



BPRACTICES Project: Towards a Sustainable European Beekeeping

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BPRACTICES Project: Towards a Sustainable European Beekeeping

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Introduction

European beekeeping suffers significant regional differences in colony losses due to the external impacts on beekeeping, including climate change and the prevalence of diseases (McMenamin and Genersch, 2015; Potts et al., 2010). The European EPILOBEE project (Chauzat et al., 2014; Laurent et al., 2015) underlined the lack of explanatory studies about risk factors affecting colony health like disease prevalence, environmental conditions, and farming practices adopted by beekeepers to detect and control the major honey bee diseases: *Varroa destructor* and associated viruses, American Foulbrood (AFB), European Foulbrood (EFB), and *Nosema* spp.

Varroa destructor is the most widespread and hard to control disease (Rosenkranz et al., 2010). Non-organic “hard treatments” produce resistant mites (Kanga et al., 2010; Maggi et al., 2010; Pettis, 2004) and reduce the quality and safety of hive products (Rosenkranz et al., 2010). American and European Foulbrood cause considerable economic losses (Forsgren, 2010; Genersch, 2010) and the illegal use of antibiotics bring a risk of residues in hive products and bacterial resistance (Alippi et al., 2007; Bargańska et al., 2011). *Nosema* spp. (especially *N. ceranae*) is an emerging pathogen affecting adult honey bees and it is associated with a reduced lifespan and an increase in winter mortality (Higes et al., 2010). Furthermore, with the spread of the exotic parasite *Aethina tumida* (Small Hive Beetle – SHB), from Italy (Neumann et al., 2016; Mutinelli et al., 2014), beekeeping trade in the EU is facing a great risk of productivity reduction and export cessation.

Today, good beekeeping management at the apiary level is a crucial point to maintain a healthy bee population (ANSES, 2015). Before the BPRACTICES project, internationally-adopted, cross-validated methods or guidelines at the EU level, to prevent and control the above-mentioned honey bee diseases in a sustainable way, including harmonized methods and analytical techniques for laboratory diagnosis, have not been adopted (Chauzat et al., 2013, 2014; Laurent et al., 2015), leading to highly variable quality and quantity of EU hive productions.

The European Union project: “New indicators and on-farm practices to improve honey bee health in the *Aethina tumida* era in Europe” (BPRACTICES), aims to support European beekeeping in the above-mentioned framework, in the context of the Horizon 2020 research and innovation program ERA-NET SusAn – European Research Area on Sustainable Animal Production Systems.

The BPRACTICES project, coordinated by Italy (IZSLT) and co-founded by Italy, Slovenia, Turkey, Spain, and Austria for a total of 951.000 €, lasted 36 months and attempted to address the above-mentioned needs by improving the EU beekeeping production system through the development of an innovative holistic approach (from apiary to jar), while considering the definition and the application of harmonized good beekeeping practices (GBPs) and biosecurity measures in beekeeping (BMBs).

GBPs and BMBs are considered systematic tools to prevent honey bee diseases,

reduce the application of veterinary medicines at the apiary level, and enhance the quality and quantity of hive products.

The outputs of the project have been to:

- Define and list GBPs and BMBs harmonized within partner countries involved in the project (including Apimondia), providing a cross-EU stakeholders debate on it;
- Develop a new approach to the management of honey bee diseases based on prevention and “preclinical” diagnosis. New biosensors from honey have been developed to monitor SHB presence and PCR techniques to diagnose, in advance, honey bee diseases (AFB, EFB, SHB) from hive debris;
- Create guidelines on innovative laboratory diagnostic methods, harmonized among project partners, with the collaboration of the European Union Reference Laboratory for Bee Health (ANSES);
- Identify sustainable honey bee diseases control guidelines that respect bee welfare and hive products’ quality (low-environmental impact approach);
- Produce an economic study concerning the impact of the innovative GBPs system application;
- Disseminate results and technical assistance/training, with the transnational participation of Apimondia (<http://apimondia.com/>) and FAO TECA platform (<http://teca.fao.org/>) and the release of a web-application as an innovative traceability system (QR Code/Rfid based) (Figure 1).

