CLIMATE CHANGE IN OUR REGIONS 3.0

Ecosystem services in conditions of a changing climate

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Helping humans to adapt honeybees to climate change: A new ecological approach to master this challenge

Michaela Korená Hillayová, Ľubomír Korený, Ján Holécy, Jaroslav Škvarenina
Technical University of Zvolen, Faculty of Forestry
Contact: ResearchGate

One-way humans can help bees adapt to climate change is to reduce the use of „hard“ chemicals in beekeeping. Using organic preparations to prevent and treat bees from deadly diseases such as varroosis benefits sustainable beekeeping, a higher yield of quality bee products, and reduced operating costs.

Varroosis is the most devastating honeybee disease worldwide, causing more damage and higher economic costs than all other known beekeeping diseases. In bee colonies attacked by *V. destructor*, there will be an overgrowth of parasitic mites and, if untreated, the entire bee colony will eventually collapse. That is why successfully controlling Varroa mites should be a natural part of every beekeeper's activity. Currently, total control of varroosis is demanded worldwide, which includes beekeeping management without the use of antibiotics and harsh chemicals, which is included in the concept of organic beekeeping and leads to a decrease in the percentage of mortality of individual bee families after the winter period. In the research, we focus on expanding knowledge about the effectiveness of managing bee colony treatment against varroosis using environmentally safe preventive means. Methodically, we propose and test the use of a combination of chemical (phytotherapy), mechanical (use of varroa board in the hive) and hygienic (disinfection of hives with fire and subsequent application of propolis tincture) methods of varroosis control, which we compare with the use of a preventive veterinary agent for the treatment of varroosis and acarapidosis. The results of our study show that using locally growing plants to treat varroosis is a suitable way to reduce infestation in bee colonies in the long term. The management of beekeeping we designed has achieved, in the long term, a highly significant decrease in infestation in monitored beehives with a multi-year application of herbal decoctions.

