

Honey Bee Colony Deadout Diagnosis Guide 2024

Prepared by Fred Putnam, Jr. and Andrew Munkres, Vermont Beekeepers Association



Deadout Diagnosis Guide

A guide to help diagnose the causes of honeybee colony losses following winter in the Northeastern USA in standard Langstroth hives

Adapted from NY Bee Wellness Winter Deadout Diagnosis Key

Prepared by **Fred Putnam, Jr. and Andrew Munkres, Vermont Beekeepers Association**

This guide can help you to identify important clues to the causes of colony losses that occur over winter and at other times of the year. Clues are found in the condition of the entrance, the state of the outer and inner cover of the hive, the position of any remaining bees in the hive, the condition of any residual brood and comb, and the bodies of the bees themselves.

There are a number of reasons colonies die. It is useful to determine what happened to be able to reduce losses in future years.

This guide describes a number of possible causes of colony death during the winter months:

- Parasitic Mite Syndrome
- Spring dwindling
- Nosema
- Starvation
- Small cluster dead – Queen died, tracheal mites, other dwindling
- Small cluster alive but died
- Damage from predation, weather, or vandals
- Brood diseases – American Foulbrood, European Foulbrood, and Chalkbrood

Preface: American Foulbrood (AFB) is a serious fatal bacterial disease of honey bee brood caused by the spore forming bacterium *Paenibacillus larvae*. The spores that transmit AFB can remain viable on frames and hive parts for 70 years or more. A colony with AFB and all of the frames in the hive must be destroyed by burning.

AFB is very serious, **so we recommend in the strongest terms to NOT use previously used equipment of unknown or contaminated origin.**

Acquiring used infected equipment is a known source of AFB cases in Vermont. More on AFB below.

Deadout Diagnosis Table of Contents

Three sections:

Section I – Number 1 cause of winter colony loss – Varroa and the viruses they transmit

Section II – Other causes or contributing factors to colony loss

Pesticide exposure – acute and sub-lethal

Spring dwindling

Nosema or dysentery

Starvation

Poor queen

Tracheal Mites

Reversing too early or unnecessarily

Extreme cold and wind

Rodents

Skunks

Wind or Vandals

Black bears

Moisture

Section III – Brood Diseases

American foulbrood

European foulbrood

Chalkbrood

Deadout Diagnosis

Section I – Number 1 cause of winter colony loss – Varroa and the viruses they transmit

The #1 reason for hive failure at any time of the year, and at any location, is viral disease brought on by unchecked Varroa mite populations.

Varroa Mites and Mite Borne Diseases

A #1 Beekeeper Priority

This is the #1 most likely cause of hive dwindling, absconding, and death. *Beekeepers often attribute colony death to other agents that can cause dwindling and small clusters when, in fact, in the majority of cases, Parasitic Mite Syndrome caused by high numbers of Varroa Mites and the viruses they transmit is the root cause.*

Many of the problems listed in Section II below (except bears and vandals) can exacerbate an underlying varroa problem so taking action to control Varroa populations is a must.

Determine if your hive had a high Varroa mite population (and thus, high disease load transmitted by Varroa mites) by checking the hive brood frames and bottom board.

1. Dead brood with extended proboscis is classic and definitive as shown in the next two pictures.



2. **Inspect brood frames:** Look for mite poop (guanine crystals.) Hold a brood frame by the top bar and at about a 45° angle to your eyes. Examine it in the sunlight or any bright light, placing yourself so that the light shines over your shoulder and onto the brood frame.

Do you see a large amount of white speckling in empty brood cells (guanine crystals) as shown in the photo?

If so, your bees most likely had a severe VARROA mite/disease transmission problem and died of parasitic mite syndrome (PMS).



A close up of mites' guanine fecal deposits. To view them in the field, orient the sun at your back, hold the frame down at about a 45° angle with the top bar toward you so that the sunlight illuminates the cells. If you see white deposits in the scattered remaining brood cells of a deadout, that's the signature of collapse due to Varroa. These white spots are patches of mite excrement that contain about 95% pure guanine, an amino acid.

