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From Healthy Bees to Healthy Humans With Chemical-Free Beekeeping

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The European honeybee plays a vital role in agro-ecosystems by mastering the pollination of one third of the world's food crops. In the European context, beekeeping generates an annual value added of EUR 1 billion, but more importantly, by pollination it contributes at least EUR 22 billion to agriculture. In the US, honeybees are essential for the pollination of about USD 20 billion worth of crop production annually. Healthy honeybees are therefore fundamental for sustainable agriculture and for our food security, and chemical-free practices will help to transform beekeeping into a future-oriented sector, writes stars alumna Dr. ***Adriana DIAZ*** *of ECODESIGN company GmbH.*

Professional and hobby beekeepers are responsible for securing the regional pollination services and contribute to the social development of rural areas. Their challenge is keeping healthy bees even with the numerous stress factors, diseases, and parasites that honeybees are exposed to. Bees suffer increasing pressure from environmental pollution, loss of their natural habitat, and especially because of the presence of the Varroa mite. The Varroa mite (Varroa destructor) is an external parasite that attacks the European and Asian honeybees. Colonies poorly or not properly treated against the mite are most likely dying in one season, bringing them over winter is a risk. In most parts of the world bee colonies are treated with chemicals, i.e. synthetic acaricides and organic acids, to control the Varroa infestations. Even for organic beekeeping, the application of acids is allowed. After more than 30 years of treating with such conventional chemicals against the Varroa mite, colony loses continue. Managed bee population (colonies kept by commercial beekeepers) decreased by 40.7% for the period 2018-2019, according to a US report. Figures are similar in Europe, where yearly losses of managed colonies range between 20% and 50%. A lost honeybee colony means 30 to 50 kilos of lost honey for the year, sold at around 12 to 15 Euros per kilo (variable in EU countries). When a colony is lost,

between 500 to 1.000 Euros per hive are lost, not counting the time of the beekeeper for cleaning and replacing it.

Why is the Varroa mite such a problem?
Varroa mites reproduce in the bee brood, and their population doubles each month. Usually cold winters meant a stop in the breeding activity of bees. Warmer winters in many locations and breeding all year round bring perfect condition for reproduction of the Varroa mites. Additionally, mites are a vector for bee viruses, additional stressors to the bees. The conventional approach of using chemicals in the hive to control the mites is less and less effective. Mites have developed resistance to some of the acaricides, and those left can only be applied under specific weather conditions and after the honey harvest, to avoid residues in the honey and wax. This often brings difficult choices for the beekeepers, either treating earlier to keep the bees, compromising the honey harvest; or harvesting honey later in the season, with the imminent risk of losing the bees due to a higher pressure of mites in the colonies. This is the start of a downward spiral of lost colonies, ruined beekeepers, and endangered regional pollination and ecosystems balance.

Inappropriate practices with objectionable chemicals in beekeeping have so far not succeeded in combating the mite, and do not help avoid the damages caused by viruses in the hives. We cannot expect having healthier bees with putting more chemicals into the beehives.

What are possible solutions?
Honeybees are system relevant for food security and for conservation of biodiversity, owing to its wide distribution, generalist foraging behaviour and competence as a pollinator. Therefore a new concept to maintain and achieve healthy colonies is imperative for turning this beekeeping spiral upwards, caring for the hives without any chemicals and avoiding colony losses. The good news is that chemical-free beekeeping is possible using the principle of hyperthermia.

Hyperthermia or heat treatment is known since the 90s and is based on the lower tolerance of the Varroa mites to heat compared to the honeybees. Taking advantage of this difference, heat can be used to effectively treat against the mites without harming the honeybees. A chemical-free treatment concept and a yearly plan centred on hyperthermia have been recently published as an outcome of the European project “Blesabee”, and its relevance for the beekeeping sector has been recognized with the “best beekeeping book award” at the 2019 international Apimondia Conference in Montreal.

The key elements of this chemical-free beekeeping approach are:

1. Understanding the biology of the parasitic mite and the honeybee host
2. Changing beekeeping practices towards a preventive approach
3. Monitoring closely the hives, to avoid that the parasite reaches a dangerous threshold
4. Treating the colonies without chemicals early in the season, before the mite population becomes a problem
5. Access to hyperthermia technology for treating against the Varroa mite

Hyperthermia is definitively an advantageous option for safe treatment of the bees and for sustainable beekeeping without chemicals. One of the most important barriers to adopting this technology is the lack of specific knowledge of the potential users on the biology of

the honeybee and its diseases. This is key to understanding and adopting hyperthermia. There is also a lack of knowledge on bee viruses and their damaging mechanisms in the hive. These interlinked factors and relationships need to be communicated so that beekeepers recognize the advantages of hyperthermia. Information from regional experts and promotion agents, who can speak both the local country and the beekeeping "languages", are very important. This pioneer technology is already available in Europe for 10 years, together with a safe and effective annual plan. More needs to be done on reaching out to small, non-professional as well as commercial beekeepers. The time is right to change practices, but also policy and rules for healthy bees and healthy humans.

*Dr. **Adriana DIAZ** received her Bachelor and Msc. degrees in Chemical Engineering from the Simón Bolivar University in Venezuela, and worked as a process engineer and consultant for the National Oil Company, pharmaceutical and consultancy firms in Venezuela. She holds a PhD in Environmental Engineering from Northeastern University in the USA. Adriana worked as post-doctoral research fellow at MIT before moving to the Center for Sustainability at the ETH Zurich. At this time Adriana attended the stars Switzerland symposium. In 2009 she joined the ECODESIGN company GmbH in Vienna to develop strategies for product improvements and eco-product design through the use of Life Cycle Assessment. Since 2011 she conducts research on chemical-free beekeeping and technology development for hyperthermia in apiculture.*

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Impressum

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