

Winter Deadout Diagnosis Key

*a dichotomous key for help diagnosing honeybee deadout colonies
following winter in the Northeastern USA*

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This key is a guide to the analysis of winter deadouts in the Northeastern US. If you examine dead hives in an organized manner, working with a standard plan, you are less likely to miss something important. The key will help you to be observant of important clues. 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. This key is written for standard Langstroth hives. If you are examining a top-bar or other hive type, you will need to modify your approach accordingly.

Be aware that the #1 reason for hive failure presently (2014) at any time of the year, and at any location, is viral disease brought on by unchecked **Varroa mite** populations. Many honeybee viral diseases are poorly characterized, and they are difficult to distinguish from each other. If your hive died this way during the winter, all you can reasonably expect to do is reach the conclusion that a virus attacked your bees and since they were also stressed by winter, they died. However, there are other reasons hives die, and it is useful to determine to the best of your ability what happened.

Begin at the top of the key and follow the instructions for proceeding to the next appropriate question as you determine each answer. For instance, if your answer to #1 is "a." then skip to question #5, as instructed.

NOTE: "Spring dwindling" is a condition where the bees make it almost all the way through winter, but then they die in March or April even though honey is present in the hive. If this happened to your hive, look for signs of brood. If there is brood present, then proceed with the key. If there is no brood, the queen may have died during the winter.

1. What do you see around the entrance of the hive?

- a. **Prominent yellow or brown spotting or smears** on the lower entrance hive body 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. GO TO #7
- b. Nothing. The entrance is clean, or there are only a few dead bees around the entrance. GO TO #3
- c. Other signs of disturbance....damaged or missing entrance reducer, cover misplaced, etc. GO TO #2

2. Are there signs of an animal predator/pest such as: Chew or claw marks around the box edges, shifted boxes, chewed wax (you would see this outside the entrance without having to take apart nest) **Take apart the boxes: mouse nest in the hive, fecal deposits, entrance reducers pulled out, scratch marks at the entrance and scat (filled with dead bees) in the apiary (skunks).**

a. Yes. *Answer: Your bees most likely died as a result of hive damage and/or predation from skunks, mice, bears, etc.*

b. No. *Answer: Your bees most likely have died as a result of weather exposure following hive body disturbance (wind or other).*

For both #2 a. and #2 b: Take apart the boxes; if there are dead bees in a small cluster, they probably died of exposure or there were too few bees to keep colony warm.

3. What do you see under the inner cover?

a. Nothing...just the tops of the frames, and there is honey in those frames. GO TO #5

b. A cluster of dead bees. GO TO #4

c. A lot of moisture, mold, dripping water under inner cover and moldy frames. *Answer: Most likely cause of death for this hive is excess moisture dripping on the bees plus cold. Hive ventilation was inadequate.*

4. Is there honey and bee bread in the hive?

a. Yes. GO TO #5

b. No. *Answer: Your bees starved.*

5. How many bees are in the hive? On a warm day (more than 40 degrees F), take out some frames and look for bees. If you have more than one box on your hive, and there are no bees in the top box, remove it and look in the lower box(es) until you find your bees. Be careful not to dislodge bees still clinging to combs. Estimate how many bees are on the total of your frames. This website is helpful for figuring out how many dead bees are clinging to your frames: <http://www.dave-cushman.net/bee/beesest.html>. Now look at the bottom board and estimate how many dead bees are on the bottom board. You can do this most accurately by scooping them into a cup measure. 300 bees is equal to ½ cup, and there are approximately 3,700 bees to a pound. This means that 6 cups of bees is about one pound.

Add the number on the bottom board to the estimate you make for the number on the frames.

a. There are at least one pound of dead bees in the frames and on the bottom board/screen. **Collect 300 bees (100mL beaker=300 bees) in a Ziplock baggie for later inspection.** GO TO #6

b. Fewer than a pound of dead bees in the entire hive, including the dead ones on the bottom board.

a. *Answer: Most likely cause of death = COLD due to lower-than-critical mass of bees (not enough bees to keep the cluster warm)*

b. *Secondary (less likely) answer: Tracheal mites can reduce colonies to small clusters with plenty of leftover honey. Examine some bees for tracheal mites.*

6. Are the bees attached to combs in one fairly compact area?

a. Yes. GO TO #7

b. No, the bees are spread out over several combs and/or boxes. Many are dead on the bottom board. GO TO #8

7. Examine the bees' wings.

- a. The wings are normally aligned for the most part. *Answer: Your bees may have starved even though they still have honey in the hive. Sometimes the cluster is unable/unwilling to move to nearby stores and dies. You can check for tracheal mites and Nosema, but the symptoms to this point suggest starvation due to failure of the cluster to move.*
- c. A large number (more than 1 in 10) have K-wings. *Answer: These bees probably have succumbed to one (or more) viruses. You can have some bees professionally analyzed to confirm this, but note that this is not a free service.*

If you have access to microscopes, EXAMINE BEES FOR TRACHEAL MITES (dissection microscope) AND/OR NOSEMA (compound microscope). **See video link for TM dissection tips on Diana Sammataro's website at USDA: <https://www.ars.usda.gov/pandp/docs.htm?docid=14370>**

If the bees in a hive with noticeable smearing/spotting at the hive entrance tests negative for Nosema, GO TO #8.

8. Hold a brood frame by the top bar and at a 45 degree 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)?

- a. Yes. *Answer: These bees most likely had a severe VARROA mite problem and died of parasitic mite syndrome (PMS). **PICTURES ARE WELCOME HERE!***
- b. No. GO TO #9

9. Is there any brood?

- a. No. *Answer: It is likely that this hive died of "spring dwindling" due to a weak or dead queen or to an unknown viral disease.*
- b. Yes. GO TO #10

10. Are there brood abnormalities such as punctured cappings, scaly brood, slimy brood, chalkbrood, etc?

- a. Yes. *Answer: Evidence of brood disease in early spring suggests a weak colony with a heavy load of pathogens. Send a sample to Beltsville.*
- b. No. If the hive had no signs of external tampering, plenty of honey, at least a pound of bees, and recent (spring) brood...but was still dead...this is a mystery! You could send some representative brood and bees to Beltsville and/or a facility for diagnosis of viral problems.

GENERAL ADVICE FOR WEAK OR FAILING COLONIES IN THE SPRING:

FEED bees both protein patties and syrup. Clean out dead bees and feed with medicated syrup if a disease is diagnosed (Fumigillin most likely); you can join weak colonies with strong ones if not diseased, as long as medicated syrup is fed, or try to save and requeen. We (Diana Sammataro, USDA) found that pollen/protein patties helped a lot.