

Bee health

Contribution of research
on risk assessment

9th December 2019

ABSTRACT
BOOKLET

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Editorial

On 9 December 2019, ANSES and the European Food Safety Authority (EFSA) are hosting an International Scientific Conference Day devoted to bee health and to the contribution of risk assessment research to this field. This is ANSES's 8th scientific event of this kind to be held on the topic of bee health and it will be co-hosted for the first time along with EFSA. The event it will be an opportunity to highlight the synergies that we have fostered over time and the common vision that we share regarding the preservation of bee health and other pollinating insects.

The main purpose of this conference, which is open to a broad audience, is to review the constructive proposals of both organisations in order to make progress in the assessment of plant protection products and to better take into account their impact on the health of bees and other pollinating insects. This event will also be devoted to presenting the research results of ANSES's Sophia Antipolis laboratory, which is also the European Union Reference Laboratory (EURL) for bee health, and the recent work of EFSA on holistic risk assessments of bee health and stakeholders' commitment.

The day will end with a round-table session that will focus on alternative treatment methods and the need for closer collaboration between beekeepers and farmers. Several actors will present initiatives promoting «sustainable beekeeping and agriculture» in France as well as throughout Europe and the rest of the world.

Throughout the day, debate and discussion will be encouraged between scientists from both ANSES and EFSA as well as with French and European stakeholders.

We hope that this day will be a new opportunity for discussion and open, constructive dialogue on the most up-to-date knowledge regarding bee health as well as certain issues that need to be explored further.

Roger Genet
Director General of ANSES

Bernhardt Url
Executive Director of EFSA

Opening

Dr. Roger Genet, PhD

Director General, French Agency for food, environmental and occupational health & safety – Maisons-Alfort, France

Director General of the French Agency for food, environmental and occupational health & safety (ANSES) since May 2016, and former Director General of Research and Innovation at the Ministry of Research (2012-2016), Roger Genet is a scientist who is fully committed to research and expertise policy, in support of public policymaking in the areas of health, agriculture and the environment.

Drawing on his 25 years' experience as a researcher at CEA (French Atomic Energy Commission), he has been a ministerial advisor at the Ministry of Higher education and Research (2005-2007). He was appointed in 2009 as CEO of a French environmental research institute (Irstea), and elected as the first president of the National Alliance for Environmental Research (AllEnvi) created in February 2010.

Engineer in biochemistry, Roger Genet holds a doctorate in enzymology and protein engineering and an habilitation to conduct research in science from the University of Paris-Sud Orsay (France).



Dr. Bernhard Url

Executive Director, European Food Safety Authority – Parma, Italy

Dr. Bernhard Url was appointed Executive Director of EFSA in June 2014, having served as Acting Executive Director for seven months. His mandate for a second term in office was renewed in 2019 for another 5 years.

Dr. Url joined EFSA in June 2012 as Head of the Risk Assessment and Scientific Assistance Department. A qualified veterinarian by training, he brings high-level management experience from food-safety organisations to his role at EFSA.

Prior to joining the Authority, Dr. Url was Managing Director of the Austrian Agency for Health and Food Safety (AGES), which represents Austria on EFSA's Advisory Forum. From 2008 to March 2012, he also served as a member of EFSA's Management Board.

During his 10 years at AGES, he was in charge of technical and scientific affairs with a remit that included the timely delivery of risk assessment and risk management services across a wide range of areas. This included ensuring effective risk communications during urgent food safety-related events.

Prior to AGES Dr. Url spent five years as an Assistant Professor at the Institute of Milk Hygiene and Milk Technology at the University of Veterinary Medicine in Vienna before running a food quality control laboratory from 1993 to 2002.

Dr. Url graduated from the University of Veterinary Medicine in Vienna in 1987 and became a Doctor of Veterinary Medicine in 1990. He has published in the field of veterinary medicine with a particular focus on listeria and milk hygiene.

SESSION 1 - Methodologies for the risk assessment and approval of plant protection products in European Union

Chair: **Richard Thiéry**

Director of the Sophia Antipolis Laboratory – ANSES

Richard THIÉRY has a PhD in molecular biophysics and an accreditation to conduct research. His primary area of research is animal virology. His scientific work deals with the description of viral species, the development of diagnostic tools, molecular epidemiology and research into prevention methods. Director of the ANSES Sophia Antipolis Laboratory, he participated in the European SmartBees research project on bee resistance to varroasis and deformed wing virus (DWV).

Proposals to improve risk assessment methodologies for honey bees and wild pollinating insects as part of marketing authorisation applications for plant protection products

Arnaud Boivin

ANSES, Regulated Products Assessment Department, Unit for the Assessment, Ecotoxicology and Environment of Plant Inputs

Dr Arnaud Boivin is the Head of the Ecotoxicology and E-Fate Risk Assessment Unit for pesticides and fertilisers at ANSES. He joined ANSES in 2007 and has been participating to Efsa expert groups linked to environmental exposure.

The Regulated Products Assessment Department (DEPR), under the coordination of the Managing Director General in charge of the Regulated Products Division, is responsible for activities consisting in assessing risks to humans, animals and the environment and evaluating efficacy in the area of plant protection active substances and products, non-indigenous macro-organisms considered beneficial to plants and introduced into the environment, biocidal active substances and products, fertilisers, growing media, and similar products.

