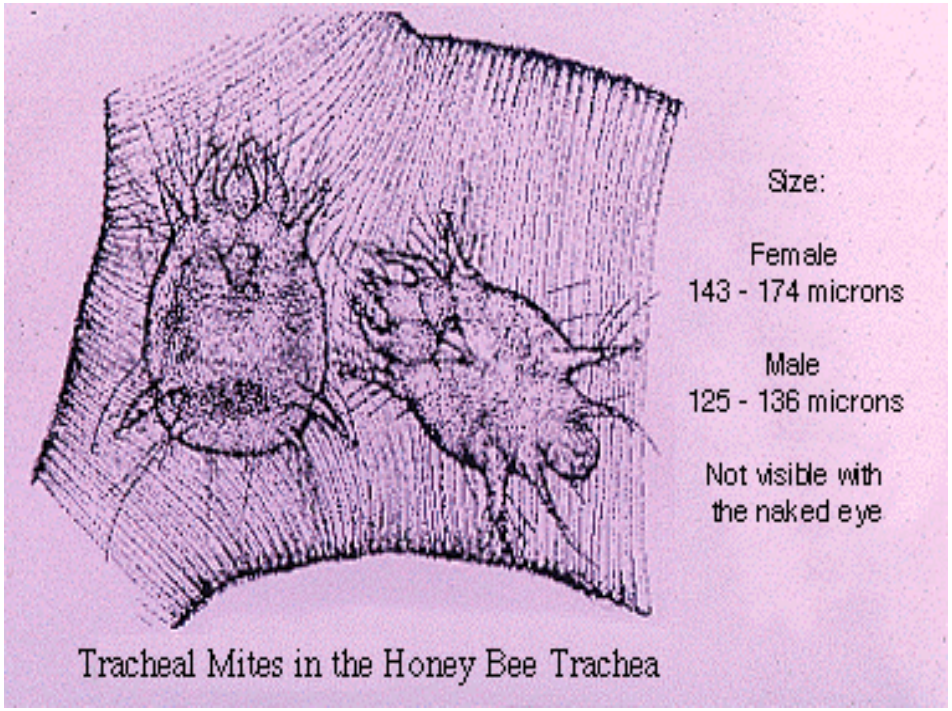


- Internal parasitic mite lives within the trachea inside the thorax of adult honey bees
- Also found in air sacs in the thorax, abdomen and head
- Pierce the breathing tube walls with their mouthparts and feed on the hemolymph of the bees

http://maarec.psu.edu/pest&disease/sl10.html

Diagram of male and female tracheal mite

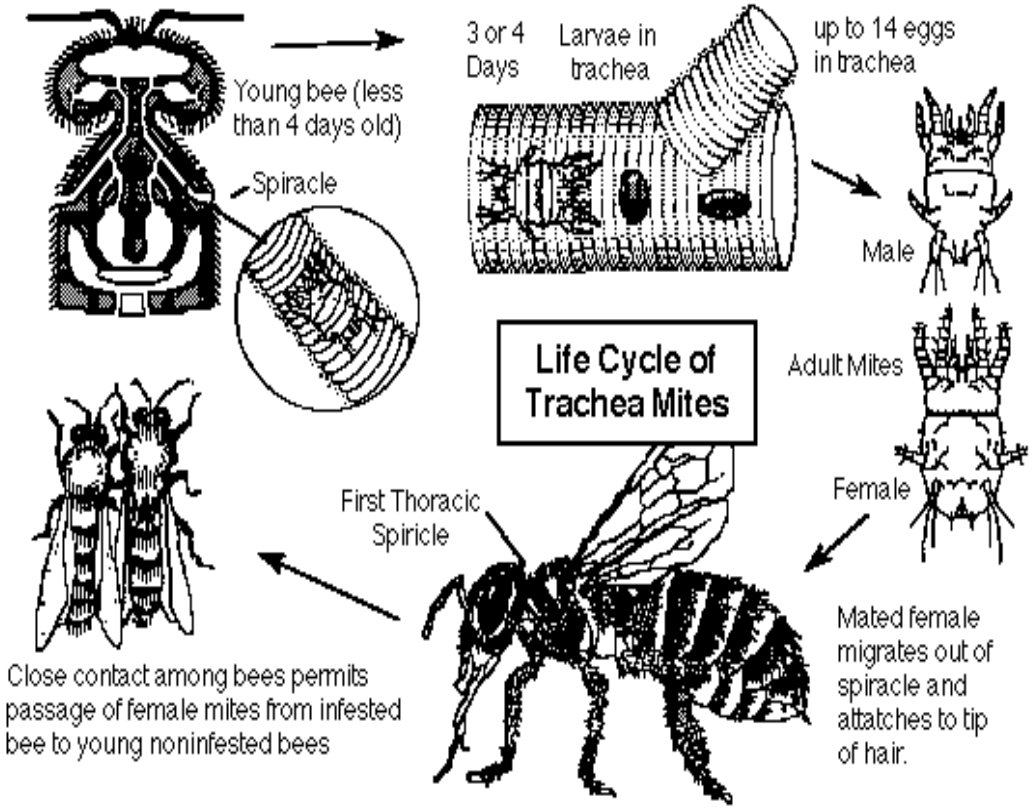
- Difficult to identify and study due to its small size-no bigger than a dust speck
- Body is oval, widest between the second and third pairs of legs, whitish in color with a shiny smooth cuticle
- A few long, fine hairs are present on the body and legs
- Has long mouthparts for active feeding on the host



http://maarec.psu.edu/pest&disease/sl10.html

Lifecycle of Tracheal Mite

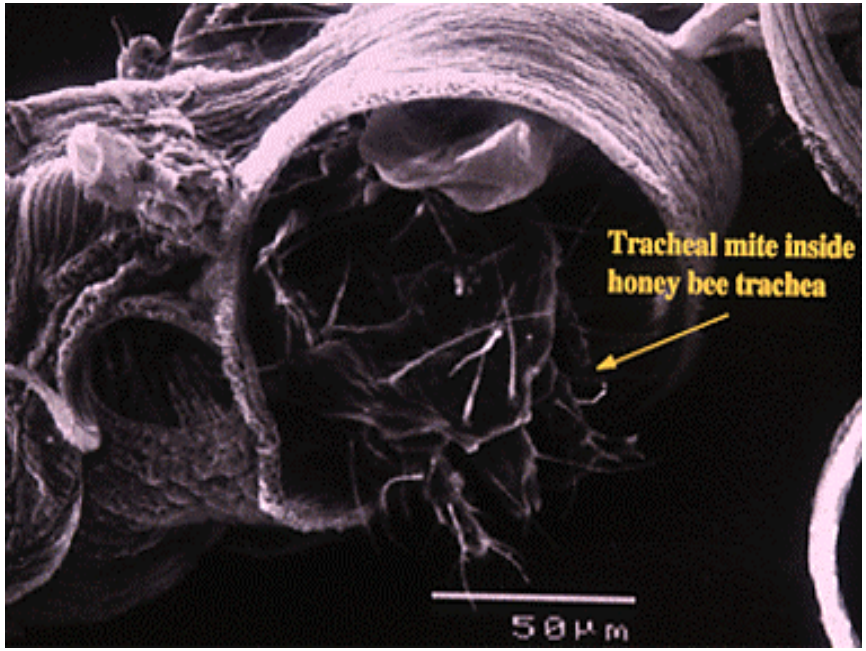
- Entire life cycle is spent within the respiratory system of bee, except for brief migratory periods
- Within 24 hours after worker bees emerge from their cells, female mites collect within their tracheae where the microscopic mite feeds and reproduces
- Each female mite lays 5 to 7 eggs which require 3 to 4 days to hatch
- Male and female mites develop from egg to adult in approximately 14 days
- Eggs hatch into six-legged larvae then molt to a non-feeding adult stage and then finally molt to the adult stage
- Stages of the mite: eggs, larvae, pharate adults and adults may be found in the tracheae of older bees



http://maarec.psu.edu/pest&disease/sl10.html

Tracheal Mites

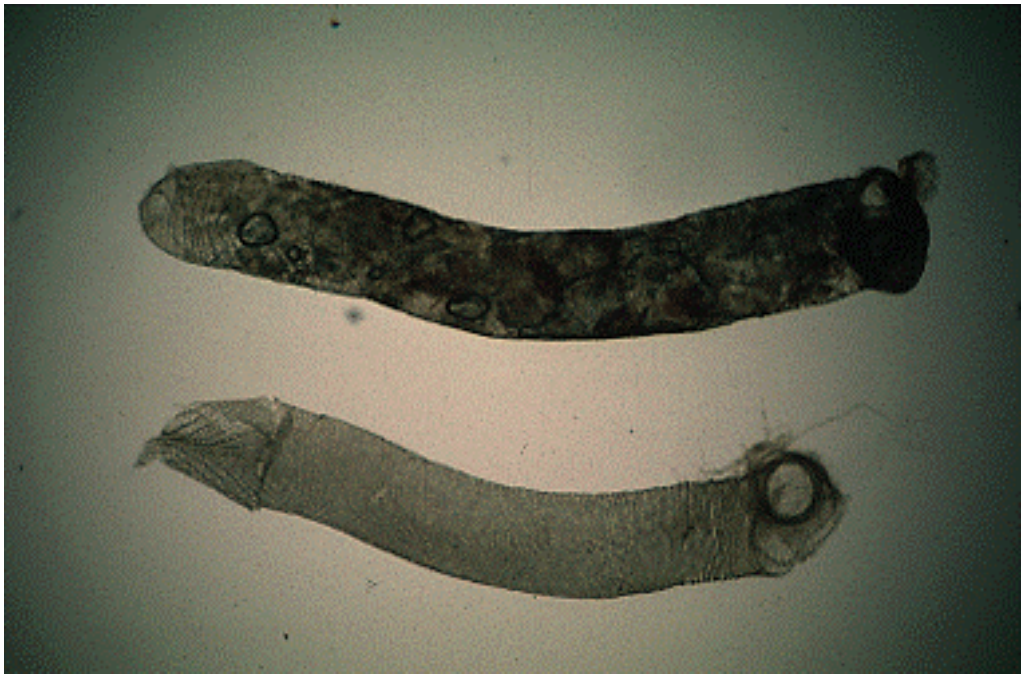
- Spread within the colony as a result of bee to bee contact
- Adult female mites leave the breathing tube and climb to the tip of an adjacent body hair
- As bees come in contact with one another, the mites attach themselves to the body hairs of a passing bee
- Bees less than 4 days old are the most susceptible



http://maarec.psu.edu/pest&disease/sl10.html

Healthy and Infested Tracheae

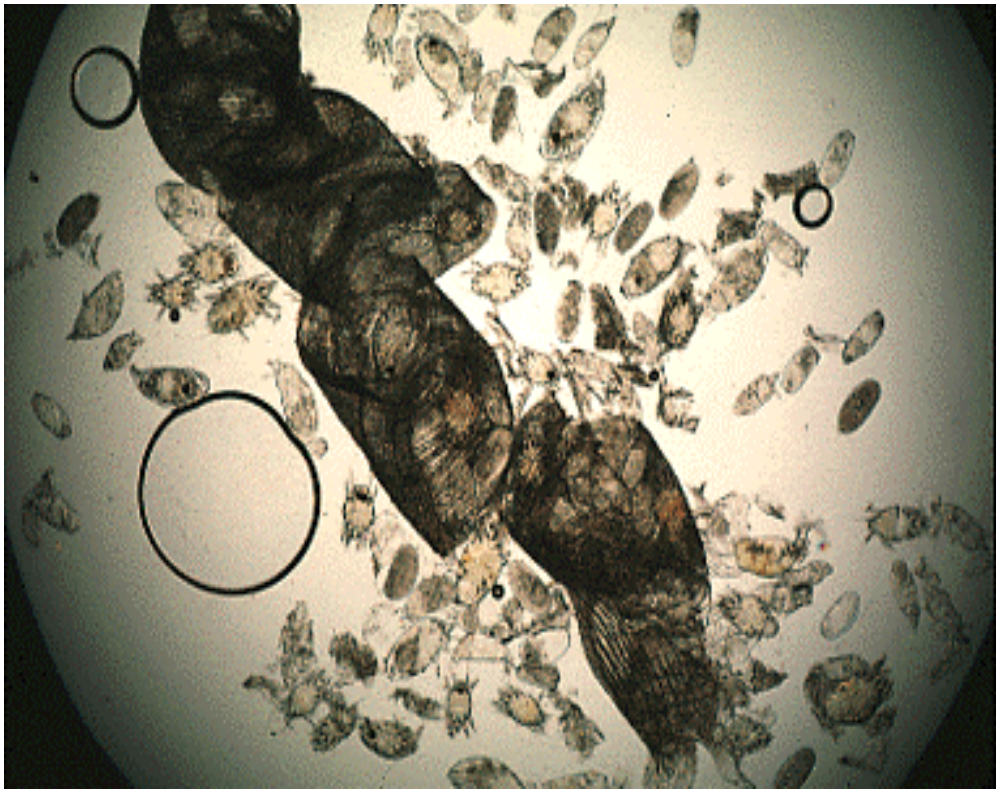
- Positive identification can be done only by dissection and microscopic examination (100 - 250x magnification)
- The tracheae of uninfested bees are clear and colorless
- In a slight infestation, one or both tracheal tubes contain a few adult mites and eggs which may be detected near the spiracular openings- tracheae appear cloudy or slightly discolored



