English Mellifera Sites

Vaporisation of oxalic acid in a field trial with 1'509 colonies

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The teaching and experimental apiary Fischermühle of the society Mellifera e.V. has developed a new method of vaporising oxalic acid. In the past winter the efficacy on the varroa mite, the tolerance by the bees and the application safety was examined in different research projects. Of special importance is a big field trial. There were 95 apiarists from seven European countries who tested the VARROX vaporiser produced by the company Andermatt BIOCONTROL AG. In total 1'509 colonies were treated and the data from 797'744 mites and 197'169 bees recorded and analysed. It's not just the bees that are hard-working but also the apiarists! Thanks to the participants of the field trial reliable data now exists regarding the vaporisation of oxalic acid for the treatment of the varroa mite.

The following text is limited to the most important results. However, a detailed report including statistical analyses was given at the "European Working Group for Integrated Varroa Control" by Thomas Radetzki York (England) June 2001) .

Official Approval of Varrox Vaporiser in Austria

In October 2001 the Varrox Vaporiser and the Varrox tablets were granted official approval in Austria thanks to efforts of the Austrian Beekeepers' Association. Austria is now the first country in the EU in which beekeepers can officially use the method, except during normal honey production times.

The new method

In the past years a new method for varroa control was developed by Mellifera e.V., Vereinigung für wesensgemässe Bienenhaltung. There, crystalline oxalic acid (oxalic acid dehydrate) is vaporised in the colony. A small vaporisation device, which operates by means of a car battery, is introduced into the hive via the entrance. The acid vaporises within about 3 minutes. The entrance of the hive is closed tightly with foam material during the treatment and for fifteen minutes after the treatment. Above all, the so-called VARROX-vaporiser is used for winter treatment in colonies that are free of brood. It can also be used in nucleus without sealed brood. The efficacy in late summer in colonies with brood is being examined in future trials.

Even in the Soviet Union the use of oxalic acid vaporisation was known. There, oxalic acid vapour was blown into the hive with pressure from the outside. However, with the soviet method a large uncontrolled amount of the acid, escapes from the hive which can be dangerous for the apiarist. This is different to the method that was developed by the teaching and experimental apiary Fischermühle. In this case, the oxalic acid vaporises in the hive without air supplied from the outside. There are therefore no pressure differences which may force the oxalic acid vapour out of the hive. This simple method can guarantee working safety.

The vaporiser has steadily been improved over the years to guarantee tolerance by the bees and the application safety. The method is now subject to a world-wide patent right, which protects the VARROX-vaporiser distributed by the company Andermatt BIOCONTORL AG(Address below).

Because pure oxalic acid is an unhealthy, toxic and corrosive substance, it is necessary to wear protective glasses, a special protective mask, gloves and long-sleeved clothes during treatment. Colonies in an beehouse must be treated from the outside and the house must be well ventilated during and after the treatment.

During the heating about half of the oxalic acid disintegrates into harmless carbon dioxide and water. The other half vaporises and forms fine drops and dusts of oxalic acid that precipitate on the bees and everywhere in the hive. In a special research project this precipitation was examined to see if there were any risks for the apiarist. Possible by-products of the vaporisation were also examined to see if they were toxic. The results have indicated that any doubts about safety can be dispelled. Therefore we would like to present the results and the new method of vaporising oxalic acid.

Structure of the field trial

In the field trial most apiarists made the first treatment around 25 November 2000. For comparison, different amounts of oxalic acid were vaporised and some colonies were treated with Perizin or

Amitraz. Initially 153 colonies remained untreated as control colonies. To obtain comparable results all apiarists received oxalic acid in capsules containing 1,4 g acid.

Since the effectiveness of the vaporisation of oxalic acid lasts for a prolonged period, dead mites and dead bees were counted for five weeks after the treatment. The follow-up treatment showed how many mites were not caught with the first treatment and served to determine the effectiveness of the first treatment (table 1). With a single vaporisation of oxalic acid 95 % of the mites were killed. The figures, given in percentages, are average values and it has to be taken into account that some of the colonies had sealed brood. A comparison of the efficacy in colonies with or without brood follows further down. The mites falling after the treatment are dead, not only knocked down.

