

Apiculture

Includes:

Beekeeping

Bee Diseases

Bee Insects & Parasites

Apiculture

2017 Recommendations

Beekeeping practices which work best in Tennessee have been determined through many years of experience and testing. Leslie Little, State Apiarist 1949-1971, now deceased, published seasonal management practices as a guide to recommended beekeeping.

These seasonal management practices developed by Mr. Little prior to 1971 have been thoroughly tested by staff members of the Department of Agricultural Biology at The University of Tennessee during 1971-1974. In 1984, Professor Harry Williams published "Beekeeping in Tennessee", (PB697 of the Agricultural Extension Service, University of Tennessee.) Several additional publications (see list, page 364) have been added since 1990 to supplement PB697, especially concerning parasitic mite management, pollination, and Africanized bee awareness. Beekeeping in Tennessee was updated in 2005, 2012 and 2016 and is now available as PB1745 from UT Extension or the AG Store on the UT web site. Publications and other information are available at <http://eppserver.ag.utk.edu/bees/test/intro.htm> These revised management practices are now recommended as the better beekeeping practices for Tennessee beekeepers by The University of Tennessee Extension Service, Entomology and Plant Pathology Section.

Beginning with Bees

- * Start small. Two colonies is an ideal number for an inexperienced person to keep for one or two years.
- * Expand as your experience and confidence grow.
- * Start right. Avoid discouraging mistakes at the very beginning by thorough preparation.
- * Buy new equipment. The experience of assembling new hives is very informative for the inexperienced beginner.
- * Beekeeping information is important. There are many good books that are excellent for beginners. Most books are very reasonably priced.
- * Plan ahead. Order your bees, hives, and other equipment well in advance. Place your order for bees, hives, and tools in the fall. The hives and tools will be delivered in time to be assembled before your bees arrive the following April.
- * Be ready. When the package bees arrive, your hives should be assembled and located on the site selected for your apiary.

Colony Performance Standards

A strong colony has these characteristics:

1. **Bee Population**
 - A. **Prolific queen**
 - (1) Full brood pattern on frame
 - (2) Few skipped cells
 - (3) 8 to 16 or more frames of brood (beginning of honey flow on approximately April 15)
 - B. **Worker bees**
 - (1) 60,000 to 100,000 bees
 - (2) 30,000 to 40,000 or more field bees
 - (3) 3,500 bees per pound or frame
 - (4) 20 full frames of bees in brood chambers
 - (5) 10 frames of super covered with bees
 - C. **Drone bees**
 - (1) 1,000 or more in strong colony
 - (a) Appear in March
 - (b) Disappear in October
 - (c) Seasonal (45-day life span) for individual drones
2. **Disposition** - Gentle bees that are easy to work with; very little tendency to sting under good flight conditions.
3. **Low-Level Swarming Instinct** - Very few or no swarm cells. Swarm prevention can be a major problem. Colonies with a low-level swarming instinct are most desirable.
4. **Honey Production** - Colonies that produce 100 pounds or more of surplus honey are most desirable. This is above the 40 to 60 pounds of stores for their use. Productive colonies can do extremely well if moved to the mountains from the low elevation areas by July 1. Double cropping of productive colonies is definitely recommended for increasing your honey production per colony.

Equipment

- * All equipment or colonies purchased from another beekeeper should be inspected by the bee inspector from the Tennessee Department of Agriculture.
- * All hive equipment should be of the modern Langstroth type with hanging, movable frames as required by the Tennessee Apiary Law.

- * All hive equipment should be the standard size for interchanging as needed.

<u>Equipment</u>	<u>Depth</u>	<u>Width</u>	<u>Length</u>
Brood chamber, hive body, deep super	9 7/16	16 1/4	19 7/8
Shallow super	5 11/16	16 1/4	19 7/8
Illinois super	6 5/8	16 1/4	19 7/8

Brood Chamber Area

- * Two hive bodies are recommended as the best brood-rearing chamber.
- * Ten frames or 9 frames and a follower board are recommended.
- * One hive body plus one shallow super is the minimum amount of brood-rearing space.
- * One hive body or deep super plus the Illinois super is also recommended as a brood chamber.
- * Full sheets of brood foundation with crinkled wires embedded vertically are recommended. Frames should be wired with two strands of horizontal banjo-tight wire to prevent warping of brood comb.

Supers

- * Four to six supers are the minimum number required per strong colony.
- * Foundation with crinkled wire embedded vertically should be used in supers to be extracted.
- * Use special milled foundation for cut comb or chunk honey.
- * Section honey is not recommended for beginners. Production requires a strong colony and a very good honey flow and special management.
- * Beekeepers with four or more colonies should have an extractor. The beekeeper should produce three supers of extracted honey for every super of cut comb honey in order to properly pack chunk comb honey.

HONEY BEE MITES

Tracheal mite -Acarapis woodi

The Problem - The tracheal mites have spread throughout Tennessee since their introduction in 1987. In the next two years, this parasite was believed

responsible for 50% losses of bee colonies statewide with local losses reaching 100%. The mite became a severe problem in part due to the difficulty in detecting the minute parasite and to the ease in which contaminated bees can spread the mites. The mites are spread among colonies by drifting bees, or among apiaries by any activities of beekeepers involved in moving adult bees. Other sources of contaminated bees include bee swarms and from package and queen bee producers.

Another parasite, the *Varroa* mite, (*Varroa destructor* formerly *Varroa jacobsoni*) has become a severe pest of honey bees in Tennessee. Detailed information about *Varroa* mites is available below.

Biology - The oblong mites are microscopic, averaging 160 microns long by 75 microns wide, about 1.5 times as long and 0.75 times wide as the diameter of a human hair (100 microns, 1/250"). They live and breed inside the trachea or breathing tubes of the bee especially in the large tubes in the prothoracic region. The mite penetrates the tracheal wall with its piercing mouthparts and feeds on hemolymph (bee blood). The effects of feeding, opening the surface to pathogens and the reduced capacity for air flow due to the wing muscles by the mites presence are the suspected damaging factors that kill bees.

Symptoms - The wings of infested bees are often unhooked, with one wing projecting 90 degrees from the axis of the body. These bees are unable to fly and crawl about the hive entrance (crawlers). Numerous bees have been observed on occasion to crawl out of the colony and die.

Population levels of mites are usually highest early in spring when bee population levels are low. As bees cluster in winter, the mite population builds up in the old bees and as brood rearing commences, mites move to young bees. If the wintering colony is weak due to food shortage or disease, the effect of mites is increased. Mite populations are lowest during summer when bee populations are high.

Detection and Diagnosis - To diagnose tracheal mites, the bees must be dissected and examined under a microscope.

Sampling for Varroa and Tracheal Mites - This method allows a single sample to be collected to detect both mites.

1. Select a frame from the brood area with bees on it.
2. Position the frame on end and scoop bees into the mouth of a quart mason jar until the jar is one third full. **Make sure the queen bee is NOT in the sample.**
3. Spray a rapid burst of ether (Starting Fluid) into the jar of bees, cap the jar quickly, and roll the mass of bees and liquid inside the jar.

4. Observe the inside jar surface for dark brown, oval, pin-head size *Varroa* mites. If you have many, this technique will reveal them in the field.
5. Add enough rubbing alcohol to half fill the jar, cap it tight and seal it with tape, if necessary.
6. Send the sample to office of county agent or this office including: name, address, phone number, number of colonies in apiary. Also, include the date of last re-queening and source of bees, if obtained commercially.

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Dissection - Fifty bees are randomly selected and placed on their backs. The front legs and head are removed with the edge of a razor blade and a thin cross-section of the prothorax containing the major tracheal trunks is made. The section is soaked overnight in an 8% solution of Potassium Hydroxide in water to dissolve muscle tissue. The trachea are observed at 20 to 40X under a dissecting microscope for mites. Infested trachea are usually discolored and darkened in the areas mites have fed.