Abstract

To reduce the exposure of bees and other pollinating insects to plant protection products, ANSES recommended, in its Opinion of 23 November 2018 (1), strengthening the national provisions imposing restrictions on product use during periods when crops are attractive to these insects. The Agency also published a new Opinion (2) aimed at improving risk assessment methods in the context of marketing authorisation applications. ANSES recommends relying on the EFSA guidance document (3), in order to



better assess the long-term risks for bees and other pollinators. In addition, the Agency stresses the need to set regulatory threshold values for chronic risks at European level, in order to harmonise the criteria used for making decisions on marketing authorisation for products.

Methodology governing the assessment of risks to bees: A set of data on toxicity to bees must be provided for each marketing authorisation application for a plant protection product. Since 2015, this has included studies on chronic toxicity to adult bees and bee larval development, in addition to acute toxicity studies. Risk assessments are conducted on the basis of test results according to a methodology that has been harmonised at European level. In 2013, EFSA proposed a guidance document to assess the risks for bees, including several exposure scenarios. This new methodology has not been adopted by the Member States and is currently being updated by EFSA.

Marketing authorisation is only granted if certain criteria have been met. These criteria correspond to threshold values not to be exceeded in terms of risks to bees. At the moment, regulatory threshold values only exist for acute effects on bees, and are currently being amended. They also need to be set for chronic risks.

Methodological changes recommended by ANSES: ANSES recommends conducting risk assessments on the basis of the EFSA 2013 guidance document. This methodology is particularly suitable for assessing chronic toxicity studies on adult bees and larval development studies, as well as bumblebee toxicity studies. It also enables different bee exposure routes to be taken into account, not just in the treated crop but also in the surrounding area, such as field margins, adjacent crops or puddles of water. The EFSA methodology also includes exposure scenarios for bumblebees.

Regulatory threshold values for these effects are essential, if the results of the risk assessment for chronic effects and larval development are to be used when making marketing authorisation decisions. Regulation (EU) No 546/2011 must be amended in order for these regulatory threshold values to be established.

References

1. ANSES Opinion on changes to the regulatory provisions aiming to protect domestic bees and wild pollinating insects. November 2018.
<https://www.anses.fr/fr/system/files/PHYTO2018SA0147.pdf>
2. ANSES Opinion on changes to the risk assessment methodology for domestic bees and wild pollinating insects as part of marketing authorisation applications for plant protection products. October 2019.
<https://www.anses.fr/fr/system/files/PHYTO2019SA0097.pdf>
3. European Food Safety Authority, 2013. EFSA Guidance Document on the risk assessment of plant protection products on bees (*Apis mellifera*, *Bombus* spp. and solitary bees). EFSA Journal 2013;11(7):3295, 268 pp., doi:10.2903/j.efsa.2013.3295; published on 4 July 2014, replaces the earlier version published on 4 July 2013

EFSA Bee Guidance Review

Manuela Tiramani

Head of the Pesticide Peer Review Unit, Scientific Evaluation of Regulated Products, EFSA

Manuela Tiramani was appointed Head of the Pesticide Peer Review Unit (PREV) of the European Food Safety Authority in January 2019.

Manuela joined EFSA in 2005 as scientific officer for mammalian toxicology in the Pesticide Unit, where she afterwards took the position of team leader responsible for mammalian toxicology risk assessment and non dietary exposure assessment.

Before joining the PREV Unit, Manuela has guided the EFSA FEED Unit from 2015 to 2018 for a total of 4 years.

Manuela graduated from the university of Milano as medical doctor, with a focus on occupational health, industrial hygiene and toxicology.

Abstract

EFSA bee GD 2.0. In 2013, EFSA adopted a Guidance Document on the risk assessment of plant protection products on bees (*Apis mellifera*, *Bombus* spp. and solitary bees) [1], which so far has not been fully implemented due to some lack of consensus between Member States. In March 2019, the European Commission has mandated EFSA to revise this Guidance Document [2]. The work program of EFSA will have to take into account the on-going discussions initiated by the Commission on defining specific environmental protection goals. Also, available relevant guidance developments (e.g. draft Guidance Document on seed treatments) should be considered. In order to have a clear picture on the main procedural aspects and timelines, EFSA has published an outline paper [3]. As asked by the mandate, several stakeholder consultations and a public consultation are planned. For the execution of the mandate, EFSA has created a working group consisting of experts from academia, regulatory experts and EFSA staff. According to the mandate and the terms of reference, this revision should focus on several aspects for which new scientific evidence may have meanwhile become available. EFSA will review:

- the evidence as regards bee background mortality
- the different exposure routes
- the list of bee-attractive crops
- the methodology regarding higher tier testing

References

1. EFSA, 2013. Guidance on the risk assessment of plant protection products on bees (*Apis mellifera*, *Bombus* spp. and solitary bees). EFSA Journal 2013;11(7):3295. doi: 10.2903/j.efsa.2013.3295
2. [SANTE/E4/SH/gb\(2019\)1623216](#)
3. <http://www.efsa.europa.eu/en/press/news/190705>



SESSION 2 – Monitoring programmes to assess bee health status in Europe

Chair: **Agnès Rortais**

Scientific Committee and Emerging Risks Unit, Risk Assessment and Scientific Advice, EFSA

Scientific officer at the European Food Safety Authority (EFSA), Agnes Rortais is the coordinator of the MUSTB project on the development of a holistic and integrated risk assessment approach to account for multiple stressors in bees. She works in the ESFA Scientific Committee and Emerging Risks Unit on the development of methodologies and the collection of data related to environmental risk assessment and emerging risks identification. She has a Ph.D. in tropical ecology and was a postdoctoral scientist at the French National Scientific Research Centre (CNRS) on honey bee genetics and biomonitoring.

