

# How to Conduct a Post-mortem (PM) on a Dead Hive

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## Introduction

On finding a dead colony (what the Americans call a 'dead-out') in their apiary most beekeepers would like to know why it had died. They may be worried that disease was the cause and call out the Seasonal Bee Inspector. However, in most cases the cause (or causes) is simple and there is nothing sinister about the death. Some deaths are avoidable but others are not and the beekeeper could have done nothing to prevent it happening. This article gives some guidelines for examining a hive (conducting a PM) to try and arrive at a diagnosis.

## Summer Losses

In the summer the cause of death for a colony of bees is usually fairly obvious and an attentive beekeeper will normally have some advanced warning that the colony has problems. The most usual reason for a summer death is queen loss or failure to re-queen after swarming. Starvation, poisoning and disease are other possibilities.

Starving bees in summer are listless and dying on the floor of the hive - and obviously there will be little or no food present. Piles of sick and dead bees outside the hive or hives may be a result of poisoning associated with agricultural crop spraying in the area. If the dead bees are largely inside the hive with some trembling on top of frames or the crown board, suspect Chronic Bee Paralysis Virus. Both of the latter are fortunately not common in Wales, further details may be found on Beebase, the National Bee Unit website.

If brood disease is suspected then the hive should be immediately closed to prevent the entry of other bees, all hive movements should cease, clothes and equipment should be washed or sterilized and the Seasonal Bee Inspector should be informed – simple as that!

## Winter Losses

It is the loss of a colony (or colonies) over winter that is the usual situation in which the beekeeper wants to know the cause. There several reasons why the beekeeper wants understand what has happened and the following questions need to be asked:-

- a) Was disease involved – **THE** most important question?
- b) Was it starvation – and this includes isolation starvation?
- c) Queen failure?
- d) Dwindling – basically too few bees for the colony to be viable and this can have a number of causes, including the above?
- e) Becoming a better beekeeper and curiosity – was this death avoidable, was it caused by something I did or didn't do, how can I avoid this in the future?

Some hive losses that are labelled as 'winter losses' are not correctly attributed. There are hives in which the signs of failure are clearly evident in the autumn if the beekeeper took the trouble to look. The old idea that you should not open a hive between September and March should be abandoned because there is lot to be learned about hive activity during this period. If a round of hive inspections is done on a good day in late October and November (just a quick look-see and nothing elaborate) it will found that some colonies do not have brood (or too little brood) to produce the bees that will take them through the winter. There may be a

queen present but not laying or she may have turned drone-layer or the colony may be queenless. Either way the colony is doomed. If this is noticed early enough it may be possible to unite what remains of the colony to another colony but we are not usually in favour of this practice. You can never be sure why the colony is failing (there may be some underlying problem) and if the queen has not been laying properly for some time then the bees will be old and you will not be doing the recipient colony and favours – a case of ‘good money after bad’?

### **Losses found in the Spring**

This is the usual time when the beekeeper realises there are dead colonies in the apiary and wants to know why. The first question is when did the colony die? The beekeeper may have no idea about this because it requires hives to be looked at (from the outside) regularly over the winter. Even then, what was assumed to be normal activity at the hive entrance may turn out to have been robbing in progress. If you look closely at entrance activity it is possible to identify robbing but it is easy to get caught out thinking all is well when it isn't. During the winter beekeepers are often alarmed by the number of dead bees that can be seen at the hive entrance after a spell of poor weather – if an alighting board is fitted it makes this more obvious. Curiously dead bees outside the hive are good news because bees in the colony are dying all the time. In good weather they will usually die outside the hive but when the colony is confined for a few days some will inevitably die in the hive. If, when the weather allows, the colony is keen to get rid of the corpses (‘bring out your dead!’) this is sign that all is well. If the corpses are not removed and start to accumulate on the floor this is the bad news.

### **What to Look for During a Post-mortem**

- 1) **Open the hive and start to look through the frames.** Somewhere there will usually be a cluster of dead bees on the frames (see Figure 1 and 2), which may be going mouldy and have an unpleasant smell. Figure 1 is interpreted as chilling, with the bees clustered on a patch of brood (or where the last brood was produced) trying to keep it warm. Figure 2 is a sign of starvation with the bees head-down in cells. Both conditions may occur on the same or adjacent frames. The dead queen may sometimes be found on the surface of the frame but that only tells you that the colony was queen-right at the time of its demise.
- 2) **Check what stores remain in the hive and their location in relation to the cluster.** If there are no stores at all in the hive that may be your answer (starvation). But if the colony has been dead for some time there may be no stores because they have been removed by robbers. If the rims of cells that should have contained stores are ragged and torn and there is lot of wax debris on the floor then the colony probably did not die of starvation but was robbed post-mortem or when there was an insufficient number of bees to defend against robbing. If there are only stores in the outside frames and what remains of the cluster is small and in the middle of the hive then the colony may have died of isolation starvation. A colony with plenty of bees would have been able to access lateral stores but a small cluster in cold weather would not.
- 3) **Is there any dead brood in the hive?** If there is no dead brood then this is a fairly clear cut case of queen failure. The implication is that the queen has not laid for some time (several months and probably not in the New Year). This means that there has been no supply of new recruits and the existing bees have died of old age. Does the dead brood look like Figure 3 where the raised cappings (drone brood in worker cells) is the sign of a drone-laying queen or laying workers – if the laying workers are responsible the queen will have been deceased first. A drone-laying queen means that

the supply of new workers has ceased early and the existing bees have exceeded their sell-by date.

