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# How can resistant Varroa mites be kept below the damage threshold? ✓



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*keywords: apis, Varroa, control, alternative, FAM*

The bee-parasite *Varroa jacobsoni*, has, in many regions of Europe become resistant to various conventional Varroacides

Alternative substances such as organic acids and constituents of ethereal oils are available as substitutes. Their application is only successful, however, if they are used as a treatment concept.

## Treatment Concept

Monitoring the Varroa population is an important measure. Thus early recognition of an increasing Varroa population is possible and the necessary control measures can be initiated in time. The mite population is significantly reduced in August and September by one or two long-term treatments with formic acid or one treatment with thymol over about 6 weeks after the honey harvest. As soon as the colonies are brood-free, they are additionally treated in November with oxalic acid. Consequently, after implementation of these concepts, no further treatments are necessary before the honey harvest

Illustration 1: The alternative Varroa treatment is successful only if it is used as concept. Monitoring the degree of infestation and the reduction of the Varroa population in August and September by formic acid or thymol as well as in November with oxalic acid is the cornerstone of this concept

## Information on individual measures

### Monitoring the Varroa population

When resistant mites increase, there is a danger that the damage threshold will be exceeded sometimes and colonies will collapse. This in turn can lead to massive re-invasions of neighbouring apiaries. It is therefore necessary to monitor mite fall from time to time between spring and the end of July. If mite fall is higher than 30 per day, control measures must be initiated, irrespective of time. With a weekly treatment using formic acid, dying of colonies can be avoided.

### Reduction of the Varroa population in spring

If mite fall at the end of May exceeds 3 Varroa per day, treatment cannot wait until August. In the next gap between honey flows, a long-term treatment of one week, or two pulse treatments with formic acid should be carried out, and supers removed. Such treatments often cause larger formic acid residues in a subsequent honey harvest. These treatments are therefore to be used in emergencies only.

The Varroa population can be reduced by about half by cutting out drone brood twice or three times, or by about a third by forming a nucleus. It is an advantage to integrate such measures into routine beekeeping procedures

### One or two treatments with formic acid?

If the natural mite fall at the beginning of August is over 10 mites per day, then two long-term treatments are necessary. The first treatment should be executed immediately after the honey harvest. The second treatment is from mid-September. However if the mite fall is fewer than 10 mites per day then one treatment is sufficient. This can be postponed until the end of August.

The necessity of a second formic acid application can also be checked by means of the natural mite fall during the third week after the end of the first treatment. If mite fall is above one Varroa per day, a second application should be carried out.

### Interpretation of the natural mite-fall within the framework of an alternative treatment

Time	Mites per day (>)	Measures
End of May	3	A long-term treatment with formic acid should be carried out immediately after the spring harvest.
End of July	10	Two long-term treatments with formic acid are necessary.
Beginning of September	1	The second long-term treatment with formic acid is necessary.
Whole Bee season	30	Damage threshold reached. Colony collapse imminent. Treatment without delay is imperative.

### Long-term treatment with formic acid

Various types of dosing equipment for long-term treatment are available on the market. On one of these, formic acid is held back by a carrier material. Here, the surface area regulates evaporation of formic acid. In others, it is stored as a liquid in a small container and evaporated via a wick. Since Varroa control is completed later with an oxalic acid treatment, it is not essential to achieve the highest possible treatment success with formic acid. Thereby the risk of queen losses is lessened considerably. Application of the various dispensers must be in accordance with instructions.

Effectiveness of one treatment can be expected to lie between 60 and 80%. Over two applications, the effectiveness increases to 90-98%. Formic acid is effective in capped brood cells and kills *Acarapis* mites in the trachea.

### Treatment with components of essential oils

Instead of formic acid, treatments with thymol can be carried out. The market is about to offer several products where the effective principle thymol is applied or incorporated into different carrier substances. For evaporating thymol, these products are placed on the queen excluder over several

weeks. The application is according to manufacturer's instructions. After the honey harvest is completed, as much feed as possible should be given. As with formic acid, treatment has to start as early as possible when natural mite fall exceeds 10 mites per day. With products where the first sheet is replaced by a second after 3 weeks, feed should be given before insertion of the second sheet.

It is estimated that effectiveness under optimum conditions is between 90 and 97%. Monitoring treatment success is not necessary because of the subsequent application of oxalic acid in November.†

### Oxalic acid in brood-free colonies

Treatment with oxalic acid in November aims to reduce residual Varroa populations in colonies to a necessary minimum. If there are no re-invasions in spring, further control measures can be dispensed with in August of the following year. This aim can only be achieved when colonies are brood-less during treatment. Oxalic acid has no effect on mites in capped brood.

### Spraying oxalic acid

For this, an oxalic acid solution of 30g oxalic acid dihydrate to 1000-ml water is used. Three to four ml solution is sprayed on each side of the comb with a hand sprayer. This method is tolerated well by the bees and is particularly suitable for bee colonies in single-brood chamber hives.

### Drip application of oxalic acid

For this application, a solution of oxalic acid in sugar water (45g oxalic acid dihydrate in 1litre sugar water, 1 to 1) is used. 5ml of this solution per bee space (gap between drawn combs) are dripped on the bees. Depending on colony size, 30-50 ml per colony is needed. This application is labour

saving; it is however less well tolerated by the bees than the spray method. Formulation, concentration, and dosage must be further improved. Therefore, the spray method is preferable for the moment. Both oxalic acid methods have an effectiveness of over 95% in brood free colonies. Repeat applications of oxalic acid drips are not recommended due to low bee tolerance and low effectiveness in colonies with brood.</div>

Both oxalic acid methods have an effectiveness of over 95% in brood free colonies.

### Protective measures

During the application of organic acids and essential oils, acid-proof gloves must always be worn. When handling formic- and oxalic acid, protective goggles should be worn and a bucket of water placed within reach. When spraying oxalic acid solution, a breathing mask of the type FFP2SL, EN 149 must be worn. All these products needed for alternative Varroa control are available from specialist dealers. Oxalic acid solutions should only be made by suitably qualified persons.

### Concluding remarks

This control concept provides a means for the beekeeper to keep Varroa below the damage threshold in Central European regions. With relatively low labour costs, it will remain possible to produce high-quality bee products successfully in the future.

### Further information

More detailed information on individual measures within the framework of alternative Varroa control have been published in various issues of the Schweizerische Bienen-Zeitung in 1998†and in English publications.

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Photo 1: By means of mesh protected inserts rapid increases of infestation through re-invasion or insufficient treatment can be recognized early and necessary measures taken in time.



Photo 2: Depending on infestation, one or two long-term treatments with formic acid are to be carried out. For this purpose, there are various formic acid dispensers on the market.



Photo 3: Instead of formic acid, thymol can be applied as an active principle, here in the form of Api-Life-Var.



Photo 4: The Varroa population can be reduced to a necessary minimum by spraying oxalic acid solution as soon as the colonies are brood-free in autumn.

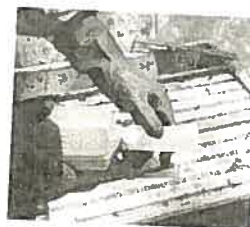


Photo 5: The drip application of the oxalic acid-sugar-water solution is less well tolerated by the bees. Formulation, concentration, and dosage must therefore be further researched. At the moment, the spray method is to be preferred

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