5 • BENEFICIAL SYMBIOTIC ORGANISMS

5 • 1

Beneficial intestinal microorganisms and their impact of the bee health

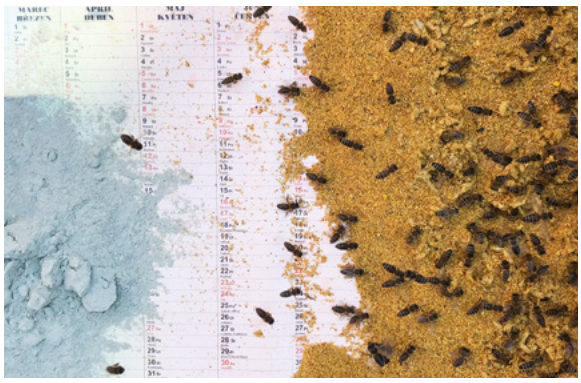
For bee nutrition and for improvement of bee immunity, it is necessary to distinguish intestinal microorganisms and nutritional supplements.

In this section we focus on the impact of microorganisms on bee health.

The use of microorganisms in mammals has already been studied in many areas and some strains are already included in animal and human nutrition. In invertebrate nutrition, including bees, such research is in its infancy, and the main focus is on the strains that are a natural part of the bee's digestive tract *(e.g. Lactobacilus)*.

Today, the relation between these microorganisms and bee immunity has been proven. If the probiotic bacteria on the intestinal mucosa are adhered in high numbers, they occupy the receptors to which the pathogenic bacteria can no longer bind, and these are excluded from the intestine.

In the experiments carried out at a group of beehives, three different species of strains were given to bees in sugar syrup and the result was a significant increase in the number of microorganisms in the digestive tract of bees *(University of the Veterinary Medicine (SK) and Secondary Vocational School Pod Banosom in Banska Bystrica)*. So far, the impact on the amount of brood produced by these colonies, bee longevity and honey yield has not been investigated. On the other hand, the complexity of the use of these microorganisms in bee nutrition should be pointed out, as they subsequently become part of bee products consumed by humans. For decades, the efforts have been made to improve the bee nutrition with nutritional supplements. It can be said that no way to fully replace pollen in bee nutrition has been found so far. One of the latest products in this respect are the algae-based nutritional supplements produced in the USA, but also in the Czech Republic. According to the first experience of practical beekeepers, if they are applied in the feed dough or in the syrup, they contribute to the development of immunity of individual bees but do not increase the amount of brood in the colonies. Conversely, if offered in a dry form in spring, the increase in brood quantity is evident. Whenever bees have an alternative to pollen, they clearly prefer pollen *(see picture)* and ignore this nutritional supplement. If it is mixed with pollen with a nutritional supplement from algae, this mixture was taken all.



5 • 2

Symbiotic macro-organisms in the bee hive environment

Restoring a suitable structure of natural fauna in the hive environment in our colonies could be another strategy to preserve the bee colonies. In this section, we will present an example of symbiotic organisms that are now at the centre of scientists' attention again.

Predatory mites, parasitoids and entomopathogens *(nematodes, protozoa, viruses, Bacillus thuringiensis, rickettsia and fungi)* were tested in the potential biological fight with the mite, *Varroa destructor.* Most attention was paid to the natural enemies of the Varroa mites, the taxonomically related species from the mite group. Entomopathogenic fungi, which attack a wide range of mite species, also have great potential. Further research also requires *Bacillus thuringiensis*, especially its strains producing specific toxins active also against non-insect hosts.

In the hive environment, there are not only parasitic mites, but also bee beneficial species that can protect bees from diseases, other parasites or cleptoparasites. These beneficial mites provide cleaning services to developing bee larvae such as the removal of harmful fungi and other microorganisms. Knowing these mites we can improve strategies of pollinators in the future. The list of mites found in colonies is at: http://idtools.org/id/mites/beemites/

After spreading the frames from the planed wooden boards about 130 years ago, along with the spread of chemical treatments in the hive environment, the European hives have not only inadvertently lost beneficial species as the acaro-fauna *("cleaning mites")* but also false scorpion *(Pseudoscorpiones)*, which the colonies probably protected from many small enemies. The effectiveness of the false scorpion in the fight with the Varroa mite has not *(yet)* been sufficiently proven. However, as the newer research suggests, one false scorpion is able to search, poison and sack one to ten *Varroa* mites per day in the hive environment.

The initial co-existence with bees was described at the end of the 19th century, when the false scorpion was re-ferred to as "a kind guest in a bee colony". Symbiosis was interrupted by the use of modern hives as well as anti-mite drugs. In 1951, even Dr. Max Beier wrote about it as about a small assistant who helped to dispose of wax moths in a hive. Attempts have shown that *Pseudoscorpions* truly feed on *Varroa* mites and a decrease in mite population and hibernation has been reported. The source of these false scorpions is the leaf mould *(phasmatodea)*. Across Europe, up to 760 different species were identified.

LIST OF SYMBIOTIC MITES

Scan the QR code with your smartphone or enter the address in your browser.

http://idtools.org/id/mites/beemites/