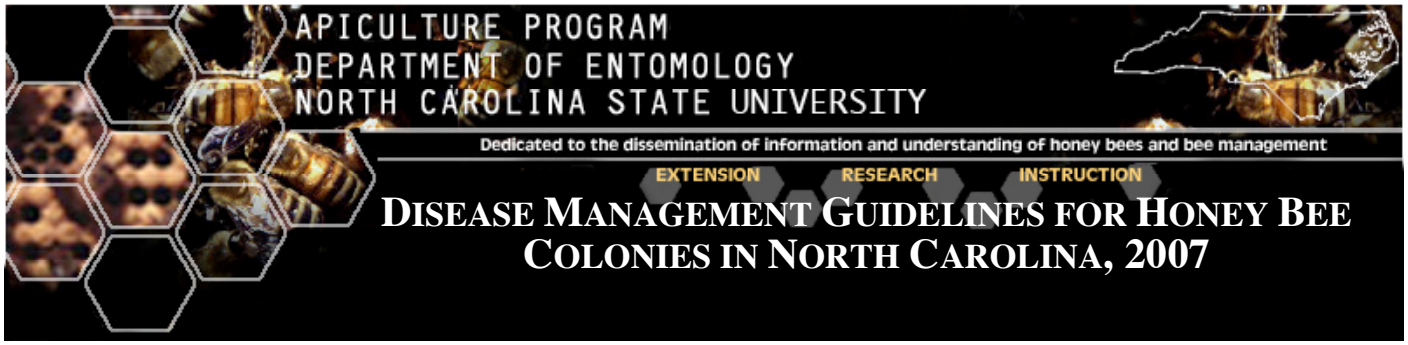

DISEASE MANAGEMENT GUIDELINES FOR HONEY BEE COLONIES IN NORTH CAROLINA, 2007

It is the goal of every beekeeper to maintain healthy, productive colonies. This can only be accomplished by reducing the frequency and prevalence of disease within beehives. The following is an outline of recommendations for detecting and treating colonies for economically important parasites and pathogens of honey bees so that beekeepers may achieve this goal, and do so in a *sustainable* way for the long-term health of their colonies.

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VARROA MITES[1]

Cause

The parasitic mite, *Varroa destructor*

Symptoms

- Presence of adult mites on adult bees, brood, or hive debris
- Adults with shortened abdomens, misshapen wings, and deformed legs
- Dramatic decline in adult population and brood area, with spotty brood pattern

Means of prevention

- Screened bottom boards
- Mite-tolerant stocks, such as Russian, SMR, or Minnesota hygienic
- Drone-brood trapping
- Treatment of inert dusts

Methods of detection

- Sugar shake or ether roll
- Sticky board
- Alcohol wash
- Drone-brood inspection or visual inspection

The varroa mite

Treatment recommendations (see flow chart, page 9)

Spring (prior to honey flow)

- If varroa levels are equal to or more than **2-3 mites per 100 adult bees** (sugar shake, ether roll, or alcohol wash) or **40-80 mites per 24 hours** per sticky board, treatment is warranted.
- The use of volatile treatments, such as thymol or formic acid, are not recommended since they can result in decreased brood area. Use the appropriate dosage of **Apistan®** or **Checkmite+®** as long the mites have not previously developed a resistance.

Late spring/summer (during/immediately following honey flow)

- Never use any chemical treatments while honey supers are on hives.
- Employ one or more means of prevention, such as screened bottom boards or mite-tolerant stock.

Autumn (preparing for winter)

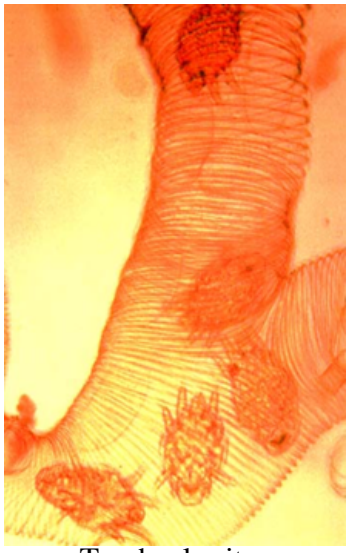
- Sample frequently for mites, preferably once a month.
- If varroa levels are equal to or more than **5-6 mites per 100 adult bees** (sugar shake, ether roll, or alcohol wash) or **100-150 mites per 24 hours** per sticky board, treatment is warranted.
- Rotate treatments as often as possible to minimize the prolonged exposure of any one chemical for the mites. This will help ensure that the mites do not develop a resistance to the available treatments.