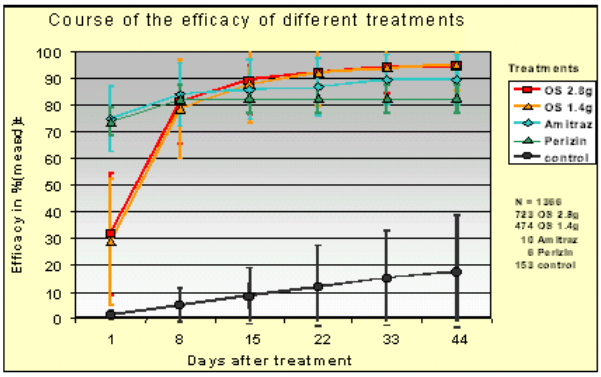
Success of treatment independent of the status of brood

Treatment	Number of colonies	Effectiveness in %
Oxalic acid 2,8 grams	723	94,8
Oxalic acid 1,4 grams	474	94,9
Amitraz	10	89,4
Perizin	6	82,2
Without treatment	153	17,4

table 1

In figure 2 the course of the effectiveness is shown as a curve. The effectiveness of the vaporisation of oxalic acid has a characteristic course (red and orange line), which clearly differs from Perizin and Amitraz (blue and green). With the vaporisation the mites do not fall directly after the treatment, but the effectiveness lasts longer than with Perizin. However, since only 16 colonies were treated with Amitraz or Perizin it is not possible to attach too much importance to the results. Unfortunately, some apiarists differed their treatments from those initially planned and some trial groups are consequently rather small.

figure 2



In figure 2, the horizontal time axis shows how many days after the treatment the dead mites were counted. These given days are average values. Because of unsuitable weather the follow-up treatment was made a little later, on the 44th day after the first treatment. The curves show the average values of the effectiveness. The vertical lines show the mean variation of the effectiveness in the form of the so-called standard deviation. The black curve shows the untreated control.

In it can be seen with which kind of follow-up treatment the efficacy of the vaporisation of oxalic acid was determined. The different follow-up treatments produce only a slight difference in the calculation of the efficacy. Therefore, they are not followed separately in this report.

table 3

	Follow-up treatment				
	Perizin	Amitraz	Oxalic acid dribbling method	Oxalic acid spraying method	3 g oxalic acid vaporisation method
Treatment					
Vaporisation of 1,4 g oxalic acid Number of colonies: Efficacy in %:	129 93,8	0 -	13 93,7	94 95,6	233 95,2
Vaporisation of 2,8 g oxalic acid Number of colonies: Efficacy in %:	204 95,2	70 91,2	27 91,2	168 95,5	225 94,9
All Vaporisation of oxalic acid Efficacy in %:	**94,7**	**91,2**	**93,1**	**95,6**	**95,1**

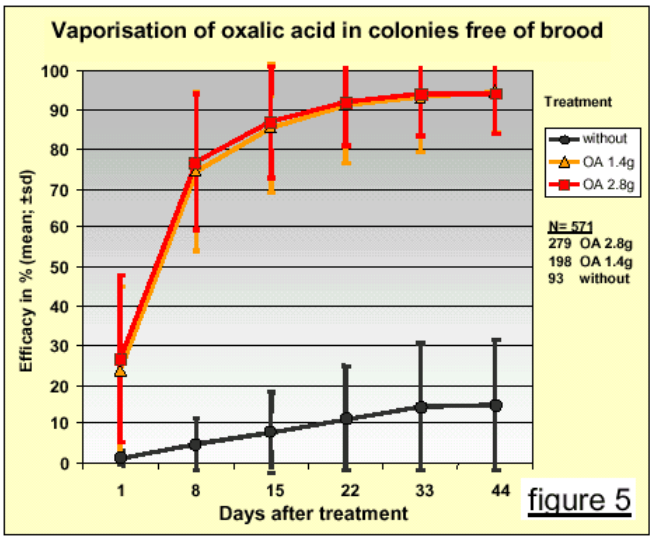
Efficacy of vaporisation of oxalic acid in winter brood