Surveillance data in EU and beyond: towards a global assessment of pesticide exposure and risk

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² *Entomology Department, University of Maryland, USA*

Dr. Simone Tosi studies bee health. His research focuses on the lethal, sublethal, and interactive effects that multiple stressors (pesticides, poor nutrition) cause on managed and wild bees. He has worked at University of California San Diego and University of Bologna, and collaborates with multiple institutions (University of Maryland, EFSA, European Commission). He coordinates a research project at ANSES aimed at refining the assessment of pesticide exposure, toxicity, and risk. He is a beekeeper.

Abstract

Bees are essential pollinators, vital for global food production and wild plant biodiversity, and so bee health decline has broad environmental implications. Bee health is driven by multiple stressors, a major one being pesticides. The standard procedure for assessing pesticide risk on bees fundamentally involves the evaluation of lethal effects caused by a single chemical only [1,2]. Nonetheless, bees are frequently exposed to sublethal levels of pesticides, which do not cause death, but behavioural or physiological alterations. Research has shown that these lower sublethal levels can be toxic and affect bee health. Furthermore, bees are not just exposed to one pesticide at the time: they are more frequently exposed to multiple pesticides simultaneously (pesticide “cocktails”) [3].

This is concerning, given that pesticide cocktails can cause “synergistic effects”, leading to a particularly amplified toxicity: pesticide doses that would not harm bees alone, become harmful in combination with another pesticide [4]. These synergistic effects can pose harm to bees *via* both lethal and sublethal effects [5]. In addition, it’s been recently discovered that pesticides can cause adverse synergistic effects even when combined with common environmental stressors such as poor nutrition, causing both lethal and sublethal effects [6,7]. Although pesticides are used worldwide, the surveys that investigate their residue levels and consequent impact (risk) on bees are mainly local, and do not often follow standardized/harmonized methodologies.

Here, we briefly present our international project that merges local efforts towards a global risk assessment, and addresses major challenges research and risk assessment are facing: the assessment of sublethal and interactive (synergistic) effects of pesticides. We will discuss about pesticide impacts from multiple perspectives (exposure, toxicity, and risk) in the framework of the RESCUE-B (Risk and Exposure Survey on Chemical Use in the Environment: Bee health) research project (based at ANSES, in partnership with University of Maryland and other universities internationally). Our recent results, obtained from multiple monitoring surveys, demonstrate the extent of pesticide contamination, highlighting the role played by pesticide cocktails (chemical mixtures). We present the sublethal and cocktail (for example, synergistic) effects that pesticides can cause on bees. Our results also show the extent of the knowledge gaps in these fields. Nonetheless, RESCUE-B is aimed at developing innovative methods to better describe and assess risk, from an international perspective. It involves bee health monitoring surveys from multiple countries and aims at an international analysis of pesticide exposure and risk, laying the foundation for future integrations of bee health surveillance initiatives. The project also aims at providing scientific knowledge that could help guiding policy makers towards an improvement of bee health and environmental sustainability. We underline the variety and complexity of pesticide effects on bees, and the consequent difficulty of performing an accurate assessment of their risk. Because sublethal and cocktail (interactive) effects are only marginally captured in risk assessment [1,2], thus possibly leading to limited and/or inaccurate conclusions, our project aims at refining the assessment of pesticide risk giving a global perspective of pesticide impacts, finally enhancing environmental and pollinator protection.

Acknowledgements

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References

1. Decourtye A, Henry M, Desneux N. 2013 Overhaul pesticide testing on bees. *Nature* 497, 188. (doi:10.1038/497188a)
2. Rortais A, Arnold G, Dorne J-L, More SJ, Sperandio G, Streissl F, Szentes C, Verdonck F. 2017 Risk assessment of pesticides and other stressors in bees: Principles, data gaps and perspectives from the European Food Safety Authority. *Sci. Total Environ.* 587–588, 524–537. (doi:10.1016/j.scitotenv.2016.09.127)
3. Tosi S, Costa C, Vesco U, Quaglia G, Guido G. 2018 A 3-year survey of Italian honey bee-collected pollen reveals widespread contamination by agricultural pesticides. *Sci. Total Environ.* 615, 208–218. (doi:10.1016/j.scitotenv.2017.09.226)
4. Carnesecchi E *et al.* 2019 Investigating combined toxicity of binary mixtures in bees : Meta-analysis of laboratory tests , modelling , mechanistic basis and implications for risk assessment. *Environ. Int.* 133, 105256. (doi:10.1016/j.envint.2019.105256)
5. Tosi S, Nieh JC. 2019 Lethal and sublethal synergistic effects of a new systemic pesticide, flupyradifurone (Sivanto®) on honey bees. *Proc. R. Soc. B Biol. Sci.* 286, 20190433. (doi:10.1098/rspb.2019.0433)
6. Tong L, James CN, Tosi S. 2019 Combined nutritional stress and a new systemic pesticide (flupyradifurone, Sivanto®) reduce bee survival, food consumption, flight success, and thermoregulation. *Chemosphere* 237, 124408. (doi:10.1016/j.chemosphere.2019.124408)
7. Tosi S, Nieh JC, Sgolastra F, Cabbri R, Medrzycki P. 2017 Neonicotinoid pesticides and nutritional stress synergistically reduce survival in honey bees. *Proc. R. Soc. B Biol. Sci.* 284, 20171711. (doi:10.1098/rspb.2017.1711)