[1] For more information, see NCSU *Beekeeping Note* **2.03** on the biology, detection, prevention, and treatment of varroa mite infestations

TRACHEAL MITES[2]

Cause

The parasitic mite, *Acarapis woodi*.



Tracheal mites

Symptoms

- There is no one tell-tale sign of this disease.
- Disjointed wings or 'K-wing', distended abdomen.
- Bees often crawling on the bottom board appearing "morbid".

Means of prevention

- Resistant stock, such as Buckfast or Russian

Methods of detection

- Positive identification of tracheal mites can only be made upon microscopic observation of trachea (the breathing tubes of adult bees).
- If you suspect a tracheal-mite infestation, contact you regional NCDA&CS Apiary inspector.

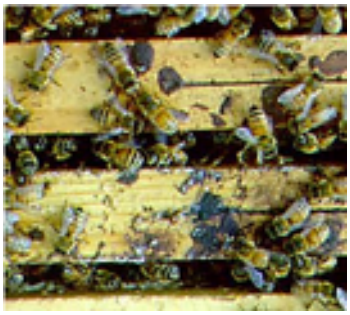
Treatment recommendation

- Verify infestation level whenever tracheal mites are suspected (see above).
- If the percentage of infested adult workers is 10% or greater, treatment is warranted. Treat colonies in the late summer or autumn.
- Recommended treatments:
  - **Mite-a-thol®** (menthol crystals)
  - **Mite-Away II®** (formic acid pads)
  - **Apilife VAR®** (thymol pads) or **Apigaurd®** (thymol gel)

NOSEMA

Cause

The protozoan, *Nosema apis*.



Bees defecating in the hive because of nosema

Symptoms

- There is no single symptom of the disease.
- Adults may have distended abdomens and defecate within the hive rather than take cleansing flights.

Means of prevention

- There is no exact means of prevention for nosema.

[2] For more information, see NCSU *Beekeeping Note* **2.02** on tracheal mites.

- Since the disease can be caused by stress, maintaining strong, healthy colonies is the best means of prevention.

Methods of detection

- Infections can only be confirmed by dissecting the digestive tract from individual bees. Diseased individuals have white, soft, and swollen ventriculae rather than brown and tubular.
- Hind gut contents can be examined under a microscope, and nosema spores can be counted using a hemocytometer.

Treatment recommendation

Spring (prior to honey flow)

- The only registered treatment for nosema is **Fumadil-B®**. Treat if there are more than **1 million spores per bee**.
- Mix **Fumadil-B®** with sugar syrup according to the label and feed to bees.

Late spring/summer (during/immediately following honey flow)

- No treatment warranted. Maintain strong colonies.

Autumn (preparing for winter)

- Treat if there are more than **1 million spores per bee**.
- Mix **Fumadil-B®** with sugar syrup according to the label and feed to bees.

AMERICAN FOULBROOD (AFB)

Cause

- The spore-forming bacterium, *Paenibacillus larvae larvae*.

Symptoms (see Table 1)

- Brood is dull white, becoming light brown to almost black.
- Age of dead brood is usually older sealed larvae or young pupae.
- Sealed brood is discolored and sunken, often with punctured cappings.
- Heavy infections have brittle, black scales that lie flat on the bottom of brood cells, formed from the dried remains of diseased brood. These scales contain billions of AFB spores and are highly contagious and persistent.

American foulbrood

Means of prevention

- Hygienic stocks
- Avoid robbing by keeping colonies strong
- Minimize comb swapping between hives
- Replace three combs in the brood chamber every year with foundation or drawn combs from honey supers

- Disinfect bee hives or suspect frames and brood boxes at the NCDA fumigation chamber using ethylene oxide
- It is **not** recommended to preventatively treat colonies with antibiotics, as it masks AFB symptoms (increasing the spread of the disease among hives) and resistant strains of AFB may develop.

