

Effects of neem oil on Varroa mites and bees

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Under laboratory conditions, bees infested with Varroa were brought into contact with neem oil. Neem oil showed a damaging effect on the Varroa mites, which was dose dependent. However, the optimum application against the parasite in bee colonies has not yet been sufficiently researched.



Fruit and leaves of the Nemm Tree,
Azadirachata Indica
(Photo: H. Schmutterer, 1995)

The neem tree (*Azadirachta indica*) grows in the subtropical countries of Asia and Africa. In India it has been known for centuries as a source of numerous materials with abundant uses. In Sanskrit the tree is called "Arishtha", which literally means reliever of illness. For centuries different parts of the neem tree have been used in Ayurvedish medicine. Ayurveda, which literally means "the science of life", is the natural healing system used throughout India. Chewing twigs helped to protect teeth from decay. Different pastes made with extracts of seeds, leaves and bark were applied against lice and skin diseases. Farmers used the leaves of the neem tree, to protect their rice reserves from parasites.

Protection from insects

Scientific research of the content materials of the neem tree and their effects began after 1960. Then the German entomologist Schmutterer observed that during a locust invasion in the Sudan, the neem trees were the only plants which were not attacked by the insects. In consequence, he and many other scientists explored the reasons for this phenomenon (Schmutterer, 1995). Today more than 100 active agents have been isolated from extracts of seeds, leaves, and bark and described chemically.

How does neem oil work?

Neem oil has many known effects against insects, mites, thread worms, fungi and bacteria. Anti-cancer, anti-inflammatory, and other characteristics have been observed in vertebrates. In certain insects, the constituent, Azadirachtin, causes the natural intestine movement to cease; the insects can no longer void their faeces and consequently can no longer feed (Blaney et al., 1990). In other insects, Azadirachtin affects the hormone system; the pupae cannot shed their skin, therefore, metamorphosis from the larval stage to adult insects cannot take place.

Owing to these characteristics, neem components are an interesting basis for the search after new, specific and natural organic pesticides. Some of the biologically active materials from the neem oil break down within a short time under the influence of sunlight.

Effects on bees

To examine the compatibility of neem oils with bees after an application for pest control, experiments were made with bees in flight tents. A control area was planted with Phacelia; a part of the area in bloom was sprayed with a neem preparation. The bees visited the sprayed and unsprayed bloom with equal regularity. There appeared to be no damage to the foraging bees or to the colony. However, 10 days after spraying with certain doses, pupae were found that could not release their skins and young bees with damaged wings. Further investigation showed that Azadirachtin could lead to metamorphosis disturbances and to the death of bee larvae (Rembold et al., 1980; Mordue and Blackwell, 1993; Naumann and Isman, 1996).

Since neem oil shows a good effect against different parasitizing mites, and since adult bees are relatively immune, it was obvious that the possibility of its use against Varroa should be explored.

Neem oil for Varroa control.

In the past, attempts were made to explore the possibilities of employing neem preparations for the control of Varroa mites in bee colonies. Thus the effect of applying neem oil was examined. The oil was filled into small dishes covered with gauze and fixed to the bottom of the frames. In these trials no effects were observed on the development of the bees or on the Varroa population. The conclusion was that the effective substances are not volatile (Bunsen J., 1991).

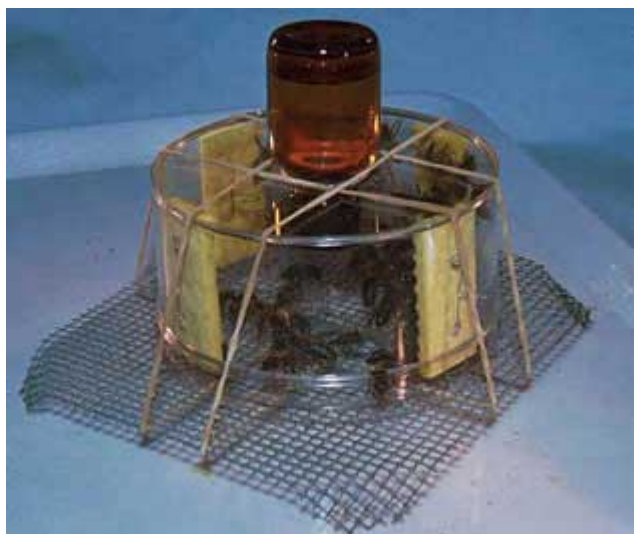
Other researchers examined the effect of neem oil emulsified in water, which was then sprayed on to the bees six times at four-day intervals. They observed a 50 – 90 % death rate in the mites but also a greatly reduced breeding area and losses of queens. When bees and mites were brought into contact with neem oil that was spread on a surface, the treatment resulted in a 95 % success (Melathopoulos et al. 2000 a and b).

Experiments in Liebefeld in 2000

The aim was to find a dose-dependent effect of the oil on Varroa and bees. Under laboratory conditions the oil was brought into contact with worker bees infected with mites.

In the trials small plastic cages were used with four sponges (2 x 4.5 cm) attached to their walls. Each cage contained 50 to 70 bees. 720 microlitres of neem oil solution in various concentrations were spread evenly on the four sponges.