Treatments for Tracheal Mites:

Resistant Stock Recently, several newly developed genetic stocks of honey bees have reported some resistance to the effects of tracheal mites. This resistance is not 100 percent, however research indicated significant improvement when compared to non-resistant lines. One stock, the BUCKFAST bee, can be purchased from Weaver Apiaries in Navasota, Texas. Additional stocks of the "Yugo" bee, tested by the USDA, have been released to queen producers to breed and sell. The New World Carniolan stock is also reported to express partial resistance to tracheal mite. Some queen producers are advertising "resistant" bees. We do not know whether the stocks are resistant or not, therefore, beekeepers should be careful when purchasing stock that claims to be resistant. It still may be necessary to apply additional treatment as explained below.

Menthol - is a crystal with fumigant action that kills tracheal mites. Temperatures must exceed 60°F for proper fumigation.

Application - Menthol should be applied after honey has been removed because it gives the honey a menthol flavor. Fifty gms, (1.8 ozs.) of crystals in a "bag" are placed flat inside the colony on the frame top bars above and to one side of the brood area if temperatures are below 80°F. If temperatures exceed 80°F. degrees, the bag should be placed on the bottom board below the brood chamber.

Menthol is a fumigant that is not effective until air temperature is above 60°F. In Tennessee, portions of the state vary with temperature, however, a general "window" for treatment starts in late spring (May-June) and ends in early fall (August). > recommend early fall for first choice because most honey flows have ended.

Menthol can be purchased in individual pre-packaged "tea-bags" or 50 gms. can be placed into a window screen bag secured by staples. Leave the bag in place for ten to twelve weeks. Do not leave menthol on all winter because it reduces brood rearing and may affect clustering behavior.

Contaminated Honey Should Not Be Eaten:

Treatments for mites including menthol and Mite-AwayII™, coumaphos, Apiguard®, ApiLife VAR® and APISTAN™ for *Varroa* mite treatment should not be made when producing honey. The chemicals can be absorbed into the honey. Remove Apistan strips or menthol packets prior to adding supers to collect honey. To treat for *Varroa* mites, use Apistan strips after all honey has been removed. Contaminated honey should not be eaten. This honey could be left in the comb and fed to the bees in late fall for over-winter food.

Sources of Menthol

A. Bee supply companies such as:

1. Walter T. Kelley Co.
3107 Elizabethtown Rd.
Clarkson, KY 42726
(502) 242-2021
2. Mann Lake Supply
County Road 40 & First Street
Hackensack, MN 56452
(800) 233-6663
3. Dadant & Sons
2425 Carroll Ave.
Lynchburg, VA 24501
(804) 846-0666
4. Brushy Mountain Bee Farm
Rt. 1 Box 135
Moravian Falls, NC 28654
(800) 233-7929

B. Agricultural Co-op's and local bee suppliers in several counties.

C. Local bee associations for their memberships: for example, Knox County residents can purchase medications from the Knox County Bee Association.

**Varroa mites -
Varroa destructor Anderson and Trueman**

The *Varroa* mite, *Varroa destructor*, was discovered in Tennessee in November of 1990. This infestation originated from contaminated honey bee queens and packages of bees shipped from producers in South Georgia to beekeepers in more than 50 Tennessee counties. Currently, *Varroa* mites are found throughout Tennessee. After being discovered in 1987 in Wisconsin and Florida, they spread rapidly throughout North America. *Varroa* mites have a world-wide distribution, and are found on all continents except Australia.

This parasite is so damaging because it has recently been introduced to a new host, the European honey bee [*Apis mellifera* L. (EHB)]. The EHB has no natural defenses to this parasite. The original host, the Asian honey bee (*A. cerana*), has established an "equilibrium" with its parasite because this bee can physically remove mites and kill them.

Economic damage: This lethal, pin-head size parasite is causing severe economic loss by killing thousands of honey bee colonies annually. It has contributed to widespread death of one-half the colonies in Tennessee, on average with severe losses in some locations of 100 percent.

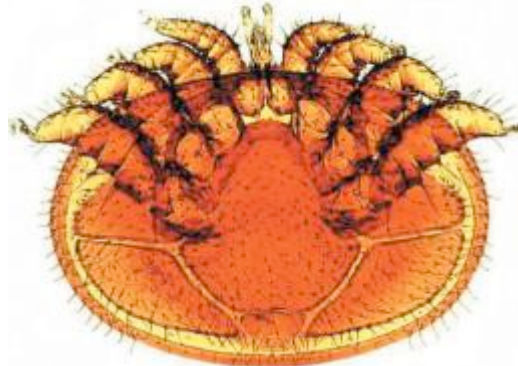
Colonies of EHB infested with *Varroa* almost always die unless the beekeeper uses effective measures to kill the mites. Colonies infested with the mites can die within one year.

Losses of bee colonies in Tennessee are believed to be affecting pollination of vegetable and orchard crops. Reductions in crop yields are suspected to be related to reduced numbers of pollinators. In some areas, growers are making contracts with beekeepers to provide adequate numbers of bees for pollination.

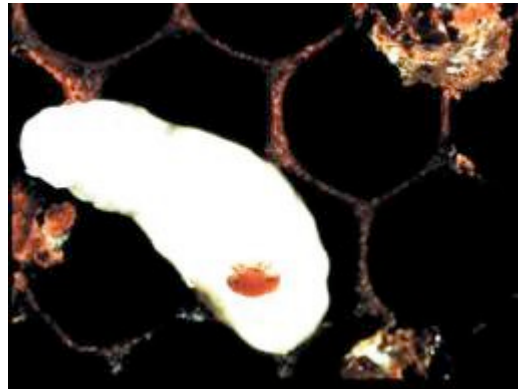
BIOLOGY - The *Varroa* mite is an external parasite of honey bee larvae, pupae and adults. The life cycle of the mite generally takes 11 days to complete [Fig 1] with female mite longevity of four to eight weeks. The infestation starts when a pregnant female mite enters the colony, attached to a returning bee (Fig 2). The adult female mite is oval (ca 1.2 X 1.6 mm), brown, with eight legs and is about the size of a pin-head (Figs 2 and 3). She searches for a larva with preference for drones>workers>queens, and crawls into the cell in the comb containing the larva. The cell is then capped over by workers. The female mite lays eggs which hatch and begin to feed on the bee larva. The mites literally suck the life out of the host bee by penetrating its internal membranes with their mouthparts and withdrawing fluids. The puncture wounds can become the entry points for disease organisms.

Bees that emerge after being parasitized by a single female and her offspring have a shorter life span than do non-parasitized bees. Bees parasitized by more than two mites may die before emerging, or if they do

emerge, they weigh less, may appear deformed and seldom leave the colony. The number of bees in the colony diminishes steadily as the number of mites increases. Less nurse bees are produced to feed the brood, and brood production ceases. At this stage, the entire colony collapses. All remaining adults usually leave the colony at one time, with each bee carrying numerous mites. These heavily infested bees often fly into nearby colonies and transfer mites in the process.



Adult female *Varroa* mite



Varroa mite on honey bee larvae

Often, the total collapse of a colony comes as a complete shock to the beekeeper. One day the colony appears "strong" (many bees), and two weeks later, the colony is dead, without a single live bee present.

Mites can be dispersed quickly whenever infested bees come in contact with uninfested ones. This can happen easily when infested bees (especially drones) drift (enter a colony that is not their own) into an uninfested colony, or during robbing, as uninfested bees remove honey from a colony occupied by infested bees.

Detection: Several methods can be used to detect *Varroa* mites: (Please see **Sensitivity** below).

Observing pupae - In this method, pupae are examined for mites by uncapping the cells, extracting the pearly white pupae and looking for the dark brown mites adhering to the surface.

