



BEE HEALTH AND AGROECOLOGY IN LEBANON

**Enhancing sustainable practices for
varroa mite control**

2024



About IECD and SDA

The European Institute for Cooperation and Development (IECD) is a French international solidarity organization founded in 1988 with the primary mission of promoting youth employment. Currently operating in 18 countries, it has been present in Lebanon since 1989.

Semeurs d'Avenir (SDA) is IECD's main local partner in Lebanon. Founded in 2010, this Lebanese association operates in the fields of vocational training, entrepreneurship and education.

IECD and SDA jointly design and implement 13 projects in their areas of expertise in all regions of Lebanon.

Since 2021, they have been implementing a project aiming at developing agroecological practices in Lebanon with a focus on beekeeping and the cultivation of aromatic and medicinal plants. This project is linked to the entrepreneurship support project initiated by IECD/SDA since 2010, with the aim of fostering agricultural entrepreneurship.

Abstract

Beekeeping is a promising activity sector in Lebanon, with significant potential for production growth and access to new markets. Various analyses of the honey value chain indicate that **this sector is profitable, including at small scale**, and allows to diversify sources of income for a significant number of people living in rural areas, including vulnerable people. Moreover, the profession of beekeeper plays a crucial role in **ecosystem preservation**, with the breeding of bees which allows plant reproduction through pollination.

Diseases affecting bees are the primary production constraints faced by beekeepers in Lebanon. The lack of knowledge and skills in terms of disease control methods is a well-identified weakness by public and development organizations. However, scientific literature on bee health in Lebanon is very limited and training and technical advisory activities are largely insufficient to meet the needs.

As part of its support activities for beekeepers and entrepreneurs, IECD/SDA has undertaken significant work on **methods to control Varroa**, a bee parasite which is one of the leading causes of hive mortality in Lebanon and worldwide. The main challenge identified is the lack of knowledge regarding the **efficacy of available treatments** and **alternative methods of control** to conventional treatments.

This report presents findings from a **groundbreaking study in Lebanon** implemented by beekeepers with the support of IECD/SDA between 2022 and 2023 to

assess the efficacy of five approved treatments in fighting varroa. A testing protocol was developed with the assistance of beekeeping experts and its implementation followed a **participatory approach**, placing beekeepers at the center of the process.

Analysis of the test results provides **initial insights**. The two treatments with active substances compatible with organic beekeeping demonstrated higher levels of efficacy compared to the three conventional treatments tested, which challenges preconceived ideas. It is necessary to repeat these tests year after year to confirm the observed trends and adapt the selection of treatments tested.

Sharing the results of this study with stakeholders in the beekeeping sector is essential to improve varroa control practices. Various formats are being explored, including participatory workshops, meetings between stakeholders in the beekeeping sector and communication actions on social networks. The continuation of these tests in 2024 and beyond and the involvement of an increasing number of stakeholders aim to **create a space for dialogue** on these essential issues and ultimately **strengthen beekeepers' productive capacities**.

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1 Context



Overview of the beekeeping sector in Lebanon

The beekeeping sector is present in all regions of Lebanon. According to the latest data published by the Lebanese Ministry of Agriculture (MoA), around 7,500 beekeepers, mainly part-timers, produced around 3,500 tons of honey with a total value of US\$ 64 million in 2016¹. The latest

observed trends indicate a steady growth in the number of beekeepers, and for good reason: beekeeping is a profitable activity that generates significant profit margins.

Box 1: Honey profitability in Lebanon

The honey value chain in Lebanon has been analyzed by several development actors, including USAID, FAO, and Acted. The latest identified publications date back to 2018 and there are no updated public data after the 2019 economic crisis. According to the available data, the average production cost of honey ranges from \$8 to \$10 per kilo depending on the size of the apiaries, and it is sold at an average price of \$20 per kilo, resulting in a high profit margin compared to other food products.

Sources :
USAID, 2017. Lebanon Honey Value Chain Analysis Report.
Kanj Hamade, 2016. Non-wood forest product value chains in Lebanon. FAO.

These estimates were confirmed by beekeepers participating in IECD/SDA beekeeping activities in spring 2024.

An analysis of sales channels indicates that 62% of honey produced in Lebanon is sold directly by beekeepers to consumers (B2C), allowing them to maximize their profits. This primarily benefits small-scale producers who have sufficiently low production volumes to not require intermediaries.

Two-thirds of beekeepers in Lebanon have less than 50 hives² and engage in beekeeping as a secondary activity to diversify sources of income. This activity is appealing due to its low level of initial investment, relatively low fixed production costs, and low workload, except during peak production periods. Beekeeping can

be considered as a tool for rural development, as it has the potential to reduce poverty and valorize local natural and forest resources.

However, for beekeeping to remain a continuous and productive practice, there must be a good understanding and

management of bee diseases. These are the main production constraints faced by beekeepers in Lebanon. They mainly include **American foulbrood**, a bacterial disease that affects bee larvae, **Varroa**, a parasitic mite that carries a viral disease that attacks bee colonies, and **colony collapse disorder**, a phenomenon whereby worker bees abandon the hive. Beekeeping experts suggest that this is due to environmental degradation, such as increased use of pesticides and water contamination.

