

# Methods of Mineral Engineering in a Fight Against Varroa Infestation

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## Abstract

The purpose of previous study centered around introducing minerals into bee colonies was to observe the *Varroa destructor* mites-repelling effect of minerals (“Pszczelarstwo” 6/2016). The results of research published so far confirmed the purpose of using minerals in the fight against Varroa infestation. This publication presents partial results of the next stage of research. Using foundation enriched with studied minerals in right proportions leads to diminishing the number of *Varroa destructor* parasites in bee colonies. It may also contribute to increase in the amount of honey obtained from bees. Foundations with minerals were in most cases correctly filled with larvae, and the new generation of bees didn't show any morphometric or physical-motor aberrations. The effect of minerals in the foundation weakens with time, which requires adequate reaction from the beekeeper. The study showed no negative effect of mineral suspensions added directly to royal jelly of larvae in the swarm cells and worker cells on the development of bees. Additional research was carried out in August and September and led to surprising observations, which are still too early to report. It obliges us to carry out further, extended subject research on a large number of bee colonies in 2017.

**Keywords:** Methods of Mineral Engineering, Fight Against Varroa Infestation.

**Major classification:** Health Science.

## 1. Materials and scope of research

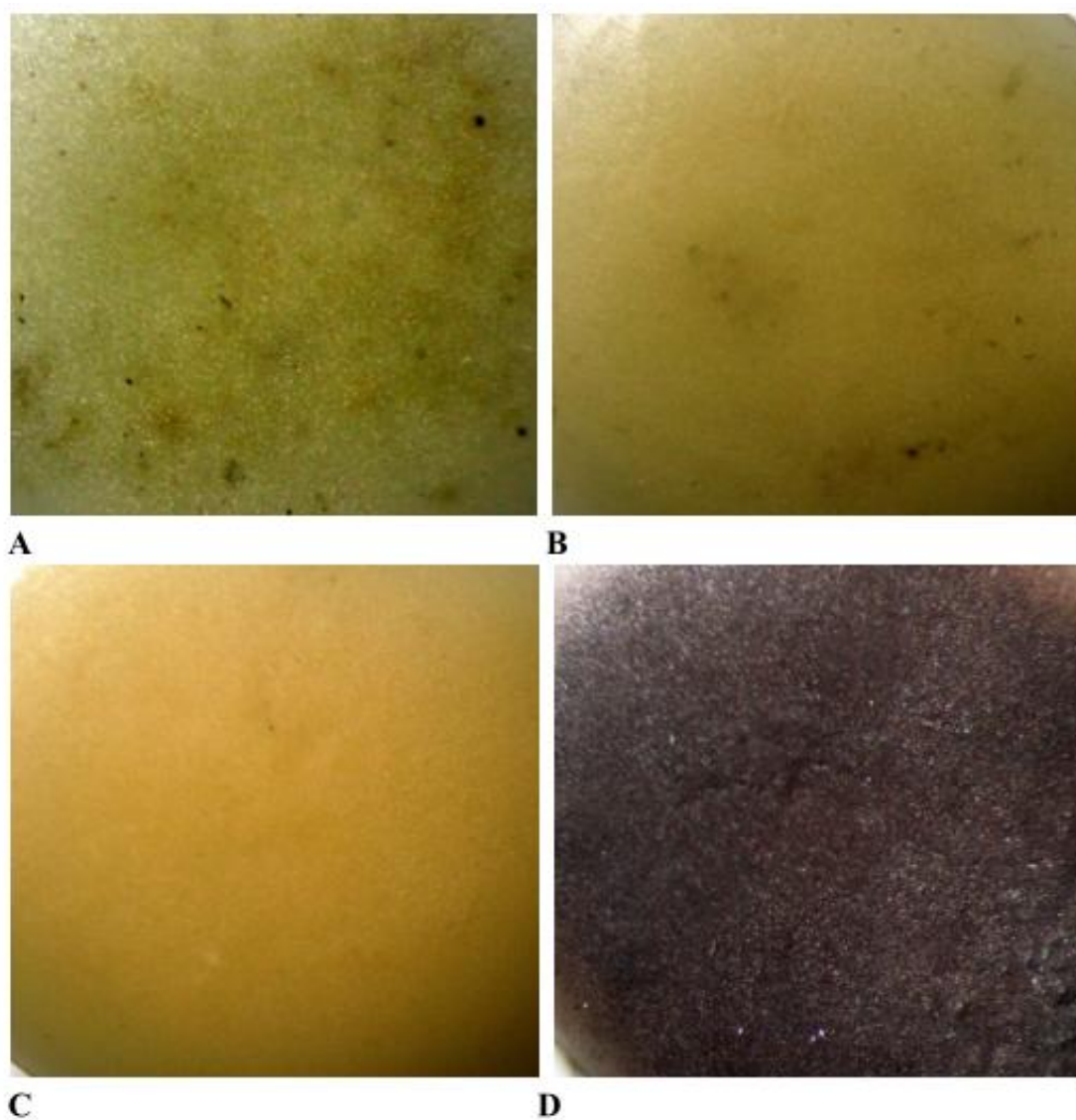
The purpose of presented research was to observe both the bees' and the *Varroa destructor* mites' reaction to minerals. A method of introducing the minerals into the foundation was used, to achieve direct influence of minerals on bee larvae and female *Varroa destructor* mites entering the bee cells to lay eggs. The foundation was made using 10% mineral and 90% wax in weight ratios. The authors are grateful to Mr. Adam Jakubowski from “Miodowa Dolina” for preparing the foundation.