Use a capping scratcher or table fork to uncapped several cells at a time, and spear the pupae beneath. A pair of tweezers can also be used to extract a single pupa from the cell. Select pupae that have pigmented eyes, because these can be extracted from the cell without

breaking apart. Select drone pupae if they are present, because *Varroa* prefer drones. If drone pupae are unavailable, then look at worker pupae. Sample at least 25 drone or 50 worker pupae to determine infestation level.

1. A sticky board trap is used to sample a whole colony for mites. A sticky board trap is placed on the bottom board inside the entrance of the bee colony. The board can be used alone or in combination with a treatment to detect mites. Mites die from natural causes, fall off the bees and land on the sticky board. A sticky board is made using stiff cardboard with a smooth, light-colored surface that is cut to fit inside the hive. A sticky substance such as "tangletrap" is applied to the upper surface to catch and hold mites. A metal screen made from eight-mesh (per inch) hardware cloth (same dimensions as the sticky board) is placed above the board, to prevent bees from removing the mites, and from becoming trapped on the board themselves.
2. The sticky board must be examined within two or three days, because other natural debris in the beehive will accumulate on the board, making it difficult to distinguish mites from debris. The examination process can be improved by hanging an Apistan® strip between frames in the brood area. These plastic 1-by-8-inch strips are impregnated with fluvalinate, an insecticide which kills the mites on the adult bees.
3. The powdered sugar shake method is used most often because it is quick and easy to perform. All that is needed is a sample of bees, powdered sugar and a screw-top glass jar with the lid replaced with eight-mesh per inch hardware cloth. (Alternately, ether starting fluid can be substituted for powdered sugar but this will kill the bees. If ether is used, spray two quick shots of starting fluid, then roll the jar. The mites will stick to the outside of the jar.) This technique is not as sensitive as some other methods (see Sensitivity of Method). Select a brood frame with worker bees on it. Make sure the queen is not on this frame because the bees will be sacrificed. Shake 300 bees (about ½ cup) from the frame into a quart jar. A funnel may aid in this transfer.

A temporary funnel can be made using a rolled up piece of paper or a plastic gallon container. Cut the plastic container in half, insert the "mouth" of the container (it becomes the spout of the funnel) into the sample jar. Instead of shaking the bees off the frame, dragging the jar top rim backwards across the frame can cause them to dislodge and fall in the jar. Pour a few tablespoons of powdered sugar into the jar with bees, cap the jar and shake vigorously. Be sure to entirely coat the bees with powdered sugar. Wait one minute, then shake the jar over a white piece of paper. The powdered sugar and mites will fall through the hardware cloth where they can be counted. The bees can be dumped at the hive entrance. Be careful not to confuse wax

scales produced by the bees, or lumps of pollen, with varroa. Wax scales are white. Probe any dark objects of similar size to varroa. Pollen lumps are soft and will break apart when probed.

4. An alcohol shake is a method used in the laboratory to more closely examine a sample. A sample is collected as mentioned above for ether roll. Add several ounces of 70 percent rubbing alcohol (isopropyl) to the sample. Place the sample jar into a laboratory shaker and shake for 30 minutes. Pour the bees and liquid through a coarse (60 mesh) soil sieve that is suspended above a vacuum filtration funnel. The bees are collected on the sieve screen; the liquid passes through the filter; and debris, including mites, is collected onto a piece of filter paper. Mites are easily observed, if present, on the white background of the filter paper. If necessary, a magnifying hand lens or microscope can be used to confirm the presence of mites.

Sensitivity of Method

Observing pupae is the only method that examines mites when they are present in the brood. *Varroa* spend 80 percent of their life in brood and only 20 percent outside on adult bees. A brood frame with a standard semi-circle pattern of capped brood (both sides) has approximately 5,000 cells. Therefore, three full frames of capped brood may contain 15,000 pupae. If you find 10 mites in 100 cells (10 percent) you may have 1,500 mites in the brood. If there are another 20 percent in the adult bees, then there are 1,875 mites in the whole colony. These figures are a crude estimate only because the amount of brood varies seasonally and with the health of the colony. When there is less capped brood, you may find more *Varroa* per cell.

Methods, such as the ether roll, that examine a small sample (300) from a colony of 30,000 are not very sensitive. The ether roll only samples 1 percent of the adult bees in the colony. The number of mites found in the jar should be multiplied by 500 to estimate the total number in the colony (including brood). This test may not detect the mites if they are present in low numbers. However, the ether roll method is easy to perform and results are available immediately, allowing the beekeeper to start treatments, if needed. If an ether roll reveals mites in a single colony in an apiary, additional tests may be used to discover a low infestation in other colonies.

The sticky board test is more sensitive than the ether roll, because it samples the entire adult population at one time. However, this test is more involved, it requires the hive to be manipulated to install the trap and requires a return visit, one or two days later, before mites can be discovered. The number of mites on the board should be multiplied by five to estimate total mite population in the colony. *Varroa* spend only 20 percent of their time on adult bees.

Treatments

For many years Apistan and Check Mite+ have been widely used miticides in the United States. Apistan consists of a pyrethroid chemical,

fluvalinate, impregnated in plastic strips. Check Mite+ contains coumaphos, an organophosphate, similarly impregnated in plastic. Although these treatments have been effective in reducing mite levels, mite resistance to these compounds is now common. Additionally both Apistan and Checkmite leach into wax and can interact with other pesticides found in the environment; therefore, we recommend other options for treatment. Apistan and Checkmite also can interact with each other, making them many more times toxic to bees than the products used alone. Never use these two chemicals together. A new product, Api var, containing the formamidine acaricide, amitraz is available now as a plastic strip. We suspect that mite resistance to this chemical will occur in a couple years.

Formic acid is a chemical that has been used in various mite control products for over a decade. Formic acid occurs in nature and can be found in honey from colonies never treated with formic acid. Formic acid products are highly caustic, so take care in handling it. Beekeepers have sustained serious chemical burns when attempting to make homemade formic acid treatments. In addition, beekeepers who do not follow product instructions have overdosed and killed their bees. Use only the labeled products, currently MAQS or Mite Away Quick Strip, and follow the instructions. The treatment period is sensitive to temperature, and colonies need a minimum population since brood rearing is negatively affected to some degree.

Oxalic Acid is one of the newest treatment methods for Varroa mites and was approved for use in beehives in 2015. Oxalic acid, when used according to label directions, is a very effective miticide and will not harm the honey bee colony when delivered correctly. Studies conducted on oxalic acid's efficacy indicate that it is 90-99 percent effective at killing mites with limited damage to the bees and brood within the colony. Even though oxalic acid treatments may be very effective at killing Varroa mites, it is not effective against mites that are under brood caps. The timing of oxalic acid applications is critical to mite population knock-down. It is suggested that treatments occur when there is little brood present, such as late fall, early spring, a caught swarm, pack-aged bees, or after completing a split without brood frames. Early morning or evening are the preferred times of the day to treat, as the highest population of bees will be present in the beehive. As with formic acid treatments, oxalic acid requires the use of personal protection equipment to apply, because oxalic acid can be absorbed through skin and the vapors are harmful. Oxalic acid is rated as Category 1 for toxicity, so proper health and safety precautions must be used. Mandatory safety equipment includes gloves, splash goggles,

synthetic apron and a vapor/dust respirator as vapors produced during treatment can contain carbon monoxide.

Oxalic acid treatments may be applied in three ways. The first method is the most effective and involves vaporizing oxalic acid crystals with heat in the beehive. A vaporizing pan tool is loaded with the recommended amount of oxalic acid and then placed 0.5 to 0.75 inch within the beehive, and the entrance is sealed with a damp rag to prevent vapor loss. The vaporizer is connected to a 12 volt, 15 amp battery to supply current which turns on the element that heats the pan to vaporize the oxalic acid crystals. The current is supplied to the vaporizer for two and a half minutes and then disconnected. The vaporizer is then left in the colony for an additional two minutes to fully release the vapors into the hive.