These diseases cause hive mortality and result in economic loss for beekeepers. They discourage many beginner beekeepers, who lose their colonies without having been able to identify the diseases. As for more advanced beekeepers, there is a lack of consensus and information on appropriate control methods. Finally, the treatment methods for these diseases are a matter of concern for end consumers of products from the hive, who fear the over-use of chemical treatments and the use of antibiotics despite health regulations.



Photo
Beekeeper visiting his hives in Saydoun, Jezzine

1. USAID, 2017. Lebanon Honey Value Chain Analysis Report.
2. The percentage of beekeepers with less than 50 hives varies between 65% and 85% depending on the sources of information (MoA, FAO, USAID).

Challenges associated with the Varroa mite



Photo
Varroa mite on a bee nymph

This study focuses on the Varroa Destructor, a bee parasitic mite, which is a global issue impacting all beekeepers. This parasite originates from Southeast Asia, and has spread to all regions where *Apis mellifera* is present. Its spread is one of the main causes of declining bee populations, which makes it crucial to have effective control methods. While chemical control was the first method used against varroa, its efficacy is steadily decreasing as varroa develop resistance to active substances.

Beekeepers must constantly adapt and explore new control methods. The agroecological approach offers an alternative pathway, based on limiting the use of treatments, employing mechanical (or biotechnical) techniques, and acquiring a good understanding of the bee and parasite life cycles.

Lack of public regulation

In Lebanon, the fight against varroa presents numerous socio-economic challenges in addition to technical ones. There are public agricultural extension centers managed by MoA in each region of Lebanon but they have been inoperative since the onset of the 2019 economic crisis. These centers used to provide technical advice and distribute varroa treatments to registered beekeepers. Furthermore, the lack of public regulation in the varroa medication market allows the proliferation of a wide range of products with varying qualities.

Many non-governmental organizations (NGOs) support beekeepers, but the lack of sustainable funding and lack of coordination limits their impact. Today, Lebanese beekeepers are largely left to fend for themselves.



Photo
Bee affected by DWV, the deformed wing virus transmitted by Varroa

Lack of technical knowledge

The lack of awareness regarding the dangers and control methods explains the weakness in practices. Counting varroa mites is rarely carried out by beekeepers, although it is a good indicator to measure the pressure exerted by the mite and to determine when to treat the colonies. Some beekeepers completely bypass treatments, either due to lack of information or lack of resources, which highly affects the colony health. For those who do treat their hives, the

choice of medication is often driven by price or by supplier recommendations, who themselves are driven by profitability rather than public health issues. Usage instructions for medications are rarely followed precisely, and many beekeepers tend to overuse medications as they believe it will eliminate more varroa mites. However, excessive use of medication has a harmful impact on bee health, biodiversity and the quality of honey produced.



Importance of the study

The aim of this study is to share the levels of efficacy of several varroa treatments with stakeholders in the Lebanese beekeeping sector, in order to improve control methods.

This is an **innovative approach** in Lebanon as there is limited specialized scientific literature on the subject. While there are studies focused on honey production, with export-oriented sector analyses, the technical dimension remains insufficiently explored. The only identified study on varroa treatments concerns the use of

essential oils as a complementary control method³. However, such studies exist in other countries such as France, where the National Federation of Departmental Beekeeping Health Organizations (FNOSAD) has been implementing efficacy tests every year since 2007 (see Box 2 below). These studies provide crucial data for beekeepers to observe the bee and parasite cycles and make informed decisions.

Box 2: Example of FNOSAD in the fight against varroa



FNOSAD is a national federation that brings together 80 departmental beekeeping health organizations and supports them in various fields. (see <https://www.fnosad.com>).

Among the actions coordinated by FNOSAD is the establishment, since 2007, of a monitoring system for the efficacy of varroa medications authorized for sale in France. This initiative involves coordinating efficacy monitoring throughout the national territory. These tests aim to evaluate annually, under real conditions, the performance (efficacy and speed of action) of these medications, and to identify any decreases in efficacy or side effects not

identified during their authorization for sale. The data collected is a valuable resource for all stakeholders, especially prescribers, and in particular for health organizations that develop collective medication control strategies. Another benefit of these monitoring activities is to allow early detection of the emergence of resistance among varroa populations to one or more active substances included in the composition of medications commonly used by beekeepers.

Every year, the results are analyzed and result in the publication of an article in the journal « La Santé de l'Abeille ».

4. Jérôme Vandame, 2023. Medications to fight varroa: results of 2022 efficiency tests, and developments since 2007. La Santé de l'Abeille, n°315. May-June 2023. https://www.apiservices.biz/documents/articles-fr/varroa_test_efficacite%C3%A9_2022.pdf

3. Dalida Darazi, 2023. Comparative study on the efficacy of essential oils against varroa (non-published study)

As part of its agroecology training activities in Lebanon, IECD/SDA, decided to launch a pilot study inspired by the work of FNOSAD. While varroa control

in Lebanon primarily relies on chemical treatments, the aim of this study is also to highlight the efficacy of treatments compatible with organic beekeeping.