PoshBee: sustaining bee health

Mark JF Brown

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Professor Mark Brown holds a Chair in Evolutionary Ecology & Conservation at Royal Holloway University of London. His research focuses on the health of bees, with a particular emphasis on the interactions between bumblebees and their parasites, and the impacts of agrochemicals on bumblebee health. Highlights of his recent work including demonstrating the importance of pathogen transmission between managed honey bees and wild bumblebees, and the impact of sulfoxaflor, the first of a new class of insecticides, on bumblebee health. He is the coordinator of PoshBee, a H2020 project aimed at understanding the pressures on bees in agricultural landscapes, and developing policy and practice to manage sustainable bee populations.

Abstract

Bees – honey bees, bumble bees, and solitary bees – pollinate our crops and wildflowers, and thus are essential for human well-being. However, in Europe, and around the globe, bees face many threats and are often in decline as a result. One potential driver of reduced bee health is agrochemicals. While laboratory and semi-field studies suggest that such chemicals negatively impact bee health, their importance and relevance in the real world remains unclear. PoshBee is a consortium of academics, governmental organisations, industry, and NGOs that will address the issue of agrochemicals to ensure the sustainable health of bees and their pollination services in Europe. Integrating the knowledge and experience of local beekeeping and farming organisations and academic researchers (including the EU RefLab for bee health), we will provide the first comprehensive pan-European assessment of the exposure hazard of chemicals, their mixtures, and co-occurrence with pathogens and nutritional stress for solitary, bumble, and honey bees across two major cropping systems. Integrated studies across the lab-to-field axis will determine the effect of chemicals, their mixtures, and interactions with pathogens and nutrition on bee health. We will combine the skills of commercial bumble bee and solitary bee producers, ecotoxicological industry, and academics to develop new model species and innovative protocols for testing chemicals in bees. With MUST-B, we will integrate this information to develop dynamic landscape environmental risk assessment models for bees. Using proteomics, we will produce new molecular markers for assessing bee health and enabling long-term monitoring schemes. Finally, combining across our partners and stakeholder board, we will deliver practice- and policy-relevant research outputs to local, national, European, and global stakeholders. Together, our work will support healthy bee populations, sustainable beekeeping, and sustainable pollination across Europe. In this talk, I report on recent developments in PoshBee's work, including laboratory, semi-field, and field exposure studies.

Acknowledgements

Thanks to all members of PoshBee. This project has received funding from the European Horizon 2020 research and innovation programme under grant agreement no. 773921.

SESSION 3 – Monitoring programmes and stakeholder involvement: case studies from France

Chair: **Richard Thiéry**

Director of the Sophia Antipolis Laboratory – ANSES

The observatory of bee mortality in France: preliminary conclusions

Sébastien Wendling

Directorate General for Food, Animal Health Office, Paris, France

Sébastien Wendling is a veterinary practitioner with a degree in «Beekeeping and Bee Diseases» from the ONIRIS/ENVA veterinary schools. He works for the Ministry of Agriculture and Food as a research officer in the Animal Health Office of the Directorate General for Food (DGAL). He monitors the health programmes implemented or supported by the DGAL for the beekeeping and pig sectors. In particular, he was in charge of coordinating the OMAA across France under the National Epidemiological Surveillance Platform for Animal Health (ESA Platform) during the construction phase of the observatory, and is now responsible for its pilot phase.

Abstract

The OMAA was set up by the Ministry of Agriculture and Food in collaboration with beekeeping organisations following major winter mortality in bee colonies in the Pyrenees during the winter of 2013-2014. Its aim was to compensate for the weaknesses of the surveillance systems in place at the time.

The OMAA is an innovative surveillance programme that guides the investigation of health events observed in apiaries and the collection of health data. The OMAA's objectives are to better identify health events observed in the region's apiaries. An overall analysis will be conducted on the data collected to characterise the health status of the honeybee population and issue alerts if abnormal disorders are found to increase in frequency or geographical distribution. The programme should help better understand bee weakening and mortality, both individually and collectively.

All sector stakeholders concerned with bee health were involved in getting the programme off the ground. It took the working group led by ITSAP (the Technical and Scientific Institute of Beekeeping and Pollination) three years to finish building the OMAA. The working group, which is now in charge of monitoring the programme, brings together experts from all the French national bee health organisations, veterinary practitioners, scientists and civil servants. The scheme is implemented as part of the ESA Platform.

The OMAA provides each region with a one-stop telephone service for beekeepers to report mortality and weakening observed in their colonies. They get to speak to a veterinary practitioner qualified in bee diseases. Working with the relevant governmental services, veterinary practitioners, bee health technicians and officers from the Ministry of Agriculture visit the affected apiaries and carry out an investigation to determine the cause at the individual level of the disorders observed. Environmental investigations may be conducted and alerts issued.

The programme thus contributes to the implementation of an effective bee health monitoring network



covering the country, as with other animal sectors.