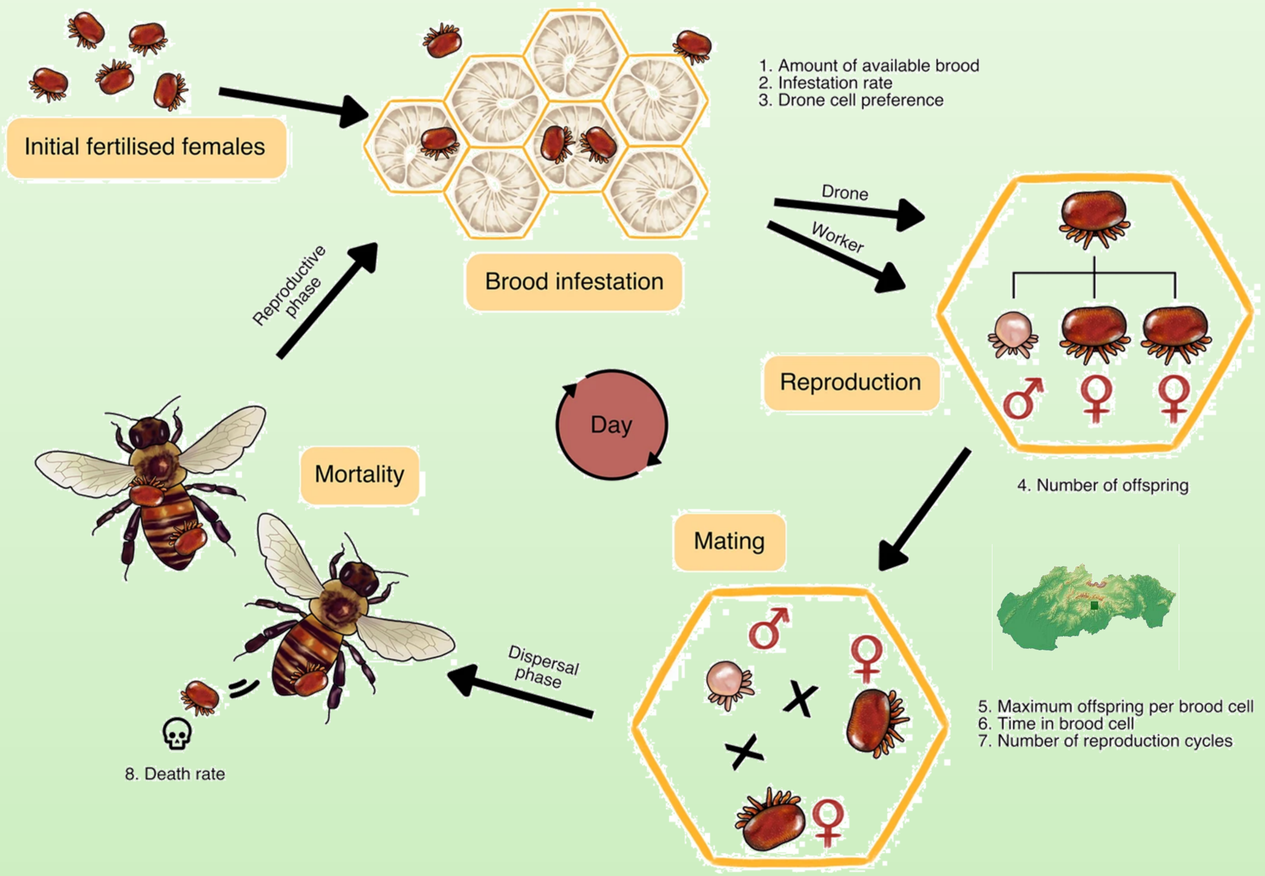

Figure 1. A gene drive in populations of the honey bee parasite Varroa destructor (*Source: Faber et al. 2021)*. *Varroa destructor* is an insect parasite growing to an average size of 1.5 mm. Females are larger than males and have round, flat bodies of brown colour. Males have a longer and slimmer body. Both sexes have eight legs and are covered with fine hairs.

It works even without "hard" miticides!

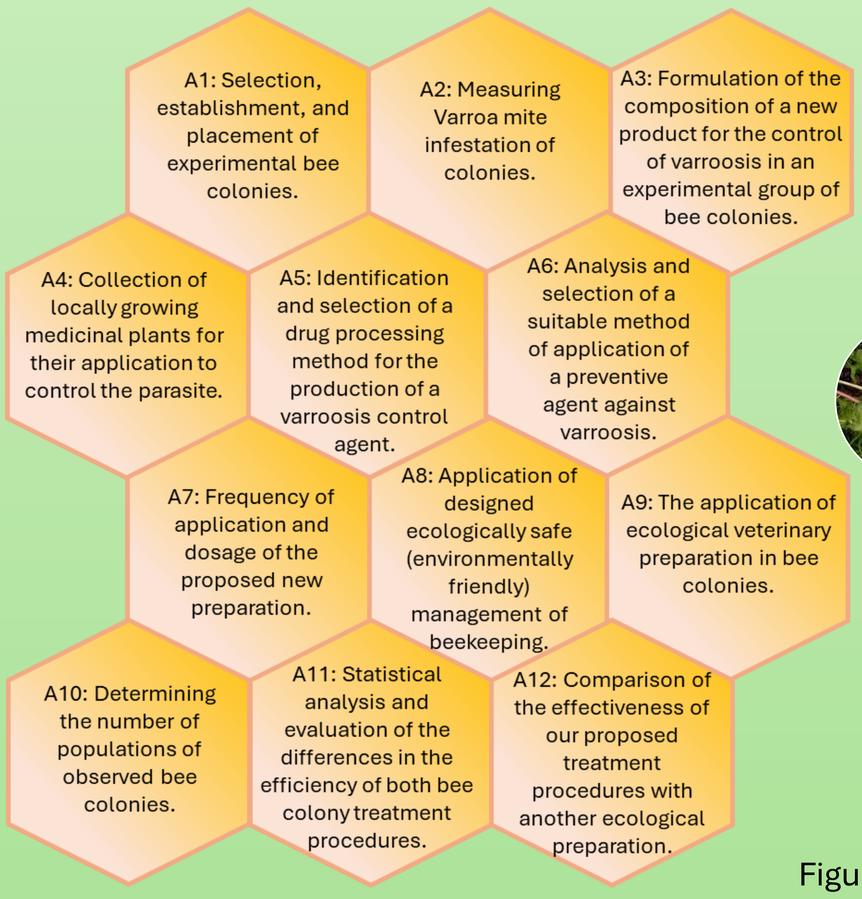

Figure 2. Methodical procedure for achieving ecologically friendly beekeeping. By following these methodological procedures, the incidence of *V. destructor* can be reduced to a minimum infestation below 0.1%.