2. Lessons from a pilot study on the efficacy of varroa treatments



Objectives



Photo
Beekeeper counting varroa mite falls

Many medications are available on the Lebanese market to fight varroa. Each one of them has its specificities, and it is important to know them in order to conduct varroa control adapted to the conditions of bee colonies and the parasitic pressure exerted by the mite.

The objective of this pilot study is to measure the efficacy of several medications under real treatment conditions after honey harvests. These tests conducted make it possible to calculate the number of varroa mites present in the hives at different stages of treatment application.

Calculating varroa population indicators allows evaluating the **parasitic pressure** exerted by the mite. The percentage of treatment efficacy, the number of residual



Photo
Varroa mite on the bottom board
inside the hive

varroa mites after treatment completion, and the speed of treatment action are all data to be considered when drawing out varroa control strategies. Furthermore, these tests contribute to **pharmacovigilance** by collecting data year after year on the medications used and by detecting varroa **resistance** to the tested medications.

By including medications containing active substances compatible with organic beekeeping, the pilot study also aims to measure their efficacy compared to more conventional medications whose efficacy is decreasing.

Test Application Protocol

The protocol adopted in the framework of this study is inspired directly by the one developed and implemented by FNOSAD in France. After several missions to Lebanon, an expert in bee health, who is also a member of FNOSAD, adapted this protocol to the Lebanese context, enabling pilot testing campaigns to be carried out in 2022 and 2023. In summary :

- The tests are based on counting the varroa mites which fall to the bottom of the hive, killed by the medication. While various counting techniques are possible, the one chosen for this study consists in placing a mesh tray under the hive and counting the number of varroa mite falls.
- Counts are carried out throughout the treatment period and during the application of the control treatment (which is used to kill and therefore count residual varroa mites, which have not been impacted by the first medication

tested). Depending on the medication tested in this study, the counting period can vary from 64 to 119 days. The frequency of counting is daily at first, then gradually spaced out. These are therefore intensive and demanding tests for the participating beekeepers.

- The test application protocol differs from one medication to another (Appendix 1), depending on the active substances and the expected intensity of varroa mite falls.
- Participating beekeepers record the data in a table indicating the counting schedule adapted to each medication. Adherence to this schedule is essential to enable data analysis.

In conclusion, counting varroa mite falls aims to determine the percentage of efficacy of each medication tested. This percentage is calculated using the following formula:

$$\% \text{ efficacy} = \frac{\text{Number of varroa mites fallen during the tested treatment} * 100}{\text{Total number of varroa mites fallen (test treatment + control treatment)}}$$

For example, in European Union countries, to obtain market authorization, the efficacy of a varroa control medication must be greater than 95% for a conventional medication and greater

than 90% for medications compatible with organic beekeeping. In Lebanon, there is no national standard to regulate the market authorization of varroa control medications .



Implementation of tests

The tests were designed and implemented following a **participatory methodology**, taking into consideration the practices and constraints of Lebanese beekeepers at all stages of design, implementation, analysis and study feedback.