3. Dead bees are scattered out over several combs and/or boxes. **Probable high Varroa mite or mite-borne disease load at some point since Sept. 1.**

4. **Bottom board:** Examine your bottom board for dead Varroa mites. The reddish brown specks mixed in with the tan colored material (pollen grains) in the picture below are dead mites. This is a very high mite load:



5. **Spotty brood, perforated cappings, partially emerged dead brood sometimes with proboscis extended:** Check emergent dead brood for or shrunken abdomens or deformed wings by gently removing partly emerged dead brood from cells with a needle or tweezers.



6. Deformed body parts

The abdomen of bee on the right is severely shrunken due to disease

Deformed wings (virus transmitted by Varroa mites)



Can the frames from a colony with Varroosis (Parasitic Mite Syndrome) be re-used?

Yes.

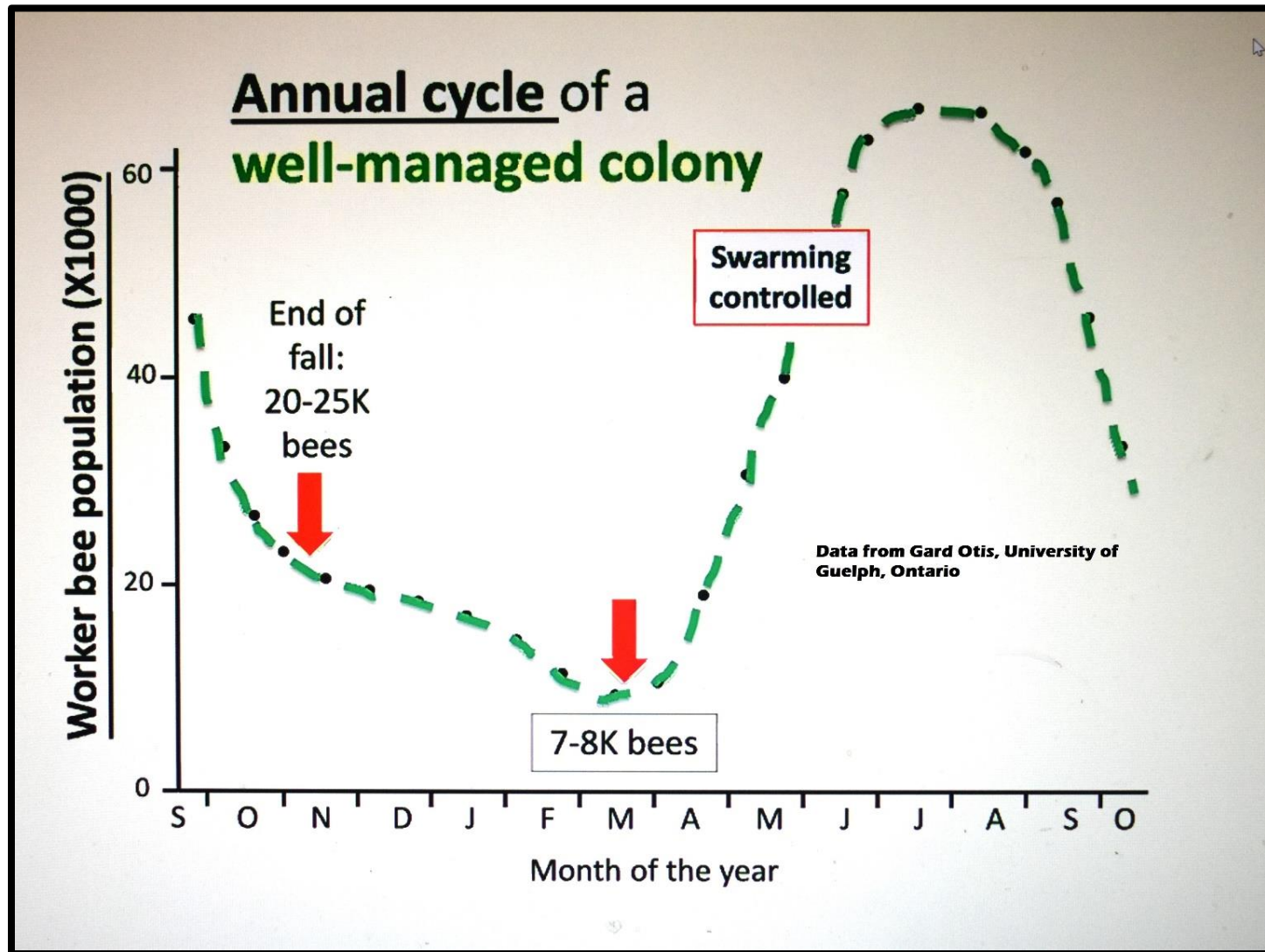
You can treat and still have a varroa problem. Many new beekeepers treat too late in the season, treat with the wrong product, or use susceptible genetics.

