Varroa Control and Treatments

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Ensuring our bees are healthy is a priority and this means that we must keep varroa levels in check. Kirsty Stainton and Sally Ponting describe the three approaches to varroa control and give specific guidance on what is most suitable to use and when – all summarised in a handy table.

For the modern beekeeper, management of varroa is an ongoing balancing act of keeping the mite levels low enough to prevent them causing damage to bees while minimizing the negative impact of an intervention (treatment or procedure) on the bees. There are many approved products available, each with different active ingredients, methods of application and contraindications, i.e. a specific situation in which a treatment or procedure should not be used because it may be harmful. In addition to the application of miticides, there are mechanical methods for keeping mite levels down. Getting to grips with which methods to use, and when and how, can be quite confusing. Here, we have compared the different methods of mite control and summarise them in a table, to inform you in making the appropriate varroa control decisions for your colonies.

First, let us summarise some important points regarding varroa biology. Varroa mites primarily exist inside sealed brood cells because this is where they reproduce. You will usually only see them on adult bees when levels of mite infestation are already very high, so it is important that this is not used as your primary parameter for determining whether you should treat. Varroa cannot reproduce during broodless periods and will eventually begin to die in the absence of brood, although they can survive on adult bees for some weeks. If there is a lot of brood in the colony and you kill only the varroa that is visible i.e. on the bees, then the majority of the mites still remain in the hive. Therefore, you need to treat in a way that kills as many mites as possible; for example, treating in winter when there is no brood present or by using a product that can kill mites through the wax cappings.

Varroa control methods

The methods for controlling varroa can be divided into three broad categories as summarised in Table 1: mechanical methods are in the green panel, organic acids in the orange panel and traditional miticides, specifically varroacides in the blue panel.

Mechanical treatments

Mechanical methods, usually performed in spring, generally involve some kind of brood disruption to remove the mites infesting the capped cells. These methods tend not to be as effective as organic acids or mitcides; effectiveness of mechanical methods can be anywhere from 50% to 90%, while use of acids/miticides is usually between 90% and 99% effective. However, these methods can still be helpful to get the number of mites as low as possible going into the beekeeping season.

Organic acids

Organic acids and other non-pesticide compounds like thymol can be very effective at reducing varroa levels without the concerns of resistance developing in mites, which can be a problem with traditional pesticides. However, only one of these products can be used when honey supers are in place and this is formic acid. As mite levels peak in July/August, it is important to consider formic acid as a summer treatment to prevent this peak in mite population while supers are on, because mites can damage the developing bees and result in high levels of Deformed Wing Virus in a colony. Used correctly, formic acid can kill more than 95% of mites, as it can penetrate the brood cappings. Thymol is also a very effective treatment but should not be used when honey supers are in place as it can taint the honey. When it comes to winter treatments, oxalic acid is the way to go. Oxalic acid, especially when sublimated, is very effective at killing mites although it is damaging to brood, so winter is the best time to use it. You want to kill as many mites as possible when they have nowhere to hide. If you have some brood in your colony over winter, consider multiple oxalic acid treatments. Use of oxalic acid during summer may cause some brood damage.[1]