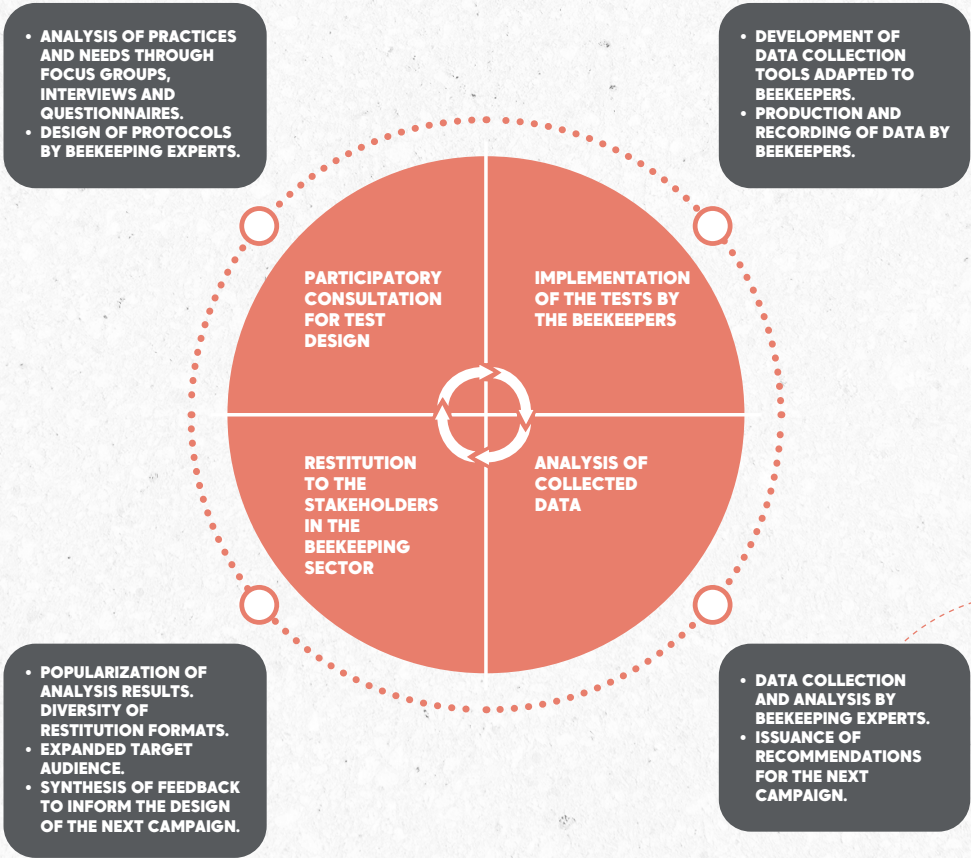


Figure 1
Participatory methodology of the study cycle

Selection of medications

Medications were selected in consultation with the project's beekeeping experts and several beekeepers who benefited from the training provided by IECD/SDA. Several factors were taken into consideration :

- The diversity of types of medications (manufacturing origin, active substances, price);
- The balance between medications with active substances compatible with organic beekeeping and conventional medications that are not compatible;
- The representativeness of medication

use among Lebanese beekeepers;

- Medications with harmful active substances were excluded. Their efficacy may be good but they have certain side effects for the health of bees.

For the 2022 testing campaign, 4 medications were selected: Apivar, Amivar, Wang's Manpu and Aluen Cap. For the 2023 campaign, tests on these 4 medications were renewed, and a fifth medication was introduced, Varrored.

Medication	Country of production	Active substances	Compatibility with organic beekeeping	Years of test
Aluen Cap	Argentina	Oxalix acid and glycerin	Compatible	2022, 2023
Amivar	Argentina	Amitraz	Not compatible	2022, 2023
Apivar	France	Amitraz	Not compatible	2022, 2023
Varrored	Turkey	Citric acid and Formic acid	Compatible	2023
Wang's Manpu	China	Flumethrin (pyrethroid)	Not compatible	2022, 2023

Table 1
Summary of tested medications





Photos
Tested medications

Selection of participants and locations

The first testing campaign in 2022 was conducted on 13 colonies of the project-managed apiary, located in a mountainous area near the village of Kfarhouna, ten kilometers south of the city of Jezzine. The tests were conducted between September 2022 and January 2023. Three beekeepers, who had received training as part of the project, took turns to do the counts.

For the 2023 campaign, the procedure evolved, with an increase in the number

of participating beekeepers and the implementation of tests directly on their colonies. In total, 7 beekeepers were selected to conduct tests on 30 colonies placed in various localities in the regions of Jezzine, Chouf and the South. It is worth noting that several of these participants had already participated in the training as part of the project, which made it possible to assess their motivation and seriousness beforehand. The tests were conducted between July and December 2023.

Beekeeper	# tested colonies	Tested medications	Locality
Beekeeper 1	3	Varrored	Saydoun
Beekeeper 2	3	Varrored	Saydoun
Beekeeper 3	9	Aluen Cap, Amivar, Wang's Manpu	Kfarhouna
Beekeeper 4	3	Aluen Cap	Karkha
Beekeeper 5	3	Apivar	Mlikh
Beekeeper 6	3	Apivar	Kfarhouna
Beekeeper 7	6	Amivar, Wang's Manpu	Marjayoun

Table 2
Summary of the implementation of the 2023 testing campaign

The project supported beekeepers in implementing the tests by providing :

- Technical support: training on the use of test application protocols and monthly remote monitoring by beekeeping experts;
- Material support: distribution of medications to be tested and mesh

trays, financial compensation of \$50 per hive tested after results validation.

At the end of the testing period, each beekeeper shared their varroa mite fall counting table. The analysis was based on these data records and on individual interviews with each participating beekeeper.



Photo
Hive frame covered with bees

Results

The data collected in 2022 and 2023 allowed for the calculation of the efficacy percentage of each medication for each colony tested. The larger the number of colonies tested per medication, the more robust the data, as it allows to calculate averages and discard unusable results without compromising the sample. It is important to note that in the present study, the number of colonies tested is relatively small (up to 6 colonies per medication), which requires some qualification of the results. However, some trends emerge:

- **Varroed** effectively neutralized numerous varroa mites. The efficacy obtained ranges from 77 to 97%, which is relatively satisfactory for a medication containing active substances compatible with organic beekeeping. However, the number of residual varroa mites (after treatment completion) remains high.
- **Aluen Cap** showed efficacy ranging from 70 to 97%, which is satisfactory for a medication containing active substances compatible with organic beekeeping. However, there is still a very high number of residual varroa mites in 3 out of 4 analyzed colonies.