## 2. Minerals used in experiment

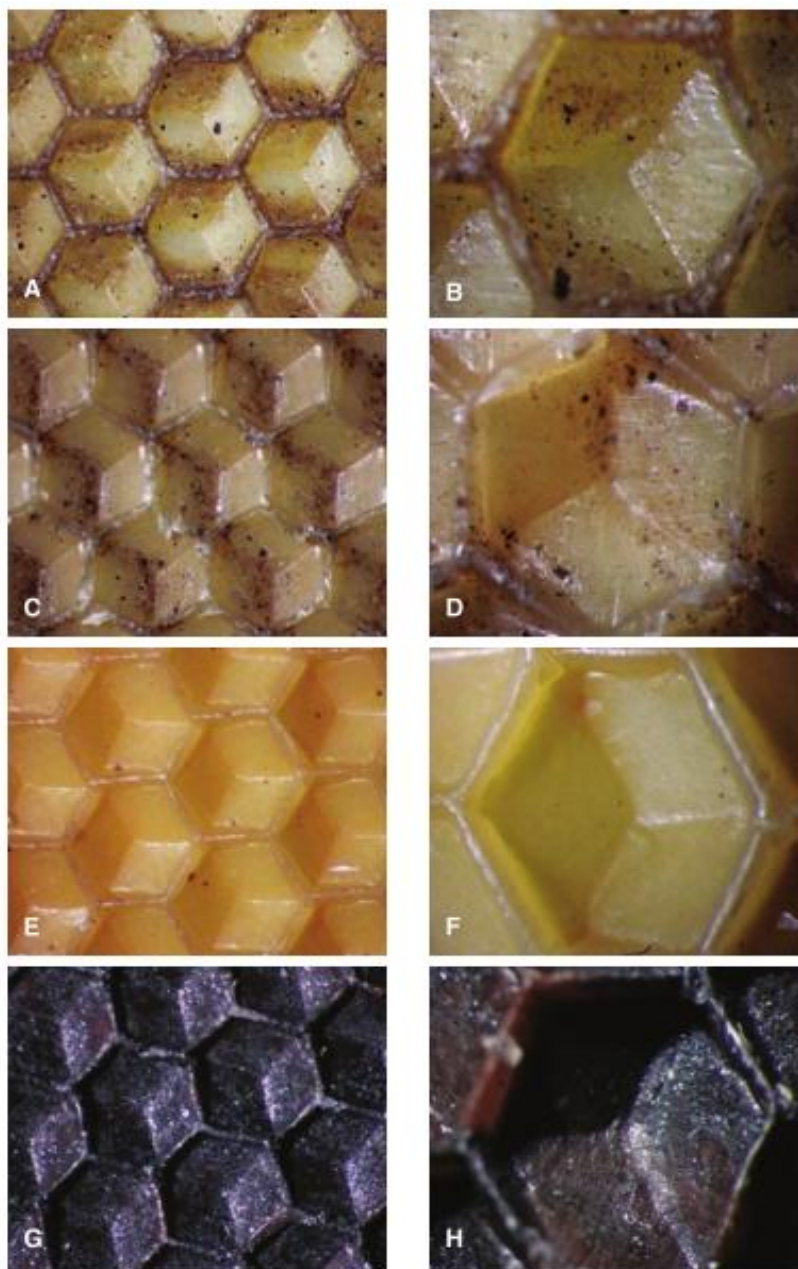
The following minerals were used in this experiment:

- K-M – kaolinite (Maria deposit – Poland),
- S-M – smectite (Kopernica deposit – Czech Republic),
- K-R – kaolinite (Rusko deposit – Poland),
- H – hematite (Lubumbashi – Congo).

Photographs of wax mixed with minerals and of foundation containing minerals are shown in **Figure 1** and **Figure 2**.



**Figure 1:** Wax mixed with minerals: A – wax mixed with K-M mineral, B – wax mixed with S-M mineral, C – wax mixed with K-R mineral, D – wax mixed with H mineral



A – foundation with K-M mineral, B – foundation with S-M mineral, C – Foundation with K-R mineral, D – foundation with powdered H mineral. Photos on the left – magnification 4x, photos on the right – magnification 10x

**Figure 2:** Foundation made of wax mixed with minerals

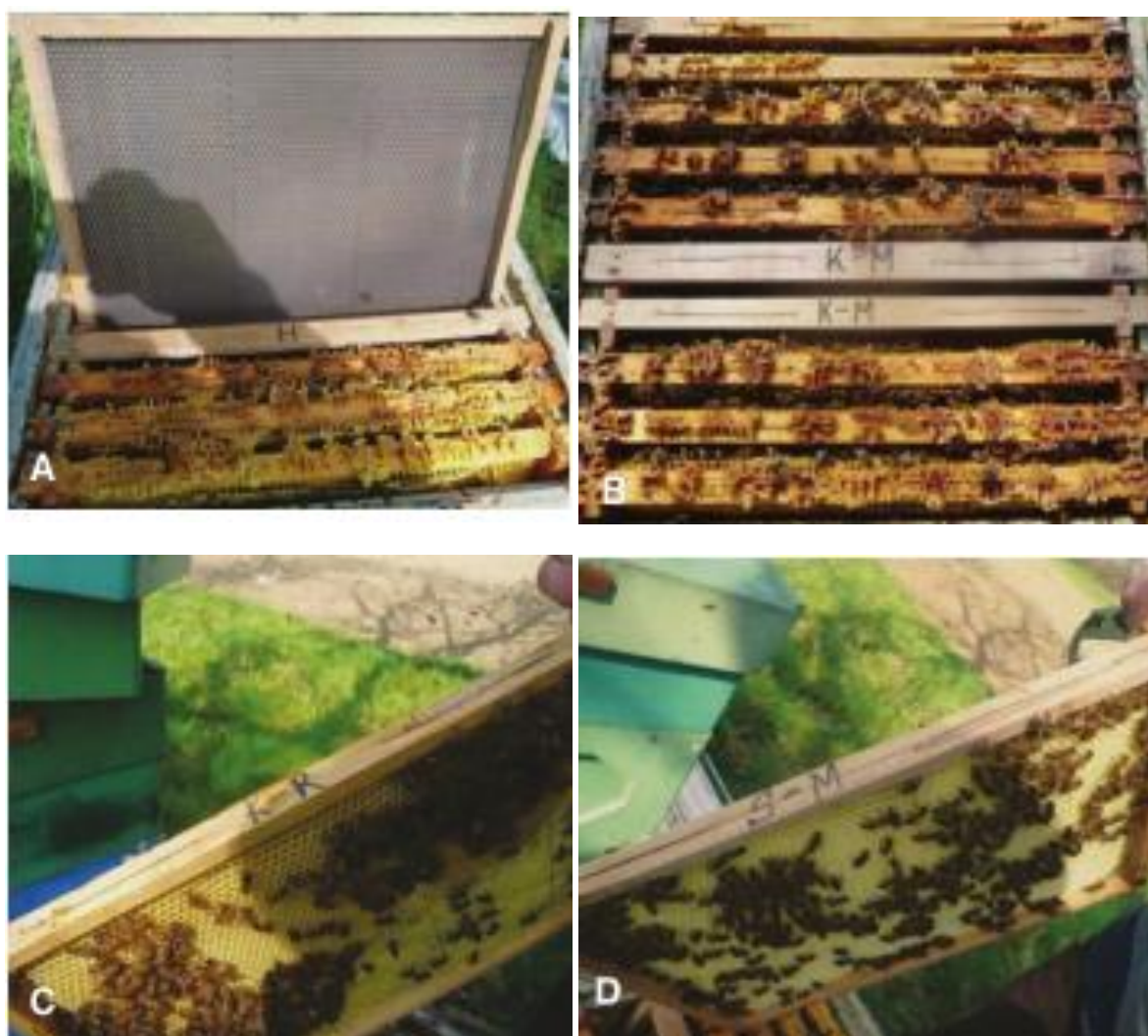
Prepared foundations, as seen in the photographs, were placed in bee colonies in the experimental migratory apiary of Leszek Stępień from Stara Słupia in the Świętokrzyskie Mountains (**Figure 3, 4**).