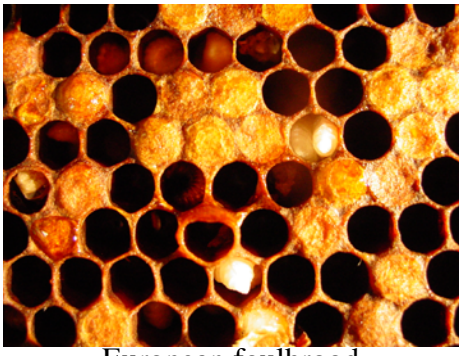
Methods of detection

- 'Ropy test'. Since larval remains of AFB-infected brood are elastic, a common field diagnostic is to pull the remains out of the cell with a toothpick or small twig. If the remains are elastic and "rope" out of the cell an inch or two, it is likely AFB rather than another brood disease.
- Holst milk test. This is a simple procedure that can be accomplished in most beekeeping operations. Place a suspect scale or smear of a diseased larva in a glass vial containing 4 ml of 1% powdered skim milk. Place the tube in a warm place (preferably at 37ºC). If AFB is present, the suspension should be clear in 10-20 minutes, since *P. larvae* spores produce proteolytic enzymes.
- Other, more sophisticated tests can be performed in the laboratory. Contact your regional NCDA&CS Apiary inspector for details.

Treatment recommendations

- Verify infestation and distinguish from other brood diseases (see Table 1).
- Contact your regional NCDA&CS Apiary inspector to inform them of an AFB outbreak.
- Burn all frames and euthanize bees
- Scorch or fumigate empty brood boxes, bottom boards, inner covers, and lids

EUROPEAN FOULBROOD (EFB)


European foulbrood

Cause

- The bacterium *Melissococcus pluton* and associated flora

Symptoms (see Table 1)

- Brood is dull white, becoming light brown to almost black.
- Age of dead brood is usually younger, unsealed larvae.
- Consistency of remains are rubbery and granular, not elastic.

Means of prevention

- EFB is largely a disease caused by stress. Thus maintaining a strong, healthy colony is the best prevention of the disease.

Methods of detection

- Visual inspection

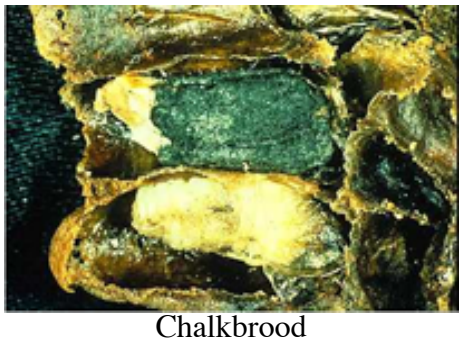
Treatment recommendations

- Verify infestation and distinguish from other brood diseases (see Table 1).
- For colonies with light infections, reduce the area of the brood nest, replace infected combs with foundation, and keep colony population strong.
- For colonies with heavy infections, treat with **Terramycin**®. Feed to colonies in powdered sugar by dusting the appropriate amount on the top bars on the outside of the brood nest.
- For all cases, maintain a hive quarantine (i.e., do not exchange frames from or into the hive) and be vigilant for re-emergent signs of EFB.

CHALKBROOD

Cause

- The fungus, *Ascophera apis*


Chalkbrood

Symptoms (see Table 1)

- Hardened, white or black "mummies" that resemble the consistency of chalk
- Mummies can be located in capped or uncapped brood cells, or they may litter the bottom board or on the ground directly outside the front entrance of a hive

Means of prevention

- Chalkbrood is largely a disease caused by stress. Thus maintaining a strong, healthy colony is the best prevention of the disease.
- Chilling may also increase chalkbrood, so ensure that there is an adequate adult population to keep the brood nest warm during cold weather.

Methods of detection

- Visual inspection is fairly obvious, thus the presence of mummies is usually sufficient to confirm infection.