- **Apivar** showed efficacy ranging from 84 to 90% for 3 of the tested colonies, and from 29 to 52% for the 3 other colonies. The heterogeneity of these results calls for caution. The number of residual varroa remains high.
- **Amivar** showed efficacy ranging from 32 to 84%, which is particularly low compared to the other medications. The number of residual varroa remains high.
- **Wang's Manpu** showed results too heterogeneous to be exploited, with efficacy ranging from 29 to 34% for 3 colonies tested and 90 to 95% for the 3 others. In all cases, the number of residual varroa remains high.

The detailed analysis of the results (Appendix 2) includes: the counting tables for the varroa mite falls before and after the treatment, calculation of efficacy percentage for each tested colony, and the evolution curve of the varroa mite falls throughout the testing period.

In summary, **the results of Aluen Cap and Varroed medications present greater homogeneity and higher levels of efficacy. Therefore, they are the most appropriate solutions for fighting varroa.** Moreover, these medications contain active substances compatible with organic beekeeping. Nevertheless, the levels of residual varroa mites remain high, warranting vigilance. When such

high levels of residual varroa mite are observed, additional treatment must be applied.

It is important to repeat such tests to confirm these results by following the study cycle described above (Figure 1 : Participatory methodology of the study cycle).



Photo
Beekeepers observing the presence of varroa mites

3

Next steps to improve the fight against Varroa



Recommendations to improve the study

This study must be repeated over several years to confirm the results. The learnings generated by the testing campaigns in 2022 and 2023 have led to the formulation of the following recommendations:

- **Introduce new types of treatments** to broaden knowledge about control methods;
- **Expand the sample size of tested colonies** to obtain more robust results;
- **Engage a larger number of serious and motivated beekeepers**, who are capable of following the test application protocols;
- Whenever possible, **reduce the frequency of counting** in the test application protocols to avoid discouraging participants;
- **Provide practical advice** to participants before starting the tests (e.g.: placing the hives near the residence, preventing ant infestation by protecting the hives, etc.);
- **Ensure closer monitoring by beekeeping advisors** during the test implementation period.

Therefore, the scope of the 2024 testing campaign has been adapted in consultation with participants from previous testing campaigns and the project's beekeeping experts. It will :

- **Renew the tests on the 5 medications tested in 2023** to confirm the results;
- **Introduce at least one additional treatment**, combining a biotechnical control method (queen caging) and a chemical control method (oxalic acid solution);
- **Double the number of colonies tested** to expand the sample size;
- **Double the number of participating beekeepers** to broaden the scope of the study. As per their experiences, participants will become ambassadors in the fight against varroa and will disseminate the results within their respective communities.

Towards improved practices

Beyond the production of data, the challenge lies in disseminating the results of the study to stakeholders in the Lebanese beekeeping sector to open a dialogue on varroa mite control methods. Partnerships with local beekeeping structures could be developed to enable broader appropriation of the study approach and results. Several activities are planned for 2024 :

- **Implementation of workshops to present the results** in several localities in Lebanon, involving groups of beekeepers. These workshops provide space for exchange between professionals, which is particularly important in the absence of functional agricultural technical centers (as described in Section 1. Context). Participants in previous testing campaigns may participate in these workshops for better assimilation of the study by beekeepers;
- **Communication via online platforms** used by beekeepers, including specialized WhatsApp groups and

Instagram, TikTok and Facebook pages focused on beekeeping⁵. Online platforms are the primary information channel for beekeepers in Lebanon, which makes them essential for any awareness-raising activity;

- **Facilitation of exchanges** between experts and beekeeping trainers regarding the results of this study, **training of trainers** to strengthen local skills in the varroa mite control.

On the long run, the intended impact is the improvement of varroa control practices. The establishment of evaluation mechanisms is necessary to measure these trends, for example through the calculation of the changes in colony mortality rates and the identification of treatments used by beekeepers before and after benefiting from the project's support.

5. There are a large number of WhatsApp groups bringing together beekeepers at a local level, most often created at the initiative of beekeeping cooperatives or associations offering beekeeping training. Some platforms operate at a nation level, such as the Izraa Facebook page ([إزرع](#)).



Photo
Group of beginner beekeepers in training at Kfarhouna, Jezzine



Annex 1

Application protocols for tested medications



APIVAR

Apivar strips contain Amitraz. This medication does not allow the practice of organic beekeeping. Two strips are placed in the hives for 10 weeks. After a latency period of 9 days, the control treatment is done with Apistan strips.

AMIVAR

Amivar strips contain Amitraz. This medication does not allow the practice of organic beekeeping. Two strips are placed in the hive for 6 weeks. After an additional latency period, the control treatment is carried out with Apistan strips.

WANG'S MANPU

Wang's Manpu strips contain flumethrin (equivalent to pyrethroid). This medication does not allow the practice of organic beekeeping. They are placed 3 times in the colonies at 5-day intervals. After removal, a latency period of 9 days is observed. Control treatment is done with the medication Apivar (Amitraz).

ALUEN CAP

The medication consists of cardboard strips impregnated with oxalic acid and glycerin. This medication allows the practice of organic beekeeping. The treatment is placed in the hive using 4 strips distributed every 3 frames. These strips remain in the hive for 42 days. Then, the leftover strips are removed. Control treatment: Apivar.