Treatment free is not the same as “do nothing.” Treatment free mite management is a lot of knowledge and work – not for a beginner.

Quote from Randy Oliver, Scientific Beekeeping:

“If you think you’re going to improve honey bee genetics by letting your untreated colonies die off, you’re fooling yourself.”

As we discuss Spring dwindling and causes of winter losses, it's helpful to understand what happens to honey bee populations as winter approaches:



It is essential to take positive action to keep the colony healthy and population numbers up so there are enough bees left to survive the cold nights in late February and early March when colony population reaches its usual seasonal low point.

Section II – Other causes or contributing factors to colony loss

Besides the Varroa associated impacts and diseases, there are several issues that can contribute further to dwindling.

Pesticide exposure – acute and sub-lethal	
Symptoms	Action
<p>Can cause a number of adverse effects on honey bees, including changes to their behavior, growth, development, and reproduction.</p> <p>Sublethal effects will occur at very low levels – as low as 5 to 10 parts per billion for some insecticides.</p> <p>The symptoms will vary depending on the pesticide.</p> <p><i>Sublethal symptoms are hard to identify; sublethal exposures to pesticides exacerbate adverse impacts from other pests, diseases, and weather.</i></p> <p>.</p> <p>These are some symptoms of acute pesticide exposure:</p> <p>Interference with orientation</p> <p>Uncoordinated movements</p> <p>Tremors</p> <p>Paralysis</p> <p>Disorientation</p> <p>Sudden aggressive behavior</p> <p>Regurgitation</p>	<p>If your apiary is located within two miles of planted agricultural crops like corn, soybeans, wheat, rye, and other grain crops, take samples of the pollen collected by your bees. Contact the Vermont Bee Lab for pollen sampling protocols.</p> <p>Report suspected lethal and sublethal exposures to: Agrichemical & Plant Industry Division at 802-461-7160 or</p> <p>https://agriculture.vermont.gov/form/environmental-complaint-form</p> <p>It is very important to call as soon as possible and provide as many details as possible so they can initiate an investigation.</p>
Can the frames and foundation be re-used?	No if pesticide exposure is confirmed.

Spring Dwindling

Symptoms

Possible Cause(s) and Actions

No brood or drone brood in worker cells.

At the entrance to the hive, pile of dead bees on the ground, handful size cluster (possibly still alive), small patch of brood maybe abandoned.

Cluster dwindled. Look further to determine why.

If there is no brood, the queen may have died during the winter.

If you find drone brood in worker cells, the queen may be failing or the queen is gone and you have a laying worker.

If there is live brood present, then proceed further.

Small cluster dead. *Hive has honey and pollen with honey in frames* – Too small to stay warm. Some bees may be facing head-in in a last-ditch effort to stay warm. **Headfirst in cells does not always indicate starvation.** It often is a last-ditch effort of bees in a failing small colony to stay warm by hunkering down inside cells. This might not be starvation:



Photo: Honeybee Suite

Bees head down in cells does not always mean starvation, although they could have. It is simply a place that bees hang out in the winter to keep the continuity of the cluster across multiple frames (frames create divisions in the cluster).