The data gathered can be analysed on a larger scale with the support of ANSES to identify the risk factors for the events observed. Some of the data collected will also be fed into the phytopharmacovigilance scheme. The OMAA has been deployed on an experimental basis in the regions of Brittany and Pays de la Loire since the second half of 2017. The observatory was shown to be highly effective, and its success prompted its deployment in other French regions, such as Auvergne-Rhône-Alpes in the spring of 2019. The ultimate objective is to deploy the OMAA across the whole of France, depending on the resources available. After being in operation for two years in the three regions concerned, the OMAA has recorded approximately 1000 reports, and more than 400 investigations have been conducted. The data collected are now expected to be analysed.

The programme has been designed to alert public authorities, beekeeping organisations and scientists should the number of health events increase in terms of frequency or geographical distribution. For example, the programme proved its effectiveness during the summer of 2019 when an alert was triggered following a cluster of depopulation phenomena in lavender honey apiaries in southern Drôme.

The scheme continues to be improved, particularly with the initial feedback from the field.

This programme is being co-funded under the European Beekeeping Programme. It also has the support of the Ministry of Agriculture and Food.

Acknowledgements

Thanks to all the people/organisations who helped build the OMAA, and to those who are implementing the programme in its pilot phase. Thanks also to the beekeepers and beekeeping organisations who are helping the programme work effectively by providing reports.

Reference

The OMAA file is available on the ESA Platform website at: <https://www.plateforme-esa.fr/page/observatoire-des-mortalites-et-des-affaiblissements-de-l-abeille-mellifere-omaa>

Winter mortality in bee colonies: 2018 – 2019 national survey, initial results

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Marion Laurent is an epidemiologist in the field of animal health. Since December 2013, she has been working in the Bee Pathology Unit of the ANSES laboratory at Sophia-Antipolis. Among other things, she coordinated the Epilabee project, which aimed to estimate bee colony mortality at European level.



She previously worked in the Caribbean animal health network (CaribVET) and coordinated the epidemiological surveillance network for nervous diseases in ruminants of Guadeloupe (RESPANG).

Abstract

Following field reports of significant bee colony mortality in the winter of 2017-2018, the French Ministry of Agriculture and Food launched a nation-wide retrospective survey in the summer of 2018. The objective was to estimate the mortality rate as accurately as possible and collect the opinions of beekeepers regarding any increase in losses in their apiaries, especially compared to the previous winter, and the possible causes. The responses were collected online and by post. The recipients were the people who had reported colonies during the 2017 mandatory reporting period .

To be able to monitor changes in mortality over time, at the meeting of the bee expert committee of the French National Council for Animal and Plant Health Policy (CNOPSAV), it was decided to repeat this survey in 2019.

This survey, like that of the previous year, was developed by a project group as part of the National Epidemiological Surveillance Platform for Animal Health (ESA). It took the form of a questionnaire that was only available online and was sent to the 51,574 people who had reported their colonies in 2018 and had agreed to be contacted by email. It ran from 19 April to 5 June 2019. By the end, 10,287 beekeepers had responded, i.e. 19.9% of the reporters contacted.

This rate was lower than that of the year before, when the survey had been conducted over a two-month period and achieved a 28.9% response rate (14,291 responders out of 49,523 contacted reporters). It was nonetheless high enough to be able to estimate winter mortality based on declarative data.

After an analysis of consistency with the data of the 2018 colony reporting campaign, the final dataset included 9,350 responses, with an 18.1% response rate.

Based on the 9,350 responses analysed, the average rate of colony mortality in the winter of 2018-2019, for all of the people having reported colonies in the 2018 mandatory reporting period, was estimated at 21.3% [19.9% – 22.7%]. This rate was more or less the same depending on the number of colonies held before wintering. It was 22.8% [22.1% – 23.4%], 19.2% [18.2% – 20.2%] and 21.5% [18.5% – 24.5%] for reporters having wintered respectively fewer than 10 colonies, 10 to 49 colonies, and 50 colonies or more.

The average mortality rate was lower than that calculated for the winter of 2017-2018, which was 29.3% [28.3% – 30.3%]. Moreover, during this first survey, a greater difference (of around 5-6%) in colony mortality had been observed depending on the number of colonies held by the reporters.

The colony mortality rate in the winter of 2018-2019 was above 30% in several départements in south-west France. Since for some départements, the variability of mortality rates and/or limited number of responses generated high uncertainty in the mortality estimate (broad confidence intervals), it may be appropriate to undertake additional local investigations into these data.

A comprehensive analysis of the questionnaire responses and a comparison with the 2017-2018 survey have been planned. The renewal of this survey as well as its use for other studies will be discussed at the next meeting of the CNOPSAV bee expert committee in February 2020.

Acknowledgements

We would like to thank all of the beekeepers who took time to participate in this survey, as well as their organisations that helped raise awareness of this initiative in the sector.



SESSION 4 – Modelling for holistic risk assessments of bee health in Europe

Chair: **Agnès Rortais**

Scientific Committee and Emerging Risks Unit, Risk Assessment and Scientific Advice, EFSA

Overview of the honey bee colony model ApisRAM: a model for integrating multiple stressor effects on bees

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Chris Topping is a Professor of Ecological Modelling at the Department of Bioscience at Aarhus University, and leader of the Social-Ecological Systems group. He is the designer and coordinator of ALMaSS, a landscape-scale detailed agent-based simulation system now with wide EU coverage. He is the developer of the forthcoming EFSA honey bee model 'ApisRAM' as well as other models covering non-target organisms from insects to mammals and people. He is also vice chair of EFSA's PPR Panel.