Additional treatment techniques include spray misting and trickle. Spray misting can be applied directly to the bees and is especially useful for treating captured swarms and packaged bees. Spray mists are applied an hour after spraying the bees with a 1:1 sugar water solution to fill their honey stomachs and reduce ingestion of the oxalic acid spray. The trickle method involves mixing the oxalic acid with a warm 1:1 sugar water solution which is then trickled with an eyedropper or syringe between the frames and onto the bees. Five mL of solution should be administered at a time, and a total of 50 mL of solution should be used per colony. Although oxalic acid has been shown to not accumulate in brood comb, honey supers should be removed prior to treatment as honey and pollen stores will become contaminated with the vapor.

As with all pesticides, caution should be exercised and all product label instructions and safety precautions followed. Oxalic acid and vaporizers may be purchased through Brushy Mountain Bee Farm and from several other online resources.

HopGuard II is a newly improved Varroa mite treatment product. It is produced from natural compounds found in the hops plant and has been shown to help reduce the level of Varroa mites in bee colonies.

This product comes as cardboard strips that have been impregnated with liquid soaked potassium salt of hop beta acid. These infused strips are hung in between the brood frames and left in place for a month. The recommended rate of application is one strip for every five frames that are covered with bees in the brood chamber, or two strips for every 10 frames that are covered with bees.

HopGuard II strips are only to be used in the brood chamber as the odorous hops extract may contaminate the wax and honey in supers, rendering the honey stores unusable. An advantage to using HopGuard II for treatment of Varroa mites is that it may be used without removing honey supers, as long as the strips are not used on the honey supers. Colonies may be treated up to three times per year; any further treatments may harm the health of the colony. Best results may be achieved by treating when the colony is broodless, as Varroa mites breeding in capped brood cells are less likely to be affected by treatment.

Treatment with HopGuard II strips requires the applicator to wear chemical-resistant gloves while handling the strips to avoid dermal irritation. Safety glasses or goggles should also be worn as HopGuard II may irritate the eyes. As with all pesticides, label instructions and precautions must be followed to ensure proper treatment and safety to bees and applicators.

Thymol based treatments — Apiguard and Apilife VAR are two thymol based varroacides. Thymol is considered a soft treatment because it's natural (derived from the thyme plant). However, just because it is a soft treatment does not mean it is totally benign. Apiguard gel can cause skin irritation or permanent eye damage in humans, and both Apiguard and Apilife VAR may cause the queen to suspend brood production. However, these products are preferred because bees may be less likely to develop resistance to thymol-based products due to its more generalized mode of action. The same is true of formic acid. Although thymol is a food additive (you may notice a "mouthwash" smell to Apiguard) these products should be removed at least two weeks prior to a honey flow to prevent the flavor from tainting the honey.

Apiguard® is extremely easy to use. It is simply a matter of placing the opened tray face upwards in the top of brood frames, preferably centered over the colony. After 10 days examine the tray and if depleted replace with a second tray. If there is product left in the tray after 10 days leave until day 14 and then replace. Leave a second tray in position for a further 2-4 weeks and treatment has been completed (duration of treatment therefore lasts 4-6 weeks).

Mode of action: After administration of the product homogeneous distribution within the bee colony is assured by vapor release and also by the bees' social behavior (feeding exchange and cleaning activities).

Contact: Worker bees climb into the Apiguard® tray and begin to remove the gel, as a hive cleaning behavior. The gel adheres to the bees' body hairs and as the bees run through the hive they distribute the product to the colony.

At low temperatures Apiguard® takes longer to evaporate and the lower activity of the bees means that gel is not distributed as efficiently. It is therefore essential to use Apiguard® when the colony is active and when temperatures are not too low (above 15 degrees F). Apiguard® will work at lower temperatures although the treatment period may need to be extended; the level of efficacy is generally better at higher temperatures.

ApiLife VAR®, a natural essential oil product, containing 74.08% thymol, 16.00% eucalyptus oil, and 3.70% L-menthol (currently there is no EPA Registration number), manufactured by Chemicals LAIF, may be used for the control of *Varroa* mites.

Applications can be made in any season (spring, summer, fall, winter) in which all applicable restrictions, precautions and directions for use can be followed. Do not use when surplus honey supers are in place. Use

when daily temperatures are between 59° F and 69° F. Do not use ApiLife VAR® at temperatures above 90° F.

Two treatments per year may be made. A treatment (3 tablets) consists of the following: Take one tablet and break into four equal pieces. Place pieces on the top corners of the hive body. Avoid placing pieces directly above the brood nest. After 7-10 days, replace with a fresh tablet broken into pieces as above. Repeat procedure again, 7-10 days later and leave last tablet for 12 days. After 12 days, remove residuals from the colony. To prevent the bees from gnawing the tablet either enclose each piece of tablet in an envelope of screen wire (8 mesh/inch) or place the uncovered pieces above a sheet of metal screen that prevents bees from contacting it. Remove ApiLife VAR® tablets from hive at least 1 month (30 days) prior to harvesting the honey.

PESTICIDE CAUTION: Fluvalinate, formic acid, Apivar® and coumaphos can cause health risks by being absorbed in honey and beeswax if not applied according to the label directions. The treatment should not be applied during a honey flow or when supers (boxes with honey in comb) of honey are present. Please read the label and follow instructions closely.

Parasitic Mite Syndrome

This new malady was discovered in 1995 by USDA scientists. This syndrome is not defined as a disease because no causative agent has been isolated. Detection of the syndrome is based on presence of symptoms identified in adult or larval (brood) bees listed below:

Adult Symptoms:

1. *Varroa destructor* is present.
2. Reduction in adult bee population.
3. Evacuation of hive by crawling adult bees.
4. Queen supersedure.
5. *Acarapis woodi* may or may not be present.

Brood Symptoms:

Some of the more puzzling aspects of this syndrome are observed as the affected brood are examined.

1. *Varroa destructor* is present.
2. Spotty brood pattern.
3. Symptoms resembling European Foulbrood, American Foulbrood, and sacbrood disease may be present. These symptoms may disappear following feeding of oxytetracycline, sugar syrup and the use of fluvalinate strips.
4. The age of affected brood can vary from "C" stage larva to prepupa. As a result, the affected brood may be seen anywhere on the comb.

5. Individual larva may appear in the "C" stage, twisted in the cell, "molten" to the bottom of the cell, light brown in color as in the early stages of American Foulbrood disease.
6. The affected individuals do not display any ropiness.
7. Some scale formation has been noted, scales are not brittle as with American Foulbrood disease and are easy to remove.
8. No typical odor can be associated with the syndrome.
9. Microscopically, the affected larva has no characteristic microbial flora. The flora is variable but no one bacterial type predominates.
10. To date, no known bee pathogen has been isolated from the affected brood with parasitic mite syndrome.

Tracheal and *Varroa* mites are believed to carry and spread the unknown agent, probably a virus, from colony to colony. Treatments for this syndrome are based on controlling mites and reducing other stresses to the bees. The syndrome is more common when bees are under stress. Maintaining young queens (less than 2 years old), feeding the colony with sugar/water syrup containing Fumadil-B, and preventative treating with Terramycin for American Foulbrood will help reduce stress.

Other Pests

Honeybees share their environment with many other opportunist predators and scavengers that cause little harm to a colony but can sometimes be found abundant in weak colonies. Yellow jackets are commonly seen prowling around the front of hives in late summer looking for recently dead bees to carry off. Below is a photo of a robber fly (Asilide) that has just caught a worker bee.

Nosema

Nosema disease has been a problem for beekeepers for more than 100 years. Nosema species are classified as microsporidians. Microsporidians are single-celled parasites related to fungi. Microsporidia are considered obligate parasites; only the spore (a dormant stage) can live outside the host. However, these spores are very resistant and can persist for many years in the environment. Until recently, the only species known to infect honeybees was *Nosema apis*. In 1996, *Nosema ceranae* was found infecting the Asian honeybee. *Nosema ceranae* has since been found throughout the world and is now more common than *N. apis* in North America. The introduction of this new species has made management more difficult because *N. ceranae* infected bees may display no obvious symptoms, like streaking, and this species may be more virulent.