Can the frames and foundation be re-used?

Maybe. Depends on what caused the dwindling.

Nosema or Dysentery

Symptoms

- Prominent yellow or brown spotting or smears on the lower entrance or top of frames under inner cover that is new since your last inspection of the (live) hive, dead bees at the entrance and on the ground in front of the hive. “Poopy” upper entrance.
- Reduced honey production
- Decreased adult population
- Slow spring buildup
- Dysentery (only with *N. apis*) –Recently disputed

Pictures 1 & 2



Picture 3

Possible Cause(s) and Actions

Nosema or Dysentery?

Pictures 1 & 2:

Have bees tested for Nosema. If negative for Nosema, review section on Varroa mites.

Picture 3

“Poopy” frames can also be caused by feeding light syrup too late into the fall. This picture shows the colony was fed too late. It may or may not have Nosema as well.

Bees ingesting improperly cured sugar syrup will develop dysentery symptoms and may or may not also have Nosema.

Feed earlier while temps are in the mid to upper 50sF and quit by the middle of October, or when daytime highs start to drop- whichever comes first.

This picture also shows Apivar mite control strips that were improperly left in the hive over winter. This can lead to Varroa mites developing resistance to Apivar.

**Reduced honey production
Decreased adult population
Slow spring buildup
Dysentery (only with *N. apis*) –Recently disputed**

Picture 4



Picture 4

Dead bees scattered over a broad area around hive during winter may be an indication of Nosema.

Locate apiary in areas of good drainage and plenty of sun.

Can the Nosema infected frames, comb, and foundation be re-used?

Maybe.

If not too “poopy”:

- **Freeze for 4 days or**
- **Fumigate with acetic acid.**
- **Heat to 120°F for 24 hours.**

If a lot of dysentery, discard fame and foundation.

Acetic acid fumigation:

<https://www.youtube.com/watch?v=f9czzJBRK1s>

Starvation

Symptoms

Hive entrance is clean and only a few dead bees and frames under the inner cover are clean. No honey or very little left or cluster not on the honey. You see a larger pile of dead bees under the inner cover on top of frames with no honey or pollen possibly with many headfirst in cells or bees are attached to combs in one fairly compact area and bees' wings are normally aligned (no K-wings.) Some bees may be headfirst in cells.1 Bees not in contact with honey.



Photo above: Ross Conrad, Bee Culture Magazine

Possible Cause(s) and Actions

Starvation

The colony starved because it was unable or unwilling to move to nearby stores or was out of stores.

Note: Bees can also starve when there is still honey present in the hive. If they lose contact with the honey during a cold spell or if the colony weakens for other reasons, they can be unable to move to new frames containing honey and will starve – called “positional starvation.”



Starvation continued

Symptoms

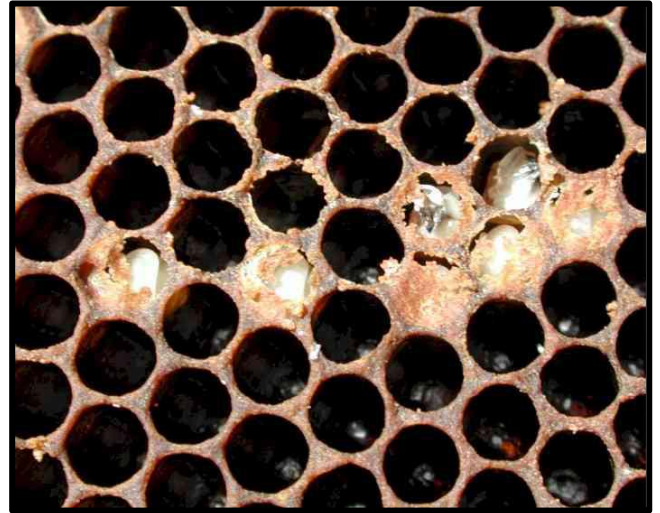


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Note: Head first in cells does not always indicate starvation. It often is a last ditch effort of bees in a failing small colony to stay warm by hunkering down inside cells.