Abstract

ApisRAM is honey bee colony model designed to assess risks posed to honey bees exposed to pesticides in interaction with Varroa, viral diseases, Nosema, weather, bee keeping practices, and the availability of resources in the landscape.

ApisRAM is built in ALMaSS, a simulation system for modelling the impact of management on animals at landscape scales using detailed agent based models. In ApisRAM, ALMaSS provides the environment into which a colony model is placed and it controls the conditions that colony model is simulated under. ALMaSS has existed for over 20 years, but is now undergoing expansion from its Danish roots to have the capability to represent conditions in 11 EU countries. The ALMaSS landscapes are highly detailed environments, modelled usually on 10 x 10km area at a resolution of 1-m². The farming activities and vegetation grown are modelled in detail, with all farming activities which might influence the bees being modelled at field level in realistic time-frames. Foraging/scouting bees can therefore interact with this landscape and be exposed to pesticides, forage/scout for resources, and bring material back to the colony from the simulated environment. The aim is that ApisRAM should be able to:

- Integrate multi-stressor impacts (pesticides and non-regulated stressors)
- Simulate interactions between components
- Predict complex system-dynamics, including the possibility to integrate mitigation options (e.g. width of sown field margins or restricted pesticide usage).
- Help to clarify the relative importance of different stressors, including how the impact of a pesticide on colony health might change with changing context, e.g. climate, and/or farming.

ApisRAM is written in C++ and follows an object-oriented programming design. Each bee is represented as an object in the simulation and the life of the bee and the tasks it performs are simulated in detail at 10-minute time intervals. The model design follows the specifications described by EFSA (2016) and considers three basic sets of modules:

1) The “Foraging”, “Colony» & in-Hive Products” modules. These modules are dynamic and comprise the following processes:

- The “Foraging” and “Colony” modules are based on energy budgeting at the individual level. Biological processes are described in terms of demographic (development, fecundity, and mortality), physiological and behavioural traits;
- The “in-Hive Products” module describes the processes of inflow, maturation, storage and outflow of in-hive products. Within the hive the resources are stored in simulated cells on simulated frames (i.e. spatially realistic).

2) «Resource Providing Unit» & «Environmental Drivers» (RPU-ED) modules. The RPU & ED modules should be able to handle hourly data for all time-varying parameters relevant to key model output parameters. The RPU & ED modules will provide input to the colony module on the spatio-temporal availability of resources and weather conditions. It is a function of the landscape module.

3) Additional factors and stressors modules:

- The “Pesticides” module comprising all the concepts involved with pesticides exposure and effects.
- The “Biological Agents” module comprising the effects on colony and in-hive products of Varroa destructor with its two associated viruses (the Deformed Wing Virus (DWV) and the Acute Bee Paralysis Virus (ABPV)), and Nosema.
- The “Beekeeping Management Practices” (BMP) module comprising a selection of common beekeeping practices.

Key design features separating this model from previous models are primarily rooted in the mechanistic detail with which the behaviour and biology of the bees is represented. The model is designed to incorporate local (to the individual) input information, including the communication between bees, and represent both positive and feedback situations that this creates. Key interactions are mediated through common ‘currencies, i.e. energy for driving many behaviours (foraging, temperature regulation), and a bee ‘vitality’ index linking effects of diseases, nutrition and Varroa to individual bee performance and lifespan. This model includes, for example, the immunosuppression action of Varroa. The model also has a detailed representation of temperature control in the winter months, when the balance between resource use and temperature is critical to bee survival.

Pesticide modelling utilises the ALMaSS pesticide models for modelling pesticide application and seed coating and environmental fate and combines this with the ‘vitality’ index using a toxic units approach. Using this approach it will be possible to model multiple pesticide stressors, although the current model only considers two pesticides at one time.

ApisRAM is now designed and being implemented, a prototype model is expected in January 2020. The model is also supported by a parallel EFSA project on data collection that will provide data to improve and test the model from landscapes located in Denmark and Portugal. The first version of ApisRAM to be released is expected in Spring 2021.

Acknowledgements

The ApisRAM model is being developed under a procurement contract from EFSA MUST-B

References

EFSA (European Food Safety Authority), 2016b. A mechanistic model to assess risks to honeybee colonies from exposure to pesticides under different scenarios of combined stressors and factors. EFSA supporting publication 2016:EN-1069. 116 pp. Available online: <https://www.efsa.europa.eu/en/supporting/pub/en-1069>



Giving Beekeeping Guidance by cOmputatiONal-assisted Decision making

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Prof. dr. Dirk de Graaf is head of the Laboratory of Molecular Entomology and Bee Pathology and director of the collaboration/service platform Honeybee Valley, both at Ghent University, Belgium. His research is focused on bee pathology with the development of tools for disease diagnosis and genotyping, the discovery of new bee pathogens using traditional and Next Generation Sequencing approaches and the breeding of disease resistant honey bees.