http://maarec.psu.edu/pest&disease/sl10.html

Severely Infested Trachea

- Severely infested bees have brown blotches, with brown scabs or crust-like lesions, or may appear completely black
- Feeding by the mites damages the walls of the tracheae
- Flight muscles in the bee's thorax may become atrophied as a result of a severe infestation



http://maarec.psu.edu/pest&disease/sl10.html

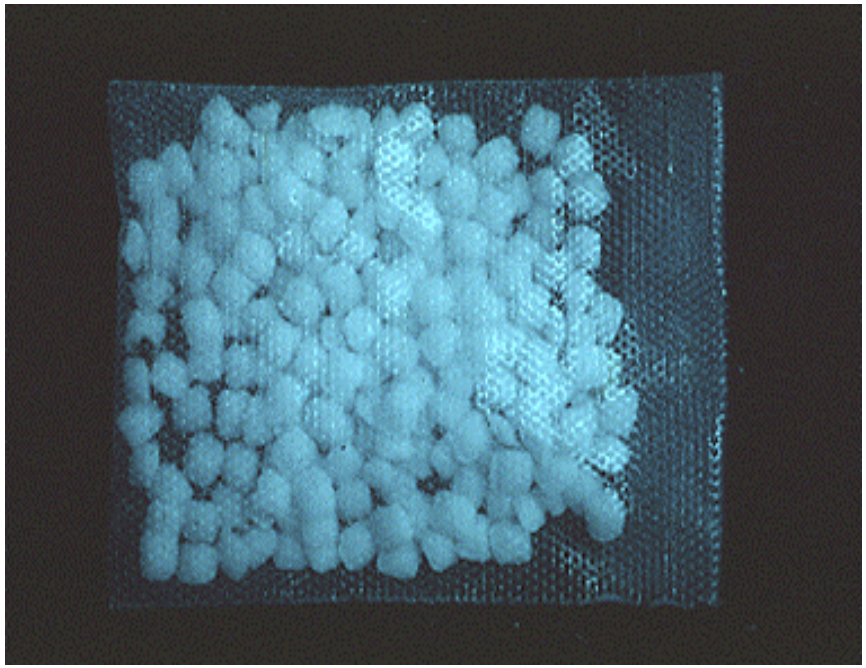
Winter Cluster with Reduced Population

- Infestation shortens the lives of adult bees and affects flight efficiency and perhaps the ability to thermoregulate
- As mite populations increase, colony populations dwindle which can ultimately lead to the death of the colony
- Many infested colonies die in late winter or early spring when tracheal mite infestation levels are high and the bee population is composed of older bees
- Severely infested colonies can die during the spring, summer or fall
- When a colony is near death, large numbers of bees can be seen crawling out of the hive- unable to fly

http://maarec.psu.edu/pest&disease/sl10.html

Menthol Packet

- Menthol is a crystalline alcohol obtained from oil of peppermint that is commonly used for odor, flavoring and cooling properties in candies, cigarettes, shaving creams, etc
- Surplus honey for human consumption must be removed
- Menthol treatment consists of 1/3-cup of menthol pellets or crystals
- Recommend that you place the menthol in 7x7 in. packets made of window screen or a similar mesh material
- One menthol packet will treat one colony
- Place on bottom board, when daytime highs are above 70ºF
- Important that all colonies in an apiary receive mite treatment at the same time
  - Untreated colonies, or those treated late, serve as nearby sources for mite reinfestation



http://maarec.psu.edu/pest&disease/sl10.html

Menthol Placement In Colony

- If the weather is expected to be cool to moderate, place the packet on the center of the top bars
- Adults clustering outside of the entrance is normal during warm afternoons- however, if more than half of the colony is hanging outside the entrance, relocate the menthol packet to a back corner of the bottom board
- Menthol should remain in the colony for 4 to 6 weeks after application
- Any remaining menthol can be combined with that left from other colonies and stored in a plastic container in the freezer for reuse next year
- If more than 1/2 of the original amount of menthol remains in the packets, it is unlikely that the colony received an effective menthol treatment

http://maarec.psu.edu/pest&disease/sl10.html

Grease Patties

- Made from a mixture of 1 part vegetable shortening and 2 parts granulated white sugar
- The paste-like mixture is divided into hamburger-sized patties on sheets of waxed paper
- One patty per colony, placed on the top bars in the middle of the broodnest
- Grease patties work very slowly to reduce tracheal mite levels by mid-fall
- Patties should be checked every 4 to 6 weeks and replaced as needed for continuous exposure throughout the summer and into fall
- Some beekeepers incorporate Terramycin into patties
- May offer some advantage to colonies with Varroa infestations or infected with diseases associated with parasitic mites
- Patties which include Terramycin (home-made or those commercially available under the brand name Terra Patties) should only be applied when bees are not storing surplus honey
- DO NOT medicate bees when there is ANY danger of contaminating the honey crop

http://maarec.psu.edu/pest&disease/sl10.html

CONTROL OF MITES

- Formic acid strips
  - Tests show that it works in cooler temperatures better than Menthol (for tracheal mites) 50-79˚F - warm conditions cause it to evaporate too fast and not offer the necessary control- remove if above 82˚F
  - Treat for 21 days, do not treat at honey flow- colony can be overwhelmed with vapors if not strong enough
- A plastic strip impregnated with several oils is being developed by the Tucson USDA lab that has a slow delivery system of 24 days
  - Important to realize that just because a chemical may be a common material, when concentrated or used directly inside a bee colony, it will **not** necessarily be safe or less toxic to bees or humans

Resistant Stock

- Bee stock resistant to or tolerant of Varroa and/or tracheal mites
- The USDA has tested a bee from Russia- studies show these bees have fewer Varroa on the worker larvae (30% U.S. vs. 7% Russia), and drone larvae (80% U.S. vs. 40% Russia)
  - **Tests run by introducing mites into clean colonies- 3X as many mites found on non-resistant bees as on the Russian bees**
  - **The stock will be maintained at the USDA Baton Rouge Lab and made available to commercial producers as breeding stock**
  - Different than in the past when stock (for example Yugo bee stock) was released and maintenance was left in the hands of commercial producers
- Scientists at the USDA Tucson Lab and some larger beekeepers have been selecting for colonies with fewer mites using natural selection
  - Working with a commercial beekeeper colony populations of Varroa mites initially at 120 mites/100 bees have decreased to 6 mites/100 bees
  - One problem is stock is at least partially Africanized, so exporting seems unlikely
- Also, hygienic bee populations that are more diligent house cleaners may be useful

Bee Louse (Braula coeca)

- Wingless fly
- Adults are small and reddish-brown in color
- Several adult flies may live on a queen, usually only one will be found on a worker
- Apparently do little harm
- Note: *Braula coeca* is rarely found in colonies since they are susceptible to treatments for parasitic mites- casual glance may mistake *Braula* for *Varroa* mites since they are similar in color and size
- *Braula* have six legs while *Varroa* have 8 legs

http://maarec.psu.edu/pest&disease/sl10.html

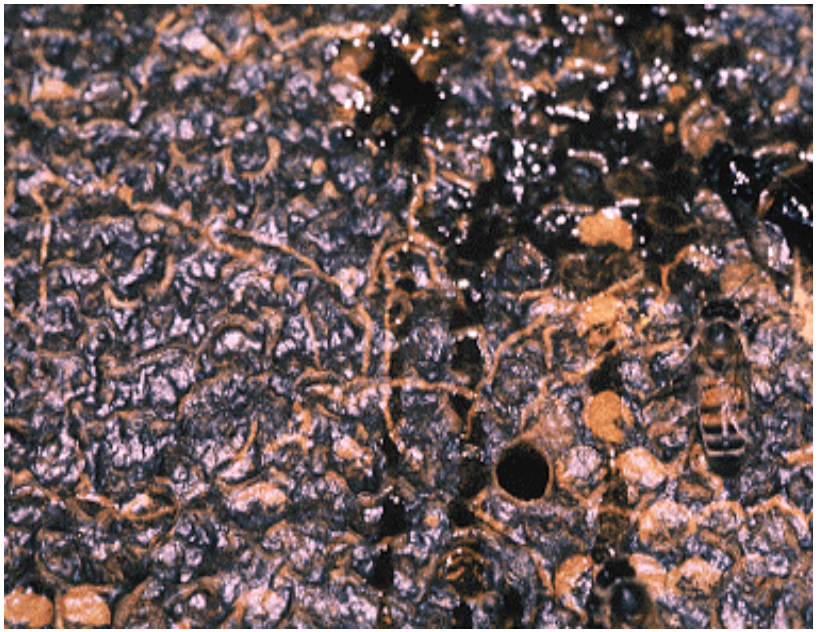
Bee Louse

- Move rapidly over the body surface, settling at the junction of the bee's thorax and abdomen
- Remain until a hunger response causes them to crawl up to the bee's head near its mouth parts
- Movement seems to cause the bee to regurgitate a drop of nectar
- Bee louse then inserts its mouth parts into its benefactor and takes its food

http://maarec.psu.edu/pest&disease/sl10.html

Bee Louse Tunnels in Honey Cappings

- Fly lays its eggs on the cappings of honey storage cells
- Upon hatching, the young burrow into the cappings
- As the larvae grow, their tunnels lengthen and broaden
- The larva pupates inside the tunnel- Soon after emergence, the young adult crawls upon a bee



http://maarec.psu.edu/pest&disease/sl10.html

Bee Lice on Queen

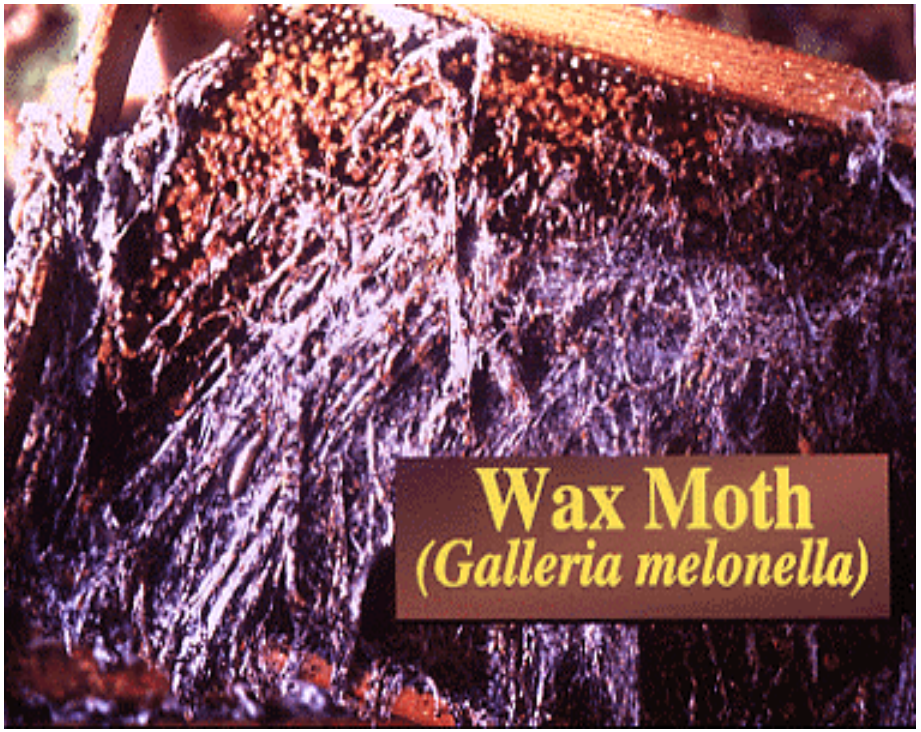
- Adults are often found on queens
- Amount of food taken by the larvae and adult lice is negligible
- Appearance of comb honey can be damaged by the tunneling larvae
- Honey production by strong colonies infested with bee lice does not seem to be affected

http://maarec.psu.edu/pest&disease/sl10.html

Predators of Bees

Wax Moth, *Galleria melonella*

- Larvae cause damage to beeswax combs left unattended by bees
- Beeswax combs in weak or dead colonies and those placed in storage are subject to attack
- Wax moths pose a continuous threat except when temperatures drop below 40 ºF



http://maarec.psu.edu/pest&disease/sl10.html

Adult Wax Moths

- Female wax moths fly at night and deposit masses of eggs on unprotected beeswax combs and in the cracks between hive bodies
- After around 5 days, eggs hatch
- Larvae crawl onto the comb and begin their feeding activity in protected areas, often near the center midrib of the cells

http://maarec.psu.edu/pest&disease/sl10.html

Damaged Combs- Silken Galleries

- Larvae damage or destroy the combs by chewing through the beeswax cells as they feed on cocoons, cast skins, and pollen
- Spin silken galleries for protection from bees
- Beeswax combs are reduced to a mass of webs and debris
- Larvae seldom attack new beeswax combs and WILL NOT feed on blocks of pure beeswax or items made from beeswax

http://maarec.psu.edu/pest&disease/sl10.html

Cocoons Attached to Frames

- The wax moth larva spins a rough silken cocoon, which is usually attached to a frame or the inside of the hive
- Larva cements the cocoon inside a boat-shaped cavity chewed into the wood
- Chewed wooden frames are weakened and easily broken
- Under warm conditions, adults may emerge at almost any time of year