VARRORED

This medication contains citric acid and Formic acid, which should allow the practice of organic beekeeping (note that the instructions for Varrored are in written Turkish, which limits the knowledge of the medication). It is applied on the bee colonies by dripping (2 ml per frame occupied by bees). 3 droppings are done at 7-days intervals. The treatment is considered finished after 30 days. Control treatment: Apivar.

Annex 2

Results for each medication tested in 2023

1. ALUEN CAP

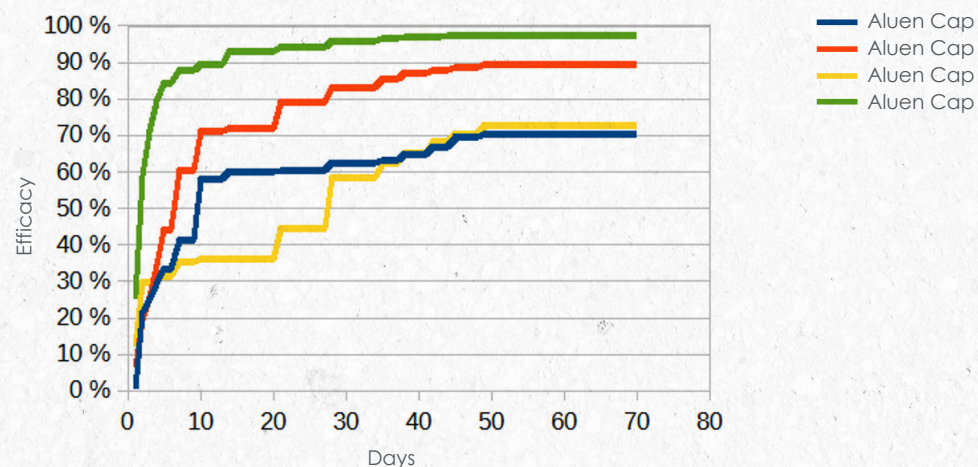
Among the 6 tested colonies, 2 were clearly too weak and were excluded from the analysis because the level of varroa mite falls was below 100. The remaining 4 colonies showed efficacy ranging from 70 to 97%, which is relatively satisfactory

for a medication with active substances compatible with organic beekeeping. Nevertheless, the number of residual varroa mites remains too high in 3 out of 4 colonies.

Beekeeper	Medication	Day 0 of treatment	Falls at the start of the treatment	Falls after treatment completion	% efficacy	Locality
Beekeeper3	Aluen Cap	7-Aug-23	511	214	70.4	Kfarhouna
Beekeeper3	Aluen Cap	7-Aug-23	1,379	163	89.4	Kfarhouna
Beekeeper3	Aluen Cap	7-Aug-23	771	291	72.6	Kfarhouna
Beekeeper4	Aluen Cap	12-Aug-23	69	12	85.2	Karkha
Beekeeper4	Aluen Cap	12-Aug-23	219	6	97.3	Karkha
Beekeeper4	Aluen Cap	12-Aug-23	70	9	88.6	Karkha

As indicated in the graph below, the speed of action is important at the start of treatment. The efficacy percentage

is above 30% from the 4th day of application. After one month, efficacy ranges from 58 to 96%.

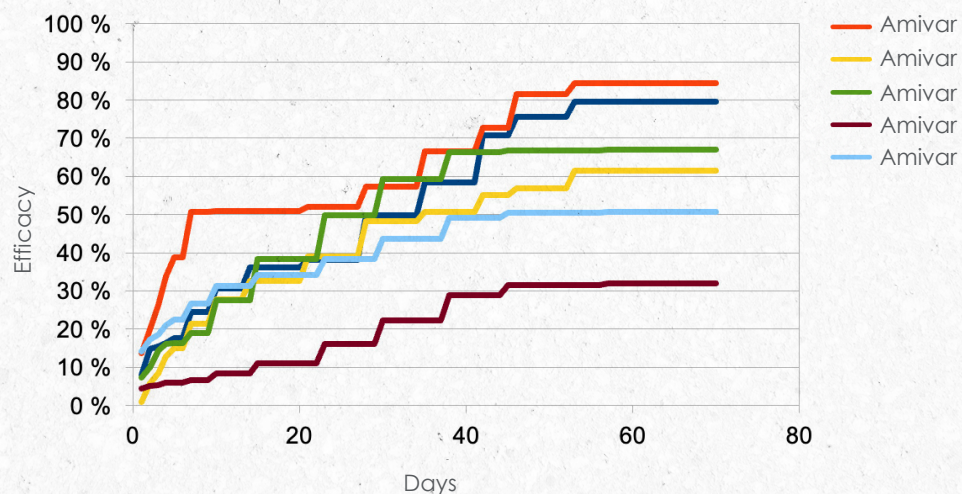


2. AMIVAR

The efficacy percentages measured are all below 85%. These particularly low rates result in high levels of residual varroa mites ranging from 113 to 1,642.