Abstract

A key to healthy beekeeping is the Health Status Index (HSI), inspired by the European Food Safety Authority's (EFSA) Healthy-B toolbox. The recently EU-funded B-GOOD project aims to make the Healthy-B toolbox fully operational through the active collaboration of beekeepers by facilitating the coordinated and harmonized flow of data from various sources (hive, bees, beekeeper) through to colony health and productivity. B-GOOD envisages a step-by-step expansion of participating apiaries to eventually cover all EU biogeographic regions. The key to sustainable beekeeping is a better understanding of its socio-economics, particularly within local value chains, its relationship with bee health, and the human-ecosystem equilibrium of the beekeeping sector. B-GOOD aims to implement these insights into data processing and decision making. B-GOOD will fully integrate socio-economic analyses, identify viable business models tailored to different contexts for European beekeeping, and determine the carrying capacity of the landscape. In close cooperation with the EU Bee Partnership, comprising a mix of institutes, scientists and major stakeholders, an EU-wide bee health and management data platform and affiliated project website will be created to enable sharing of knowledge and learning between scientists and stakeholders within and outside of B-GOOD. We will utilize and further expand the classification of the open source IT-application for digital beekeeping, BEEP, to streamline the flow of data related to beekeeping management,



the beehive and its environment (landscape, agricultural practices, weather and climate) from various sources. The dynamic bee health and management data platform will allow us to identify correlative relationships among factors impacting a Health Status Index (HSI), assess the risk of emerging pests and predators, and enable beekeepers to develop adaptive management strategies that account for local and EU-wide issues. Reinforcing and establishing, where necessary, new multi-actor networks of collaboration will engender a lasting learning and innovation system to ensure social-ecological resilient and sustainable beekeeping.

Acknowledgements

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SESSION 5 – Multi-actor approach for strengthening evidence-based risk assessments

Chair: **Richard Thiery**

Director of the Sophia Antipolis Laboratory – ANSES

European Union Bee Partnership: Initiatives for harmonised data collection, sharing, processing and communication on bee health and beekeeping in the European Union

Noa Simon Delso

Beekeeping Research Center and Information, Louvain la Neuve, Belgium

Noa Simon Delso is a veterinarian specialised in bee health and beekeeping, MSc in Agricultural Business Economics and PhD in bee eco-toxicology. She is the scientific-technical advisor of BeeLife European Beekeeping Coordination, European association dealing with the environmental protection of pollinators, on behalf of which she participates to the EU Bee Partnership.

Abstract

The decline in biodiversity in Europe is well documented. Every day, different interest groups collect various types of data for different purposes, ranging from data on population demographics to information on the various stressors affecting bees. All combined data might provide further insights on the origin of these trends of decline. Data collected by beekeepers also aim to help in their practical decision making. In the era of digitalisation, different producers and/or consumers of bee-related data came together to explore the possibilities to improve harmonised data collection, management, sharing and communications on bee health in order to support a more sustainable beekeeping in Europe and beyond. As a result, the EU Bee Partnership moderated by EFSA was set up in 2018 bringing together EU stakeholders involved in bee health and beekeeping. The Partnership members agreed on the terms of reference, the first steps towards the achievement of the described objectives based on a Proof of Concept (PoC) approach: small scale attempts supported by in-kind contributions by the stakeholders.

In the last 12 months, members of the Partnership have been working on two PoCs, building on the knowledge gained from the BeeXML and Bee Hub projects. Both projects benefit from the standardisation effort, which enables the sharing of data from multiple sources across several platforms. BeeXML is dealing with the standardisation of bee-related data using XML format and Bee Hub is dealing with data collection, management, sharing and communication. Volunteers working either on data collection or data science develop the former. They have formalised the work by creating an Apimondia Working Group on Standardization of data on bees and beekeeping.

The latter is currently being developed by BeeLife thanks to the EU project IoBee and aims to develop a user-friendly European (even worldwide) platform that integrates any relevant data linked to bee pollinators. The presentation highlights on the background, logic and state of the art of both PoCs.

Acknowledgements

I want to thank the stakeholders participating in the EU Bee Partnership for their enthusiasm and constructiveness, in particular, the EFSA for their facilitating role and the beekeeping organisations for their dynamism.

Beekeeper focus groups: a societal perspective for healthy honeybee colonies

Laura Maxim

LISIS (Laboratoire Interdisciplinaire Sciences Innovations Sociétés), UMR 1326/9003 CNRS, ESIEE Paris, INRA, UPEM

Researcher at the National Center for Scientific research (CNRS), Laura Maxim was trained in ecology and has a Ph.D. in ecological economics. Her research focuses on the production, use and communication of scientific knowledge in chemical risk governance - in regulatory advisory activities and in practices of innovation in green chemistry. She contributed to the European Environment Agency's report « Late Lessons from early warnings » with a chapter on neonicotinoid insecticides and honeybees.

Abstract

Ensuring the health of honeybee colonies in Europe involves interaction with beekeepers who take care of them on a daily basis. This presentation will address an initiative developed by EFSA together with experts in its "Social research methods and advice" working group, to provide a societal perspective in support of the development of a holistic risk assessment approach for managed honey bees – under the umbrella of EFSA's MUST-B project

Focus groups of two to three hours are being organized in eight countries, selected to represent different landscapes in Europe (northern, southern, central), as well as to consider the size of beekeeping activity.