- 4) **Is there any evidence of disease?** The colony is less likely to have died of a notifiable disease at this time of year but it is worth checking. Because there is no fresh brood it may not be possible to check for EFB using a lateral flow device. There might be signs of AFB and with dead and rotting brood present this will not be easy, but, using a light source and a 45° angle, look from above for scales on the lower wall of the cell. If there are signs of dysentery (faeces smears on the frames and hive wall) Nosema might have contributed to the death but this would need checking microscopically. As many colonies seem to have resistance to Nosema it can be argued that if a colony has died of this cause it is good riddance (natural selection).
- 5) **How many dead bees are on the floor of the hive?** This is difficult to interpret but if there are a lot (and I mean hundreds or even thousands) it implies that they died in large numbers over a short period and the remaining bees were overwhelmed and unable cope with all the corpses. Occasionally the queen may found amongst the dead bees but again that does not tell you anything useful. In our experience mass deaths are the result of starvation, poisoning or old age possibly exacerbated by virus infection (see below).

#### **What is dwindling and what is it caused by?**

Dwindling occurs when the number bees dying exceeds the number of new bees emerging from the brood. If this state of affairs persists for some time the colony will reach the point of no return when it is so short on bees that it is no longer viable. The causes of dwindling are numerous and include most of the above. Queen failure and shortage of stores (and that may include pollen) are the most usual causes of dwindling but there are other important causes that are not easily identified except by knowing the history of the colony – and even then they can only be guessed at.

- a) **Deformed wing virus (DWV).** If adequate control of Varroa has not been achieved in the autumn then a significant proportion of the worker bees may be carrying a DWV infection. Most bees (probably 95%+) with a DWV infection will be asymptomatic, ie. they do not have deformed wings and look quite normal. The problem is that they will die prematurely and will not survive the 5-7 months that is expected of a healthy winter bee. Virus infected bees may survive until the New Year after which they start to die faster than they can be replaced with the inevitable result that the colony dwindles and ceases to be viable. Brood affected by Parasitic Mite Syndrome (PMS) is nibbled, desiccated and has perforated cappings with heads of dead bees visible.
- b) **Shortage of proper winter bees.** Winter bees have a different physiology from summer bees and in particular have well-developed fat bodies. These are thought to be a food reserve enabling the bee to survive hard-times but the fat-bodies are also play some role in the bee's immune system which may also be important for longevity. In order to develop their fat bodies winter bees have a diet that includes more pollen than summer bees and if there is a pollen shortage or limited foraging weather during the autumn they may not get an adequate diet. Another cause of winter bee shortage is limited flying time towards the end of the season (in July and August). This results in summer bees surviving into the autumn (by which time they should have died from overwork) and this seems to confuse the colony in terms of its size. Too few

replacement (winter) bees may be produced and when the summer bees inevitably die this can reduce colony size fairly dramatically.

- c) **Other suggested causes of dwindling.** Great tits and other birds pecking at the hive entrance to induce bees to come out to investigate and then picking them off as food is sometimes claimed to be a factor in dwindling. Shrews, and particularly the Pygmy shrew, can enter hives even when protected by a mouse guard. It is claimed that they can pick-off and consume bees from the outside of the cluster but whether in significant numbers is open to question. Shrews do seem to enter most hives during the winter and their incursion is evidenced by the remains of dead bees with just the thorax missing – the flight muscles in the thorax are rich source of food and they seem to reject the head and abdomen. Mouse damage is usually fairly obvious and ranges from patches of eaten comb to a mouse nest being present. Mice are less likely to take up residence over an open-mesh floor.

### **Summary**

In order to survive the winter and build-up for the coming season, the number of bees emerging from the brood must exceed the number dying. The queen can only lay (or is allowed to lay) the amount of brood that the existing number of bees can feed and keep warm, so a small colony is always walking a tightrope during the early months of the year. Sometimes they fall off!

### **Apiary Hygiene**

Dead hives should have their entrance blocked and then be removed from the apiary as soon as possible. Any frames that have dead bees or brood on them should have the wax melted-down, the frame should be washed in a hot solution of washing soda before they are re-used. If disease is thought to be a factor the boxes should be flamed before they are re-used.