If the status of brood in the treated colonies is taken into account, the efficacy of the vaporisation of oxalic acid in colonies free of brood is 95,9 %. The efficacy in colonies with brood is 92,0 % (see table 4, fig. 5 and 6). Many colonies incubate on several combs; but the exact volume of brood was not revealed. The temperatures in November and December were extraordinarily high, and at some locations the colonies even made pollen flights at this time.

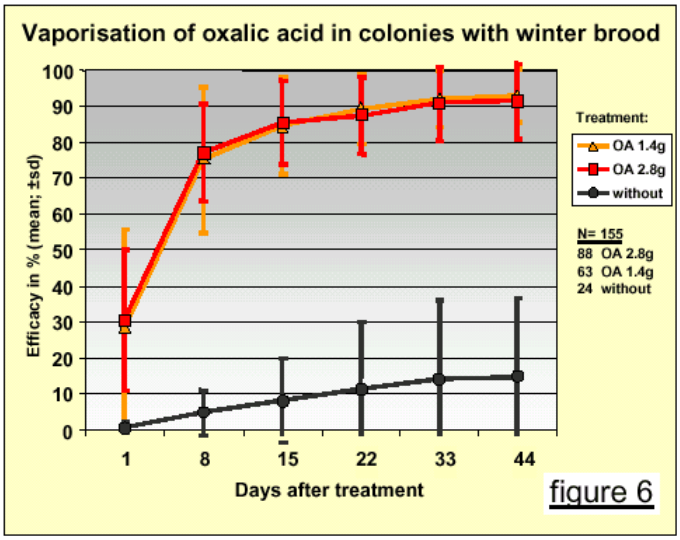
In practice this means that if it is not clear whether the colonies have brood or if a very high attack of varroa is present, a second treatment should be carried out for an effective winter treatment. This should take place about two weeks after the first treatment. Since the bees show a high level of tolerance to this treatment , a follow-up treatment does not produce any problems.

table 4

Treatment	Efficacy		
	Free of brood	Status of brood not known	With brood
Vaporisation of 1,4 g oxalic acid			
Number of colonies:	208	198	63
Efficacy in %:	95,7	94,8	92,9
Vaporisation of 2,8 g oxalic acid			
Number of colonies:	327	279	88
Efficacy in %:	96,0	94,2	91,4
All vaporisation of g oxalic acid			
Efficacy in %:	**95,9**	**94,4**	**92,0**



(OA = oxalic acid)

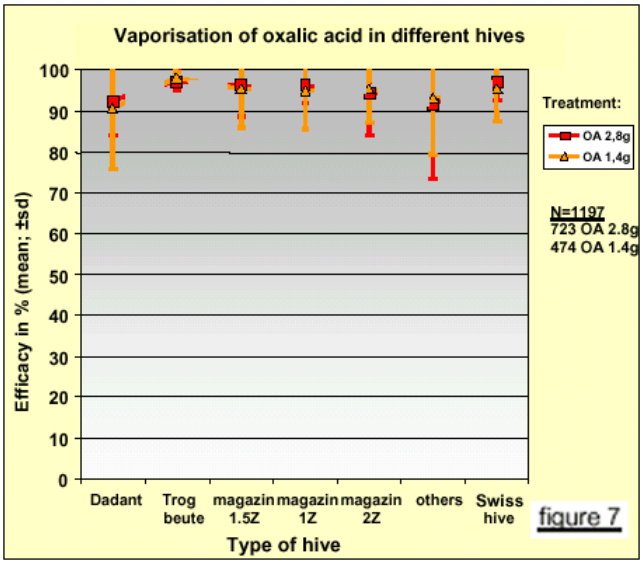


(OA = oxalic acid)

Efficacy of the vaporisation of oxalic acid in different hives

The large amount of existing data enabled an investigation into whether the efficacy of the vaporisation of oxalic acid is dependent on the hive system. In figure 7 the colony data is grouped accordingly. For each type of hive the efficacy of the vaporisation of 1,4 and 2,8 grams of oxalic acid is shown. There were only slight differences in the efficacy and surprisingly, this was not dependent on the amount of oxalic acid used (1,4 or 2,8 grams).