	Product names	Use when supers on?	Use when Brood present?	Duration of application	Time of application	Temperature range
Mechanical methods						
Queen trapping	n.a.	**Yes**	Yes	Trap queen for 21 days	Spring	Once queen is laying
Drone brood removal	n.a.	**Yes**	Yes	Remove sealed drone brood after 21 days	Spring, early summer	-
Artificial swarm	n.a.	**Yes**	Yes	Process takes up to 30 days	Spring	-
Organic acids/oils						
Oxalic acid	**ApiBioxal**	No	No	Leave on treatment	Winter	Minimum temperature 3°C
Oxalic acid	**Oxuvar**	No	No	Leave on treatment	Winter	Trickle -15°C to 5°C Spray above 8°C
Oxalic acid	**Oxybee**	No	No	Leave on treatment	Winter	Minimum temperature 3°C
Formic acid	**MAQS**	Yes	Yes	Leave in for 7 days	Spring, summer or autumn	Minimum temperature 10°C
Thymol	**Apiguard**	No	Yes	Two consecutive 2week treatments	Summer or autumn	Min 15°C to Max 40°C
Thymol	**Thymovar**	No	Yes	Two consecutive 3-4week treatments	Most effective in summer	Min 15°C to Max 30°C
Formic and Oxalic acid	**VarroMed**	No	No	Leave on treatment	Spring, autumn, winter	Minimum temperature 10°C
Thymol, menthol, eucalyptol, camphor	**Apilife Var**	No	Low levels only (1-2 frames)	Two consecutive 7-10 day treatments followed by one 12day treatment	Spring or autumn	Min 15°C to Max 30°C
Pesticides						
Flumethrin	**Polyvar**	No	Yes	Leave in for 60 to 120 days	Spring or autumn	Less effective at cold temperatures
Flumethrin	**Bayvarol**	No	Yes	Leave in for 43 days	Spring or autumn	Less effective at cold temperatures
Amitraz	**ApiVar**	No	Yes	Leave in for 6 to 10 weeks	Spring or autumn	Less effective at cold temperatures
Amitraz	**Apitraz**	No	Low levels only (1-2 frames)	Leave in for 60 to 80 days	Spring or autumn	Less effective at cold temperatures
Tau-fluvalinate	**Apistan**	No	Yes	Leave in for 42 to 56 days	Spring or autumn	Minimum temperature 10°C

Table 1. Summary of authorised treatments for treatment of Varroa mite infestation in honey bee colonies and conditions of their use. Methods for controlling varroa can be divided into three broad categories: mechanical methods (green panel), organic acids (orange panel) and traditional miticides, specifically varroacides (blue panel).

Traditional pesticides

Traditional pesticides/miticides can be incredibly effective at killing mites and could probably be considered the most effective of all the treatments, if it were not for the matter of resistance. Resistance varies by geographical region and by product. If the same active ingredient is used every year in an area, without another form of varroa management, resistance can occur quickly, which results in a reduction in the effectiveness of the product. Rotating between different pesticide classes can help, i.e. if you use an amitraz product this year, use a flumethrin or tau-fluvalinate based product next year. Similarly, alternating between an organic acid-based product and pesticide treatment can be helpful to minimise the development of resistance.

Note: Flumethrin and tau-fluvalinate are both synthetic pyrethroids having the same mode of action and should not be rotated against each other; mites exhibiting resistance to one of these products will also be resistant to the other.

Beekeepers' treatments of choice

In the annual beekeeping husbandry survey performed by the National Bee Unit, 6% of beekeepers report that they use no treatment for varroa, as shown in Figure 1. In some cases, in an isolated area for example, there will be low infestation of mites from surrounding areas so mite levels may remain low, but mite levels in the colony should still be monitored and colonies treated if mites reach high levels. The beekeeper has a responsibility of care to the bees, but also a responsibility to neighbouring beekeepers who may be experiencing high levels of re-infestation due to having a neighbour nearby with high mite levels. Many groups are working on developing strains of honey bee with tolerance or resistance to varroa mites, but until those strains are available, high overwintering losses will be suffered in heavily infested and untreated apiaries.

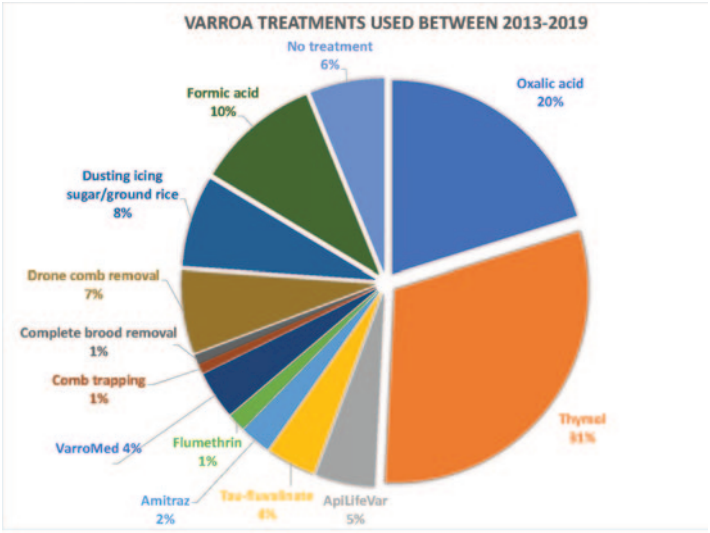

Figure 1. Treatments used by beekeepers in England and Wales from 2013 to 2019.