http://maarec.psu.edu/pest&disease/sl10.html

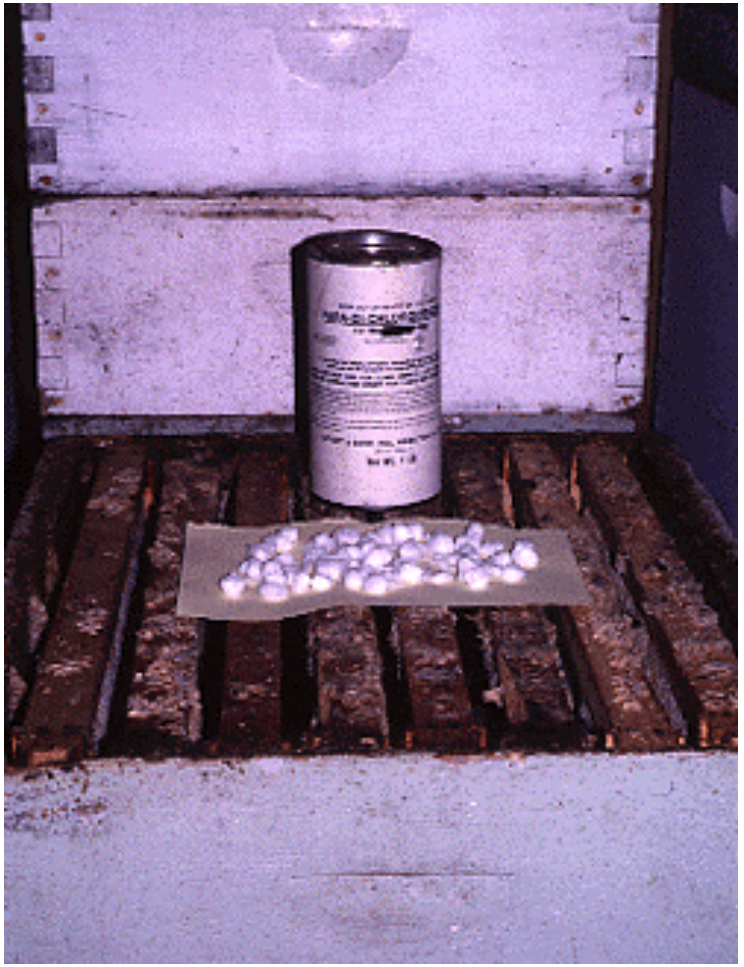
Wax Moths

- Best defense is to maintain strong, healthy colonies
- Strong colonies can defend themselves against wax moths
- Stored equipment and comb honey off colonies must be protected
- Honey supers, brood combs and comb honey can be stored in freezer during periods when wax moths are problematic

http://maarec.psu.edu/pest&disease/sl10.html

PDB Crystals

- Paradichlorobenzene (PDB) crystals
- Crystals placed on a small piece of paper between every fifth super in a stack and covered
- Treatment must be continued at regular intervals as PDB kills adults and immature wax moths, but not eggs
- Presence of crystals within the stack repels moths, prohibits egg laying, and kills any young larvae that hatch after the combs are placed in storage
- Moth balls made from naphthalene, **should not** be used for wax moth control



http://maarec.psu.edu/pest&disease/sl10.html

Other Methods to Control Moths

- Fumigation on a large scale is with aluminum phosphide in gas-tight rooms
- Non-chemical approaches to wax moth control: stacking suppers in a criss-cross pattern under a open air shed: cold or hot treatments(10º F/3 hrs or 120ºF/40 min) and modified atmospheres with CO_2
  - Suppers stacked above an inner cover on an active hive
  - Resident bees will keep the equipment clean

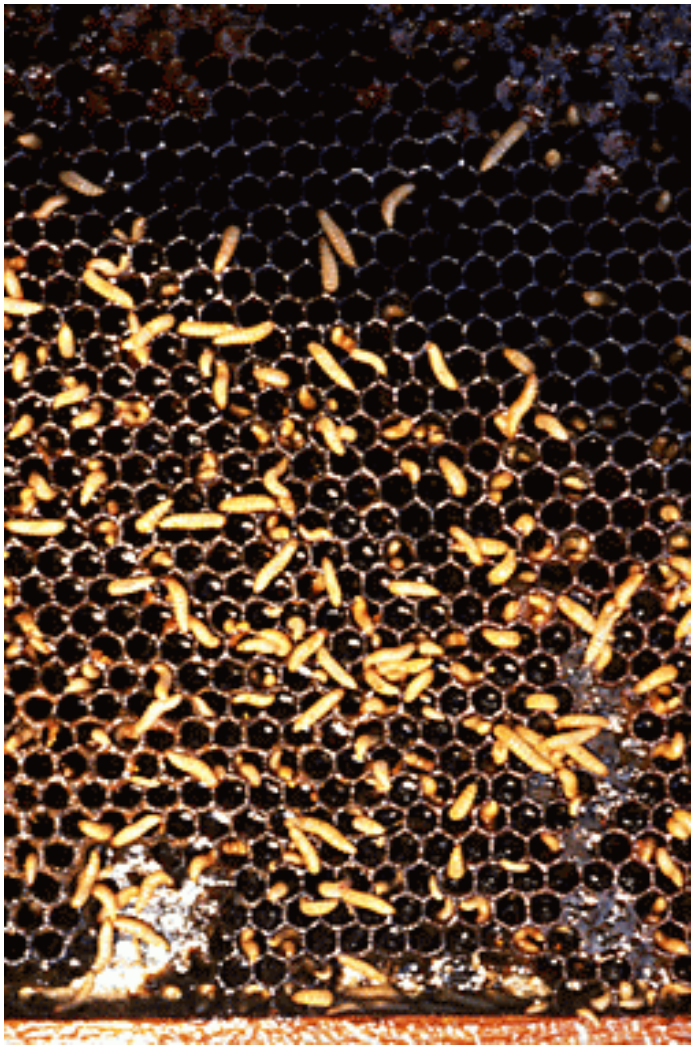
Small Hive Beetle

- Small hive beetle, *Athina tumida*
- First discovered in South Carolina and then in Florida in the spring of 1998
- Pest originated in Africa and found its way to North America
- Small, black and covered with fine hair

http://maarec.psu.edu/pest&disease/sl10.html

Small Hive Beetle

- The beetle lays its eggs on or near beeswax combs
- Eggs hatch and larvae similar in appearance to wax moth larvae
- Can differentiate the beetle larvae from wax moth larvae by examining their legs
  - Both species have three sets of legs just behind the head
  - Small hive beetles larvae lack the series of paired prolegs that run the length of the wax moth larvae's body
- Beetle larvae consume pollen and comb but also will eat larval honey bees
- Crawl out of the hive and pupate in the soil
- Adult beetles will feed on honey bee eggs



http://maarec.psu.edu/pest&disease/sl10.html

Small Hive Beetles

- The beetle defecates in the honey and causes it to ferment and run out of the comb
- Most vulnerable are weak hives with stored honey or full honey supers either in storage or above bee escapes
- Check Mite + (coumophos)- strips cut into ½ and placed on cardboard on bottom board
- West trap: two piece plastic trap with holes on top piece and bottom filled with vegetable oil

http://maarec.psu.edu/pest&disease/sl10.html

Skunks

- Hamper the development of strong colonies
- Raid bee yards nightly, consuming large numbers of bees
- Attacks are most common in the spring- can occur throughout the summer and fall

http://maarec.psu.edu/pest&disease/sl10.html

Skunks

- To capture bees, skunks scratch at the hive entrance and guard bees that come out to investigate the disturbance
- Feed at the hive entrance for an hour or more to rapidly deplete the bee population
- Colonies visited by skunks may become defensive since skunks usually return night after night
- Skunk predation can be detected by the front of the hive being scratched-vegetation in front of the hive packed down or torn up

http://maarec.psu.edu/pest&disease/sl10.html

Skunks

- Skunks also leave behind small piles of chewed-up bees- Chews the bees until all the juices are consumed, then spits out the remains
- Remains resemble chewing tobacco
- Opossums and raccoons sometimes attack and the damage they do is similar to that of skunks
- The feces of these animals also contain large amount of honey bee exoskeletons since it cannot be digested by animals

http://maarec.psu.edu/pest&disease/sl10.html

Skunks

- Maintaining strong colonies is a partial deterrent to animal predation
- Skunks and mice may be discouraged by screens
- Devices hamper the skunk's efforts to scratch at the front entrance and if it climbs up the screen over the entrance, its belly becomes vulnerable to stings
- Elevating the hives on stands of blocks, bricks and fencing the bee yard
- Moving your bees to a new location is another option

http://maarec.psu.edu/pest&disease/sl10.html

Mice

- Pest of stored combs and active honey bee colonies
- Rodents chew combs and frames to make room for building their nests
- Mouse urine on combs and frames
- Bees reluctant to use the combs or clean out these nests

http://maarec.psu.edu/pest&disease/sl10.html

Mice

- Mice nest in the corners of the lower hive
- Can build a nest even in a strong colony
- Move in and out of the colony while the bees are inactive, and their nests furnish additional protection
- Their activity may disturb the bees but the greater damage is to combs and equipment from their nest building

http://maarec.psu.edu/pest&disease/sl10.html

Restricting Mice

- Entrance to bee colonies should be restricted with entrance cleats or hardware cloth (three mesh to the inch) to keep the mice out
- Chase away any mice found inside a colony, then remove the nest and restrict the entrance
- If comb chewing is extensive, replace the frames

http://maarec.psu.edu/pest&disease/sl10.html

Ants

- Certain species may enter colonies to search for food or establish nesting sites
- Ants are typically found between the inner and outer covers of the hive and in pollen traps
- Can be a nuisance to the beekeeper

http://maarec.psu.edu/pest&disease/sl10.html

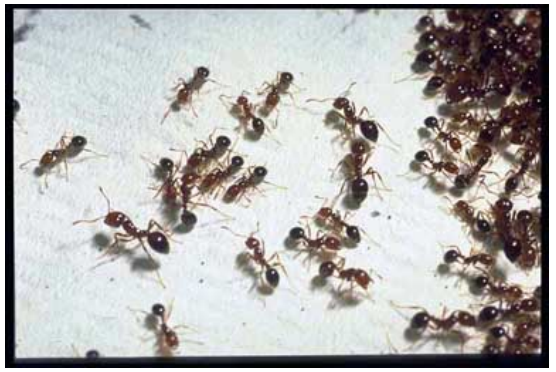
Fire Ants

- Feed in honey bee boxes and under certain conditions destroy colonies
  - As long as the hive is strong, with large number of workers-fire ants not a problem
  - Should a colony decline, fire ants will invade and eat bees, brood and eggs
- Fire ants are often a greater problem for the beekeepers

Fire Ants

- Can sting repeatedly and in high numbers when their colonies or food sources are disturbed
- Beekeepers can be attacked during hive maintenance operations

Fire Ants



- Identify the ants correctly
- Avoid attracting foraging worker ants to hives by leaving dead brood and other material near bee hives
- To discourage ant colonies from moving into bee hives, elevate the hives several inches on timbers, bricks or stones
- Prevent imported fire ants from spreading by inspecting hives and eliminating the ants *before* moving the bees to new locations
- If insecticides are to be used near bee hives, be careful not to poison the bees

Treating for Fire Ants

- Broadcast bait products: abamectin (Ascend ®), hydramethylnon (Amdro Pro ®) ,fenoxycarb (Award ®), pyriproxifen (Esteem ®), or s-methoprene (Extinguish ®) twice per year over an area of about ½ to 1 acre around the hives
- Then treat individual mounds to eliminate ant mounds posing an immediate hazard
- Also, the outer surface of the pallets or stand elevating the hives can be carefully treated by applying contact insecticides (Topchoice®, Over 'N Out®, Talstar®, Ortho Max®)
  - Treat before moving the bee hives to the location
  - To prevent bees from contacting treated surfaces, apply insecticides late in the evening or early in the morning when bees are not active

