Frequently Asked Questions about mite resistance

What does resistance mean for a varroa treatment?

It means that a varroa mite (*Varroa destructor*) population that has been exposed to a specific miticide before is now able to survive normally lethal rates of this active ingredient or miticide. Thus, a resistant varroa population would be able to survive an authorized varroa treatment containing this active ingredient, even when it was applied in compliance with the label instructions.[1]

How does resistance develop?

Resistance in varroa mite populations develops after repeated contact of the mites with a specific active ingredient over time. The molecule, targeting the mites, imposes a high selection pressure on the local varroa population. This means, finding a way to become less sensitive, or resistant, against an active ingredient is literally a question of life or death for the mites. Those mites that are less sensitive to the active ingredient are more likely to survive a treatment and reproduce. When traits resulting in a lower sensitivity towards any molecule can be passed on to the next generation, the trait of resistance can spread in a mite population exposed repeatedly to the active ingredient.

How can I help reduce the development of resistance in my colonies?

Respect the treatment instructions and label. Do not overdose treatments, and do not use the treatment longer or more often than recommended.
Secondly, only use registered and authorized medicines for varroa treatment in honeybee colonies. Authorized treatments have been tested for safety, toxicity, and efficacy in honeybee colonies in the field. The dosage, number of applications, and duration of the treatment have all been developed specifically for honeybee colonies before the authorization in clinical trials. Thus, authorized medicines offer the exact amount of active ingredient that is necessary for treatment, does not harm the bees, and minimizes the risk of residues in the colonies.
Finally, we do not recommend overusing the same active ingredient repeatedly, for example several times a year. Please note that this also refers to the use of two different treatments with the **same active ingredient**. You should rotate the active ingredient, not just the treatment!

How can I tell resistance apart from low efficacy in my colonies?

Our recommendation is to observe and monitor your colonies throughout the season, especially the mite infestation level. It is very important to compare mite levels before a varroa treatment with mite numbers right after the treatment. If you have applied a treatment in compliance with the instructions and see no reduction of the mite infestation, that may be a sign of low sensitivity of your local mite population against the active ingredient you have used. However, other factors such as extremely low or high pre-treatment infestation, a re-infestation from other colonies or environmental factors may affect treatment efficacy as well. In any case, we recommend applying a different treatment (active ingredient!) after you have noticed treatment failure to get the mite infestation in your colonies under control. Right after, you should contact the (pharmaceutical) producer of the failed treatment, inform them about your treatment experience and ask them for advice. They are legally obliged to record, archive and report the incident to the responsible authorities.

Is resistance final?

Not necessarily. Research studies indicate that resistance reversion in the field is possible and that active ingredient / pesticide resistance can be associated with fitness costs for varroa mites.[2] However, researchers do not know yet how long resistance reversion takes in the field for every active ingredient. There is some evidence that tau-fluvalinate resistance in varroa mites takes 4-6 years to be reversed, whereas amitraz resistance reversal may already happen after 1 year.[3,4,5] Amitraz resistance reports are not new, with the first publications dating back to the 1990s and early 2000s.[6] Despite several resistance reports over the years, amitraz remains largely effective, even in countries where it has been in use for a long time.[7,8]

Is there amitraz resistance?

So far, we are not seeing a widespread and largescale resistance in varroa mites against amitraz, as has been reported for tau-fluvalinate, coumaphos or flumethrin before.[9,10,11] There is some indication from recent research studies that pockets of amitraz resistance have developed in certain regions or operations.[8]
Other data suggest that amitraz resistance could be much less persistent compared to resistance against other miticides in varroa mites. For example, the increase of the LC50 (lethal concentration 50%) of amitraz after decades of use measured in one study is considerably less compared to other miticides[8], and the reduced field efficacy of an amitraz treatment observed in another study is much less pronounced compared to other active ingredients.[12] Finally, these first data suggest a high potential for resistance reversal in the case of amitraz (see above).[5]

Are you doing your own research on amitraz resistance?

Yes, in 2020 we have started a research project in collaboration with the LDA 39 (French analytical laboratory, specialized and certified in Animal Health, including Bee Pathology) to determine amitraz sensitivity of varroa mites all over France, the home country of Véto-pharma where Apivar has been used in beekeeping since 1995.[13,14]

Of 17 colonies from all over the country, 15 were found to be sensitive to amitraz (mortality in the assay >75%), whereas 2 colonies (in 2 different apiaries) showed intermediate sensitivity (73% and 74% mite mortality in the assay).[13] When we genotyped the mites from this sensitivity trial, we found that mites carrying a mutation that has been suggested to code for amitraz resistance in varroa mites occurred in both groups: varroa mites that died from amitraz exposure in the assays and mites that survived amitraz exposure in the laboratory.[14] Thus, our first analysis in France gives no indication of reduced mite sensitivity towards amitraz. However, we will continue to investigate the subject of potential amitraz resistance in future projects in Europe and North America.

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