Bees are infected after ingesting Nosema spores. This infection can happen when a house bee cleans a bit of

comb that has been contaminated with infected feces. These spores then germinate in the gut and invade one of the cells lining the midgut. They rob nutrients from the cell and reproduce by dividing. The parasite will continue to reproduce until the cell becomes exhausted, eventually rupturing and spilling the new spores into the gut. These spores may germinate immediately, infecting other cells, or they may be expelled with the feces

Diagnosis

Nosema apis was relatively easy to diagnose due to the presence of fecal spotting on the front of the hive. Bees infected with *N. ceranae*, the more common pathogen today, don't exhibit this symptom so more direct diagnosis is necessary. (Example of direct diagnosis at <http://www.extension.org/pages/25556/testing-for-nosema-spores>.) This diagnosis will require a 400x microscope, slides for the microscope and items you should be able to find in your kitchen.

To sample for Nosema, older field bees should be collected from in front of the hive in good weather. Older bees are needed because young infected bees will have few developed spores. You can use a bee vac or you can block the front of the hive with the inner cover and snatch bees out of the air with a small hand net. You'll want 25-50 bees. Place all bees in a mortar, a bowl or a zipper seal plastic bag. Then measure 1 mL water for each bee sampled (a large syringe works well). Place a small amount of water into the mortar, bowl or plastic bag. Using a pestle, spoon or rolling pin (for use with mortar, bowl or plastic bag respectively), crush the bees thoroughly. Add the remainder of the water to bring level to one mL per bee. Stir this mixture really well and place a drop onto a microscope slide. Apply a cover slip and wait 60 seconds for the spores to settle. If present the spores will be visible as small, consistently smooth-sided ovals. There is no well-defined threshold for treatment of Nosema at this time. This method will tell you if your colonies are infected or not and if spores are abundant or sparse. You'll need to decide if treatment is warranted based on your personal techniques and climate. Generally if you see 20 or more spores in the field of view at 400 times magnification, treatment may be necessary.

The Small Hive Beetle

A new pest of honeybees was found in Tennessee in 2000 when a beekeeper discovered beetles damaging beehives. The beetles were identified as *Aethina tumida* Murray, the small hive beetle, a pest from South Africa. The adults are 6 mm (1/4 inch) long, dark brown to black, flattened, oval to oblong, with the head often "tucked" below the thorax. If the head is in view, the short antennae have a conspicuous club on the last segment. The larvae are elongate, whitish grubs, tapered at front and rear ends, which under magnification have rows of spines on the dorsum. Adults and larvae inhabit beehives, where they feed on larvae, stored honey and pollen. As they feed, the brood and honeycombs are damaged, especially as the beetle larvae burrow through it. As the infestation increases, the honey ferments and bubbles out of the cells. Brood rearing stops when beetle numbers are high.

Honeybees have been observed to abandon colonies infested by the beetles. As the infestation builds, fermented honey is observed to run out of the hive; this is often the first external symptom that is noticed. Pupae of the beetles are white to brown and can be found in the soil beneath and near the hive. The development of the beetle from egg to adult in South Africa requires 38 to 81 days, with five generations possible during warm months. Small hive beetles are most likely to be found in colonies that have been weakened by something else, usually mites. Larvae congregate in corners, possibly to cluster together to retain heat. This clustering distinguishes the beetle larvae from wax moth larvae that are found scattered throughout weak colonies. Hive beetle larvae make a slime as they feed. This slime acts as a repellent to the bees. When the larvae become numerous, the slime is believed to cause the bees to leave the hive. Honeybees will not re-enter "slimy" comb. The slime must be washed off with water. Hive beetles will be noticed especially between the inner cover and top, but also will be noticed in other areas of the hive. Presence of the adults is considered normal while presence of larvae indicates a problem may be imminent. Do not store honey in comb for long periods, especially if pollen is present. Beetles can begin destroying unprotected combs in a number of days. Also, you should be careful about stacking weak colonies and extracted supers onto other colonies. Freezing combs will kill *A. tumida* eggs, larvae and adults

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American Foulbrood

American foulbrood is a disease of honeybee brood caused by the bacterium *Paenobacillus larvae*. Symptoms of the disease include a spotty brood pattern; concave, punctured capped brood cells; discolored larvae; dried, shrunken brood (called scales) stuck tightly onto the bottom of cells; and an unpleasant odor. This disease affects the capped stage of brood and cappings will need to be removed to examine larvae. Pearly white larvae turn chocolate brown and melt into the bottom of the cell. In some cases the pupal tongue may protrude out of the remnants of the larvae to the top of the cell. The disease is spread by long-lived, hardy spores transmitted by bees, on beekeeping equipment, in honey and in other ways. Because of the persistence of spores and the devastating effects of the disease, the recommended

action for American foulbrood is burning of the infested colony, including bees and woodenware. It is a law in Tennessee that hives infected with American foulbrood are to be reported to the Tennessee State Apiarist. Control should be coordinated with the Tennessee State Apiarist.

Once an infestation is detected, the bees in the affected colony should be killed (one way to do this is by spraying ether starter fluid in the entrance). Plug the entrance, then burn the entire colony in a hole in the ground. After burning, the remains should be covered with soil. Tools coming into contact with the hive should be sterilized. Bleach does not sterilize American foulbrood because it cannot penetrate the spore cell wall.

American foulbrood can be suppressed with treatments of the antibiotic terramycin. Unfortunately, this practice has led to resistant strains of American Foulbrood and should no longer be used. Some sources recommend treatment with terramycin after AFB symptoms have been observed to suppress the disease. Although legal and apparently effective, it is an irresponsible practice that will ultimately spread the disease to neighboring beekeepers. Treatment with antibiotics will stop symptoms within the hive but will not destroy spores. AFB spores are extremely persistent, and so once begun treatment must continue indefinitely. Also, if the hive dies and is robbed by bees not receiving antibiotic treatment AFB will appear in those hives. Since American Foulbrood is such a devastating disease and so easily spread, we do not recommend treatment with terramycin for AFB. Severe infections of European foulbrood can be mistaken for American foulbrood.

European Foulbrood

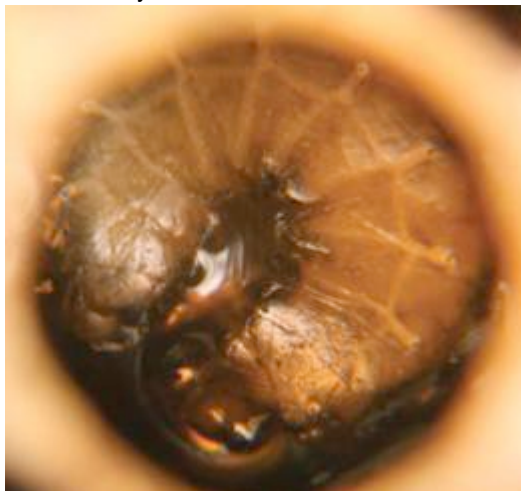
European foulbrood, or EFB, is a bacterial disease that affects honeybee larvae before the capped stage. European foulbrood disease is characterized by dead and dying larvae which can appear curled upwards, brown or yellow, melted, or dried out and rubbery. The causative bacterium, *Melissococcus plutonius*, is ingested by honeybee larvae after which the bacterium competes for food inside the larvae. If the bacterium outcompetes the larva, the larva will die before the cell is capped. Alternatively, the bee may survive until adulthood if the larva has sufficient food resources.