Controlling for Ants

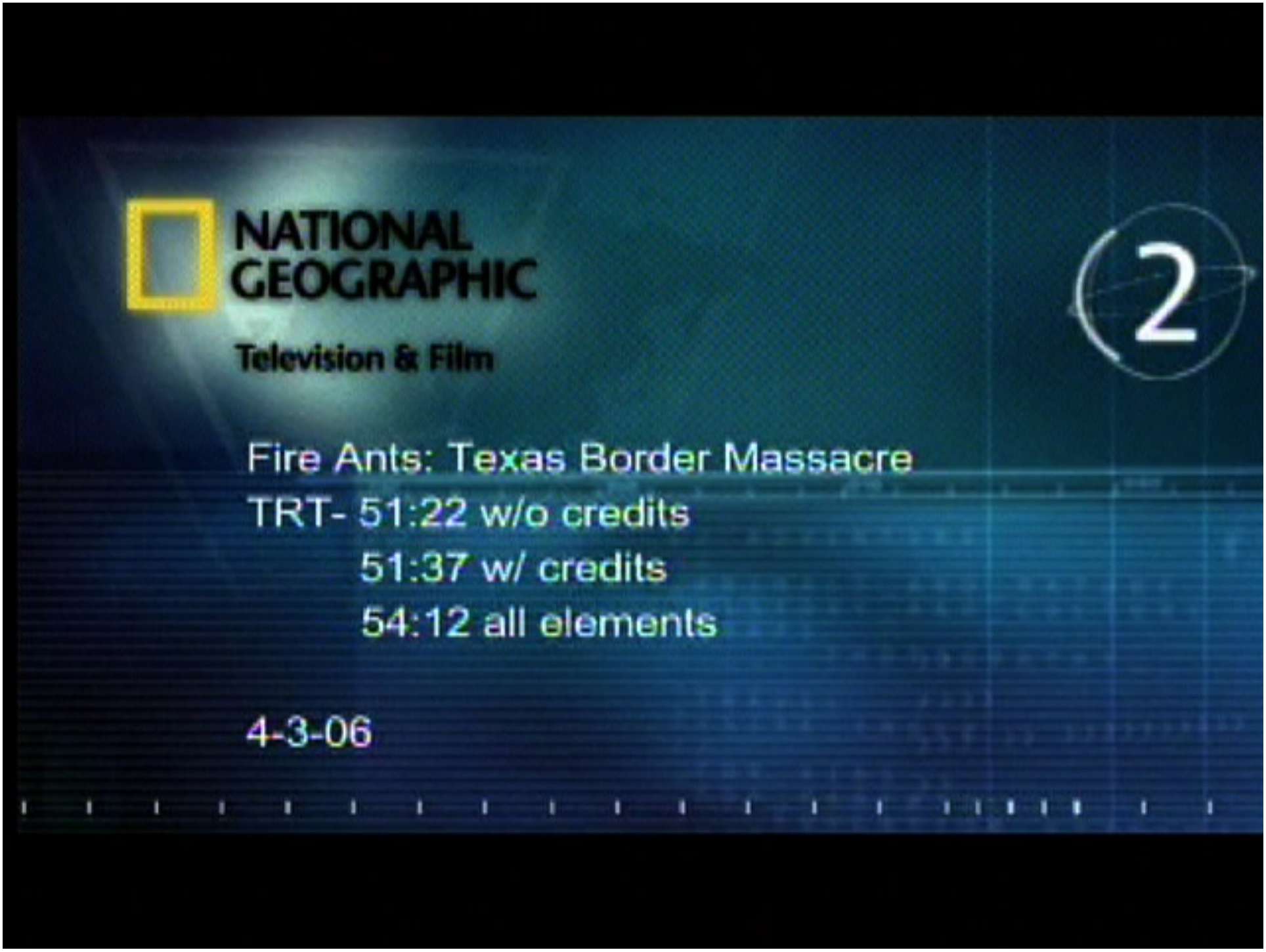
- Remove brush, rotten wood, grass, and weeds from around the colonies
- Single colonies can be placed on stands with oil or sticky barriers
- Ant problems may be reduced by allowing the bees access to the space between the inner and outer covers

http://maarec.psu.edu/pest&disease/sl10.html

Natural Enemies of Fire Ants

One Natural Enemy:

The Phorid Fly

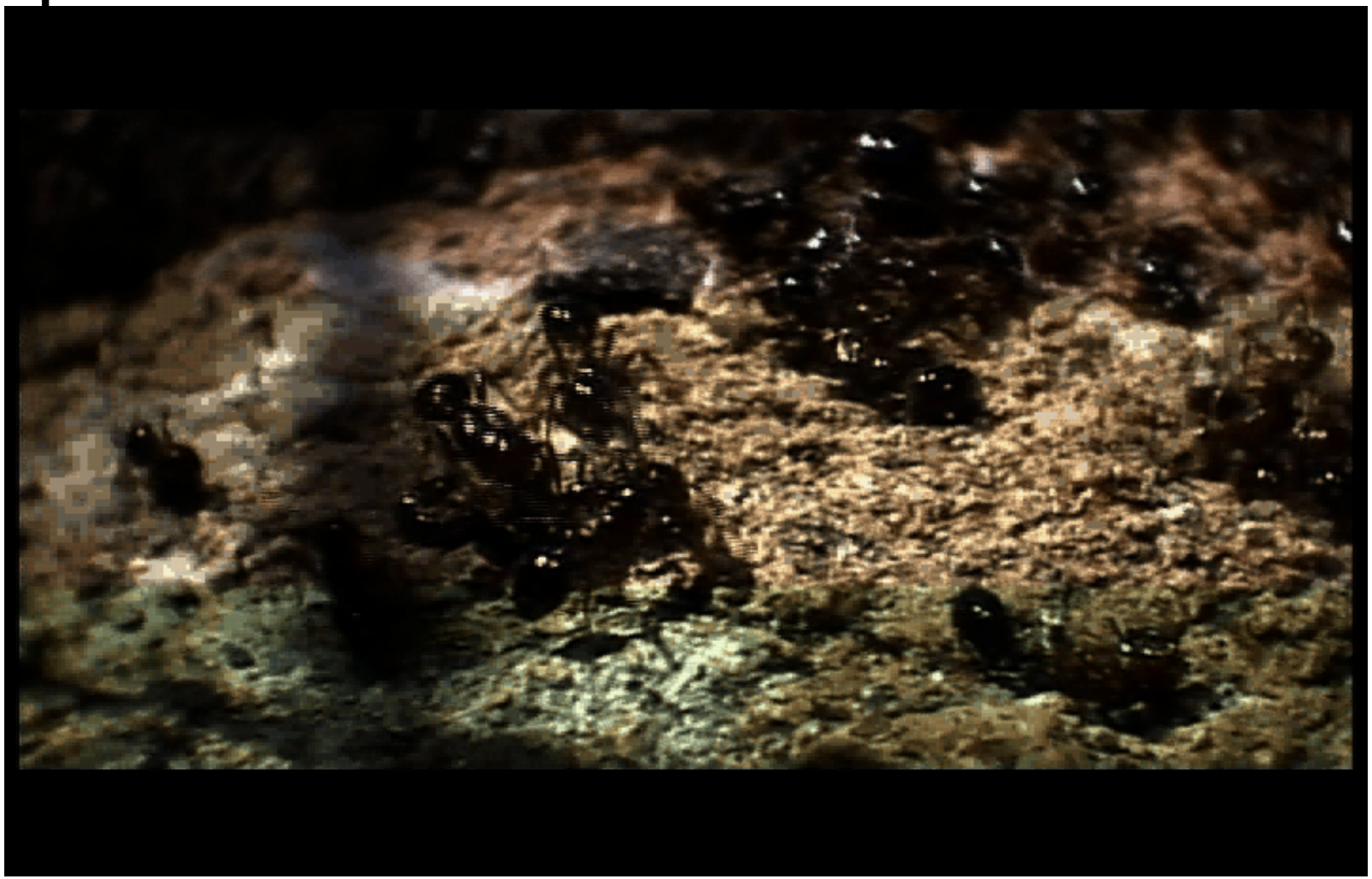

NATIONAL
GEOGRAPHIC
Television & Film
2
Fire Ants: Texas Border Massacre
TRT- 51:22 w/o credits
51:37 w/ credits
54:12 all elements
4-3-06

Phorid Fly Attack

Phorid Fly Attack

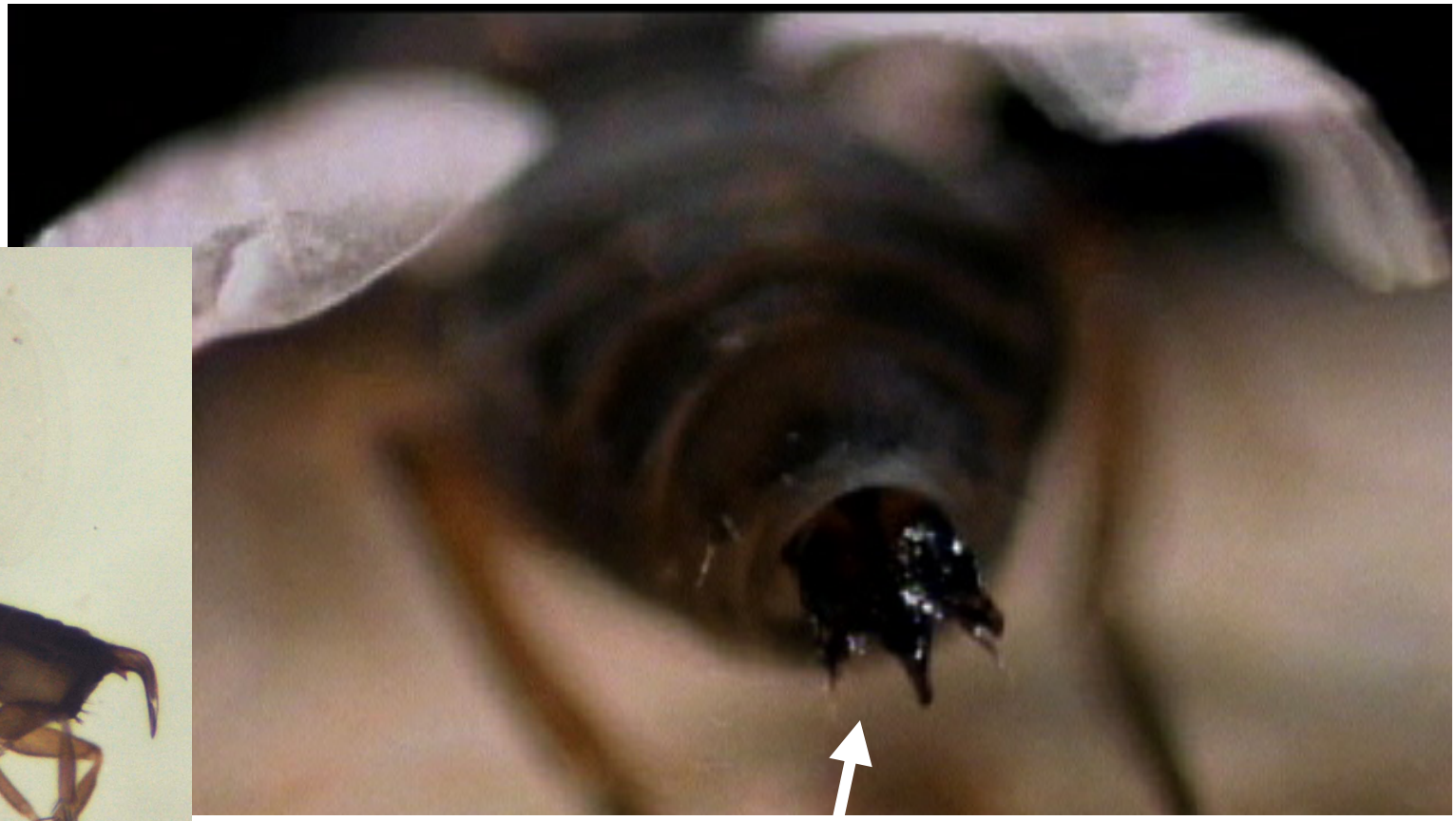
Phorid Fly Lifecycle

Phorid Fly Emergence



Phorid Fly Emergence

Pseudacteon tricuspis ovipositor



P. curvatus

Passive Trap

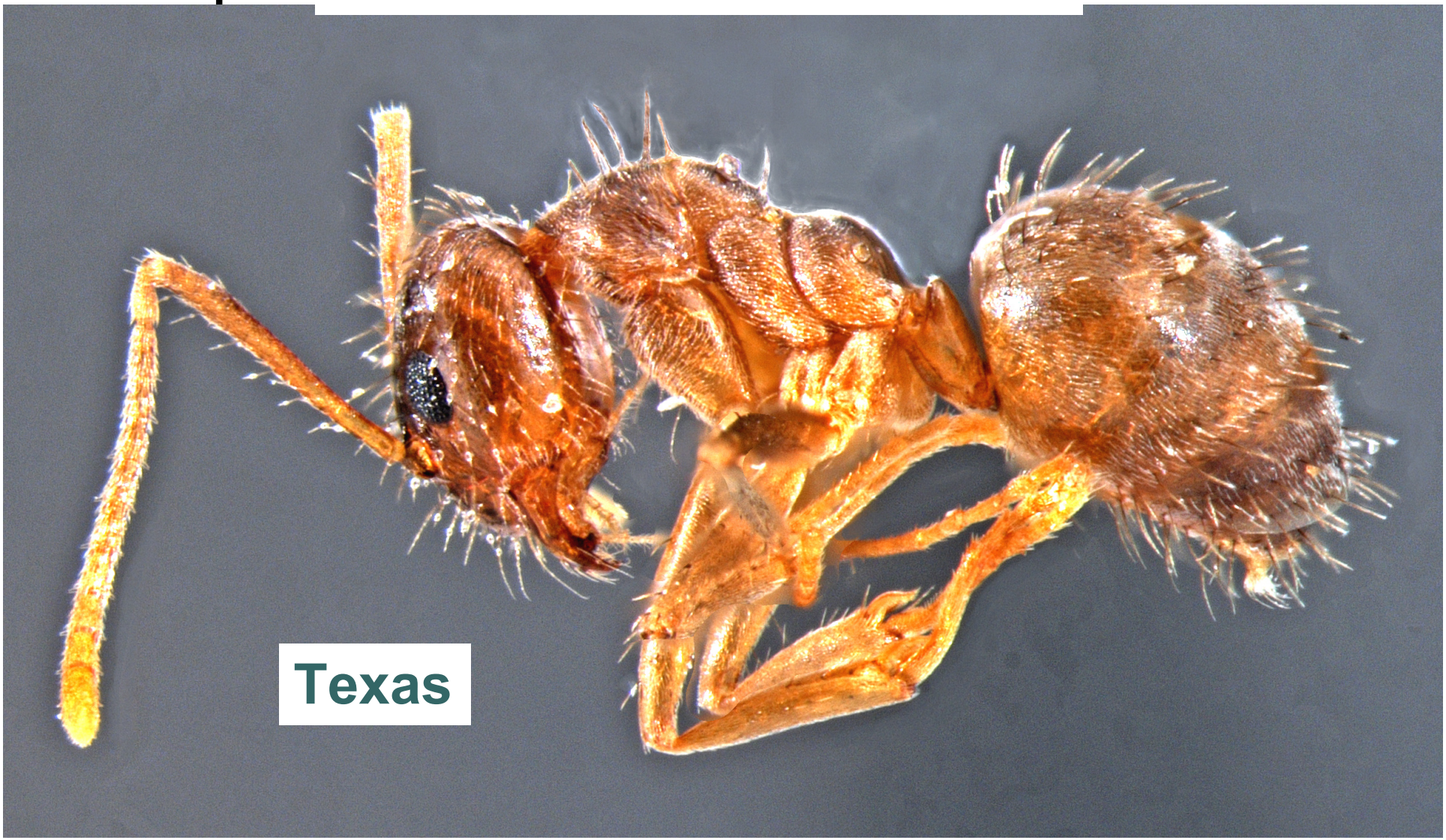
A Happy Ending…..