Treatment recommendations

- There are no chemotherapies for chalkbrood. Requeening may be beneficial.

SACBROOD

Cause

- A viral pathogen of bee larvae


Sacbrood

Symptoms (see Table 1)

- Dead larvae appear watery and granular with a thick skin that forms a sac.

- The head of an infected larva is lifted toward the top of the cell, resembling the shape of a canoe.

Means of prevention

- Sacbrood is largely a disease caused by stress. Thus maintaining a strong, healthy colony is the best prevention of the disease.

Methods of detection

- Visual inspection

Treatment recommendations

- There are no chemotherapies for sacbrood. Requeening may be beneficial, and maintaining a strong colony often the best cure for the disease.

WAX MOTHS

Cause

- Larvae of the *Galeria mellonella* moth

Symptoms

- Large, 1.5 inch larvae tunneling through the wax combs of weak hives or stored bee equipment
- Silk cocoons, typically found on the side bars or top bars of frames in infested hives or equipment

Means of prevention

- Maintain strong colonies and inspect weak colonies often
- Cycle combs through the freezer for 1-2 days before storing
- Place **Paramoth® crystals** on stacks of stored combs according to the label

Methods of detection

- Visual inspection

Wax moths

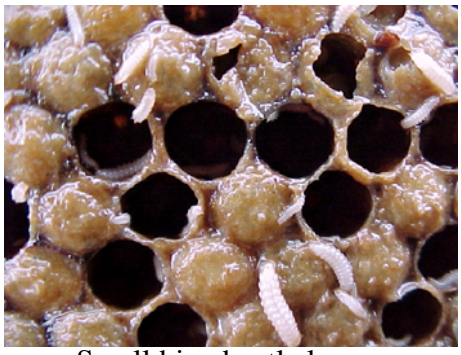
Treatment recommendations

- Store unused combs with PDB crystals. ***Never*** place crystals on a living colony, as the fumes are highly toxic to adult bees and brood.
- If heavy infestations are found, freeze combs for 1-2 days before reusing.

SMALL HIVE BEETLE (SHB)[3]

Cause

- Larvae of the beetle *Aethinda tumida*


Small hive beetle larvae

Symptoms

- Presence of adult beetles ***and*** eggs or larvae (presence of adults only does not necessarily indicate a problem).
- Watery, fermenting comb with small white grubs eating the wax.
- Larvae crawling out of the front entrance of the hive and burrowing into the soil.

Means of prevention

- There are no chemical products that deter SHB infestation[4].
- Beekeeping supply stores sell SHB traps that are inserted between the bottom board and brood chamber

Methods of detection

- Visual inspection and verification of SHB larvae.
- Young wax moth larvae can sometimes be mistaken for SHB larvae. The two can be distinguished since SHB larvae have dorsal spines, whereas wax moth larvae do not.

Treatment recommendations

- If adults are present, tape 1/2 a strip of **Checkmite+®** beneath a square of corrugated cardboard placed on the bottom board of the hive. The beetles often seek a refuge below the cardboard and come into contact with the pesticide. NOTE: the presence of **Checkmite+®** strips for the control of varroa mites does not simultaneously confer control for SHB.
- If larvae are present and crawling out of the hive:
  - Replace infected combs with foundation, then burn them or freeze them if salvageable.
  - Apply **GuardStar®** soil drench around the perimeter of the hive to kill developing pupae in the ground around the hive.
  - There are currently no in-hive chemical treatments for SHB larvae.

[3] For additional information about SHB biology, identification, prevention, and treatment, see NCSU *Beekeeping Note* **2.05**.

[4] Researchers are currently working on a SHB lure, but the technology is not yet available for use by beekeepers.

