

Abstract: Effect of oxalic acid on Varroa mites (*Varroa destructor*) and honeybees (*Apis mellifera*)

Oxalic acid is an effective substance in the control of varroa in brood-free bee colonies. The three application methods (spraying, trickling and vaporizing) show a high effectiveness when being carried out properly and with the right dosage. However, there are numerous aspects, that haven't been sufficiently researched, such as the effects of those methods during intense breeding time or the mechanisms of oxalic acid uptake by varroa mites and bees.

Oxalic acid uptake:

In the reports at hand, the effects of oxalic acid on varroa mites have been studied over a period of 12 years with simple methods. When feeding bees with honey syrup it was apparent that bees refrain from ingesting oxalic acid with the food and thereby that oxalic acid uptake by the varroa cannot happen via the bees system. When examining the feet (tarsus) of fallen-off but still alive mites under a microscope, major accumulations of oxalic acid crystals could be found at the outermost segment of the tarsus with the moist adhesive pad. The mites died within 24 hours of the examination. During this time it was noticeable that the oxalic acid crystals at the adhesive pad of the mites dissolved and penetrated the pad. This was accompanied by a simultaneous cease in life signs in the mites. This observation leads to the hypothesis that oxalic acid crystals are collected in great numbers with the adhesive pads on the mites feet, where they then dissolve within a few hours and penetrate the body of the varroa via the membranes in the adhesive pads. This hypothesis is also supported by the fact that the same observation can be made, regardless of the method of application (spraying, trickling or vaporizing).

Application methods:

Existing application methods have many advantages but also certain disadvantages in areas such as the working safety, easiness of use, bee tolerance and durability.

Following the conclusions from the oxalic acid uptake, the author of the reports tested new method of application, which could overcome some of these disadvantages. In this dry application method, the oxalic acid dehydrate is ground in a mortar and dried at 40°. This process is repeated until a very fine powder results. This is then mixed with powdered sugar to get a 6% oxalic acid and powdered sugar mix. This powder is then sieved directly over the bees with 30g per hive.

Initial trials return promising result with this method. In the trial the powder was applied in 7 hives on the 2nd of December at 7°C and following temperatures between 2° and 12°C. After two weeks 150 to 350 fallen-off mites per hive was counted. As a control treatment the same hives were treated with the vaporized oxalic acid on the 24th of December. Two weeks later, in 2 hives there was 1 fallen-off mite, for the others 0. A full success of the treatment would be expected with temperatures below zero.

Despite the missing statistical analysis, the data can provide the foundation for further research in this field. Further research should focus on the confirmation of the effectiveness of this dry method.