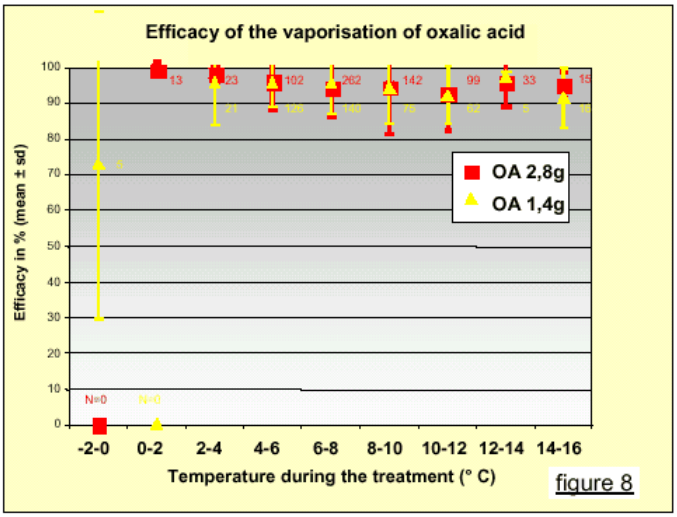
In the group “other hives” the efficacy was slightly lower. However, since this group comprised 37 colonies in different, uncommon hive systems little importance should be attached to the result.
A conspicuous results the low efficacy in Dadant hives (165 colonies). Although these hives have a large volume, this has been excluded as the reason. Multiple-storey hives with 2 frames, which have an even larger volume than Dadant hives, showed a better efficacy (531 colonies). It is also not the case that the colonies in Dadant hives had large amounts of brood during the treatment. No further clues to explain the slightly low efficacy were found.



(OA = oxalic acid)

Vaporisation of oxalic acid also with low temperature

The apiarists recorded the temperature during the treatments. Thus, it could be determined that the efficacy of the vaporisation of oxalic acid is almost the same for temperatures between 2 and 16 °C (fig. 8). This means that with this vaporisation method, the apiarist is widely independent of the weather, a great advantage over the spraying and trickling method with oxalic acid. In cold months too, it is possible to start treatment early in the morning. Within one day, an apiarist can treat 70 to 100 colonies perfectly with the vaporiser. With large apiaries, one person can use three vaporisers at the same time and can, therefore, carry out more treatments. The colonies do not have to be opened and the top does not have to be removed.



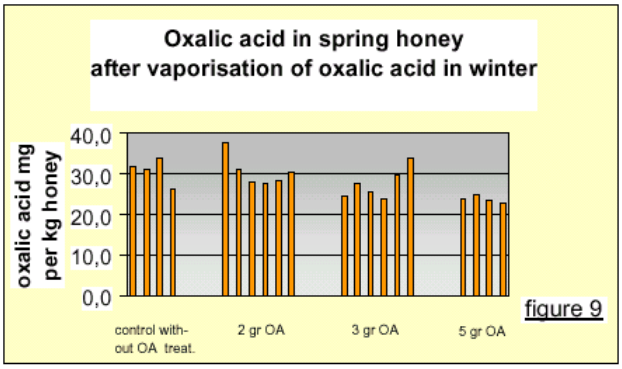
(OA = oxalic acid)

Solubility of wax and residues in honey

Oxalic acid is not water soluble. This is a most important fact when considering a use free of residues. In the year 2000, the spring honey of colonies that were not treated with oxalic acid was compared with honey of colonies in which different amounts of oxalic acid were vaporised. The honey harvest took place at the same time in nearby apiaries.

