In partnership with

RNSBB 2023 Workshop

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Proceedings

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Table of Contents

Agenda

8.3.2023.

13:30 – 18:30 Excursion with a bus

14:00-15:00 – visit to Tikveš castle in Kopački rit nature park

16:00-18:00 – visit to Kovačić family queen production operation

18:30 Social dinner (cost covered)

9.3.2023.

08:30-09:00 Registration

09:00-11:00 1st session: Task force activities

09:00-09:30 Welcome and general information (Marin Kovačić and Zlatko Puškadija)

09:30-09:45 Introduction to the workshop and overview of the task force activities (Cecilia Costa and Marina Meixner)

09:45-10:30 Report on the progress of the Task Force book "Sustainable Bee Breeding: why and how" (Norman Carreck)

10:30-11:00 Identifying images for chapters of the book (everybody)

11:00-11:30 Coffee break

11:30-13:00 2nd session: honey bee diversity and breeding

11:30 – 12:00 Honey bee breeding projects in Canada (Pierre Giovenazzo)

12:00-12:30 Evaluating SNPs across honey bee populations (Per Kryger)

12:30-13:00 Discussion on honey bee characterization methods (everybody)

13:00-14:30 Lunch break

14:30-16:00 3rd session: Varroa resistance traits (hybrid form – link will be circulated in the morning of 9.3)

14:30-15:15 Varroa resistance explained – what´s next? (Ralph Büchler)

15:15-16:00 Varroa non-reproduction and recapping in Carniolan honey bee population (Marin Kovačić)

16:00-16:30 Coffee Break

16:30-18:00 4th session: honey bee mating control (hybrid form)

16:30-17:15 Honey bee nuptials: environmental conditions and success (Janez Prešern)

17:15-18:00 Discussion on Task Force initiatives to support establishment of mating control initiatives

20:00 Social dinner

10.3.2023.

08:30-10:30 5th session: ongoing projects

08:30-09:30 The Horizon projects POSHBEE and BEEGUARDS: lessons learned and plans for the future (Cecilia Costa)

09:30:10:30 Open discussion on collaboration between BeeGuards project and RNSBB Task Force

10:30-11:00 Coffee break

11:00-12:30 6th session: ongoing projects

11:00-12:00 Progress of multiactor breeding project in Germany (Marina Meixner)

12:00-12:30 Planning activities for the future year

12:30-13:30 Lunch break

Abstracts

The Horizon projects POSHBEE and BEEGUARDS: lessons learned and plans for the future

Cecilia Costa

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Abstract
The Horizon POSHBEE (Pan-European assessment, monitoring, and mitigation Of Stressors on the Health of BEEs) project, funded by the EU, is investigating the effects of agrochemicals on bee health. In addition to honey bees, wild Apoidea are also considered, both at a monitoring and experimental level, which are fundamental for the pollination activity of cultivated and spontaneous flora. The field and laboratory activities carried out by CREA-AA began in 2019 and continued into 2023. The results of the project will support the development of rapid diagnostic tools to identify the causes of colony collapse and for the development of forecasting models, which take into account the multitude of possible stressors, including pesticides, pathogens and landscape features. These tools will help in the protection of bees and pollinators, and therefore by extension to beekeepers and consumers. In this direction, “practice abstracts” have been prepared and collected in a “stakeholder summaries booklet”, freely downloadable on the www.poshbee.eu website.

Building on the experience of various EU funded projects, a consortium was set up to submit a proposal for a call on “Resilient Beekeping”: the BeeGuards project aims to strengthen the resilience of the European beekeeping sector by providing sustainable management practices, novel breeding strategies and digital and forecasting tools that allow the sector to adapt to a changing environment. We focus on determining how abiotic factors such as management practices, climate change, nutrition and resource limitations drive emerging biotic stressors that threaten colony health and erode the resilience of European beekeeping. BeeGuards comprises multiple actors and adopts a multi-actor approach from inception which has led to an open and inclusive design of the work programme. As a community, we will perform European-wide field studies evaluating and validating innovative threshold-based management and breeding strategies for resilience, using hives equipped with technological measurement tools. Complementary detailed immunological, behavioural, microbiological, pathological, ecological will elucidate the ways in which management and climate act on honey bees and other pollinators.