European foulbrood should not be confused with American foulbrood, or AFB, which is caused by a different bacterium that produces different symptoms and control requirements. European foulbrood is considered to be more problematic in situations where forage nectar is sporadic, or other situations that result in fewer nurse bees in colonies to feed larvae. At the onset of nectar flow in early spring, forage recruitment of house bees may increase rapidly resulting in few bees in colonies to feed honeybee larvae. Often, when the nurse bee to larvae ratio stabilizes later in the season, or remains stable throughout a season, symptoms disappear. However, this disease can occur throughout a season and will sometimes not clear up on

its own. In severe cases, colony death can occur. Also, yearly recurrence of EFB from contaminated combs and equipment can occur. The bacterium that causes EFB does not produce spores, but combs contaminated with the bacterium can still re-infect honeybees in subsequent years.

Causative agent

European foulbrood is caused by the bacterium *Melissococcus plutonius* meaning “pertaining to Pluto or the underworld.” Additionally, several other bacteria that are only found in association with *M. plutonius* have been credited with causing EFB. These bacteria can overgrow *M. plutonius* and sometimes seem to improve its growth in lab conditions. These secondary, infective bacteria present with *M. plutonius* include *Paenibacillus alvei*, *Achromobacter* (Bacterium) *eurydice*, and *Bacillus laterosporus* Laubach. These bacteria are sometimes considered symbiotic and may cause some of the differences in smell and appearance in infected larvae. There is suspicion that some of these bacteria may have some causal relationship to symptom onset, but this link has never been clearly established.



Larvae infected with *M. plutonius* can appear deflated with their tracheal system more defined.

Life cycle of European foulbrood

Larvae become infected with European foulbrood when they consume brood food that contains the bacteria *M. plutonius*. There is also some evidence that transmission may occur from bites of the parasitic mite, *Varroa destructor*. Depending on the level of infection, and possibly the amount of available food, the infected larva will either survive or die.

Surviving larvae will become adults with generally lower weight and delayed pupation when compared to their uninfected counterparts. It is noted that an increased food supply from adequate numbers of nurse bees can reduce larval death and observed symptoms. This may explain why expression of the disease can change sporadically year to year, and season to season, depending on the balance of nurse bee to larvae ratio and thus, the amount of brood food made available to the larvae



Pictured are off-colored to dull white larvae from a hive infected with European foulbrood. Note the somewhat pronounced tracheal tubes in the melted larvae to the right.

Symptoms of European foulbrood

In hives infected with EFB, dying and dead larvae can become yellow and then brown. A sour, fishy odor may be present or not. Tracheal tubes can become more apparent as the larvae flattens or ‘deflates’. The larvae can also twist as they die and can die curled upwards. Other times they melt in their cells and will generally be mushy. The remains can be slightly ropey with threads less than 1.5 cm long. To test if the remains are ropey, a toothpick, match or small stick can be probed into the cell and removed (Figure 48). Once dried, a rubbery scale remains. Test kits available from Vita can confirm diagnosis.



Probing a larva melted by European foulbrood. Note that the melted larva is usually not ropey.

Control of EFB

There are limited options for possible cultural control of this disease. However, as noted above, treatment may not always be necessary in all cases if conditions change that result in disappearance of the disease. Control is sometimes necessary though. Requeening the colony may have some benefit, due to a break in the brood cycle, and supplying a queen that is more prolific. There is some evidence of genetic resistance towards the disease, but there are no known lines or breeds that are resistant to EFB, including lines bred for hygienic behavior. Hygienic lines are, however, clearly resistant to American foulbrood.

Due to the infectious activity of the bacteria on contaminated combs, moving combs and equipment should be expected to cause cross contamination. In some countries, destruction or sanitation of infected combs and equipment is required.

In the U.S., Terramycin is the only product labeled for the control of European foulbrood. Various concentrations are available. Users of this product should pay particular attention to the product label to deliver the correct dose, or contact their local state beekeeping inspector or extension specialist for assistance.

Locating an Apiary

The location of the apiary should provide the essential elements for maximum performance by your colonies.

1. An abundant source of nectar and pollen should be near the apiary.
2. Nectar- and pollen-producing plants that bloom in late summer, fall, winter, and early spring are very beneficial to colonies for brood rearing and overwintering.
3. A good supply of clean water should be available within one-quarter of a mile.
4. The apiary should be located on a hillside for maximum air drainage to reduce humidity.
5. Late afternoon shade is desirable to aid in cooling the colony.
6. A good vegetative growth on the North should be available to protect colonies from the cold winter winds. Trees or shrubs are good wind breaks and protect colonies from the cold winds.
7. An apiary should be near a hard-surface road. It is necessary to visit your apiary in all kinds of weather.

Major Honey Flows

Tennessee has two major honey flows during the spring and summer months.

Spring Flow - The major spring flow occurs between April 15 and June 15 at lower elevations across the State. Colonies should be developed to maximum strength by April 15 for maximum production.

Summer Flow - The major summer flow occurs between June 25 and August 15 at higher elevations. Colonies in the higher mountain elevations should be at peak strength by the last week of June for maximum production.

Colonies which have produced a good crop or well-developed packages should be moved from the valley to the mountain by July 1.

Lima beans, soybeans, and cotton produce nectar during July and August. These crops are grown primarily in the western part of the State.

Wax Moth Control

- * Strong queen-right colonies with a balance of young housekeeping bees resist wax moth invasion.
- * Return all extracted supers to strong colonies just before dark for cleaning by the bees before

storing equipment. Pollen and honey left in supers attract wax moths.

- * Supers of hive bodies that are to be kept off a colony for four or more days should be inspected periodically for the presence of wax moths. The larvae eat the wax, make webbing and ruin the comb.
- * Supers with dry drawn comb can be frozen for a week in a freezer to kill all stages of wax moth. Be careful when handling frozen frames because the wax will shatter easily if the frame is dropped.
- * Wax moth damage can be reduced by exposing the combs to light and air flow since wax moth prefer dark moist conditions. Supers can be hung up individually or when stacked they are alternated by placing a side front forward and then an end front forward in sequence.
- * Para-di-chloro-benzene (PDB) crystals can still legally be used to fumigate supers with dry comb. However, this material is suspected to cause cancer, therefore, the decision is yours to make.
- * Fumigation with PDB: Stack supers 8 high; seal holes and cracks with masking tape. Pour 2 tablespoons of para-di-chloro-benzene crystals in a shallow dish setting on frames in top super. Seal top of stack with inverted inner cover and outer cover.
- * Check stored supers occasionally for signs of wax moth damage.
- * Air fumigated supers for 24 hours before using this equipment on a colony.

Requeen weak moth-infested colonies.

Seasonal Management

Winter Season

December

- > Repair and paint equipment.
- > Clean supers, hive bodies, covers and frames of burr comb and propolis.
- > Cull combs. Cull all combs with more than 2 square inches of drone cells from the frames, unless more drone production is desired.
- > Do not disturb the cluster of bees. The hive can be lifted from the rear to estimate stores. On a warm, sunny day, the top can be removed to see the adult cluster size.

January Clean, paint and repair equipment.

- > Check apiary for wind and animal damage.
- > On a warm, sunny day, check the honey stores and feed, with a candy board, any colonies that have less than 15 pounds (six frames of capped honey in a shallow super or two to three frames in a deep super). Note, this is an emergency feeding to prevent starvation and not recommended for colonies with adequate stores. Do not disturb the cluster of bees. The hive can be lifted from the rear to estimate stores. On a warm, sunny day, the top can be removed to see the adult cluster size.

February > Check Colony

for laying queen, brood and diseases.

- > Check amount of honey stores. The hive can be lifted from the rear to estimate stores. On cool, but not cold days, the top can be removed to see the adult cluster size.
- > Feed all colonies with less than 15 pounds of honey with a candy board to prevent starvation. Watch for incoming pollen on warm days. In February, brood rearing increases as the days become longer and pollen is produced by early flowering plants.
- > Feed syrup and pollen substitute, if early, increased brood rearing is desired. Note: early, increased brood rearing increases risks of starvation in spring with sudden, prolonged cold snaps. During cold spells, the colony will cluster over the brood, keeping it warm. The colony will be unwilling to move to frames of stored honey. Also, feeding strong colonies in February will result in an early swarm season for your bees.
- > Unite weak or queenless colonies with another colony (bees should cover five or more frames, but smaller colonies can often survive and build up in time to make some honey). Also, queens may not be apparently laying much at this time.
- > Select the best of the two queens before uniting the two colonies. Remove one of the two queens before uniting. Use the newspaper method.
- > February is the breeding season for skunks. They may be more active during this time. Skunks may scratch at hive entrances and eat the bees that come out to check.