Possible Cause(s) and Actions

Photo: Bee Informed Partnership
A hive that begins to starve will suck the body fluids from the brood, in the attempt to save the colony:




Can the frames, comb, and foundation be re-used?

Yes, if it was truly starvation that caused the colony to expire.

Poor Queen	
Symptoms	Possible Cause(s) and Actions
<p>Small cluster dead. <i>Hive has honey and pollen with honey in frames</i> and fewer than 1 lb. (6 cups) of dead bees on frames and bottom board.</p>	<p>Small cluster going into winter due to unproductive queen.</p> <p>The live small cluster in the spring can be also be caused by any of the aforementioned causes of death: Nosema, tracheal mite, varroa, poor queen, late swarm, etc. You just got there before they completely died off.</p>
<p>Can the frames, comb, and foundation be re-used?</p>	<p>Probably, as long as no other disease issues.</p>

Tracheal Mites

Symptoms	Possible Cause(s) and Actions
<p>The bees make it almost all the way through winter, but then they die in March, April, or May even though honey is present in the hive. Small cluster may die suddenly. <i>Hive has honey and pollen with honey in frames</i> and fewer than 1 lb. (6 cups) of dead bees on frames and bottom board.</p> <p>Tracheal mites can reduce colonies to small clusters less than a pound in size (about 6 cups of bees) that cannot survive the cold.</p>	<p>If a large number (more than 1 in 10) have K-wings:</p>  <p>Possible tracheal mites. Send sample of dead bees to a lab for testing to obtain and firm diagnosis.</p>
<p>Can the frames, comb, and foundation be re-used?</p>	<p>Yes. If a lab affirms tracheal mites, fumigate colony with menthol crystals.</p> <p>Remove supers.</p> <p>Keep colony population high and well nourished.</p>

Reversing Too Early or Unnecessarily

Symptoms

Possible Cause(s) and Actions

Colony lost due to reversing too early or unnecessarily.

Live small cluster in Spring.



Before reversing, evaluate the strength of the cluster early in the spring to determine if reversing is really needed.

Generally, it is wise to wait until just before dandelion bloom to reverse IF reversing is even necessary.

A really strong cluster 8-10 seams of bees might need to be reversed (and supered or split) earlier.

A small colony may need to wait until nights are no longer cold or may not need to be reversed at all.

Often more damage is done reversing too early rather than too late.

Live small cluster in Spring.



Chilled Brood


Chilled partially developed brood on landing board. Possible complete loss of colony.



Reversed too early.

Can the frames, comb, and foundation be re-used?

Yes.

Exposure to extreme cold and wind	
Symptoms	Possible Cause(s) and Actions
<p>Cluster of any size dead. Hive has honey and pollen with honey in frames.</p>	<p>Seemingly healthy colonies with plenty of honey can die if they are located in an exposed location and there is sustained extreme cold combined with wind.</p> <p>Add windbreak:</p> 
<p>Can the frames, comb, and foundation be re-used?</p>	<p>Yes.</p>

Rodents

Symptoms

Signs of disturbance at hive entrance such as damaged or missing entrance reducer, cover misplaced, etc. Chew or claw marks around box edges, shifted boxes. Inside: mouse nest, mouse poop. Outside reducers pulled out, scratch marks at entrance. Skunk scat filled with dead bees in or around the apiary:

Take frames apart:



Mouse nest in the hive, fecal deposits

Possible Cause(s) and Actions

Mice, voles, or shrews damaged your colony.

Mice will not usually kill a colony, but they can take advantage of a weak one and make it more difficult for the colony to function.

They can also destroy valuable drawn comb.

Install mouse guards on or around September 1.

Can the frames, comb, and foundation be re-used?

Maybe, but if foundation is badly damaged or soaked with rodent urine, discard foundation and possibly frames.