Nylanderia species near *pubens*

http://urbanentomology.tamu.edu/ants/exotic_tx.cfm

- First found in Deer Park: West of Houston, Harris Co., TX, June 2005
- Now continuing to spread westward

Color is reddish to brown



Monomorphic, 1/8 inches in length

Nesting and Diet

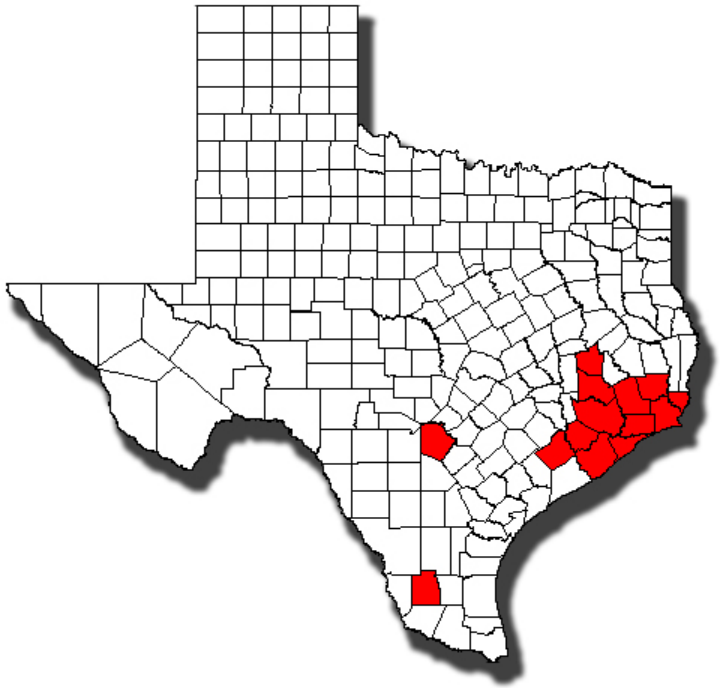
- Found under almost any moist object: stumps, soil, concrete, rocks, potted plants
- Nests primarily occur outdoors- will forage indoors
- Omnivores:
  - Workers "tend" hemipterous insects for honeydew
  - Also attracted to sweet parts of plants including damaged and over-ripe fruit
  - Also consume other insects and small vertebrates for protein

Danger to Other Wildlife

- Masses of crazy ants covering the ground and trees affect ground and tree-nesting birds and other small animals
- Ants are even displacing fire ants in areas of heavy infestation
- Related species of crazy ants displacing other ant species
  - Caused chickens to die of asphyxia due to ants obstructing their nasal passages
  - Larger animals attacked around the eyes, nasal area and hooves

Distribution

- Large populations in Pasadena, Deer Park, Friendswood, San Jacinto Port, Pearland, Seabrook and La Porte
- Localized infestations confirmed in Bexar, Brazoria, Fort Bend, Chambers, Galveston, Hardin, Harris, Jefferson, Jim Hogg, Liberty, Montgomery, Orange, Walker and Wharton counties
- Potential to spread beyond coastal Texas
- Semi-tropical ant so northern distribution will be limited by cooler weather conditions

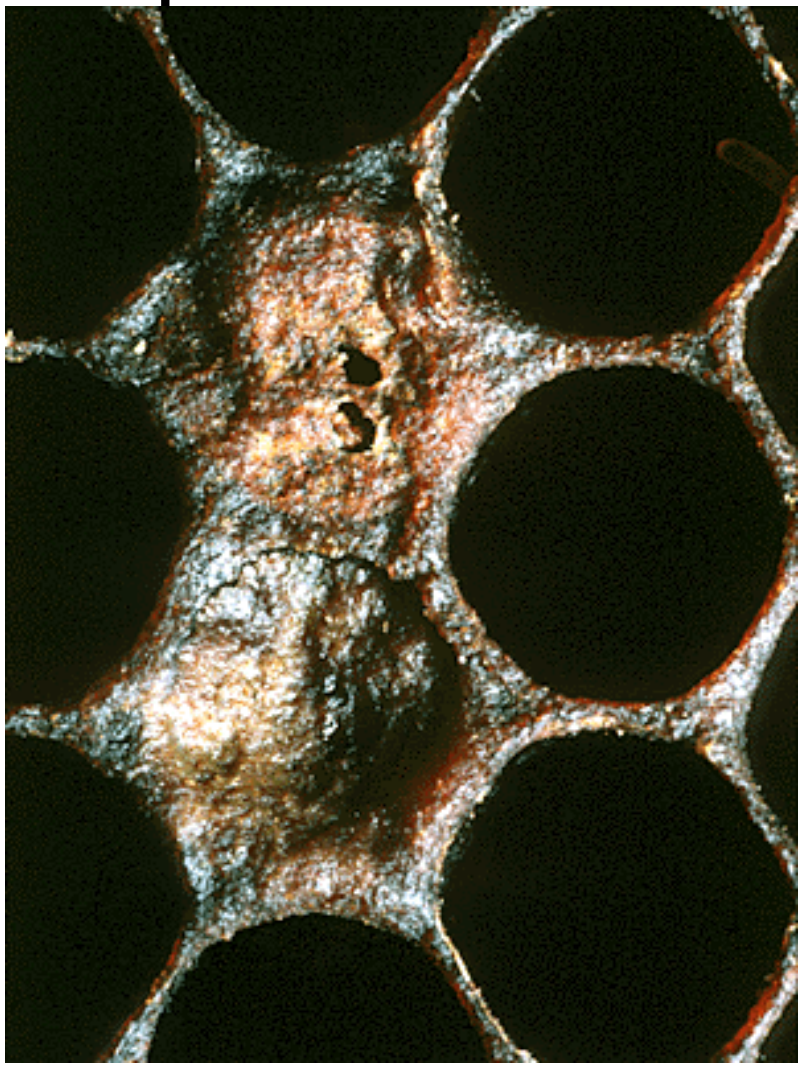


Diseases of Bees

American Foulbrood

- *Bacillus larvae* White, spore-forming bacterium
- Highly contagious, brood disease
- Most widespread and destructive affecting queen, drone, and worker larvae
- Adult bees not affected by AFB
- *Bacillus larvae* occurs in two forms: vegetative (rod-shaped bacterial cells) and spores
  - Only the spore stage is infectious to honey bees
  - Spores germinate into the vegetative stage soon after they enter the larval gut
  - Spores highly-resistant to desiccation, heat, and chemical disinfectants
  - Spores can remain virulent for more than forty years in combs and honey

American Foulbrood



- Larvae less than 2 ½ days old become infected by swallowing spores in their food
- Older larvae not susceptible
- Death occurs after the cell is capped, during the last two days of the larval stage or first two days of the pupal stage
- New spores form after the larva or pupa dies

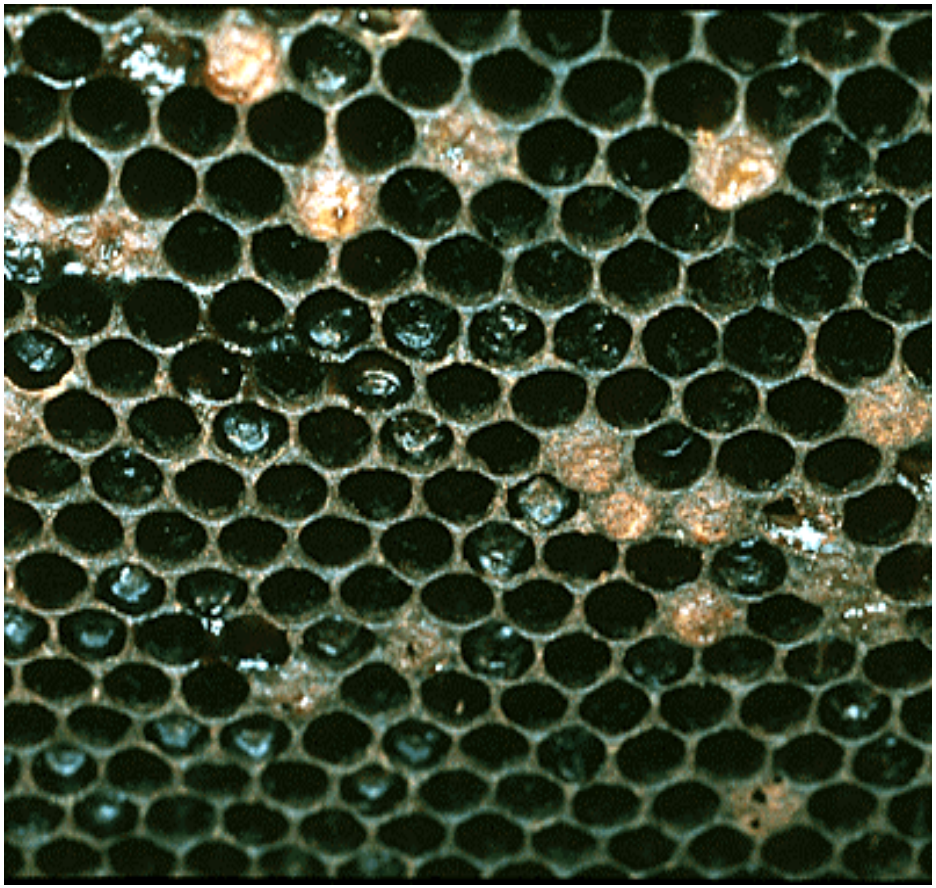
http://maarec.psu.edu/pest&disease/sl10.html

American Foulbrood

- Dead larvae change from a healthy pearly-white to light brown and then to a darker brown
- Color change is uniform over the entire body
- Infected larvae look melted-down and lie flat in the bottom side of the cell

http://maarec.psu.edu/pest&disease/sl10.html

American Foulbrood

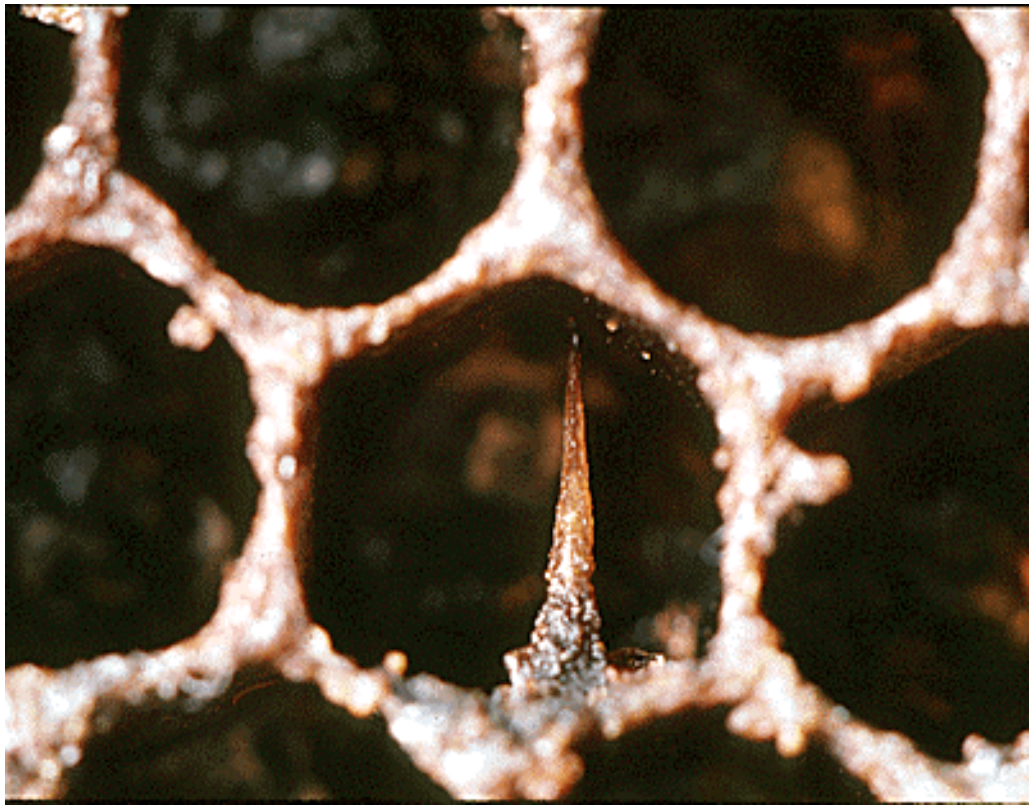


- Within a month, these dead larvae dry to brittle scales that are almost black
- Each scale contains as many as 100 million AFB spores
- The scales lie flat along the lower walls of the cells with the rear portion curving up at the bottom of the cell
- House bees have difficulty removing the scales from the cells