The objectives are multiple:

- Collect evidence on the beekeepers' views on the proposed approach within the regulatory landscape in Europe;
- Examine the needs and expectations in terms of data sharing for beehive management, including: i) understanding the conditions under which such data can serenely feed the Must-B model; and ii) examine views on how the data to be produced by the model could help beekeepers in their daily honeybee-related activities.
- Understand beekeepers' views on adoption of "digital beehives" and their potential influence on beekeeping.
- Address the relationship between applied research and beekeepers.

EFSA, together with its experts from MUST-B and Social Research Methods and Advice WG has designed the questionnaire for the study and outsourced the study execution to facilitators with experience in leading focus groups. Meetings will take place in the national language of each of the countries included in the study. Beekeepers participating to the focus groups will essentially be representatives of the associations



and unions active in each country. We hope to get the most inclusive participation possible across the professional beekeepers and hobbyist, and across the different viewpoints in each country.

Exploring beekeepers needs and views for their future means being fully open to any feedback from their response to EFSA's invitation to participate in the study. Focus groups are discussions freely evolving around predefined broad topics and are perfectly adapted to such an objective, as they allow a flow of new information from participants that is either not known or not envisaged by the organizers before the study. The findings of the study will be summarized to inform the relevant aspects of the MUST-B project.



SESSION 6 – Round Table

Chair: **Yves Le Conte**

Bees and the Environment Unit, UMR PrADE, INRA

Research Director at the I.N.R.A. (Institut National de la Recherche Agronomique, in France) in charge of programs dealing with behavioral, physiological, aspects of the honey bee biology, genetics and pathology. Head of the INRA Research Unit UR 406 *Bees and the Environment*, in Avignon, France, until end of 2017.

Since 1983, my research focuses on the biology and chemical ecology of honey bee colonies. With my team and collaborators, we have discovered pheromones from the brood and the adult bees, which are at the center of social regulations in the honey bee colony. Those are primer and releaser pheromones. The primer effect had been studied at the molecular and physiological level. Varroa destructor is a serious threat of the honey bee in Europe and it is also very much involved in my research dealing with host parasite relationships and also applied research to control the mite.

Since the recent honey bee losses in Europe, my team and I study the effects of different pathogens and parasites on bee health and focus on the interactions with pesticides to understand honey bee decline from the molecular and socio-genomic level to colony and landscape level.

Beekeeper since 12 years old. Editor of le Journal *Apidologie*.

Towards a sustainable apiculture-agriculture system: the need for alternative treatment methods and a tighter collaboration between beekeepers and farmers

Fani Hatjina

Division of Apiculture, Institute of Animal Science- Hellenic Agricultural Organization 'DEMETER'

Fani Hatjina is a biologist with a Ph.D on pollination. She is the Director of Institute of Animal Science in Greece, a Council Member of I.B.R.A., the Coordinator of the APIMONDIA Working group «Adverse effects of pesticides and Veterinary Medicines to bees» and the President of Bee Health Scientific Commission of APIMONDIA. Main research interests of Fani Hatjina are : bee breeding , breeding for resistance, conservation of local breeds, effects of pesticides on honey bees' behaviour and physiology, biological control of diseases.



Clotilde Bois-Marchand

EU Farmers and Agri cooperatives (COPA-COGECA)

Walter Haefeker

European Professional Beekeeping Association (EPBA)

Martin Dermine

Pesticide Action Network Europe (PAN EU)

Martin Dermine is a doctor in veterinary medicine and holds a PhD in veterinary pathology. He is working at Pesticide Action Network (PAN) Europe on the toxicity of pesticides on pollinators since 2012. PAN Europe is a Brussels-based NGO working on replacing pesticides with environmental-friendly alternatives. Martin is also a beekeeper since the age of 14 and active in several beekeeping organisations, passionate about bee health as well as the conservation of local breeds of honey bees.

Hervé LAPIE

Symbiose

Fifty-years old, married and the father of three children, Hervé LAPIE is a farmer (135 hectares) and pig breeder (farrow-to-finish) in La Cheppe, near Châlons-en-Champagne, organised as a company with his brother and a neighbour. The holding has two employees *via* an employers' association. He has been Chair of the FDSEA Marne departmental farmers' union since 2014 and Chair of the FRSEA Grand Est regional farmers' union, as well as board member for the FNSEA national farmers' union, since 2017. He is also Chair of the CAF Marne family allowance fund. Before becoming Chair of the FDSEA Marne, he was involved in its local levels and in the mutual agricultural land grouping (GFAM) of the Suippes region which he co-managed. This grouping encompasses 350 hectares and 29 farmers. Together with other stakeholders in the Champagne-Ardenne region, he created the "Symbiose pour des paysages de biodiversité" (Symbiosis for biodiversity in landscapes) association. This association, which he chairs, aims to initiate collective and local projects in favour of biodiversity. He is also Chair of the CGAVAC (accredited agricultural and viticultural management centre of Champagne) and a director of the CIRHYO pig & pork cooperative.

General conclusions and perspectives

Gilles Salvat

Managing director general of Research and Reference Division, Anses, Maisons-Alfort, France

Gilles SALVAT is DVM and PhD in food microbiology. Researcher in food microbiology, he authored and co-authored more than 250 peer review articles and conferences about *Salmonella*, *Campylobacter* and *Listeria* in poultry and swine production. He's expert in food hygiene and animal health and welfare. As scientific director of animal health and welfare and managing general director of research & reference division for Anses, he is involved in building the research strategy of Anses on bee health.

