

## Scientific note

### A scientific note on oxalic acid by topical application for the control of varroosis

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Tests on the use of oxalic acid for controlling varroosis (Takeuchi et al, 1983; Zjuman, 1987; Radetzki et al, 1994; Nanetti et al, 1995; Imdorf et al, 1997) have given very good results either in terms of efficacy (23.8–90.3%; 95%; 97.29%; 98% and 99.5%, respectively) or tolerability by bees. In these previous investigations bees were sprayed with 2–3% oxalic acid water solution (3–5 mL per each comb side) during a broodless period.

It was our aim to evaluate the activity of 5% (w/v) oxalic acid in a water–sugar solution by topical application on the bees. We also planned to verify the possible effect of these treatments on the oxalic acid content of honey.

The trial was carried out on 15 Dadant-Blatt hives with an 'anti-*Varroa*' tray and five or six combs occupied by bees. The hives were located in the province of Padova (northeastern Italy). Five hives treated with 20% water–sugar solution were used as control.

The solution used for the topical treatment had the following composition: 5% (w/v) oxalic acid (70 g dihydrate oxalic acid, Prolabo, No 20 558.296), sugar (200 g) and distilled water to 1 000 mL. The dosage was 25–30 mL per hive (5 mL per comb covered by bees). At the time

of administration it was sunny, 10 °C and some bees were flying.

The treatment was repeated weekly three times (30 October, 6 November, 13 November). Perizin® (Bayer) was used for the control treatments. It was administered twice at a 12-day interval (21 November and 3 December) according to the producer instructions. The first control treatment was carried out 8 days after the last administration of the acid.

Bee mortality was determined using 'under-basket traps' applied to each hive (Accorti, 1994).

The mean efficacy of the three treatments with oxalic acid was 95% ( $\pm 7.39\%$ ) (table I). At the time of administration capped brood accounted for approximately 3 400 cells per hive. A 73.7% mean efficacy was achieved after the first oxalic acid treatment. The results obtained in each hive were homogeneous except for one hive, which accounted for a 22.6% efficacy. In the treated hives no queenlessness was recorded and bee mortality (12.59 bees/day) did not differ significantly from that observed in the control hives (12.32 bees/day). No behavioural changes were detected in bees at the time of administration.

In this trial topical administration of oxalic acid resulted in a mean efficacy slightly lower than the spray one (98.3% after only one treat-

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**Table I.** Five percent oxalic acid efficacy against varroosis by topical application and mean values of oxalic acid content in honey taken from the nest of the treated hives.

Hives	1st treatment			2nd treatment			3rd treatment			control <sup>a</sup>		Total fallen mites	Total efficacy (%)
	Fallen mites	Efficacy (%)	Oxalic acid content (ppm; w/v)	Fallen mites	Efficacy (%)	Oxalic acid content (ppm; w/v)	Fallen mites	Efficacy (%)	Oxalic acid content (ppm; w/v)	Fallen mites	Efficacy (%)		
Mean	380.70	73.70	282.44	53.60	9.31	288.79	33.90	12.09	239.37	12.40	5.0	480.60	95.00
SD	386.23	22.19	76.59	96.14	8.03	77.68	15.30	10.96	93.97	10.99	7.56	477.64	7.39
N	10	10	10	10	10	10	10	10	10	10	10	10	10

<sup>a</sup>Two treatments with Perizin® (Bayer).

ment in broodless period) (Nanetti et al, 1995), but it is surely easier and faster to apply, even though at least two administrations are required when brood is still present.

Oxalic acid has been determined as oxalate using a commercially available kit (Oxalate SIGMA Diagnostics kit, Cat No 591-D) adapted to honey (detection level  $\geq 3$  ppm). The content of oxalic acid in honey taken from the nest of treated hives did not change during the trial (pre-treatment oxalic acid content:  $239.79 \pm 61.72$  ppm). The difference between pre- and post-treatment content was not significant (two-tailed *t*-test; *t* = 0.461, ns) (table I). This shows that the possible increase in the natural content of this organic acid in honey (Kary, 1987) can be avoided, when the protocol described above is followed.

From the toxicological standpoint it is advisable to avoid ingestion, inhalation as well as any skin or mucosal contact with oxalic acid wearing protective glasses and gloves (Reynolds, 1993).

### Eine wissenschaftliche Notiz zur topikalen Anwendung von Oxalsäure in der Behandlung der Varroose

### Note scientifique sur l'application topique d'acide oxalique dans le traitement de la varroose

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