



Building tools for Integrated Varroa Mite Management

Field monitoring of varroa sensitivity to miticides in the Grand Est region, France



Grand Est region
France

About us

The ADA Grand Est is a professional regional organisation that works towards the development, support and promotion of modern and sustainable beekeeping. It aims at gathering beekeepers from the Grand Est region of France around issues that are relevant to them: the health and environment of bees, breeding techniques, and the promotion of beekeeping and bee products.

Key numbers

32 beekeepers involved in the project over 3 years
455 hives included in the protocols
988 phenotypic tests conducted

Methodology

Two kinds of tests were carried out:

In situ phenotypic tests

applying the molecule through direct contact of phoretic mites on living bees

• 2023 and 2024: **Pettis tests** (Pettis J, 1998), with glass jars.

• Since 2025: + **Apiarium tests** (Bahreini et al.; 2020 & 2023), 125ml plastic containers.

- A sample of 300 bees is collected from each hive registered in the experiment (x12/apiary).

- The bees are placed in containers maintained at approximately 25°C.

- The bees and their phoretic Varroa mites are exposed to a sized-down strip of the chosen treatment molecule (amitraz, flumethrin or tau-fluvalinate).

- The dead Varroa mites collected into the petri dish are counted after 24h for tau-fluvalinate and after 6h for amitraz and flumethrin.

- The bees are washed with a detergent to count the remaining alive mites (VP100).

- The level of varroa sensitivity is evaluated by dividing the number of dead mites by the total number of mites counted.



Ex situ phenotypic tests

sampling varroa mites from capped brood and testing the samples in petri dishes

• Samples sent and tested in lab by APINOV

- Samples of capped brood are cut and collected from the apiary, on hives with >3% infestation.

- The samples are sent to our partner lab (APINOV).

- The varroas collected from the samples are exposed to the chosen treatment molecule in Petri dishes.

- The level of varroa sensitivity is evaluated by dividing the number of dead mites by the total number of mites counted.



Varroa infestation: Randy Oliver's Varroa Model was used to better understand varroa population dynamics and better estimate treatment's efficiency. Varroa population in V3 was compared to model estimated population without treatment:

JULY - V1 sampling

Varroa count: Nb varroa/100 bees
Counts on hives that were part of the project at N-1.
Counts on new hives that joined the protocol to replace winter losses.

AUGUST - V2 sampling

Varroa count: Nb varroa/100 bees | Pettis tests or Apiarium on 3 molecules (amitraz, tau-fluvalinate and flumethrin) - 12 hives per apiary monitored to analyse phoretic varroa sensitivity.
Lab tests by APINOV - Sampling of capped brood, picked among the most infested hives (> 3% infestation).

SEPT. - V3 sampling

Varroa count: Nb Varroa/100 bees
Same process as V1.

The « Alternance project »

a field-based approach geared towards beekeepers

• Initiated by the ADA Grand Est in 2023.

• 8 beekeepers involved in 2023, 13 beekeepers in 2024, and 11 beekeepers in 2025.

• Started in the Grand Est region (see map above), and is now starting to be carried out by our network partners (ADA network + ITSAP-Bee Institute).

• **MAIN GOAL:** measuring the loss of sensitivity of the varroa mite towards miticides at the scale of the apiary, allowing beekeepers to adapt their treatment strategy, and to favorise an IPM approach rather than monotherapy.

• **OBJECTIVES:**

◦ Collecting initial indications of sensitivity/reversion dynamics.

◦ Developing a tool and reflections based on individual beekeepers' protocols.

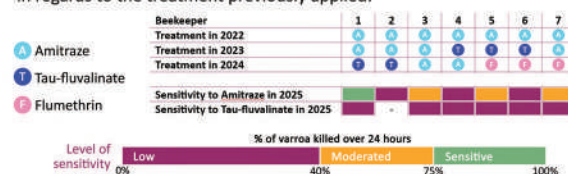
◦ Exploring Integrated Pest Management approaches as alternatives to monotherapy (Randy Oliver, ABJ, 12/2006).

◦ Going further than conventional mite monitoring.

◦ Understanding apiaries' dynamics around treatments and mite development throughout the year.

Results highlights

Average sensitivity level of the apiaries monitored in 2025 (APINOV tests), in regards to the treatment previously applied:



Main analysis (for now)

◦ Variability of varroa sensitivity within the same apiary.

◦ Results overall consistent and correlated, validated over the years and follow-up of the same hives.

◦ Strong correlation between treatment efficiency in the field and lab sensitivity monitoring (Pettis and Apinov).

◦ Two main categories of treatment failure: proven resistance and/or poor timing of treatment on excessive mite infestation (Varroa Model).

◦ Environmental impact and diversity of events can impact results (weather, viruses and pests, hive loss over the winter and new hives entering the protocol, timing and/or quality of treatment...).

Conclusion

This on-going 3-year project shows the need to keep integrating complementary strategies such as winter treatment, alternation of molecules and population-based control method. Interannual monitoring also showed an improvement for miticide sensitivity when a molecule rotation is introduced. The ADA GE intends to collect data and monitor reversion time on a multiyear sequence; we keep exploring ways to improve the methodology and protocol and bring the experiment closer to bees' natural behaviour when receiving a treatment, testing types of jars (Pettis, Apiarium), sizes and time exposure with each molecule.

Building tools for Integrated Varroa Mite Management: field monitoring of varroa sensitivity to acaricides in the Grand Est region

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ADA-GE aims to support beekeeping development in the region. Placing specific emphasis on experimentation, through projects to monitor varroa infestation, it collaborates regularly with ITSAP, the ADA network, APINOV and ARISTA Bee Research. Varroa destructor remains a foremost challenge for honeybee health. The number of active substances is today limited. Sensitivity loss to amitraz has been recently observed, adding up to the already documented tau fluvalinate resistance. Building ALTERNANCE project, ADA-GE monitors varroa population sensitivity level to these two molecules at apiary scale. Two kinds of tests were carried out: Pettis test that involves applying the molecule through direct contact of phoretic mites on live bees; and Phenotypic test in petri dishes by sampling varroa mites from closed brood. Concurrently, varroa infestation measurement was made at each stage of the protocol, reporting treatment effectiveness in the field. Varroa-model© was used for better understanding of varroa population dynamics. Over two years, 646 phenotypic tests were made, and 343 hives were monitored. In 2024, two causes have been identified to explain high level of varroa mites remaining post treatment: 6 apiaries failures linked to varroa medium to high loss of sensitivity towards acaricides, and 3 apiaries with failures linked to late treatment, preventing sufficient reduction in varroa dynamics in the colony, 4 apiaries where treatment was efficient and varroa sensitivity was still sufficient. A strong correlation was found between treatment effectiveness and laboratory measured sensitivity. This confirms the need for integrating complementary strategies such as winter treatment and population-based control method. Interannual monitoring also showed a slight improvement for miticide sensitivity when a molecules rotation was introduced for a first year. So far, the study revealed a high degree of heterogeneity towards miticide sensitivity within the apiaries, with moderate to prominent levels of resistance. This result underlines the importance of a global, integrated approach combining environmental factors, infestation monitoring and associating population-based control methods with existing acaricide treatments. ADA-GE aims to continue this study to refine its understanding of sensitivity-loss dynamics and give beekeepers a flexible and optimised tool to build the most suitable integrated management strategy to their apiaries.