The content of oxalic acid in the treated colonies was between 22,8 and 37,7 mg/kg honey (fig. 9). Each column represents the content of oxalic acid of a collective sample of at least nine honey combs from two or three colonies. The colonies that were treated with oxalic acid on average had a lower content of oxalic acid in honey than the non-treated colonies. The vaporisation of oxalic acid, therefore seems to be completely harmless in this respect too.

The content of oxalic acid in the examined honey samples was in each case in the lower area of what is know as natural variation. Franco Mutinelli 3) looked at the natural content of oxalic acid in 32 samples of different Italian honeys. He found a content of 20 to 400 mg oxalic acid per kilogram honey.



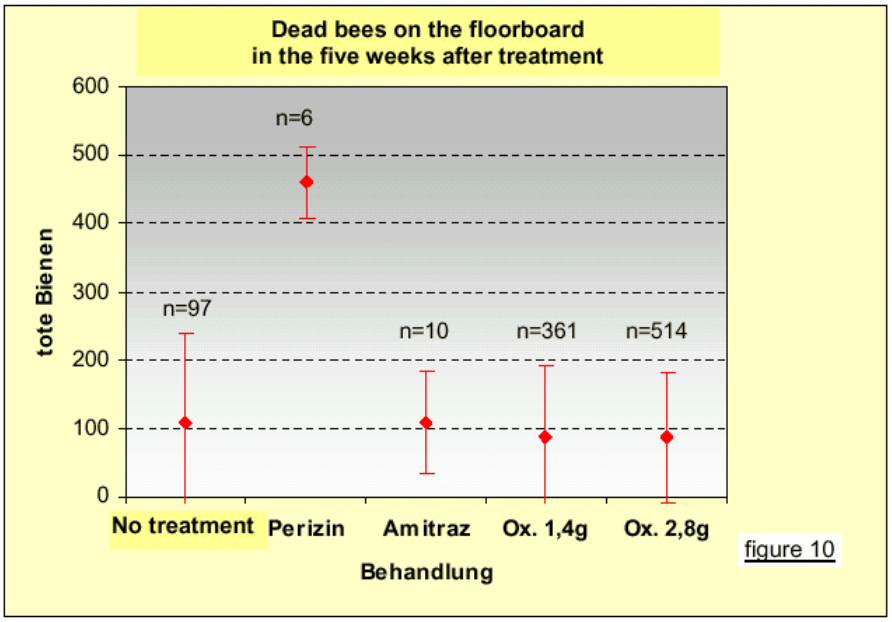
(OA = oxalic acid)

Good tolerance by the bees

Many apiarists who participated in the field trial, regularly counted the dead bees on the bottom of the hive. After the treatment the deadfall of bees was counted over a period of five weeks. After the vaporisation of oxalic acid there was a slightly lower deadfall count than in the non-treated colonies. In figure 10, the deadfall of bees after the different treatments is illustrated. These are average values, of more than 1'000 colonies in which oxalic acid was vaporised! The non-treated control group comprised at least 130 colonies. There seems to be little difference in the number of dead bees after vaporisation with 1,4 and 2,8 grams of oxalic acid. The use of double the amount of oxalic acid does not cause a higher deadfall of bees. Within 5 weeks after the vaporisation of oxalic acid, less than 200 bees fell as winter deadfall.

Since relatively low numbers of colonies were treated with Perizin or Amitraz, the levels of bee

mortality after treatment cannot be regarded as representative.
Although the bees that flew off in winter and did not come back could not be registered, the data points to a good tolerance by the bees. This good tolerance is confirmed by further.



(Ox = oxalic acid)

Technical details

The entrance of the hive must be minimum of 14 mm high and 85 mm wide to introduce the VARROX- vaporiser. The VARROX-vaporiser produced by the company Andermatt BIOCONTORL AG (as well as the protective mask) comes with; detailed instructions for use, a 3-meter-cable with car battery-clips and a measuring spoon

Addresses

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Literature

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3) F. Mutinelli et al, l'acido ossalico nella lotta alla varroasi, L'ape 4/1997, Istituto Zooprofilattico, Legnaro, Italy


Zurück