

**FROM [WWW.APIMONDIA.ORG](http://WWW.APIMONDIA.ORG)****Oxalic acid by VarroX® to varroa control in central Italy**

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**ABSTRACT**

The utilization of oxalic acid to control varroa is a wide practice in central Italy area. The oxalic acid sugar solution applied by trickling on the bees space is the beekeeper's best known method. To test the oxalic acid performance by vaporisation a trial was carried out with VARROX® device. During two-years trials in our apiary, close to Rome, in brood free colonies were vaporised 1 or 2 g of oxalic acid dehydrate. The results showed like the application of OA vaporised improve the efficacy and values rise up to 80% mean. No side effects and no significant differences among the groups were recorded. The analyses of OA in the honeys are been carried out with an enzymatic kit (Sigma) and don't show significant variation of the contents in respect to the amount naturally present.

**Keywords:** *Varroa control, Oxalic acid, Residues, VarroX®*

**INTRODUCTION**

The use of oxalic acid (OA) as acaricide is a wide practice of the last years, for its high efficacy and the low risk of honey contamination. This acid, in fact, is already present in honey like minor component and its amount is variable depending on the different botanical origin. (Mutinelli *et al.*, 1997a). Furthermore, the last December it has been successfully completed the MRL procedure and recommended the inclusion of OA in honey bees Annex II of Council Regulation N° 2377/90. The first technics of OA administration were realized spraying the honeycombs with a 3% solution and the results showed an efficacy superior to 90% on colonies with reduced brood or broodless (Radetzki *et al.*, 1994; Nanetti *et al.*, 1995; Imdorf *et al.*, 1997; Floris e Satta 2000). However, some problems related to this technic (high costs and times, toxicological aspects and orphanity risks for the bee colonies) suggested to test others kinds of administration, like trickling sugar solution with 4,2% OA in the colony by a syringe according to the dose of 5 ml/DB combs partially or fully occupied by the bees. For the beekeepers, this administration way is more simple and cheap, particularly in the northern places where the broodless is maintaining for a long period during the winter season (Mutinelli *et al.*, 1997b; Nanetti e Stradi, 1997; Higes *et al.*, 1999; Brødsgaard *et al.*, 1999; Marinelli *et al.*, 2000). Another type of administration has been developed and used in the last periods of time, especially in the central European sides (Radetzki, 2001), based on

the vaporisation of OA easily obtained by means of an apposite Varrox® device produced by Andermatt Biocontrol AG. Aim of the present work was to test this technic of OA administration in our experimental apiary, to evaluate the efficacy of vaporized OA, the tolerance of honeybees in respect to it and the amount of residual OA in the honey after treatments (Wallner, 1999).

## MATERIALS AND METHODS

The trials are been carried out during November and December 2003 in the experimental apiary of Istituto Sperimentale per la Zoologia Agraria, Sezione di Apicoltura, located in Tormancina (Rome). The treatments are been carried out on broodless colonies. Three groups of ten colonies, selected for their strength calculates in numbers of frame of adult bee and brood, are been tested and disposed in DB beehives with 10 frames and movable



**Figure 1:** Varrox® device. (Photo De Pace)

bottom board. The device, produced by Andermatt BIOCONTROL AG and distributed in Italy by Intrachem BIOITALIA S. P.A., has been utilized for the administration of OA. It consists in a small vaporization pan, that warms up by means of a battery at 12 volts, melting and vaporizing the OA crystals. The device is introduced into the hive by the entrance and is close tightly with foam material during the treatment and after, for other fifteen minutes.

First group of ten colonies, named A, was treated with two administrations, one each fifteen days, distributing 1 g of OA dihydrate (Carlo Erba cod. 408737).

The second group of ten colonies, B, was treated with one administration of 2 g of OA dihydrate (Carlo Erba cod. 408737).

A third group, C, has not been treated at all.

The control treatments at the end of the trials were carried out utilising Perizin®.

The mites death-rate has been verified examining periodically the antivarroa diagnostic boards.

Efficacy of treatments has been calculated by the following formula:

$\text{Efficacy} = \frac{\text{N}^\circ \text{ of mites falled after OA treatment}}{\text{Total number of falled mites}} \times 100$
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A statistical evaluation of trial results was carried out with ANOVA test for variance analysis and with the Student – Newman – Keuls test for the mean values. During the trials, air temperatures and rainfalls were monitored too, with the aid of an electronic recording device.

*Honeybees tolerance.* Acute toxicity was evaluated testing the mortality of adult honeybees. These were collected with underbasket cages positioned just in front of the beehives. To verify possible damages, the colony strength was measured by Sixth method before and after treatments. The analysis were carried out with the diagnostic kit for oxalate of Greiner Diagnostic, distributed in Italy by Prisma s.r.l., using an enzymatic method (Mutinelli et al., 1997b; Cossu e Alamanni, 1999). This method is based on the enzymatic oxidation of oxalate to carbon dioxide and hydrogen peroxide and the coloured substance formed in the reactions is detected spettrofometrically at 590 nm (UV/VIS Cary 100- Varian).