All those objectives have been achieved by using multidisciplinary strategies: with the combination of scientific research; on-field experience for the validation of the methods; food safety control; and economic, societal and commercial analysis. This wide approach has been possible thanks to multi-actor involvement on the project, including those with different specialties and abilities, with the user experience of the Appalachian State University and the practical experience of the beekeepers.

The Structure of the Project

The BPRACTICES project was structured in eight Work Packages (WPs). WP1 (varroosis and viruses), WP2 (AFB and EFB), WP3 (*Nosema*), WP4 (*A. tumida*) were finalized to identify the best cross-EU GBPs and BMBs for proper honey bee colony management, develop innovative on-field methods to effectively prevent and control pathogens sustainably and holistically, and implement standardized laboratory methods for early disease diagnosis to guarantee low-environmental impact management and hive products quality and safety. WP5 (validation) performed the standardization and harmonization of the GBPs and

BMBs, which were verified with a feasibility and compliance study in collaboration by beekeepers and researchers: the validation of laboratory methods among partners through ring tests, the collaboration with the EU Reference Laboratory for Bee Health (ANSES), and the validation of best diseases control methods at the apiary level with specific field trials. WP6 (economic impact) provided an economic evaluation of impacts of the new practice's application on the quality/safety/value of hive products and gave an overview of the added value of the innovations proposed within the project to the European beekeeping. WP7 (new traceability system) developed and applied an innovative traceability system based on QRCode/RFID technology from hive to the jar, which had been previously tested by beekeepers and consumers in WP8. WP8 (dissemination and sharing) disseminated all the innovations developed by the project.

Results

Thanks to the combined work of the partners involved, GBPs and BMBs were defined and harmonized. The list of GBPs has been published in an article (Rivera-Gomis et al., 2019) and the list of BMBs is under the review process (Pietropaoli

et al., 2020). Both are available on the project's website (<http://www.izslt.it/bpractices/>).

Guidelines for sustainable honey bee disease management in Europe and laboratory diagnostic methods, harmonized among project partners, have been published on the project website.

GBPs and BMBs' applicability both for professional and hobbyist beekeepers were verified through the use of surveys available at the TECA FAO website. The definitive compliance and feasibility study on the economic study, concerning the impact of the new management system, are available on the project website.

Dissemination activities considered several papers in journals (Della Marta et al. 2018a, b; FAO, 2018; Pietropaoli et al. 2019; Rivera-Gomis, Gregorc, et al., 2017; Rivera-Gomis et al., 2018a), proceedings (Formato & Pietropaoli, 2016; Pietropaoli et al., 2018; Rivera-Gomis, Cersini, et al. 2017; Rivera-Gomis, Pietropaoli, et al. 2017; Rivera-Gomis et al. 2018b), and publications on the FAO TECA platform. Additionally, on 30 November 2019, a popular dissemination event was organized by Apimondia and IZSLT in Montefiascone (Italy).