Beekeeper	Medication	Day 0 of treatment	Falls at the start of the treatment	Falls after treatment completion	% efficacy	Locality
Beekeeper3	Amivar	07-Aug-23	659	170	79.5	Kfarhouna
Beekeeper3	Amivar	07-Aug-23	891	164	84.5	Kfarhouna
Beekeeper3	Amivar	07-Aug-23	181	113	61.6	Kfarhouna
Beekeeper7	Amivar	29-Jul-23	1,854	915	67.0	Marjayoun
Beekeeper7	Amivar	29-Jul-23	771	1,642	32.0	Marjayoun
Beekeeper7	Amivar	29-Jul-23	330	320	50.8	Marjayoun

The graph below highlights the linearity of the action of Amivar. Varroa mite fall levels are not more effective at the start of treatment than at the end of treatment, which means either that Amitraz is released very gradually and consistently throughout the treatment period, which seems unlikely, or that varroa mites are not very sensitive to the quantity of Amitraz released.



3. APIVAR

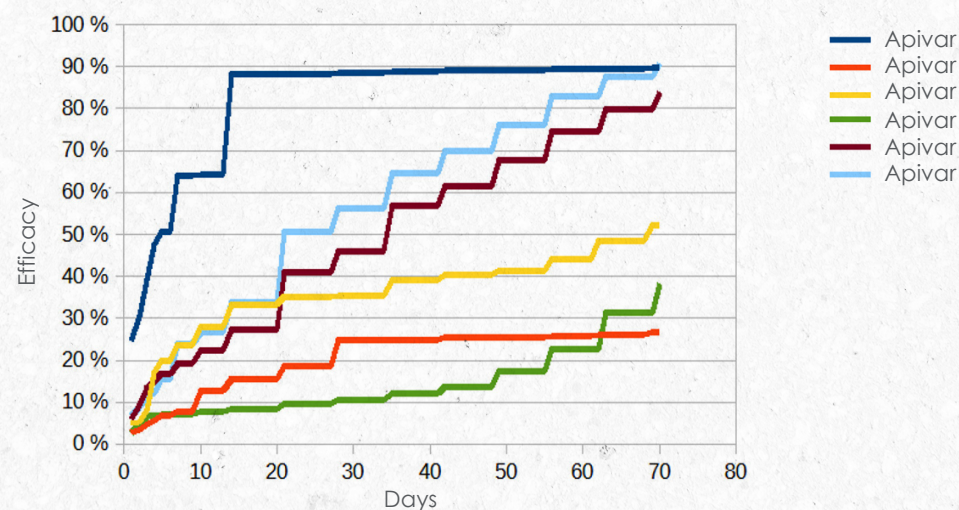
The measured efficacy percentages range from 84 to 90% for 3 colonies and are very low for the other 3 (29 to 52%). This heterogeneity of results is also noted for residual varroa mites which range from 89 to 1,348. For the colonies with

very high levels of residual varroa mites, tools are needed to detect the high load and immediately organize additional treatment to prevent the colonies from being affected.

Beekeeper	Medication	Day 0 of treatment	Falls at the start of the treatment	Falls after treatment completion	% efficacy	Locality
Beekeeper5	Apivar	04-Aug-23	1,279	146	89.8	Mlikh
Beekeeper5	Apivar	04-Aug-23	563	1,348	29.5	Mlikh
Beekeeper5	Apivar	04-Aug-23	99	89	52.7	Mlikh
Beekeeper6	Apivar	09-Aug-23	772	1,116	39.8	Kfarhouna
Beekeeper6	Apivar	09-Aug-23	3,032	573	84.1	Kfarhouna
Beekeeper6	Apivar	09-Aug-23	3,594	363	90.8	Kfarhouna

The graph below signifies that, for 2 out of the 3 colonies where efficacy approaches 90%, the action of the medication is gradual. Therefore, it takes 70 days to reach a good level of efficacy, which is not preferred because throughout the

treatment period, numerous varroa mites exert their pathogenic action on the colonies. For the third colony, efficacy is faster, with the threshold of 88% being reached as early as the 14th day.



4. VARRORED

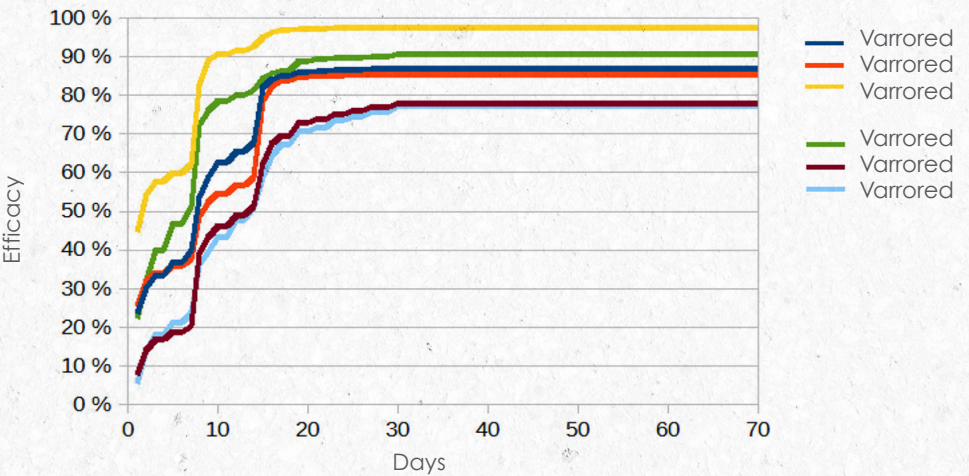
The medication neutralized many varroa mites. The efficacy obtained ranges from 77 to 97%, which is relatively satisfactory. Nevertheless, the number of residual varroa mites remains high after the treatment completion, reaching over 300 varroa mites in 5 out of 6 colonies.