- > Order spring bees in this month or earlier if the supplier accepts earlier orders. Suppliers often sell out in March.

Spring Season

March

- > Check brood chambers. If all of the brood is in the upper part of the brood chamber, reverse the upper and lower brood chamber units. Do not split the brood by reversing when brood is present in both boxes. Reversing the chambers will cause the queen to use both units for egg laying. However, expanding the brood nest too early may cause chilled brood if cold weather reappears.
- > Check the brood for diseases and mites each time you open the colony. Check the honey stores. Feed all colonies that have less than 15 pounds of honey stores to prevent starvation. Syrup, not candy boards, should be used at this time.
- > Super colonies with drawn comb if available. It's a little early to super with foundation. March is a good time to find queens and mark them with paint and a clipped wing since the population of adult bees will be smaller at this time.

April

- > Super colonies for honey production with drawn comb or foundation early in April. Multiple boxes of drawn comb can be used, but only one foundation box at a time is needed.
- > Strong colonies will consume large amounts of honey stores in April. If all reserves have been used up, the colonies will starve just prior to the honey flow if prolonged rainy weather sets in. Check stores and feed all colonies that have less than 15 pounds of honey, remove honey supers first. Feeding with honey supers on will contaminate your honey with syrup.
- > Check brood chamber for diseases and mites.
- > Install package bees in April. Package bees will do well when installed on all new foundation in the hive. When drawn comb and two frames of brood are available, packages get off to a better start.
- > Add new foundation for drawing comb in upper hive body during a honey flow.
- > Colonies with prolific queens and ample food will be strong in population and may need room. Add a super of drawn comb to relieve crowding.
- > By April, you should have developed colony strength to 80,000 worker bees to produce a maximum honey crop.
- > Check for the development of the swarming instinct. Raise the super just above the brood chamber and check for swarm cells along the bottom bars of the frames. If developing cells (not empty cups) are present, a swarm is imminent. Either split the hive to artificially swarm it, or watch for an issuing swarm in coming days. Recheck for swarm cells every seven to 14 days.

April is a good month to divide colonies in advance

of swarming instinct.

> Feed package bees 2 gallons of a 1:1 sugar syrup containing Fumidol-B. Package bees often suffer from nosema disease.

> Prepare supers with cut comb foundation just prior to using them.

Remove entrance reducer from overwintered strong colonies by mid-April.

May

> It is time to add another super when the honey super on a colony is one-half to two-thirds filled

(six to seven frames). A few drawn frames can be moved up into an empty foundation super to encourage the bees to move up.

> Supers of cut comb honey foundation should be added on top of the honey super, which is on top of the brood chamber, to reduce the amount of pollen in the cut comb honey.

> Continue to check for swarm cells every seven to 14 days. Raise the super just above the brood chamber and check for swarm cells along the bottom bars of the frames. If developing cells (not empty cups) are present, a swarm is imminent. Either split the hive to artificially swarm it, or watch for an issuing swarm in coming days.

> Keep empty storage space in the supers on all colonies until the honey flow has ended.

> Remove and extract capped supers from your colonies if you need additional supers.

Summer Season

June

> Combine all swarms issuing after June 1 with weak colonies or feed them constantly until they are a full-sized hive.

> Continue to check for swarm cells every 14 days. Raise the super just above the brood chamber and check for swarm cells along the bottom bars of the frames. If developing cells (not empty cups) are present, a swarm is imminent. Either split the hive to artificially swarm it, or watch for an issuing swarm in coming days.

> Continue to add supers as needed until the honey flow ends.

> Remove the capped honey after June 15. Or after Aug. 15 if in sourwood honey producing areas (usually higher elevations).

> Uncapped honey should be checked for moisture content before extracting.

> Prepare and move your bees to the mountains or the second honey flow (sourwood areas) if you want maximum production.

> Extract the honey immediately to prevent destruction by small hive beetles.

July

> If moving colonies to sourwood areas, have your bees in their new location before the first week of July.

> Extract any unremoved capped honey to have the supers available for the sourwood honey flow.

> Return extracted supers to the colonies just before dark to prevent robbing.

> Fumigate all supers of extracted combs that will be off the colonies for the remainder of the season with para-di-chloro-benzene. Wax moths can begin destroying them in a matter of days, depending on the situation.

> Pack honey in a quality, attractive package – all new, clean glassware or plastic ware and lids.

> Swarms issuing after mid-June will require constant feeding until they are a full-sized hive. They can be combined with weak colonies.

> Check for varroa mites.

> If your honey flow is over by this month, insert entrance reducers to prevent robbing and reduce the hive to the size of overwintering to help the colony manage hive beetles.

> Colonies will readily take feed and convert it to brood after the honey flow is over. Feed colonies where it is desired to build up their population (e.g. new colonies started late).

August

> Extract remaining supers.

> Return extracted supers to colony for cleaning just before dark to prevent robbing by colonies.

> Remove cleaned supers from colony, and store under para-di-chloro-benzene fumigation to prevent wax moth damage.

> Check brood nest for diseases and mites. Mite populations tend to peak late in August or early September and can cause death or irreversible damage in this month. Treat for varroa mites if necessary. Remove honey for human consumption first. If treating annually, treat in August to control mites in advance of the production of overwintering bees and peak in mite numbers.

> Requeen if desired before or after treating for mites, but not during. Many mite treatments affect queen laying.

> Before placing new caged queen in the colony, remove the old queen. Check the brood chamber and make sure you have adequate brood and adult bee population for survival (e.g. two or more frames of sealed brood). Place the caged queen over the frames of brood, 24 hours later.

> Recheck the requeened colonies in three days for release from the cage and at 10 days for a laying queen. If eggs are present, do not disturb the colony.

> Insert entrance reducers to prevent robbing and reduce the hive to the size of overwintering to help the colony manage hive beetles, if not already done.

> Colonies will readily take feed and convert it to brood after the honey flow is over. Feed colonies where it is desired to build their population (e.g. weak colonies

and new colonies started late).

Fall Season

September

- > Check colony for varroa. If numerous (see Sensitivity of Method), apply treatment, if not already treated in August.
- > Requeen colonies that you did not requeen in August or that rejected the introduced queen in August if desired
- > Colonies will begin to arrange their brood nest for overwintering. Do not mix up frames by moving them around unnecessarily.
- > Replace all hive parts that need repairing or painting with reconditioned parts. Repair and painting can be done much more easily in the shop
- > Feeding in September can stimulate additional foraging, honey storage, and brood rearing for colonies that need the extra help.
- > Colonies will need at least 40 pounds of stored honey for overwintering by the first frost.
- > If feeding Fumadil-B to reduce nosema spore load, do this in late September or early October when colonies are more likely to accept feed.

October

- > October is usually too late to treat for mites. The recommended products will not work as well in cool temperatures and varroa reproduction has already peaked and caused damage if levels were high.
- > Check each colony for a laying queen.
- > Feed all colonies that do not have at least 40 pounds of honey stored. (A deep-brood frame holds 6 to 7 pounds of honey; a medium frame holds 4 1/2 pounds; a shallow super frame holds 3 1/2 pounds.)
- > Feed a mixture of 2 parts of sugar to 1 part water (measured by weight) to make a heavier feed, however 1:1 is acceptable and can be mixed without heating. Colonies typically slow down or stop taking syrup feed after the first hard frost.
- > If feeding Fumadil-B to reduce nosema spore load, do so by early October when colonies are more likely to accept feed.
- > Rake all leaves and dead grass away from around colonies to prevent fire in at risk areas. The Tennessee fall fire season usually begins in mid-October.