Skunks

Symptoms

Reducers pulled out, scratch marks at the entrance or on ground and scat (filled with dead bees) in the apiary (skunks).



Control skunk with an electric fence or tack boards.

Possible Cause(s) and Actions

Skunk scat



Skunk(s) “harassing” hive

Skunks will scratch at a hive and eat nbees that come to the entrance. Uncontrolled, this can inhibit the growth of the colony and therefore its ability to gropw to be able survive the winter.

Can the frames, comb, and foundation be re-used?

Yes. Skunks will eat the bees but will not damage frames and foundation.

Wind or vandals.

Symptoms

Hives tipped over or no cover. Frames and hive boxes mostly intact.



Can the frames, comb, and foundation be re-used?

Possible Cause(s) and Actions

Lacking a storm event or if hives are in a secure location, possible damage by a young bear. Look for tracks and scat to confirm two legged or four legged vandals. Bears don't wear work boots or shoes! More on bears next section.

Strap the hives tightly to keep them from falling apart when tipped over. The strap in the picture on the left is too loose. A strapped hive that stays intact will probably survive.

Hive strapped to its base ahead of high wind forecast:



Yes, as long as frames and foundation are not damaged.

Black bears

Symptoms

Hive(s) and frames ripped apart:



Possible Cause(s) and Actions

ALWAYS... protect your apiary with an effective electric fence!

Install an electric fence first then get bees. It's much easier to deter a bear before they get into an apiary than keep them out after.

Same note as above on strapping but metal banding straps are preferable to nylon straps.

Once the bear has found an apiary, it will be back. Sometimes, it takes a second or third visit before a young bear will break a hive apart. That depends on the experience level of the bear, (young bears tend to be more tentative.) It also depends if it is warm enough for the bees to fly and defend the hive although a determined bear will ignore them.

Guide to apiary fencing:
<https://www.vermontbeekeepers.org/resources/for-beekeepers/education/protecting-beehives-from-bears>

Can the frames, comb, and foundation be re-used?

Yes, as long as frames and foundation are not damaged.

Moisture

Symptoms

You find honey and pollen with honey in frames and MORE than 1 lb. (6 cups) of dead bees on frames and bottom board.

There is a lot of moisture, mold, or dripping water under inner cover, and moldy frames:



Possible Cause(s) and Actions

Colony **MAY** or **MAY NOT HAVE** died from excess moisture dripping onto bees during cold weather.

Ensure the hive has ventilation and inner cover insulation is adequate.

Moisture is often incorrectly cited as the cause of colony loss because a beekeeper sees moisture or condensation in the hive.

Mold and moisture can show up in overwintered colonies even if there is adequate ventilation.

When the bees die, their warmth and air circulation are no longer present so mold can develop.

Mold and moisture are usually secondary to some other cause of death.



Can the frames, comb, and foundation be re-used?

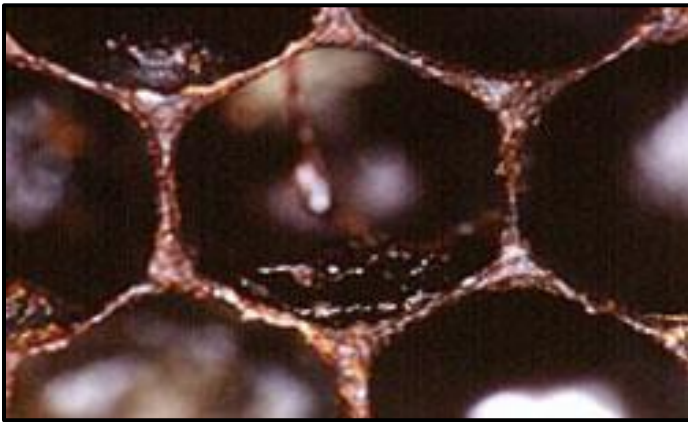
Yes, as long as frames and foundation are not extremely moldy.