The research was performed in the following foraging zones: willow, orchard, rape flower, phacelia, and goldenrod-heather. The behavior of bees was observed: mortality of *Varroa destructor* was monitored on the trays of screened bottom boards.



**Figure 3:** In the apiary of Leszek Stępień. From the left – M. Pawlikowski, L. Stępień, H. Przybyszewski

Two frames with mineral foundation were placed in bee nests based on a single Wielkopolski hive (**Figure 4**).

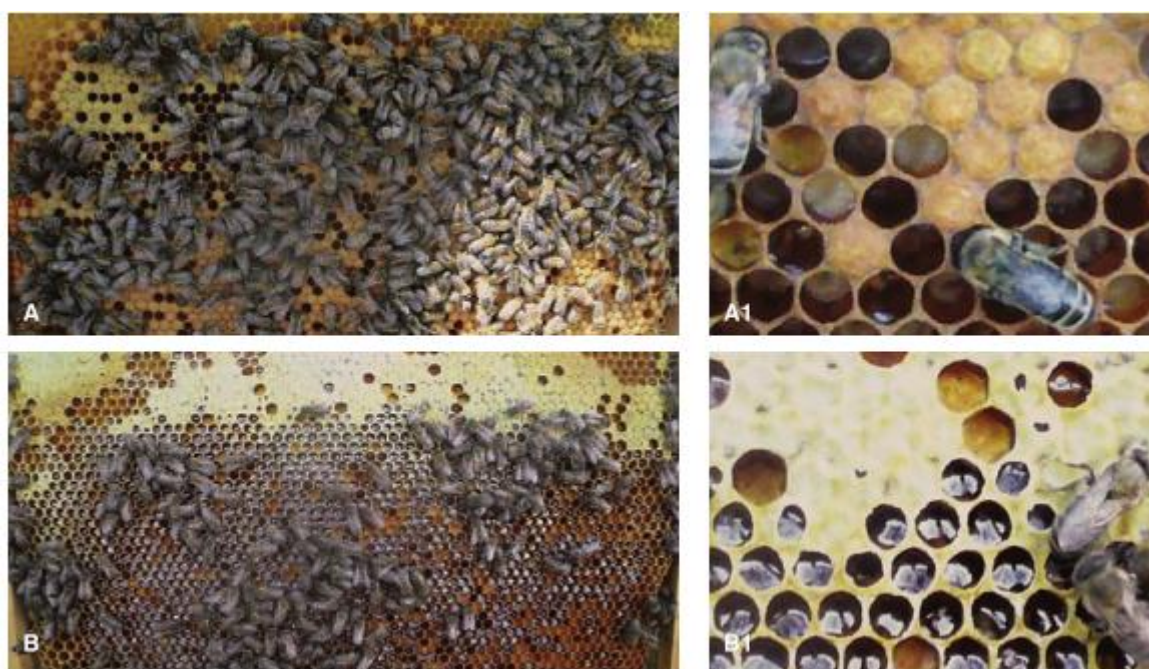


A – placing the frame with foundation enriched with H mineral in Wielkopolski hive, B – two frames (light colored) with S-M minerals in the hive prepared for the experiment, C – bees rebuilding the foundation with K-R minerals 4 days after placing the frames, D – bees rebuilding the S-M mineral foundation 4 days after placing the frames