http://maarec.psu.edu/pest&disease/sl10.html

American foulbrood

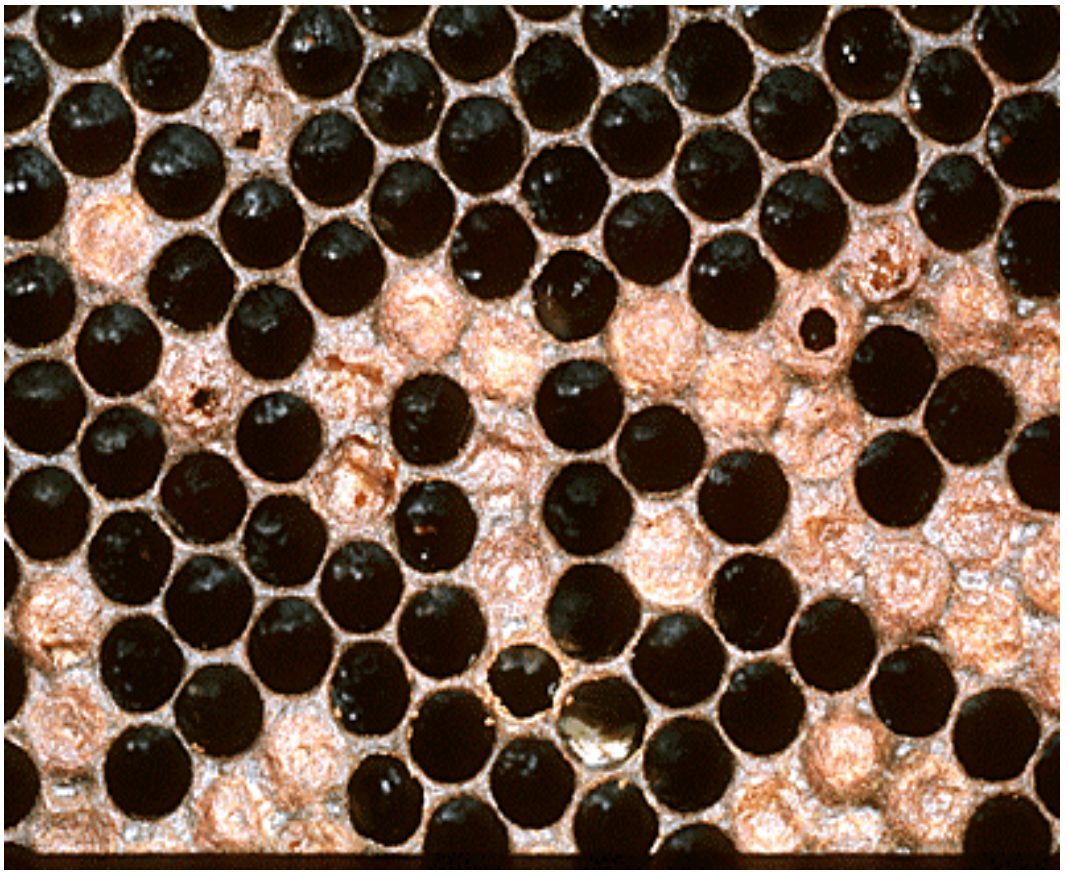
- If death occurs during the pupal stage, pupae undergo the same changes in color and consistency as larvae
- Also, the pupal "tongue" usually sticks to the top wall of the cell
- Presence of pupal tongue is one of the most characteristic symptoms of American foulbrood



http://maarec.psu.edu/pest&disease/sl10.htm

American Foulbrood

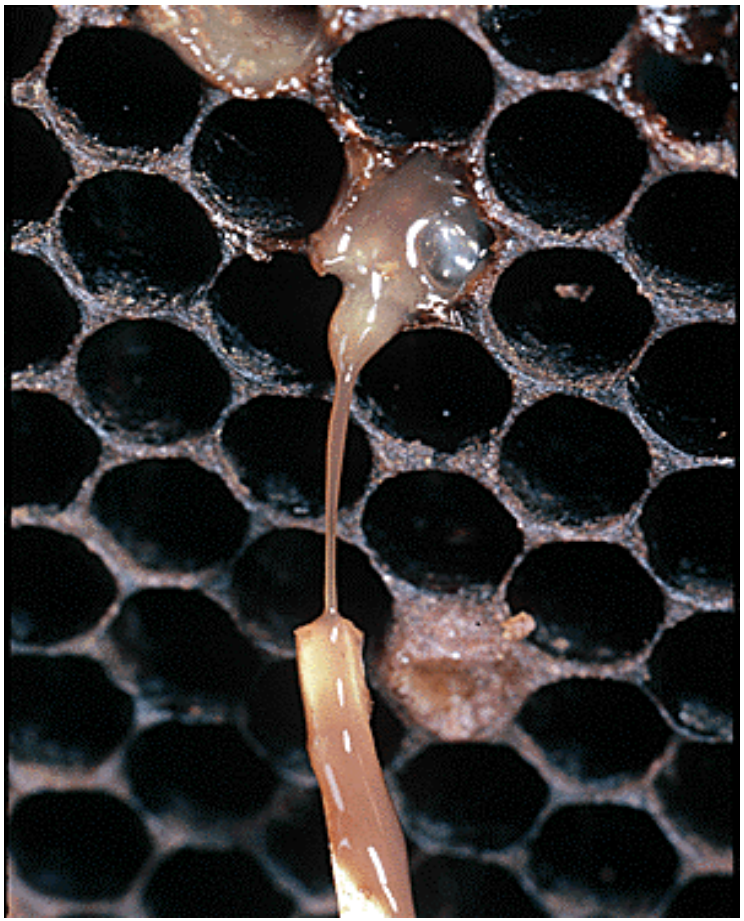
- Brood combs have a scattered and irregular pattern of capped and uncapped cells
- Infected cells are discolored, sunken, and often have punctured cappings
- “Pepperbox" appearance contrasts with the yellowish-brown, convex, and entirely sealed cells of a healthy brood comb



http://maarec.psu.edu/pest&disease/sl10.htm

American Foulbrood

- Up until 3 weeks after death, the dead larvae have a glue-like consistency
- To test for the disease, choose a larva that is discolored and exhibits a melted-down appearance
- Insert a twig or toothpick into the cell, stir the remains of the dead larva and then slowly withdraw the test stick
- If a portion of the decaying larva clings to the twig and can be drawn out about an inch or more while adhering to the dead mass, its death was probably due to AFB
- This "ropiness" of freshly-dead larvae is a characteristic symptom



http://maarec.psu.edu/pest&disease/sl10.htm

American Foulbrood

- The secret is to find the disease in its early stages
- The beekeeper should make inspections and be alert for signs of the disease

http://maarec.psu.edu/pest&disease/sl10.htm

American Foulbrood

- Highly-resistant to common disinfecting methods and can remain alive and virulent for more than forty years in combs and honey
- Only treatment considered to be totally effective is the burning of infected colonies and all contaminated equipment

http://maarec.psu.edu/pest&disease/sl10.html

American Foulbrood

- Terramycin®: Oxytetracycline hydrochloride
- Approved for use as a preventive treatment
- Antibiotic does not kill *Bacillus larva* spores
- Prevents AFB spores from germinating to the vegetative stage and delays vegetative growth in larvae
- Allows individual larvae to survive and has no effect on the virulent spores in the contaminated equipment
- AFB usually re-appears once Terramycin® treatment stops

http://maarec.psu.edu/pest&disease/sl10.htm

American Foulbrood

- Treatments made at least one month before the first major nectar flow, and again after the honey crop has been removed
- Terramycin® is relatively unstable in honey or syrup solutions- should be fed as a dust mixed with powdered sugar
- **NEVER** medicate bees when there is any danger of contaminating the honey crop

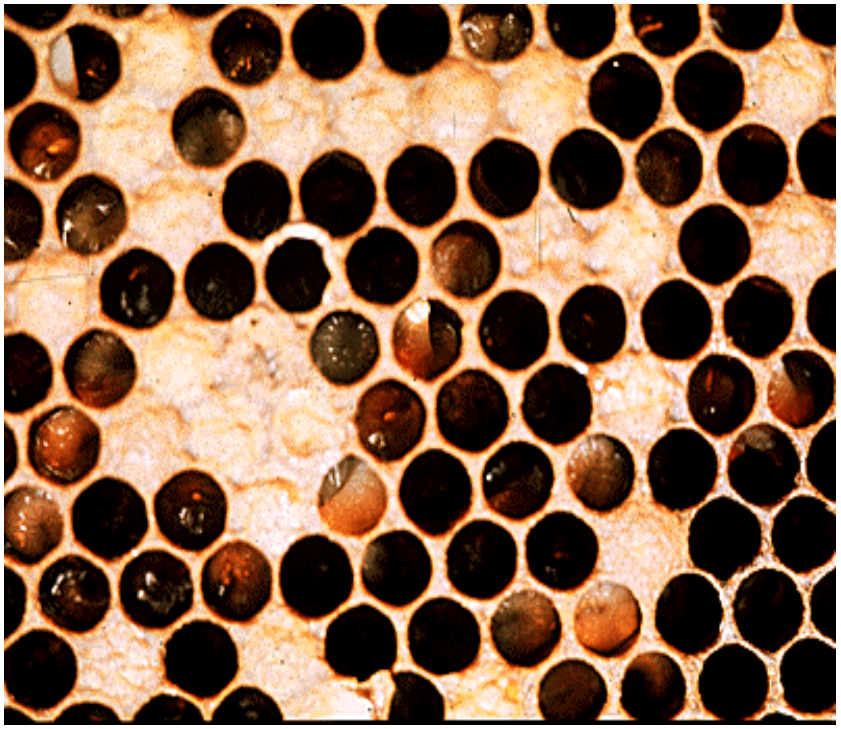
http://maarec.psu.edu/pest&disease/sl10.htm

European foulbrood

- ***Melissococcus pluton,* non spore-forming bacterium**
- **Brood disease, stress disease**
- Mostly found in spring and early summer
- Overwinters on combs and gains entry into the larva in contaminated brood food and multiplies within the gut of larva
- Frequently disappears with a nectar flow
- Disease can remain active throughout the entire foraging season
- All castes of bees are susceptible, although various commercial strains differ in susceptibility

European Foulbrood

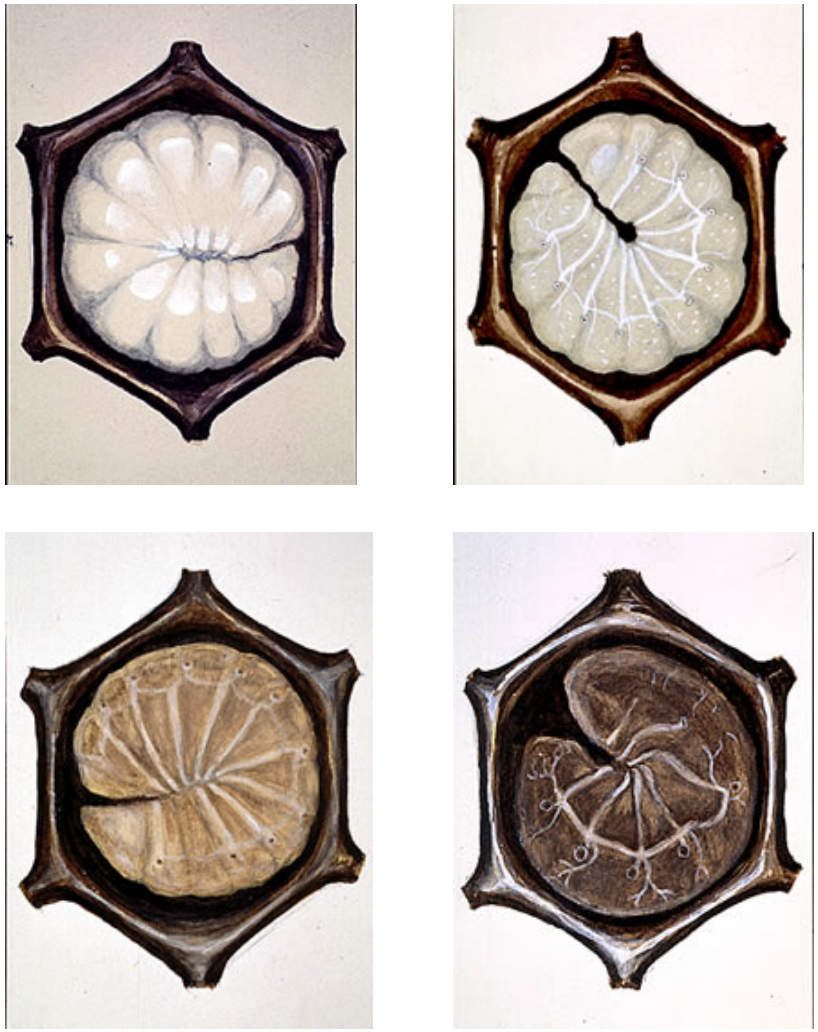
- Kills larvae that are 2 to 4 days old, while still C-shaped in the bottom of the cells
- Most of the larvae die before their cells are capped
- A spotty pattern of capped and uncapped cells develops only when EFB becomes serious
- Occasionally, pupae die from the disease



http://maarec.psu.edu/pest&disease/sl10.htm

European Foulbrood

- Most significant symptom is non-uniform color change of the larvae
- Change from a normal pearly-white to yellowish, then brown, and finally grayish-black but can be blotchy or mottled
- Infected larvae look under nourished
- Their trachea are visible as distinct white lines
- Unlike larvae killed by AFB (larvae rarely pull out in a ropy string when tested with a toothpick), the dead larvae form a thin, brown or blackish-brown scale which can be easily removed
- Does not kill colonies, but will affect population growth



http://maarec.psu.edu/pest&disease/sl10.htm

European Foulbrood

- Can be eliminated by re-queening colonies
- Requeening provides a time lag between brood cycles that allows the house bees to remove diseased larvae
- The antibiotic Terramycin® can be used
- Treatments are made at least one month before the first major nectar flow, and again after the honey crop has been removed
- But if the disease threatens the survival of the colony, Terramycin® may be fed at anytime of the year
- If treatment is given just before or during a honey flow, extracting supers must be removed prior to treatment- any honey produced cannot be used for human consumption
- Terramycin® is relatively unstable in honey or syrup solutions- should be fed as a dust mixed with powdered sugar

http://maarec.psu.edu/pest&disease/sl10.htm

Chalkbrood

- *Ascophaera apis, s*pore-forming fungus
- Brood disease
- Worker, drone, and queen larvae are all susceptible
- Spores of the fungus are ingested with larval food
- The spores germinate in the hind gut of larva, but mycelial (vegetative) growth is arrested until the larva is sealed in its cell
- When larvae are 6 or 7 days old and sealed in their cells, the mycelia break through the gut wall and invade the larval tissues, until entire larva is overcome
- Process takes from 2 to 3 days