Section III – Brood Diseases

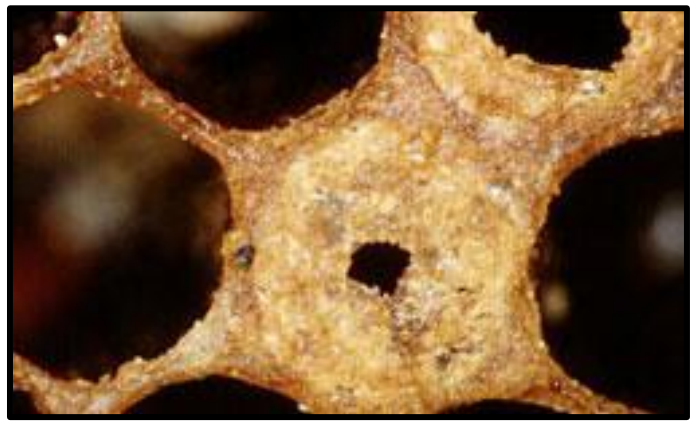
American Foulbrood (check every dead colony for AFB)

If you see or suspect signs of AFB, State Law requires that it be reported to the Vermont State Apiculturist and Pollinator Health Specialist, since AFB is nearly incurable and deadly. Do NOT take used equipment unless you can be absolutely positive that it has never housed a colony infected with AFB.

Scaly brood



Punctured cappings

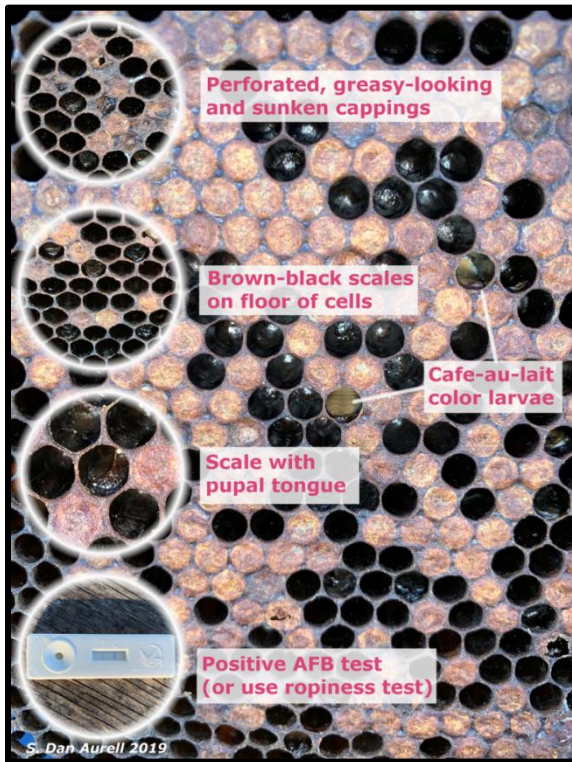


Spotty brood pattern



“Rope” test for AFB





Colonies infected with AFB must be destroyed by burning.

An AFB field test kit can help to verify the presence or absence of AFB.

AFB	
Can the frames, comb, and foundation be re-used?	Absolutely not!!

European foulbrood (EFB)

- Spotty brood pattern, whitish-yellow to brown larvae, curled upward or twisted.
- Deflated larvae in the bottom of the cell with a defined tracheal system (usually greyish to brown in color with white trachea.)
- Sometimes ropes stretching up to 1.5 cm.
- Odors produced can be sour or fish-like, or no odor at all (different odors can come from secondary bacteria.) Scale is usually from brown to black sunken to the bottom of the cell.
- Outside frames of the brood nest are usually infected first.
- EFB field test kit can help to verify the presence or absence of EFB.