FLOW CHART FOR VARROA MITE DETECTION AND TREATMENT

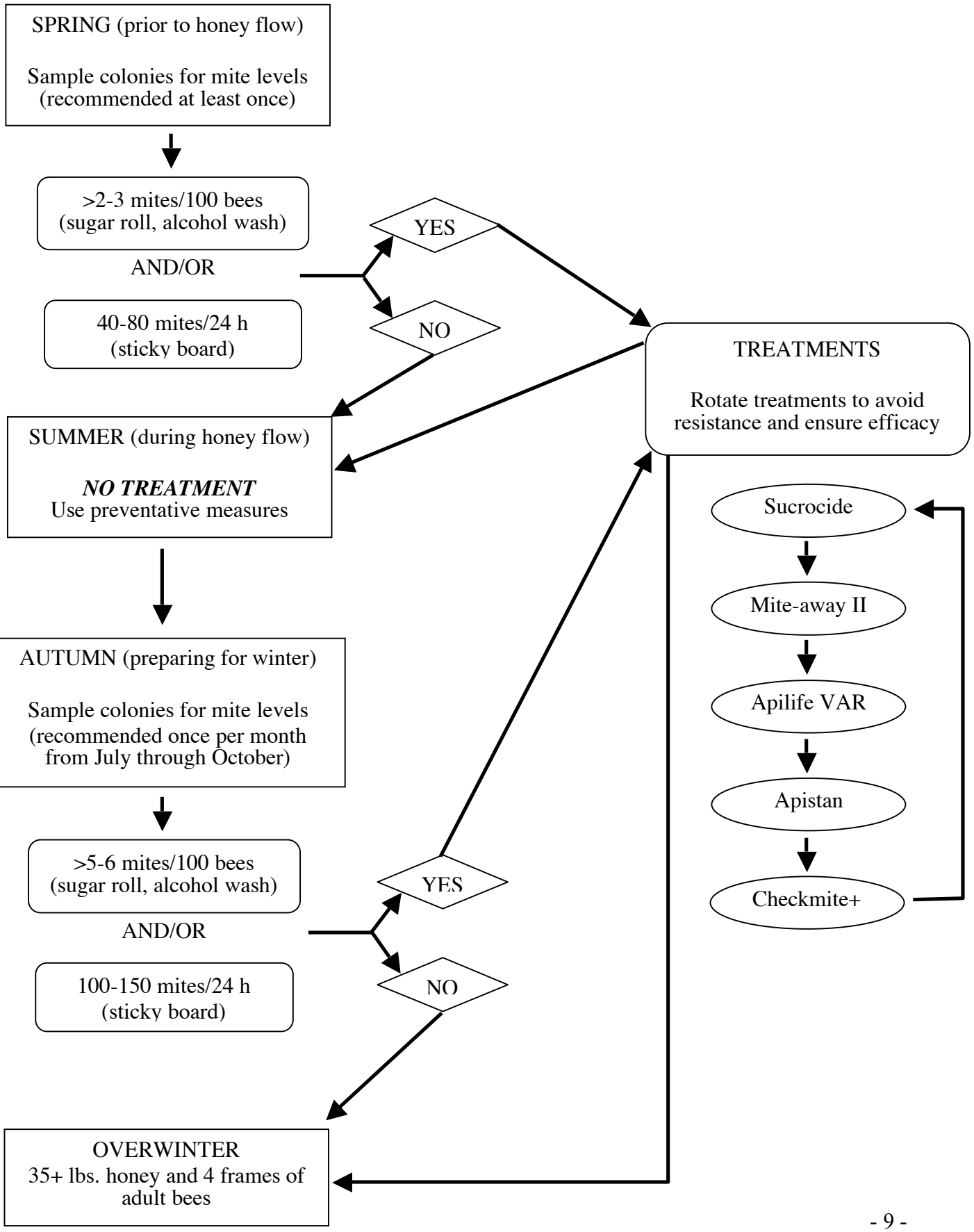


Table 1. Comparative symptoms of various brood pathogens of honey bees. Symptoms in ***bold italics*** indicate the most useful characteristics to distinguish the various diseases in the field. Table taken from Shimanuki and Knox (2000), Diagnosis of honey bee diseases, USDA Agriculture Handbook 690.