## RESULTS AND DISCUSSION

Aggregate results show a satisfactory efficacy level of the vaporised OA (Table I, Figure 2). In the group of colonies A, 1g of OA administrated two times with a break of fifteen days, the recorded mean acaricide efficacy was 85,3% with values ranging from 73,1% min. to 100% max. Similar is the mean efficacy level of group B, with 2g of OA administrated once, which values are respectively 80,6% mean, 73,1% min, 89,1% max. The natural fall of control group results assested at 7,8%.

**Table 1:** Results of trials with OA vaporized by Varro. Tormancina (Rome) 2003.

Group	n. beehives	Trials 2003			
		mean eff. %	std dev	min eff. %	max eff. %
<b>A (OA 1g)</b>	10	85,3 a *	7,9	73,8	100
<b>B (OA 2g)</b>	10	80,6 a	5,6	73,1	89,1
<b>C (control)</b>	10	7,8 b	1,5	3,9	10,1

\* The values of the same column with no equal letter are different for P=0,05

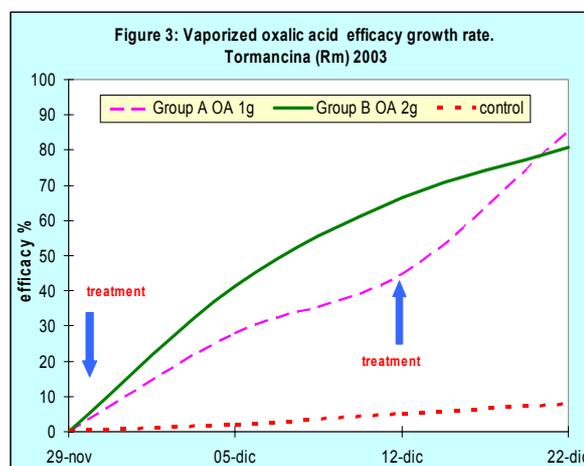
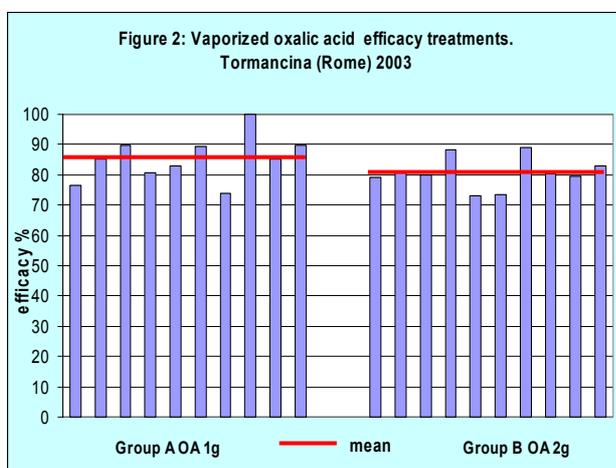
The trend of acaricide efficacy shows a quite constant proceeding in the group B during the entire trial while a fall of the acaricide efficacy is remarkable for the group A just before the second administration (Figure 3).

*Side-effects on the honeybees.* There are no significant differences between the control and treated groups for the acute mortality when the dead honeybees are being detected by means of the *underbasket* cages. The strength of colonies, detected before and after the treatments with the Sixth method, resulted perfectly regular in all the colonies used for the trials.

**Table 2:** Residues of OA in 6 samples of nest honey for each group. Values: mean, min-max in ppm (mg/Kg honey) and std dev.

COLONIES/ADMINISTRATION	ppm OA before	ppm OA after
<b>GROUP A 1G IN TWO STEPS</b>	275 min 116 – max 331 std dev 81,3	278 min 216 – max 429 std dev 76,9
<b>Group B 2g once</b>	233 min116 – max 380 std dev 90,0	243 min141 – max 347 std dev 74,3
<b>Group C no treated</b>	226 min121 – max 231 std dev 65,0	225 min 142 – max 298 std dev 50,9

*Residues.* Six nest honey samples were collected for each group of colonies to be analysed for the OA content before and after treatments. Data reported in Table II show no particular increasing of residual OA content after treatments with mean values increased of +1,1% in group A and 4,1% in group B respectively, after treatments.



## CONCLUSIONS

The broodless trials of autumn-winter 2003 confirms the vaporised OA acaricide action and the importance of this substance in varroa control especially in low environmental impact strategies during broodless period. Its efficacy reached the same levels of the trickling way administration in the central Italy conditions. Both results are around 80% of efficacy, important value, even if the complete cleaning of colonies seems to be quite far too. Otherwise the Varrox® administration technic is more labour intensive of the trickling distribution and this fact surely needs a great care and a more difficult practice by the beekeepers point of view, particularly for those with a large number of beehives. About the

toxicity of OA is important to repeat that beside this substance is naturally present in several foods, it can be toxic also at low concentrations so the risks related to the handling are always high and it needs to use safety devices during the preparation and distribution phases. As regards to the levels of residue OA in the honey samples, the trial pointed out no significant differences between the contents, due to the treatments.

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