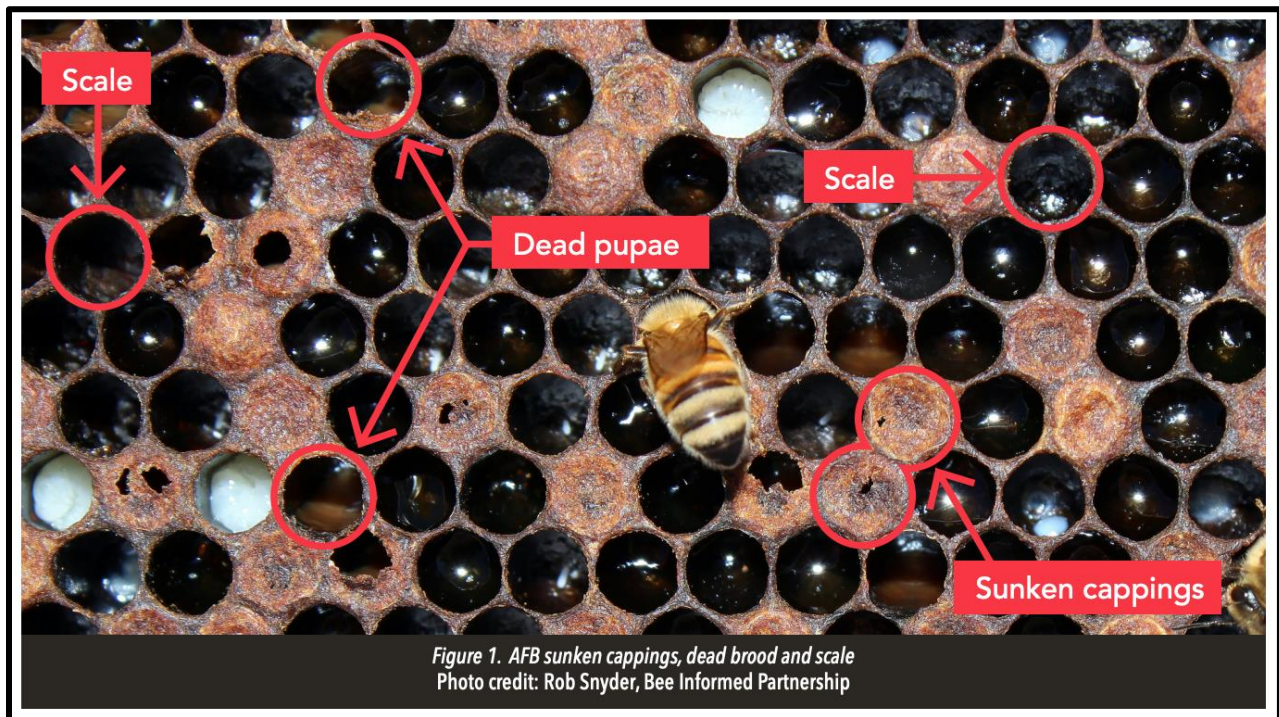


Figure 1. AFB sunken cappings, dead brood and scale
Photo credit: Rob Snyder, Bee Informed Partnership

Note: AFB and EFB are hard to diagnose in the spring if the colony died, there is no live brood to evaluate. Overwintered sealed (dead) brood can become mushy and hard for a beginner to determine ropiness.

Search for dark hard brood scales in brood cells to determine if AFB was present vs. EFB.

EFB can be mistaken for Varroosis (parasitic mite syndrome). If Antibiotics are possible.

Create brood break by requeening.

Sometimes, improving colony nutrition by feeding syrup and pollen can help a colony recover on its own. A strong natural nectar and pollen flow can also help a colony recover.

EFB	
Can the frames, comb, and foundation be re-used?	Possibly but safest to discard frames that have had EFB infected brood.

Chalkbrood

A fungal disease. Hard white dried out brood. Dead white shriveled bee carcasses on landing board.



Chalkbrood

Can the frames, comb, and foundation be re-used?

Possibly but if more than 10% chalkbrood on a frame, discard the frame, or cut out the affected area if all mummies are close together.

Mummies are very hard for workers to remove and spread infection as they are discarded by the hive.

If queen is older than 2 years, replace her.

The end!!

Other questions?