**Figure 4:** Placing frames in beehives (April 4, 2016)

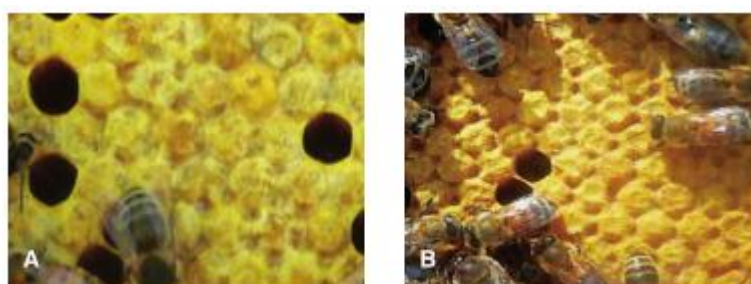
Rebuilding of the mineral foundation was seen to be comparable with the foundation in control colonies. The bees used the wax from the mineral foundation to build cells (without apparent problem), although in hives where the H foundation was placed, gray sediment from that foundation was clearly visible on bottom board trays. It is hard to determine what was the reason of that. At the same time, bees used the foundation with powdered H mineral to build honeycombs. In the other three cases, practically no chewed-off sediment was observed. When bees don't tolerate something, they chew it off and remove it from the hive.

In the three-week period between April 4 and April 26, intense rebuilding of all foundation sheets was observed (**Figure 5, 6**).



A – foundation with S-M mineral, A1 – magnification of rebuilt wax, B – foundation with H mineral, B1 – magnification of rebuilt wax

**Figure 5:** Rebuilt foundation sheets. Examples of situation three weeks after placing mineral foundation (April 26, 2016)



A – with S-M mineral, B – with H mineral

**Figure 6:** Example photos of larvae sealed in the cells of combs rebuilt on mineral foundations 5 weeks after their placement in bee colonies. Fragments of combs created on foundation

### 3. Results of research and observation

- All foundation sheets placed in the hives have been rebuilt by the bees.

- As early as a few days after placing the foundation containing minerals used in the experiment in the hives, mortality of *Varroa destructor* was observed. Counting of the fallen parasites, repeated every 10 days, showed the result of 2-16.
- One foundation was rebuilt with slight malformations. The cells were different sized; that foundation caused minor aggression of the bees until the end of the season.
- All the foundations – with the addition of kaolinite, smectite, and hematite – caused decrease in the numbers of *Varroa destructor* mites in experimental colonies compared to the control colonies.
- In case of all the foundations used in the experiment, the mortality of *Varroa destructor* was several times higher than natural.
- The highest mortality of *Varroa destructor* was observed in the bee colony where H foundation sheets containing hematite were used.
- Mortality of *Varroa destructor* diminished with time; after 2 months it settled at the 50% level of that from the beginning of the experiment.
- In the hives with mineral foundation, especially in the one with “hematite” foundation, 30-50% increase in the amount of obtained honey was observed in comparison with control colonies. It was particularly visible in the goldenrod-heather foraging zone in August and September.

#### 4. Conclusions

1. Using foundation enriched with studied minerals in right proportions leads to diminishing the number of *Varroa destructor* parasites in bee colonies. It may also contribute to increase in the amount of honey obtained from bees.
2. Foundations with minerals were in most cases correctly filled with larvae, and the new generation of bees didn't show any morphometric or physical-motor aberrations.
3. The effect of minerals in the foundation weakens with time, which requires adequate reaction from the beekeeper.
4. The study showed no negative effect of mineral suspensions added directly to royal jelly of larvae in the swarm cells and worker cells on the development of bees.
5. Additional research was carried out in August and September and led to surprising observations, which are still too early to report. It obliges us to carry out further, extended subject research on a large number of bee colonies in 2017.

**Technology and composition of the preparations are protected by patent application number P. 420291 in the Polish Patent Office.**