

Scientists determine how to control parasite without harming bees



A "phoretic" Varroa mite on the body of a honey bee. Photo courtesy of Alex Wild.



A honey bee hive being treated with oxalic acid via sublimation. The oxalic acid vapour is normally confined to the inside of the hive but is shown here for illustration.

Scientists at the University of Sussex have determined the best way of controlling Varroa mites – one of the biggest threats facing honey bees – without harming the bees themselves.

A team from the Laboratory of Apiculture and Social Insects (LASI) has determined the best dose and method for treating hives with oxalic acid, a naturally occurring chemical already being used by beekeepers to control Varroa.

The study, to be published tomorrow (Tuesday 5 January 2016) in the *Journal of Apicultural Research*, shows that two of the three methods used by beekeepers to apply the chemical cause harm to bee colonies, resulting in reduced winter survival.

But one method – sublimation, by which the chemical is vapourised inside the hive using an electrically heated tool – has no negative effect on the bees. In fact, colonies treated in this way had 20% more bees four months later than untreated colonies.

It is also the easiest to use, the deadliest to the mites - killing 97% with one application - and is effective at lower doses than the other methods.

What's more, it only costs a few pence to treat each hive.

Professor Francis Ratnieks, head of LASI, says that beekeepers should cease using the other two methods ("trickling" and "spraying", in which a solution of oxalic acid is used) as they are harmful to the bees and less effective at killing Varroa.

Professor Ratnieks says: "It is almost too good to be true that sublimation, the best method for killing Varroa with oxalic acid, also has no harmful effects on the bees, and is the quickest to apply.

"Beekeepers should only use the sublimation method. If they apply oxalic acid in this way, they can be confident that it will kill most of the mites and will not harm the bees."

Varroa mites harm honey bees directly and also spread virus diseases that kill colonies.

Controlling Varroa was at first simple, as the product Apistan could be used. Apistan contains a synthetic chemical that kills 99% of the Varroa but is not harmful to the bees. However, Varroa have now evolved resistance to the active ingredient.

Previous research has shown that oxalic acid is able to kill Varroa but nobody had compared different doses and application methods, nor quantified the proportion of Varroa killed.

LASI's research, which was funded by the Esmée Fairbairn Foundation and Rowse Honey Ltd, filled these important gaps.

Notes for editors

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'Towards integrated control of varroa: comparing application methods and doses of oxalic acid on the mortality of phoretic Varroa destructor mites and their honey bee hosts' by Hasan Al Toufailya, Luciano Scandian and Francis Ratnieks will be available from Tuesday 5 January 2016 at:-

<http://www.tandfonline.com/action/showAxaArticles?journalCode=tjar20>

About the research

The study used 110 bee hives in Sussex, UK, in the winter of 2012/3 and another 90 in winter 2013/4.

The hives were all without brood, as occurs naturally in winter. Broodlessness is important. Varroa are found in two locations in a hive: 1) In sealed brood cells (i.e., a cell with a pupal bee), where the female mites lay their eggs and where the young mites develop by feeding on the blood of the pupa; 2) Phoretic: clinging to the body of adult worker bees. Oxalic acid only kills Varroa in position 2.

Three application methods already being used by beekeepers were compared: 1) sublimation, in which crystals of oxalic acid are vaporized using a special heated tool inserted into the hive entrance; 2) trickling, in which the lid of the hive is removed and a solution of oxalic acid is poured onto the bees; 3) spraying, as in trickling, except the frames of bees are sprayed with the solution.

Three doses were used: 0.56, 1.125, 2.25 grams per hive, plus an additional dose of 4.5 grams per hive for sublimation.

The proportion of Varroa killed was determined by extracting mites from a sample of approximately 300 worker bees, taken immediately before treatment and again 2 weeks later. The mites are extracted with a jet of water and counted. If the first sample had 25 mites per 100 bees and the second 1 mite per 100 bees, then the mortality is 24/25 or 96%.

In addition, the project quantified possible harmful effects of oxalic acid, both in terms of the number of worker bees killed at the time of treatment and the mortality and strength of the colonies four months later in spring.

The project was led by PhD student Hasan Al Toufalia, whose PhD was funded by the University of Damascus, and Professor Ratnieks with the assistance of beekeeping technician Luciano Scandian.

By: James Hakner

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