Symptom of dead brood	American foulbrood	European foulbrood	Chalkbrood	Sacbrood
Appearance of comb	Sealed brood is discolored and sunken, often with punctured cappings	Sealed brood is discolored and sunken, often with punctured cappings	Mummies found in sealed and unsealed brood	Scattered sealed brood with punctured cappings
Age	***Usually older sealed larvae or young pupae***	***Usually young, unsealed larvae***, but occasionally older coiled larvae	Older larvae in upright cells	Usually older sealed larvae upright in cells
Color	Dull white, becoming light brown, coffee brown, dark brown, then almost black	Dull white, becoming light brown, coffee brown, dark brown, then almost black	***Chalk white or black***	Grayish or straw-colored, becoming brown or darker
Consistency	***Soft, becoming sticky to ropy***	Watery and ***granular***; rarely sticky or ropy	Hard and rocklike	***Watery and granular; tough skin forms a sac***
Odor	Slight to pronounced odor of gym socks	Slightly sour to penetratingly sour	Slight, non-objectionable	None to slightly sour
Scale characteristics	Hard, brittle, and black. Uniformly lies flat on lower side of cell. Adheres tightly. ***Fine, threadlike tongue of dead pupae*** may be present.	Usually twisted in cell. Does not adhere to cell wall. ***Rubbery*** and black.	Does not adhere to cell wall. ***Brittle and chalky***, white to black in color.	Head prominently ***curled toward center of cell like a canoe***. Does not adhere to cell wall.
Picture				

Table 2. A list of products that are currently registered for the treatment of honey bee parasites, pathogens, and pests.

Brand name	Type(s) of chemical	Varroa mites	Tracheal mites	Nosema	AFB/EFB	Wax moths	SHB
Apigaurd	Thymol, an essential oils	**X**	**X**	-	-	-	-
*Apilife VAR	Blend of essential oils, particularly thymol	**X**	**X**	-	-	-	-
Apistan	Fluvalinate, a synthetic pyrethroid	**X**	-	-	-	-	-
*Checkmite+	Coumaphos, an organophosphate	**X**	-	-	-	-	**X**
Fumadil-B	Fumigilin, an antibiotic	-	-	**X**	-	-	-
GardStar	Pemethrin, a synthetic pyrethroid	-	-	-	-	-	**X**
Mite-a-thol	Menthol, an essential oil	-	**X**	-	-	-	-
Mite-Away II	Formic acid, an organic biopesticide	**X**	**X**	-	-	-	-
Paramoth	PDB crystals, a fumigant	-	-	-	-	**X**	-
Sucrocide	Sucrose octanoate, a synthetic biopesticide	**X**	-	-	-	-	-
Terramycin	Oxy-tetracycline, an antibiotic	-	-	-	**X**	-	-

* - These products are registered as a Section 18 Emergency-use pesticide, and therefore require a private applicators pesticide license to purchase and apply.

AS ALWAYS, USE OF NON-APPROVED CHEMICAL TREATMENTS IS STRICTLY PROHIBITED, AS ARE ANY APPLICATIONS OF CHEMICALS THAT DO NOT FOLLOW THE REGISTERED LABEL.

CONTACT INFORMATION

North Carolina Department of Agriculture and Consumer Services, Apiary Inspection

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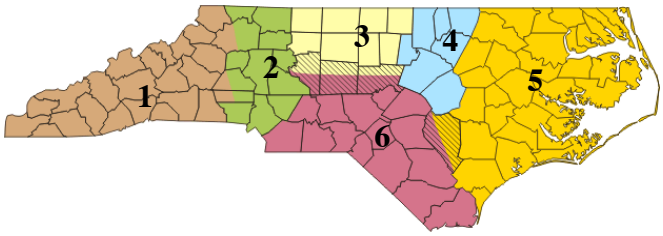
State Apiarist	Don Hopkins	(919) 218-3310
Region 1	Jack Hanel	(828) 230-4544
Region 2	Richard Lippard	(704) 880-3056
Region 3	Don Hopkins	(919) 218-3310
Region 4	Will Hicks	(919) 691-0022
Region 5	Adolphus Leonard	(252) 916-3444
Region 6	Bill Sheppard	(910) 690-9555



http://www.agr.state.nc.us/plantind/plant/apiary/apiarymp.htm

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