Green infrastructures: a potential to protect the bee health?

Poll-Ole-GI project aims to increase the food supplies for pollinators in oleaginous systems in order to protect crop auxiliaries. In particular, a good nutrition is a key point for the bee health through a continuous availability in pollen and nectar.

Actually, risks for honeybees come from different stressors which weaken them as chemicals, biological predators, lack of resources and agricultural practices. *Varroa destructor*, a parasitic mite and his associated diseases are one of them and its development is known to be a good indicator of the bee health (Dietemann, Nazzi et al. 2013; Panziera 2015). Varroa travels from one colony to another one by holding the thorax or abdomen of adult bees. This phoretic phase is not lethal for bees but may lead to symptoms after an extended period of exposure. When it reaches a hive, the mite goes into brood to reproduce, as well in male or worker cells. This parasitic mite of the honeybee feeds with the haemolymph and the fat body tissue of his host which leads to a reduction of proteins and a higher viral load (Ramsey, Ochoa et al. 2019). A weakness in their immune system is an open door to secondary infestation such as viruses and bacteria (Di Pasquale, Alaux et al. 2016). Therefore without sufficient food resources, bees are more sensitive and vulnerable to diseases and predators as varroas.

Annual varroa's population dynamic is depicted as exponential inside a colony. Consequently the infestation reaches a peak at the end of the season related with a high amount of brood during spring. A high number of mites in autumn period is the most damaging because bee population is the most vulnerable and will have to survive all along the winter. Therefore in autumn, a systematic treatment is applied to slow down or contain the infestation under prejudicial threshold. Beekeepers have to follow the infestation during the season and pay attention to different symptoms related to varroas because if the infestation stays untreated, it may lead to a decline of a colony in few months. Hence; the control of the initial infestation in spring, is a crucial point to maintain it under a threshold of 1 varroa per 100 bees.

Twice a month during each intervention at ECOBEE system, a varroa assessment is done using the icing sugar method. This control is performed with some icing sugar in a box with a wire netting on the cover and previously weighed on a portable scale in the apiary. After putting bees inside the box; it is reweighed and shacked gently to homogenise the icing sugar on bees. Then the box is vigorously shacked after a waiting time of 1 minute and turn over above a plate, in order that varroas fall. After mite counting, bees are put back into the hive (see Fig.1).

Figure 1: Assessment of varroa load

During Poll-Ole-Gi projet, data syntheses on varroa infestation have been carried out after the beekeeping season by Nathalie Lemaire at INRA-APIS Unit. As expected, we found an exponential infestation trend with significant higher varroa mite loads during food shortage and sunflower periods, followed by a reduction in autumn due to the miticide treatment (see Fig. 2). We distinguished four periods based on our palynological observations: rapeseed (CZ), food shortage (DI), sunflower (TL) and autumn (AU) and we calculated an amount index based on the pollen mass collected in the pollen traps of the hives during the whole season. Thought it was not-significant, a negative trend has been observed between the pollen amount during pollen scarcity and the varroa load. This would imply that the food abundance, especially during spring, is linked with a better ability of the colonies to maintain a low varroa level.

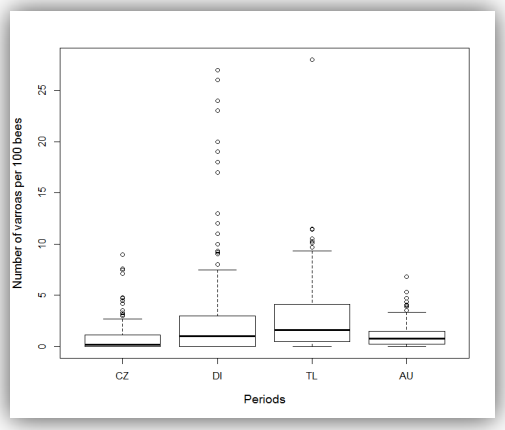

Figure 2: Infestation of varroas according to periods

However, a previous study on Ecobee including a longer duration on several years had been confirmed a relationship between the lack of resources in spring, a reduced brood production, a smaller adults population size later in the season and less reserves for winter. Consequently, this cascade events had resulted in higher seasonal and winter losses (Requier, Odoux et al. 2016). Hence, if the scarcity of food supply during spring time is too strong, the dynamic and the health of the colony are impacted. These considerations indicate another reason to protect pollinators by bringing food supplies in their environment. Green infrastructures and floral resources they bring with weeds populations can be a relevant solution to smooth this constraint.

Pauline Arnéodo

References:

Di Pasquale, G., C. Alaux, et al. (2016). "Variations in the availability of pollen resources affect honey bee health." PLos ONE **11**(9).

Dietemann, V., F. Nazzi, et al. (2013). "Standard methods for varroa research." Journal of Apicultural Research **52**(1).

Panziera, D. (2015). Quantification du Varroa et réflexion autour d'un indicateur sanitaire au sein du dispositif Ecobee. M2 GDV article.

Ramsey S., Ochoa R., et al. (2019). "*Varroa destructor* feeds primarly on honeybee fat tissue and not hemolymph", PNAS January 29, 2019 116 (5) 1792-1801; published ahead of print January 29, 2019 https://doi.org/10.1073/pnas.1818371116

Requier, F., J. F. Odoux, et al. (2016). "The carry-over effects of pollen shortage decrease the survival of honeybee colonies in farmlands." Journal of Applied Ecology.