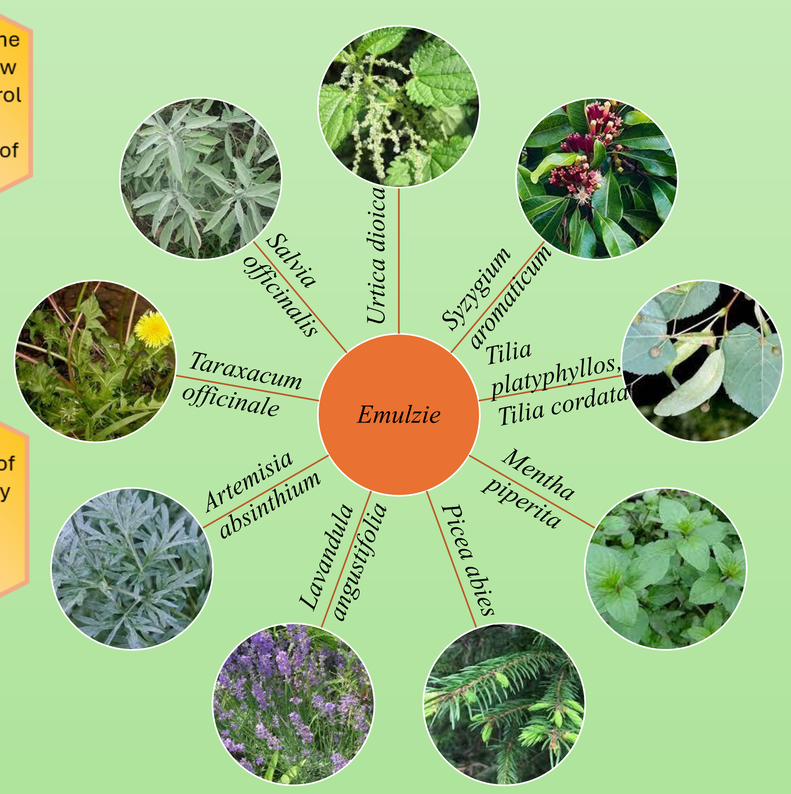

Figure 3. Identification and selection of plants with proven content of organic compounds against varroosis. These plants grow gradually throughout the entire beekeeping season in the territory of central Slovakia. They contain active substances to reduce the mite population.

The part of the plant used / The period of decoction application		March	April	May	June	July	August	September	October	November
Urtica dioica	The whole plant									
Tilia	Flower									
Mentha piperita	Leaf and stem									
Syzygium aromaticum	Flower									
Picea abies	Young shoots									
Artemisia absinthium	Leaf									
Lavandula angustifolia	Flower									
Salvia officinalis	Leaf									
Taraxacum officinale	Flower and leaf									

Figure 4. Combinations of plants for decoction in a given month according to growth and flowering in the locality of central Slovakia. The correct combination and application of plants in the decoction can prevent varroa resistance.

High annual efficiency

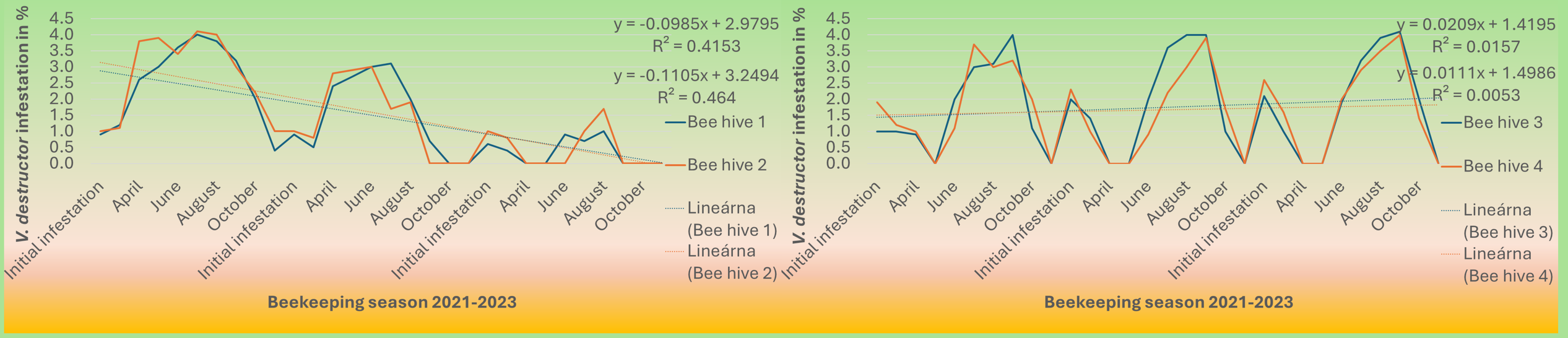

Figure 5. Development of the time trend of interannual infestation in the monitored groups of bee colonies. The figure on the left shows that the treatment of bees against varroosis we proposed is more effective in the long term than treatment with common ecological preparations (Ekopol, Bisanar, etc.).

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