November

- > Cut tall grass to reduce moisture against hives and reduce wood rot.
- > Check all tops to be sure they are waterproof.
- > Place a weight on the outer cover to prevent the wind from blowing the top off the hive.
- > Feed all colonies that do not have at least 40 pounds of honey stored. (A deep-brood frame holds 6 to 7 pounds of honey; a medium frame holds 4 1/2 pounds; a shallow super frame holds 3 1/2 pounds.)

Feed 2:1 syrup or prepare a candy board for feeding colonies without enough stored honey for overwinter. Colonies may not take syrup after the first hard frost and tend to not be able to convert syrup to stored honey. Alternatively to a candy board, sugar 'goop' may be used. To make sugar goop, a spacer can be placed above the top box. Lay a single layer of newspaper down. Trowl out a mixture of granulated sugar and water. The mixture is made with a very small amount of water so that the sugar granules stick together and do not run.

Wax Moth Control

- * Strong queen-right colonies with a balance of young housekeeping bees resist wax moth invasion.
- * Return all extracted supers to strong colonies just before dark for cleaning by the bees before storing equipment. Pollen and honey left in supers attract wax moths.
- * Supers of hive bodies that are to be kept off a colony for four or more days should be inspected periodically for the presence of wax moths. The larvae eat the wax, make webbing and ruin the comb.
- * Supers with dry drawn comb can be frozen for a week in a freezer to kill all stages of wax moth. Be careful when handling frozen frames because the wax will shatter easily if the frame is dropped.
- * Wax moth damage can be reduced by exposing the combs to light and air flow since wax moths prefer dark moist conditions. Supers can be hung up individually or when stacked they are alternated by placing a side front forward and then an end front forward in sequence.
- * Para-di-chloro-benzene (PDB) crystals can still legally be used to fumigate supers with dry comb. However, this material is suspected to cause cancer, therefore, the decision is yours to make.
- * Fumigation with PDB: Stack supers 8 high; seal holes and cracks with masking tape. Pour 2 tablespoons of para-di-chloro-benzene crystals in a shallow dish setting on frames in top super. Seal top of stack with inverted inner cover and outer cover.
- * Check stored supers occasionally for signs of wax moth damage.
- * Air fumigated supers for 24 hours before using this equipment on a colony.
- * Requeen weak moth-infested colonies.

Protect Honeybees from Insecticides

Pesticide Applicator

1. Use spray applications instead of dusts.
2. Apply sprays to plants when bees are not foraging on the plants.
 - a. plants not in bloom
 - b. after petal fall
 - c. late in the day when blossoms are closed
 - d. mow cover crops under fruit trees before applying cover sprays
 - e. mow blooming plants foraged by honeybees around field borders
3. Use insecticides which are less toxic to honeybees when possible.
4. Use insecticides with short-residual life.
5. To reduce drift, apply insecticides during periods when wind velocity is less than 5 miles per hour.
6. Keep sprayers in good repair for efficient coverage of crop plants.
7. Direct spray application on and under target plant in fine mist for effective coverage of crop.
8. Do not spray over colonies. Do not spray when drift is in the direction of colonies.
9. Notify beekeepers in your area at least 2 days in advance when frequent spray applications are scheduled for the following crops:
 - a. sweet corn
 - b. fruit
 - c. cotton
 - d. vegetables

Beekeeper

1. Register colonies with State Apiarist's office by July 1 each year, as required by law.
2. You are responsible for protection of your colonies.
3. You can confine your colonies for 3 days during periods of heavy insecticide spraying in your area. The colonies should be released for at least 1 day of flying at the end of the 3 days. Confining bees is not practical when a large number of colonies are located a considerable distance away from a good source of water. Draping with burlap is not practical in that it requires the application of water every 1-2 hours. However, this is the only protective measure we have short of moving the apiary out of the area.
4. Locate colonies a distance of 300 feet or more away from fields. Use wind breaks of vegetative growth to filter insecticide drifts.
5. Locate colonies upwind of field in direction of prevailing winds in the area.
6. Locate colonies so that flight path is not directly over fields that are sprayed frequently.
7. Move colonies two miles away from large fields that must be sprayed frequently.
8. You should be thoroughly familiar with all agricultural crops and pesticide use within flight range of your colonies.
9. Avoid hazards, anticipate problems, and cooperate with your neighbors.

TENNESSEE BEEMASTER PROGRAM

Publications Provided (UT/USDA)

TITLE	PUBLICATION #	AUTHOR (S)
Beekeeping in Tennessee	Pub 1745	Skinner et al.
Honey Bee Tracheal Mite	Pub 1359	Harry E. Williams
Honey Bees and Pesticides	Pub 1155	USDA
Tracheal Mites in Tennessee	SP409 A	John A. Skinner
Squash Pollination Guidelines	SP409 B	John A. Skinner
Tennessee BeeMaster Program	E&PP INFO 96	John A. Skinner
Crop Pollination	E&PP INFO 302	John A. Skinner
The Small Hive Beetle – A New Pest of Honeybees	SP 594	John A. Skinner
Using Terramycin for the Prevention of American Foulbrood	SP 596	John A. Skinner
Honey Bees in a World!!! What Can Be Done??	Pub 1508	John A. Skinner
Varroa Mites in Tennessee	Pub 1511	John A. Skinner
Bee Aware: Africanized Honey Bee Facts	Pub 1513	John A. Skinner
Making a Pollination Contract	Pub 1516	John A. Skinner
Preparing for Honeybee Emergencies	Pub 1522	John A. Skinner
Swarming Honey Bees: What Should be Done	Pub 1524	John A. Skinner
ID & Control of Honey Bee Diseases	Pub 1112	USDA
Controlling the Greater Wax Moth	Pub 1111	USDA

4-H PUBLICATIONS		
The Family Tree of the Honey Bee	Unit 1 - Pub 711	Harry E. Williams
A Honey Bee Colony	Unit 2 - Pub 722	Harry E. Williams
Beekeeping Equipment	Unit 3 - Pub 744	Harry E. Williams
Seasonal Management of Honey Bees	Unit 4 - Pub 1070	Harry E. Williams
Processing and Packing Honey	Unit 5 - Pub 1074	Harry E. Williams
Nectar and Pollen Sources for Honey Bees	Unit 6 - Pub 1181	Harry E. Williams
Honey Bee Disease Pests, Poisoning and Regulation	Unit 7 - Pub 1217	Harry E. Williams

Africanized Honey Bees in Tennessee

3/10

To date there have been no reports of Africanized honey bees in the state of Tennessee. Prior to 2005 Africanized were found only west of the Mississippi river. In 2005 Africanized honey bees were found in Florida.

[The USDA has a map detailing the spread of the Africanized honey bee over time by county in the US.](#)

The Tennessee Department of Agriculture and the University of Tennessee Extension are working together to prepare emergency personnel, pesticide applicators, beekeepers and the general public for the arrival of Africanized honey bees in Tennessee. If you believe you have found a colony of Africanized honey bees, get away from it as quickly as possible and contact the [State Apiarist](#) at 615-837-5342.



Africanized honey bees differ from European honey bees in behavior not appearance. Neither type of honey bee will indiscriminately attack humans or animals. The Hollywood image of “killer bees” is a dramatic exaggeration devised to sell movie tickets. Stinging is a defensive behavior employed by the colony to protect their brood (young bees) and food supply. Once a honey bee stings it dies. All bee colonies should be respected. Wild (feral) colonies should be avoided and reported to the [county extension agent](#) or the [State Apiarist](#). Africanized honey bees will respond in much greater numbers than European honey bees to a perceived threat.

<http://www.tennessee.gov/agriculture/regulatory/africanizedbees.html>

Disclaimer

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication.

Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. The author(s), the University of Tennessee Institute of Agriculture and University of Tennessee Extension assume no liability resulting from the use of these recommendations.