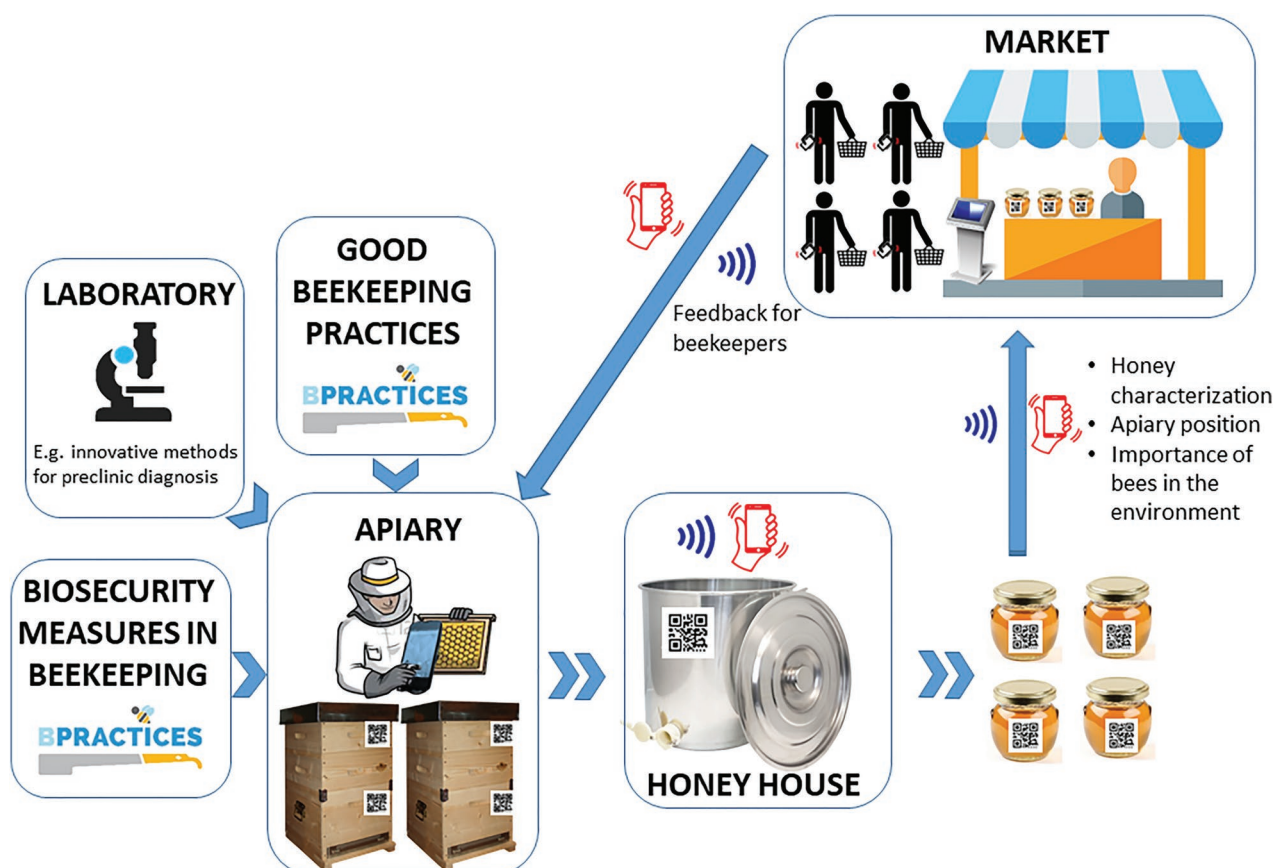


Figure 1. BPRACTICES honey traceability system.

The web-application with the innovative traceability system is available at: <https://www.hivelog.dk/>. Two reports have been published about consumers' opinions, perceptions, and behaviours: one report related to the purchase and consumption of honey in the EU and the other report related to the traceability system for accessing the information on honey. The two studies showed that the origin of the product plays a very important role in the respondents' purchasing and consumption behaviours. Moreover, even if most respondents evaluated the information contained on the label as "sufficient", the need to have more information about the exact origin of honey was observed. Again, the "Place of origin" was considered the most important information on the label by those who declared that they usually read it, and more than 60% of the respondents stated that they would use the QR code to access further information about honey. Most respondents stated that they were willing to pay a higher price for a package of honey if it offered them more information about the product; additionally, a lack of knowledge about honey and its production chain was observed among the interviewees.

Weaknesses and strengths of the traceability system based on QRCode/RFID technology were identified by means of two different social research methods: focus groups and questionnaires. Participants seemed to positively welcome the proposal of the traceability system and, in general, most considered the information on honey provided on the webpage to be "complete", "clear", "original", and "useful". The possibility of having more information on the beekeeper was greatly appreciated, particularly if that information was authentic.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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