The mortality of bees and mites was recorded daily during the four days. In the diagram below the effect of a particular neem oil solution (No. 903198) on bees as well as mites is shown.

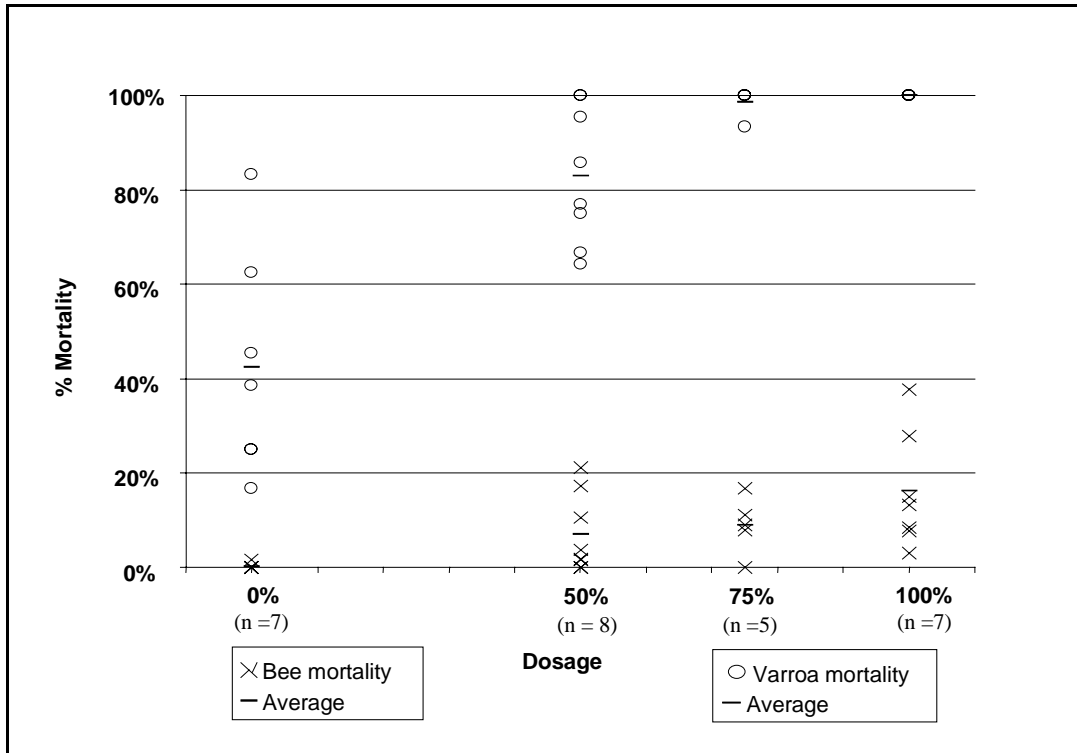


Experimental assembly for contact application of neem oil on bees with Varroa under laboratory conditions. The polystyrene cages with mesh floors were kept in a thermal cabinet at approximately 31°C and with at least 42% air humidity. The feeding bottles with sterilized sugar syrup (1:1) were renewed every two days. The four pieces of sponge contained a total of 720 microlitres of an aqueous emulsion of 0% (control), 50%, 75% or 100% neem oil. (Photo: K. Ruoff)

Results

Under the chosen laboratory conditions the 75 % solution of neem oil formulation showed a mite death rate of approximately 100 % with 10 % mortality in the bees. In 50 %, 75 % and 100 % solutions almost all Varroa mites died in the first half of the treatment whilst the bees died mainly in the second half of the treatment.

High Varroa mortality was also observed in the control group (0 % solution), but only in the second half of the treatment. This may have been caused by unfavourable conditions in the experiment, e.g. the plastic cages could have been charged electro-statically through the movement of the bees.



Results of contact application of neem oil on Varroa infested bees under laboratory conditions. (25 September to 6 October 2000).

Significance of the results

It was proven that neem-oil has a dose dependent effect on Varroa mites. It is not known, however, which of the over 100 components of neem oil are responsible for this effect. Based on experiments with other mites it may be assumed that Azadirachtin which is known for its damage to bee brood has no affect against Varroa. The compatibility with bees could be improved with better solutions, dosage and length of treatment without loss of effect on the mites.

And where to go from here?

In further research on the suitability of neem oil in the fight against Varroa, the components of neem oil which kill Varroa would need to be identified and tested for their compatibility with bees. Until a suitable varroacide is created, many years would have to be spent on costly product development. At the moment we advise against the use of neem preparations on bee colonies because of the risk of damage to brood and uncertainty with regard to effectiveness and further side effects.

Acknowledgement

We thank Professor H. Rembold, Munich, for the free supply of neem preparations and suggestions. A complete report in German about the experiments in Liebefeld can be obtained from the Swiss Bee Research Centre.

After: Schenk P., Imdorf A. und Fluri P.(2001), Wirkungen von Niemöl auf Varroamilben und Bienen, Schweiz. Bienenztg. 124 (3) 25-27

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