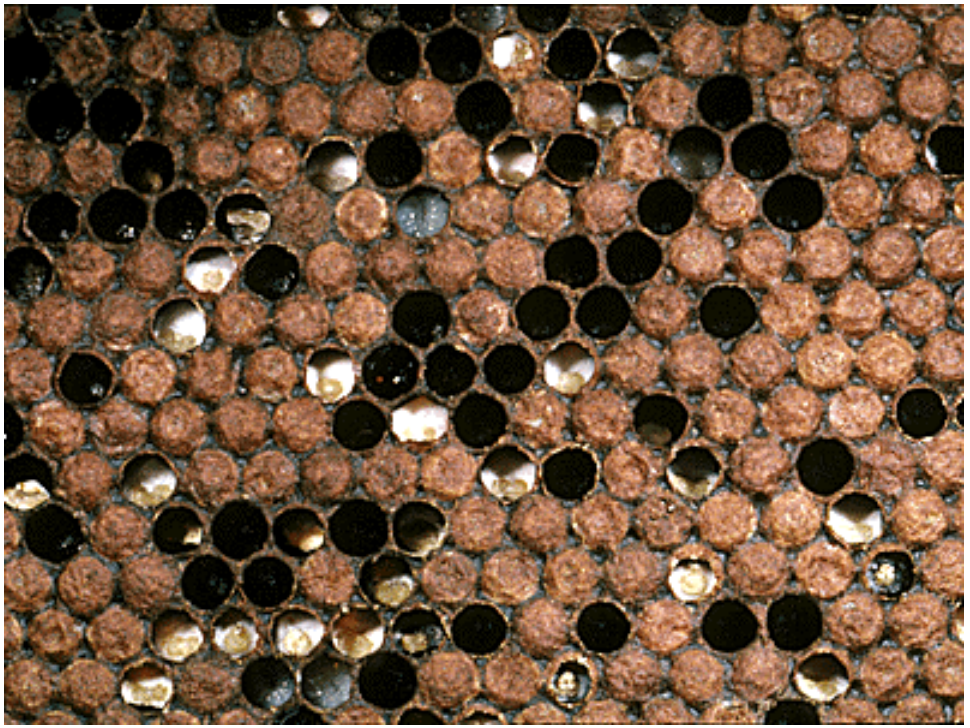
Chalkbrood

- Dead larvae are chalky white and usually covered with mycelia- have a fluffy, cotton-like appearance
- Mummified larvae may be mottled with brown or black spots, especially on the under sides
- Larvae that have been dead for a long time may become completely black as the fruiting bodies fully mature

http://maarec.psu.edu/pest&disease/sl10.htm

Chalkbrood

- Diseased larvae found throughout the brood-rearing season- most prevalent when the brood nest is expanding
- Affected larvae found on outer fringes of brood nest where insufficient nurse bees are available to maintain an elevated temperature
- Brood cells can be either sealed or unsealed
- Young pupae or recently sealed larvae are susceptible
- House bees often puncture or remove cappings



http://maarec.psu.edu/pest&disease/sl10.htm

Chalkbrood

- Infected larvae become stretched out in their cells in an upright position- removed by nurse bees 2 to 3 days after symptoms appear
- Dead larvae are found in front of the hive, on the landing board, or in pollen trap
- In strong colonies, most mummies will be discarded by worker bees outside of the hive- reducing possibility of re-infection from those that have died
- **No treatment is presently available for control**
- Chalkbrood reduced by re-queening colonies with young queen

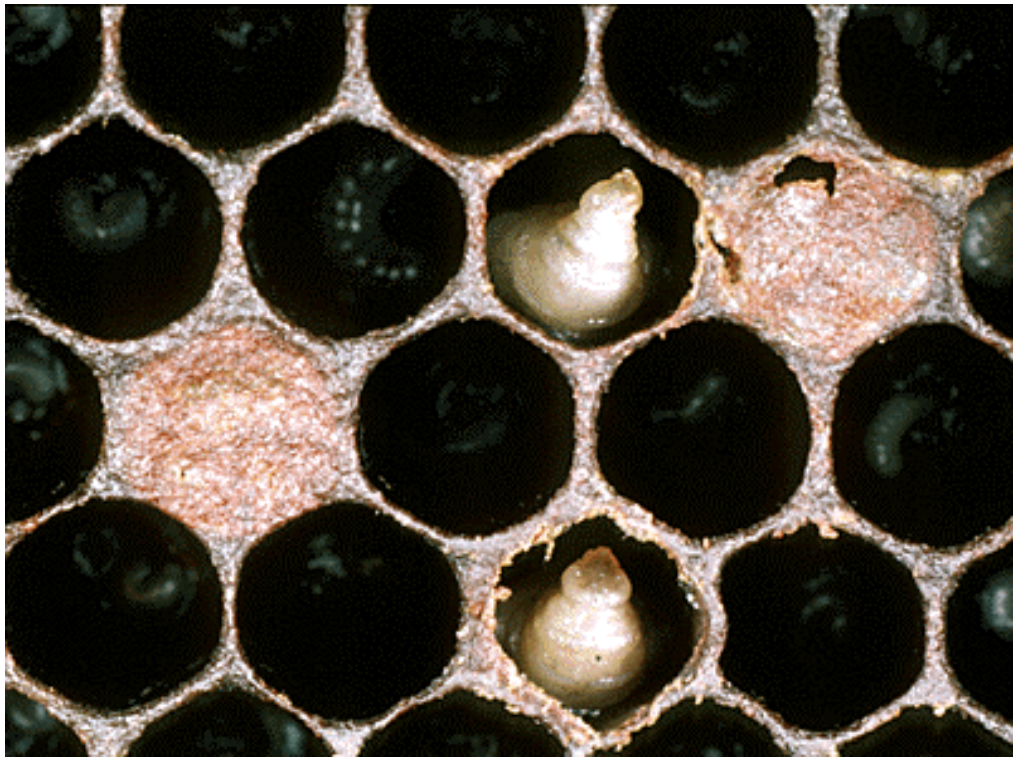
http://maarec.psu.edu/pest&disease/sl10.htm

Sacbrood

- Caused by: Sacbrood Virus (SBV)
- Brood disease
- Most common during the first half of the brood rearing season
- Often goes unnoticed, since usually affects only a small percentage of the brood
- Adult bees detect and remove infected larvae
- If sacbrood is observed, then the disease may be too severe for the adult worker population to handle

Sacbrood

- Both worker and drone larvae can be infected
- Death occurs after the cell is sealed and larva has spun its cocoon
- Pupae killed occasionally, but adult bees immune
- Dead brood often scattered among healthy brood
- Cappings over dead brood are first punctured and the affected brood removed by the bees
- The larvae gradually change from pearly white to dull yellow or gray, and finally black
- Head of the larva becomes black
- Larvae die in a stretched-out position with their heads raised



http://maarec.psu.edu/pest&disease/sl10.htm

Sacbrood

- Larvae are easily removed intact from the cells (unlike those killed by American foulbrood)
- The larvae are watery with tough outer "sack" or bag of fluid which is filled with millions of sacbrood virus particles
- The dried sacbrood scale lies flat, with the head end raised and tail flat on the bottom side of the cell
- The scales are rough and brittle- do not adhere tightly to the cell wall
- Sacbrood disappears when the honey flow starts
- Strong colonies and regular re-queening seem most effective in combating this disease
- No antibiotic is effective in preventing or controlling sacbrood

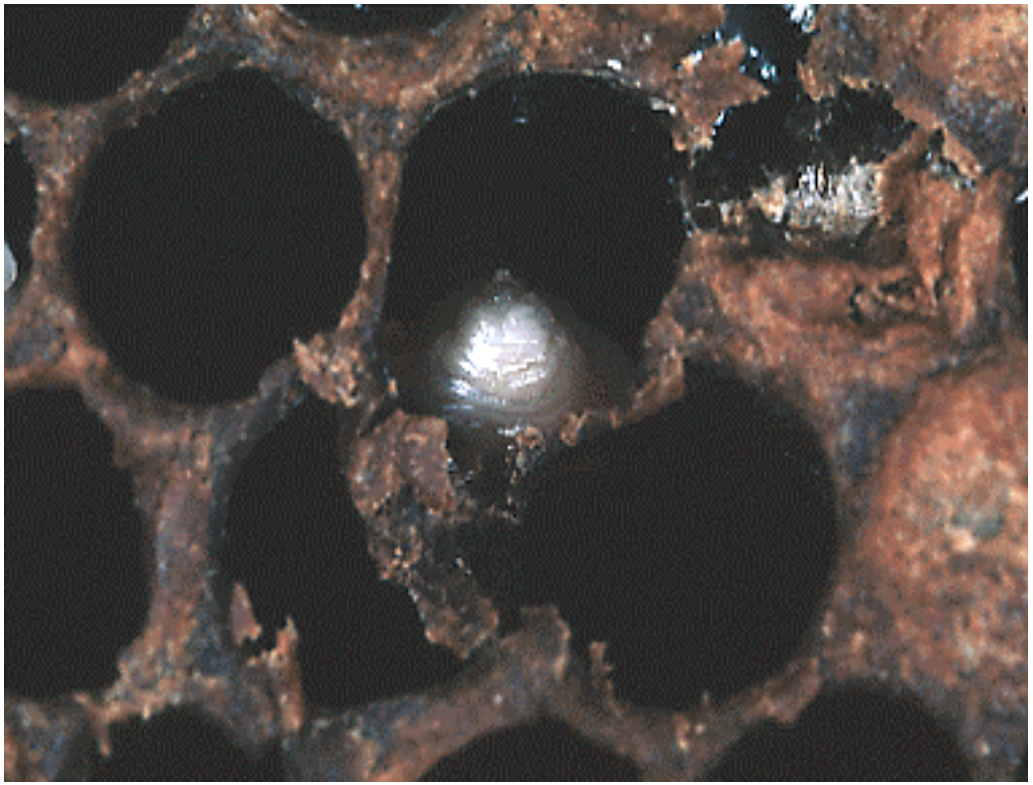
http://maarec.psu.edu/pest&disease/sl10.htm

Parasitic Mite Syndrome (PMS)

- Likely associated with Varroa mites, viruses or a combination of both
- Complex of symptoms has been given the name "Parasitic Mite Syndrome" o PMS

http://maarec.psu.edu/pest&disease/sl10.html

Virus Infected Larvae



http://maarec.psu.edu/pest&disease/sl10.html

- Affected larvae die in the late larval or prepupal stage, stretched out in their cells with their heads raised
- In the early stage of infection, are white but dull rather than glistening and look deflated
- Later larva have gray or brownish spots
- Prepupa die after the cell have been capped- cappings may be perforated or the cells may be uncapped completely
- When the larval remains are stirred with a toothpick or small twig, they do not rope out but are globular-similar to European Foulbrood

Apistan™

- Virus complex associated with Varroa mites, then controlling the mites is important in controlling the viruses
- If used according to label directions, Apistan™ (fluvalinate) is effective in controlling Varroa mites

http://maarec.psu.edu/pest&disease/sl10.html

Terramycin®

http://maarec.psu.edu/pest&disease/sl10.html

- Treating Varroa infested colonies with the antibiotic Terramycin® seems to help the bees survive and perform better
- Terramycin® is effective in treating the bacterial disease European Foulbrood- only masks symptoms of American Foulbrood
- Not likely to have a direct effect on a virus but some control over Varroa infestations

Chilled Brood

- Caused by poor brood conditions, cold weather
- Larvae are underfed
- Colony inspection during cold weather
- If larvae are underfed, or if the brood covers a larger area than the bees can keep warm, some of the brood will die
- Uncapped brood turns gray
- Infected brood will be removed from cells as soon as the colony grows stronger and returns to normal
- Loss of brood from chilling or lack of food may be prevented by observing the following precautions:
  - (I) Work with the bees as little as possible when weather is cold
  - (2) Replace combs in order in which they were removed
  - (3) Do not leave frames of brood standing outside the hive any longer than necessary

Nosema

- *Nosema apis,* spore-forming protozoan
- Adult disease
- Common in cool, wet weather
- Infection of digestive tract of workers, queens, and drones
- Ingested with food or water
- Spores germinate and multiply within the lining of the midgut
- Millions of spores are shed into the digestive tract and eliminated in the feces

