

Testing for VSH

Preamble

It has been suggested that the character SMR is none other than a form of super hygiene. Indeed it is now known as Varroa Specific Hygiene. By this is meant that the bees selectively remove larvae on which mites are reproducing. They do this so well, that the mites remaining on larvae are reproducing poorly. So, when scientists carry out detailed inspections in these colonies, they find a preponderance of mites which have poor reproduction, hence the original name Suppressed Mite Reproduction. The trait is inheritable. One conjecture is that the two genes involved (detection of sick larvae and removal of sick larvae, which are independent characters) are highly present in a large % of the bees. However, they also seem to eat out larvae on or before the purple eye stage, that have reproducing mites. In West Cornwall, we have seen debris on our varroa collecting trays that suggest our bees do the same (immature varroa around bits of pupa).

Normal, healthy brood follows a reproducible pattern as laying develops. Small patches of eggs become larvae and are sealed: a disc of sealed brood grows outwards and becomes a series of concentric rings as bees hatch and the cells are laid in once again to repeat the cycle. Once rapid expansion occurs, whole frames are laid and develop in a regular fashion, though irregularity is normal during the time of bee emergence. In the absence of disease, and subsequent hygienic removal of larvae or pupae, there are few gaps, except along the line of wire in the septum/foundation. Once disease appears or mite numbers rise, an increase in the number of emptied cells (which may be replaced by eggs – or nectar or pollen) gives rise to an obvious pattern where the egg, larvae, sealed brood pattern is no longer regular. In the case of high inbreeding, removal of a steady % occurs all the time as diploid drones in worker cells are removed early. It has been observed that the highest rates of larval removal with mites occurs in spring and in late summer.

Enquiring about hygienic removal of mites

The 5 styles of observation described below are designed to demonstrate if your bees open cells with mites, remove larvae with mites or selectively remove larvae with reproducing mites. You may like to stop your enquiries at Stage 1 or Stage 2 or continue right through to Stage 5 depending on your interest and time. Each forms a valid enquiry.

Your observations will be most easily done with freshly drawn comb on frames you have inserted with foundation (or a starter strip) this season. This works with drone comb as well as worker comb.

Direct observation of hygienic removal: in practice we keep our hive assessments brief to keep disturbance to a minimum. Nevertheless, a keen eye might observe bees removing larvae or bees from a cell. If you see this, check if the larva/pupa or bee is carrying mites and see if they remain on the bee as it is removed. You may also observe this at the hive entrance, where you may stay longer without disturbing the bees.

Biting bees

Rodger Dewhurst has made what I believe to be a world first observation and deduction. You read it first here, though you may have heard it at one of his talks in early 2006. You might care to see if your bees bite. He considers that since bees defend their nest against all sorts of invaders of the small sort and use only 2 weapons – their sting and their mandibles. These have 2 modes of action as far as I can see – the tips, acting like pincers and the insides, acting like side cutters. Naturally they will apply the latter to the mite, hence the style of mite damage seen by those who look for it – conical dents and valley dents, even severing cuts. You may observe this on the mites on the varroa collecting tray.

Rodger has been selecting his breeder colonies each year for several years now on this trait and has successfully bred it into his bees and now (2006) has a mating apiary surrounded by high trees in which to confine new queens to mate.

Draft Protocol

Stage 1. Look for uncapped cells where the larvae or pupae are lying along the cell, which they should do after the cell is capped. Check if the cell has been uncapped by bees as above, or by wax moth. If the former, remove larvae/pupae and examine them for mites. Look first in the cell as mites can remain there. Can you see an adult? Can you see daughters?

Stage 2. Look for an obvious pepper-pot pattern, where brood is out of synchrony.

Examine the colony for obvious chalk brood. If this is significant, especially if you have seen chalk mummies in your varroa tray or outside the hive, then it is probable that this is the cause. It would be more difficult to determine the extent your bees remove larvae with varroa. At least they will be hygienic. Similarly EFB. Note that drone brood is often more highly affected by chalk brood, especially if it is along the bottom edges of frames.

In the absence of disease, examine the rims of empty cells. Is there evidence from the state of the wax edge, that bees have hatched from the cell (wax roughness lifted outwards) or that bees have been removed from the cell (neat edge)? If so, hold the frame so that the upper parts of the cells are lit by the sky. Mite faeces will fluoresce. Can you see this? This implies that the bees have both hygienic traits.

Stage 3. Now remove larvae from the 6 cells adjacent to those you have identified as having had larvae removed by the bees. You can use small tweezers. (If you wait you may see this happening, though this is likely to be quite rare). Examine them carefully for mites. Is there one adult mite? How many daughter mites can you see in all stages of development? Is the number and development of daughter mites what is expected for the larval/pupal stage? If these cells are workers, then you may find no mites in all 6 cells. Repeat for other cells, until you give up.

Drone larvae may hold more promise, even though the original research eliminated drones from the colonies, to concentrate the scientific effort. See if you can find drone cells which the bees have started to uncapped (they may remove wax so you can see the cocoon) and carefully remove the larva/pupa with tweezers: examine the cell and the larva for mites. Then fork out a clump of adjacent drone pupae in the recommended way and look for mites both in the cells and on the pupae. Compare this with the number of mites on the larvae you have inspected. If the bees are selectively removing larvae with reproducing mites, you should see a difference in the number of daughter mites, when the drones are at the same stage of development.

Stage 4. Before you open a hive, carefully observe the debris on the varroa tray under the mesh floor. See where the varroa are. Note the line of debris marking the gap between the frames. Look out for immatures. Note if there are any bits of pupa: eyes, antennae, body, cocoon. Look also for damage to the mites: conical dents, valley dents and slicing cuts. All this needs a magnifying glass. When you open the hive, look for empty cells above the point where you discovered pupal debris and/or immature mites. Note where the mites are in relation to: larvae, sealed brood, hatching brood and opened cells.

Stage 5. Insert one or more new frames with foundation or starter strip every time you open the hive during the spring if the flow and the state of the bees warrant it, say 7-10 days. When you look at each frame next time, look for empty cells (perhaps indicating diploid drones removal) (take a photo if you are keen enough). Next time, all the cells should be capped and those emptied lagging behind. Any new empty cells may indicate larval/pupal removal on account of varroa. Depending on your timing and how quickly your bees drew out the cells and the queens laid the cells up, you may have another observation next time. Each time see if there was/is debris beneath the empty cell.

Recording. Record your findings. Your first notes may be qualitative. As you gain confidence you should attempt to record the numbers of cells in each category you count mites in, or on larvae, and those without mites. Report them to James. Note that the presence and removal of chalk brood will make life more difficult, perhaps even impossible to infer varroa specific hygiene at all.