Beekeeper	Medication	Day 0 of treatment	Falls at the start of the treatment	Falls after treatment completion	% efficacy	Locality
Beekeeper1	Varrored	21-Jul-23	3,445	512	87.1	Saydoun
Beekeeper1	Varrored	21-Jul-23	2,183	372	85.4	Saydoun
Beekeeper1	Varrored	21-Jul-23	1,348	35	97.5	Saydoun
Beekeeper2	Varrored	25-Jul-23	7,775	810	90.6	Saydoun
Beekeeper2	Varrored	25-Jul-23	1,943	554	77.8	Saydoun
Beekeeper2	Varrored	25-Jul-23	1,265	370	77.4	Saydoun

Two drawbacks must be emphasized:

- The treatment involves opening the hives and therefore disturbing the bees three times;
- An additional treatment must be applied in the weeks after the application of Varrored, to prevent the residual varroa mites from multiplying again and reaching a pathogenic threshold.

On the positive side, the speed of action is significant, as indicated by the graph below. Furthermore, the results are rather consistent, despite the heterogeneity of infestations.

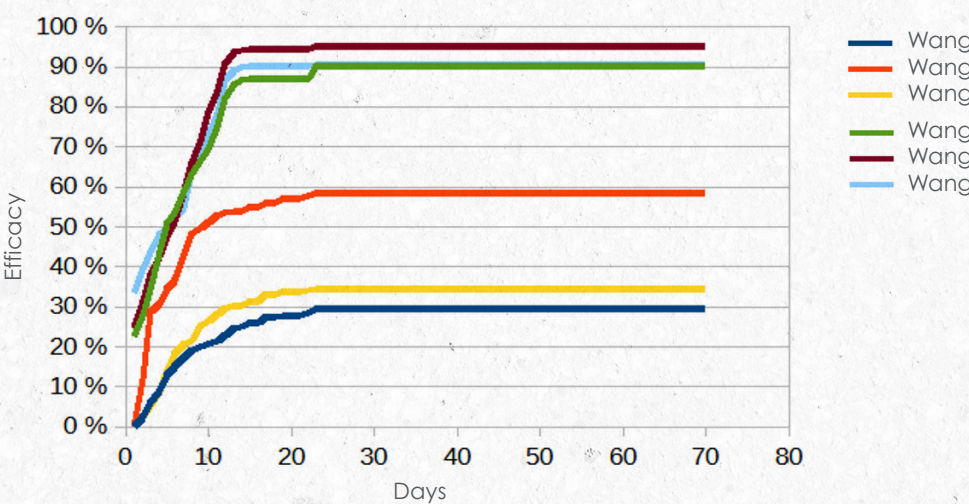


5. WANG'S MANPU

The results of the 2 groups of colonies are very different. In the first group, few varroa mites are counted after treatment and an equivalent or greater quantity is neutralized by the control treatment. In the second group, many varroa-mites fell during both the treatment and during the control treatment.

Beekeeper	Medication	Day 0 of treatment	Falls at the start of the treatment	Falls after treatment completion	% efficacy	Locality
Beekeeper3	Wang's Manpu	06-Aug-23	83	198	29.5	Kfarhouna
Beekeeper3	Wang's Manpu	06-Aug-23	220	156	58.5	Kfarhouna
Beekeeper3	Wang's Manpu	06-Aug-23	110	208	34.6	Kfarhouna
Beekeeper7	Wang's Manpu	29-Jul-23	3,652	398	90.2	Marjayoun
Beekeeper7	Wang's Manpu	29-Jul-23	4,394	229	95.0	Marjayoun
Beekeeper7	Wang's Manpu	29-Jul-23	1,362	142	90.6	Marjayoun

This heterogeneity between the two groups of colonies raises questions. Is it related to the medication, where in one case it may have little or no effectiveness and in the other case, high effectiveness? Or is it related to the situation of the colonies where, in one case, there may be varroa mites resistant to the active substances of the medication (flumethrin) and, in the other group, varroa mites are more sensitive? The fact remains that the Wang's Manpu treatment must be supplemented by another treatment so that the colonies are effectively protected against varroa parasite pressure.



Contributors

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En partenariat
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