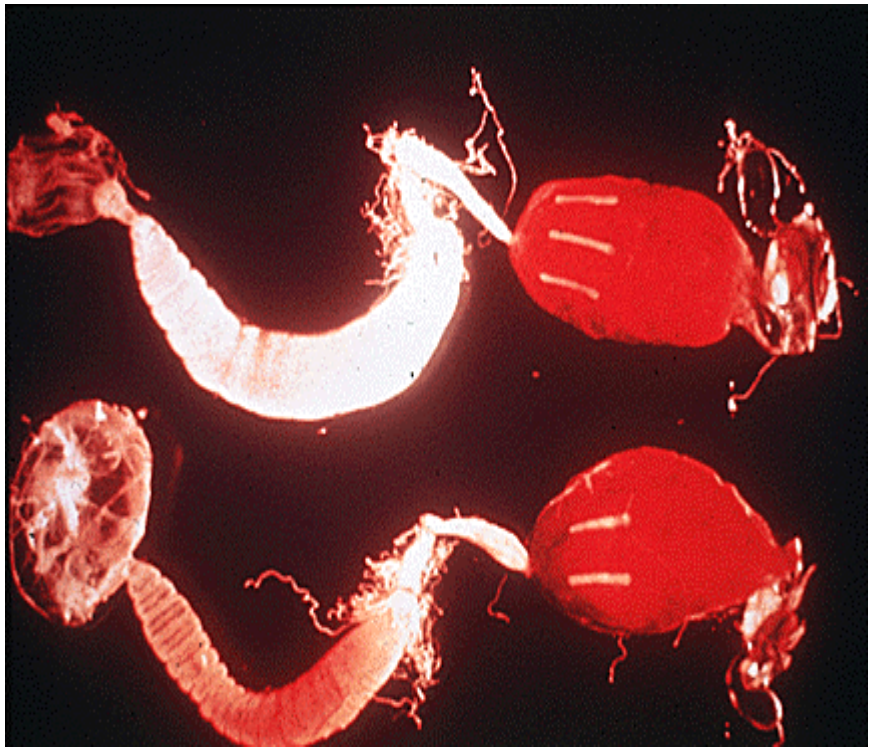
Nosema

- Commonly affects 20-30% of colonies
- Damage to the digestive tract may produce symptoms of dysentery
- Infected workers defecate in the hive or on the outside of the hive rather than defecating out in the field
- When queens infected, egg production and life span are reduced
- Infection of worker bees inhibits digestion of food in the stomach and production of royal jelly
- Productive life of the worker is shortened- ability to produce brood-food decreases so reduces brood production and colony development

http://maarec.psu.edu/pest&disease/sl10.htm

Nosema

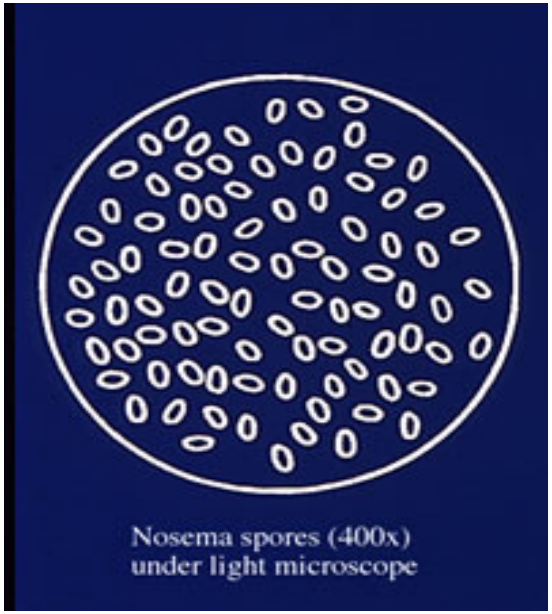
- Positive way to identify is dissection of adult bees
- The hind gut and digestive tract of diseased bees are chalky white or milky white
- Healthy bees have amber or translucent digestive tracts
- Individual circular constrictions of a healthy bee's gut are visible, but gut of infected bee is swollen and constrictions may not be visible

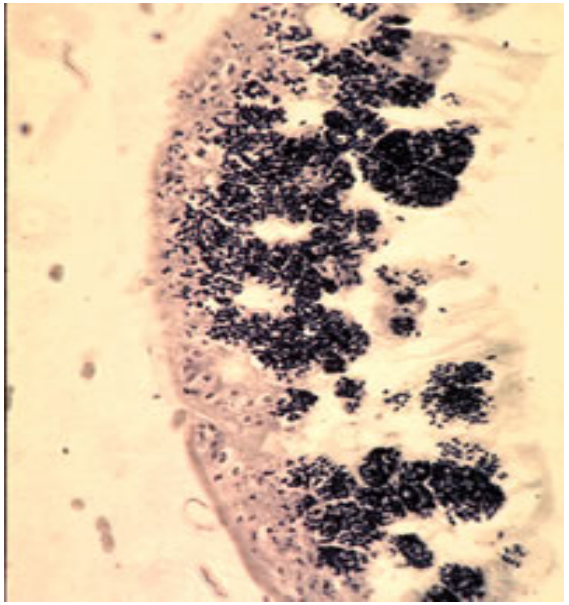


http://maarec.psu.edu/pest&disease/sl10.htm

Nosema

- Most easily detected by the microscopic examination of macerated abdominal tissue
- Diagram shows nosema spores as they appear under the microscope
- Figure shows a section through the gut stained to highlight nosema disease





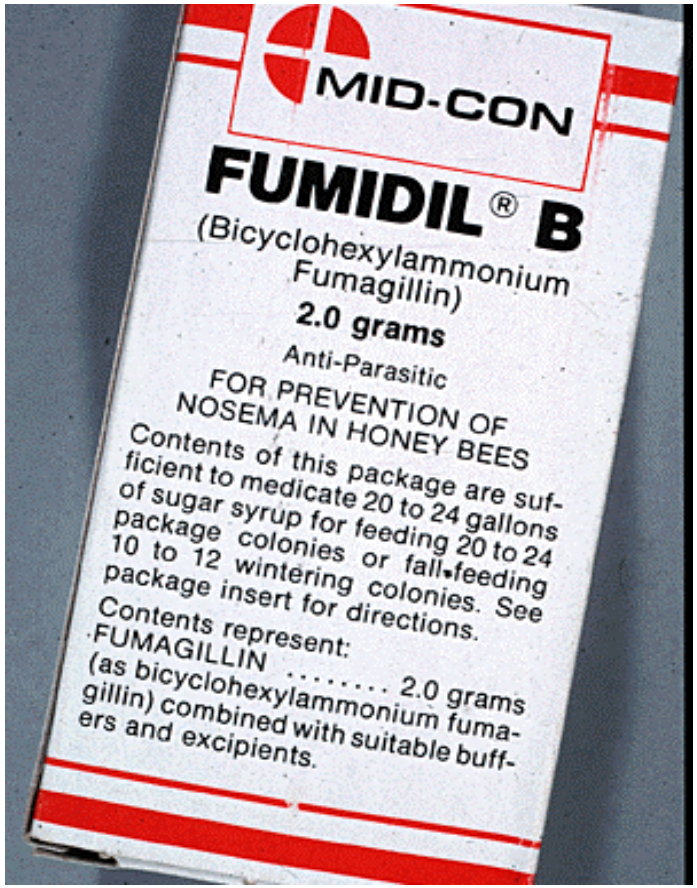
http://maarec.psu.edu/pest&disease/sl10.htm

Nosema (dysentery)

- Colonies in moist areas or areas with poor air drainage may have signs of dysentery
- To prevent dysentery, make sure hives are stocked with high-quality food and are well-ventilated
- Hives should be rainproof and situated in a dry location-good air circulation is important

Fumidil® - B box

- Fumidil-B ® (Fumagillin), fed in syrup- proven effective in suppressing nosema in fall and spring
- Treatment will not completely eliminate the disease- only suppresses vegetative stage
- Less effective when fed with powdered sugar, extender patties, candy, or pollen supplements



http://maarec.psu.edu/pest&disease/sl10.htm

Paralysis

Caused by:

Chronic paralysis virus (CPV)

Acute paralysis virus (APV)

- Other suspected causes of paralysis include:
  - Pollen and nectar from such plants as buttercup, rhododendron, laurel, and some species of basswood
  - Pollen deficiencies during brood rearing in the early spring
  - Consumption of fermented stored pollen

Paralysis

- Tremble uncontrollably and unable to fly
- Lose the hair from bodies and have a dark, shiny, or greasy appearance
- Large numbers of bees found at colony entrance, crawling up the sides of the hive and/or blades of grass around the hive, and then tumbling to the ground
- Affected bees also found on top bars or frames next to the hive cover with wings extended
- Colony may recover from paralysis after a short time, or may continue for a year or more without killing the colony
- Susceptibility to disease is often inherited
- If paralysis persists, requeen with a different strain of bees
- Adding a frame or two of sealed brood from a healthy colony into the diseased colony is helpful

http://maarec.psu.edu/pest&disease/sl10.htm

Colony Collapse Disorder

- Sudden death of adult bees with absence of dead bees in front of colony entrances
- Honey and stored pollen are present and signs of recent brood rearing
- Delayed robbing and slow invasion by common pests such as wax moths and small hive beetles

Colony Collapse Disorder

- From 1947 to 2005 number of managed bee colonies has decreased by over 40%, from 5.9 million to 2.4 million
- Beekeepers with CCD are reporting losses of 30-90%
- Shortages so critical in 2005, honey bees were imported from outside the U.S. for the first time in 83 years since the passage of the Honeybee Act of 1922

Colony Collapse Disorder

- Due to the varroa mite, new or emerging diseases (*Nosema* species) and pesticide poisoning
- The most highly-suspected cause of CCD is immune-suppressing stress on bees
- Stresses: poor nutrition by apiary overcrowding, pollination of crops with low nutritional value, drought, and migratory stress by the increased need to move bees long distances to provide pollination services
- Stress could be compromising the immune system of bees, making more susceptible to disease

Colony Collapse Disorder

- Surviving colonies too small to be rented as pollinating or honey producing units
- Losses have been reported in migratory operations wintering in CA, FL, OK and TX
- First “report” of CCD made in mid-November 2006 by a Pennsylvania beekeeper overwintering in Florida
- Number of large beekeepers have discovered higher than normal losses compared to the past few years -may or may not be related to CCD
- No evidence that CCD affects quality of honey- affected colonies are unlikely to make enough honey for harvest
- The impact of CCD appears to be limited to adult bees

Early Signs of CCD

- 1. Insufficient number of adults to maintain the brood
- 2. The remaining bees are mostly young adults
- 3. The queen is present, appears healthy and usually still laying eggs
- 4. Reluctant to consume feed provided: sugar syrup and protein supplement
- 5. Foraging populations are greatly reduced to almost non-existent

Other Possibilities of CCD

- Imidacloprid, applied as a systemic, has been found in corn, sunflower pollen at levels high enough to harm bees-bees do collect corn pollen
  - If bees are eating fresh or stored pollen contaminated with chemicals at low levels- may not cause mortality but may impact the bee's ability to learn or make memories
  - Young bees leaving the hive to make orientation flights may not learn the location of the hive-may not return causing the colony to eventually die
- Also shifts in the Earth's magnetic field could affect bee navigation- have not been correlated but cannot be completely ruled out at this time

Hard vs. Soft Chemicals

- If you observe high levels of varroa mites, treat them using soft chemicals- Apiguard (thymol), Apilife VAR (thymol, eucalyptus oil and menthol), or MiteAway II (formic acid)
  - DO NOT use oxalic acid, or home made hard chemical mixtures
- Harder chemicals (fluvalinate, coumaphos, and amitraz) may have a sub lethal affect on bees which may add additional stress on the bees
- Treating with soft chemicals helps keep the mite population low while avoiding the potentially negative effects of hard chemicals

What can I do to reduce the likelihood of CCD?

- 1. Keep colonies strong by practicing good management practices
- 2. Don’t combine dead or weak colonies with strong colonies
- 3. Feed colonies fumigillin (Fumidil®-B) in the spring-treating for nosema helps reduce colony stress

DO NOT combine collapsing colonies with strong colonies

- If you combine a collapsing colony with a healthy colony, the healthy bees may become ill- lose both colonies
- Put the equipment in storage area within TWO WEEKS of collapse to prevent robbing by neighboring colonies
- Wear a protective face mask to prevent the inhalation of mold spores that may grow on the comb

Is it safe to reuse the equipment from dead colonies?

- **If you suspect CCD,** do not reuse until causal agents have been identified
- Consider the best practice of replacing old comb with new on a regular basis
- Equipment sterilization (ethylene oxide or gamma irradiation) may be necessary- DO NOT recommend burning infected equipment

Honey Bee Genome

- Fully sequenced- permitting the creation of new molecular approaches
- Helping identify the most likely causal factors underlying CCD
- **Potential to reveal: how the bees are responding to potential pathogens, environmental toxins, or other stressors**
- The genome has already shown that bees are weak in detoxifying enzymes -which would make them particularly vulnerable to pesticide poisoning
- Have weak immune systems-depend on sociality to protect their colony from diseases-depend on hygienic behavior to remove infected brood from the hive

www.honeybee.tamu.edu

Tanya Pankiw
Assistant Professor
Department of Entomology
Texas A&M University
College Station, Texas 77843
t-pankiw@tamu.edu