As 8% of beekeepers stated they use icing sugar as a treatment against varroa (Figure 1), it should be noted that this is not an effective way to remove mites from a colony[2] as the majority of mites in a colony are in the brood cells, not on the bees. Seventy percent of beekeepers are using organic acids and thymol for treatment of mites, while only 7% report using traditional miticides and 9% are using mechanical methods for removal of mites. This pie chart does not capture multiple treatments, but generally a beekeeper will need to use more than one treatment for varroa each year so consult Table 1 above to help chose the most appropriate treatment for the time of year. Table 1 can be used as a guide to help decide what treatment is suitable for you and, when

used in combination with the tips below, should help you to maximise the effectiveness of the treatment options available.

Tips for managing varroa

Count varroa mites

Counting varroa may not be the most exciting task in the beekeeping calendar, but it is absolutely crucial. You must know approximately how many varroa are in your colony so you know roughly when you should treat and when you should not treat. The best method for counting varroa, in that it gives the best indication of the number of mites in the hive, is through counting floor drop. Monitor mite drop by placing a sticky board in the floor board for seven days. Remove the board after seven days, count the number of mites and calculate your daily mite drop by dividing the number of mites counted by seven. Alternatively, you can count daily if it suits you. Broadly speaking, average daily mite drop should not be more than thirty as this indicates a serious mite infestation and treatment is urgently needed, while below ten is considered acceptable and you do not need to treat just now. Between ten and thirty, you are in a zone where you should be treating imminently. Even easier, you can use the NBU varroa calculator to determine the number of mites in your hive and what it means for you: http://www.nationalbeeunit.com/public/BeeDiseases/varroaCalculator.cfm

Protect yourself appropriately

Always wear the appropriate protective equipment. Gloves are a minimum requirement for all treatments but for oxalic acid treatments, further equipment is necessary. If you are vaporising (sublimating) oxalic acid, you should wear a full-face FFP3 mask respirator with the appropriate filters for organic acids. When handling oxalic acid solution, protective eye-ware and gloves are needed.

Check the local temperature

Be aware of the temperature. Some treatments are not effective below or above certain temperatures. Read the instruction leaflet that accompanies the treatment. If the environmental temperature is outside the recommended range, the effectiveness of your treatment could be significantly reduced or may cause damage to the bees. This information is summarised in Table 1.

Apply treatments as instructed by manufacturers

Product placement is important for effectiveness. Each treatment requires a different positioning within the hive. Some treatments may harm brood if placed too closely or are less effective if too far away from brood nest. Comply with the recommendations in the product literature for maximum effectiveness.

Use only the recommended doses

Do not use more or less than recommended. Correct dosage is critical for maximum killing of mites, but too much can harm the bees. Too little and this will give reduced efficacy and can also lead to the mites developing resistance to the product. This applies to products being out of date too; products should only be used within shelf life as the efficacy of mite-killing will decrease as the product ages. Always use the appropriate amount of product for the brood space and avoid cutting strips unless advised to do so in the information leaflet provided.

References

1. Rademacher E, Harz M, Schneider S. Effects of oxalic acid on *Apis mellifera* (Hymenoptera: Apidae). *Insects* 2017; 8(3): 84. doi:10.3390/insects8030084.
2. Ellis AM, Hayes GW, Ellis JD. (2009) The efficacy of dusting honey bee colonies with powdered sugar to reduce varroa mite populations. *Journal of Apicultural Research* 2009; 48(1): 72–6.