How to Determine Varroa Infestation Levels in Hives

Varroa mites harm honey bee colonies by weakening the bees they feed on and by spreading virus diseases. Beekeepers use various control measures to keep varroa levels low. To do this effectively it helps to know varroa levels in hives. This pamphlet shows a simple and accurate way to do this: extracting varroa from workers taken from broodless colonies in winter when all are phoretic.

Determining varroa levels in a sample of worker bees. *Top left:* Worker bees are shaken into a tub or bucket and a sample of c. 250-300 is taken with a scoop or small cup, put into a zip-loc bag and frozen for counting later. Do not take the queen by mistake. *Top right:* Varroa are washed off the dead bees with a jet of water using a double-mesh honey strainer. The upper, coarse, mesh traps the bees. *Bottom left:* Varroa mites pass through the upper mesh but are trapped by the second, finer, mesh where they are counted. *Bottom right:* After varroa extraction, the bees in the sample are counted to work out the number of mites per 100 bees.

Determining the number of varroa in a hive is not easy because varroa occur in two locations: 1) phoretic (adult female mites clinging to adult bees); 2) in sealed brood cells (adult females and their offspring). When sealed brood is present in a hive, most varroa are found there. LASI research in Sussex, England, has found that in colonies with normal amounts of brood, approximately 75% of the adult female varroa are in sealed brood cells. Even a small amount of sealed brood will contain a surprisingly large proportion of the varroa. Drone brood is more attractive than worker brood. LASI research has found that varroa levels in sealed drone cells are 13 times higher than sealed worker cells.

To quantify varroa in sealed cells is difficult as hundreds must be uncapped and inspected to get a good estimate. In addition, if sealed drone cells are present these must also be checked. One simple way round this is to quantify varroa levels in broodless colonies. That way, all the varroa are phoretic on worker bees. In Sussex, December is the month with least brood. However, some colonies have small amounts of sealed brood even in December. This should be removed or scraped out a few days before sampling workers.

Knowing the number of varroa is important for several reasons. First, it can be used to determine if control is needed. Second, if two samples are taken it is possible to work out varroa population change between the sample dates. For example, a beekeeper who treats a queenless hive with oxalic acid can work out how effective the treatment was at killing varroa by taking one sample just before treatment and another 7-10 days later. A beekeeper who takes two samples a year apart can work out how much the varroa population grows per year. This will help in planning and evaluating a varroa control strategy.

Calculating Annual Growth of the Varroa Population in a Hive

To determine varroa increase in one year, two samples per hive are needed. For example, December one year and December the next. If the first sample is 3 varroa in 250 bees then the level is 1.2 varroa per 100 bees. If next year's sample has 110 varroa in 275 bees this is 40 varroa per 100 bees, and shows that over one year the varroa population grew 40/1.2 = 33.3 times. This calculation assumes that the hive has the same worker population at both sampling dates. If it has grown, then growth rate of the varroa population will be underestimated. If the colony has twice as many bees, multiply by 2. If there are half as many workers then multiply by 0.5, etc.

Why is it Useful to Know Varroa Annual Population Growth?

Varroa control methods vary in effectiveness. LASI research has shown that treating broodless hives with oxalic acid via sublimation in December is highly effective, killing 97.6% of the varroa. The surviving 2.4% will need to increase in population by 100/2.4 = 42 times to build back to pre-treatment level. If a beekeeper checks varroa levels twice, one year apart, and population increase is less than 42 times, this means that annual treatment is enough. Using the method shown here on many hives, LASI research has found that varroa populations grow about 40 times per year in Sussex.

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