Evaluating SNPs across honey bee populations

Per Kryger

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Abstract
In the SmartBees project, we developed a new tool to separate subspecies European origin, consisting of 4165 SNPs. Not all SNPs are producing valid data, either they seem to fail in all individuals of certain populations or the observed genotypes are far from Hardy-Weinberg expectations. Honey bees are known to have an extremely high recombination rate, in particular for the size of the genome. Bases genotypes from honey bee workers from a wide range of populations, and several cases of drone offspring from individual queens I will try to illustrate some relevant findings, across the 16 linkage groups.

Varroa resistance explained – what´s next?

Ralph Büchler

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Abstract
Grindrod and Martin (2021) evaluated the data of 60 scientific studies on the resistance of *Apis mellifera to Varroa destructor* on a worldwide level. Their synopsis leads to a coherent explanation for the interaction and relevance of various resistance traits. From papers by Hoppe et al (2020), Gabel et al (2023) and findings of the EurBeST study (Büchler et al, 2022) some first estimations of the heritability and correlation parameters for some of those traits are available which will be discussed in regard to an optimization of selective breeding on varroa resistance. Furthermore, some reflections on how to establish varroa resistance in wider commercial bee populations will be shared.

Honey bee nuptias: environmental conditions and success

Janez Prešern[1], Ajda Moškrič[1], Andraž Marinč[1], Katarina Mole[1], Aleksandar Uzunov[2,3], Borče Pavlov[2], Goran Aleksovski[2], Marin Kovačić[4,5], Zlatko Puškadija[4,5], Bjørn Dahle[6], Jakob Wegener[7], Ralph Büchler[8], Sreten Andonov[3,9]

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Abstract

Nuptial flights of honey bee queens are performed mid-air at the very beginning of the queen bee's life. For this reason, it is very important that sexual partners are of sufficient quality and quantity which allow the colony to survive and prosper. The duration and the success rate of the flights can indicate the distance to the drone congregation area (mating place). The focus of the EEA & Norway Grants Fund for Regional cooperation project BeeConSel is mating control as a key in guaranteeing the genetic gain in selection and conservation programs for honey bees (conservation via utilization). In two successive years we have tested three different approaches to obtain controlled mating. Namely, geographical isolation, isolation by saturation (biological isolation) and temporal isolation are being tested in partner countries in a desire to evaluate the suitability of certain approaches.

Two groups of parameters were followed: first group were measurements of efforts of queens to get mated (frequency, duration of nuptial flights); the second group was related to paternity assignments. In the geographical isolation experiments, none of the areas suggested as isolated, turned out to be drone-tight which matches experience so far. However, where the nuptial flight effort parameters were compared with the similar locations with known presence of other colonies (DPC or other), the values of measured parameters were clearly divided into two groups, the latter having shorter successful flights and lower flight frequency (averages 19 - 26 min without DPC vs. 11 - 17 minutes with DPCs; 2.6 - 8.8 flights without DPCs vs. 1.6 - 2.2 flights with DPCs). Additionally, we were able to manipulate measured parameters by placing colonies in the location without DPCs and thus shortened them. Furthermore, the biological isolation experiment performed in Croatian lowlands returned similar values: average duration of successful mating flight was 14 minutes, owing to the abundance of drones. Temporal isolation with two different approaches was tested in Macedonia and Slovenia. In Macedonia, we tested the so-called cooling and labyrinth methods; first one was when the boxes were kept in the dark and cold chamber from 8 pm until 5 pm the next day, and the second group with use of a labyrinth. For the cooling method, the earliest and the latest successful mating flights were registered at 17:54 and 19:55, and for the labyrinth 17:43 and 18:17, respectively. In Slovenia, the test queens were let out at 17:17 and 18:17. Again, effort to get mated was measured by direct observation. There were more flights in the later group; however, addition of DPCs with timed drone release at 18:17 increased the duration of successful flights in the first group (from 20 to 32 minutes) and decreased in the second group (from 28 min to 15 min).

Paternity assignment was performed using microsatellite multiplex. In Croatian lowlands, 93 % of brood was assigned to installed DPCs. In Slovenian Alpine valley with 87 %.

Vitalbiene' – Effects of innovative beekeeping on performance and vitality of Apis mellifera L.

Lena Frank, Ralph Büchler, Marina D. Meixner

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Abstract
The 'Vitalbiene' project compares *Apis mellifera* L. colonies under different treatment concepts in terms of health, performance, population development and mating success. In an innovative approach (IN) an artificial brood interruption in summer was induced followed by an oxalic acid treatment in the brood-free state. Neither drone brood removal nor winter treatment were applied. The control group (CO) was managed according to a conventional treatment concept (drone brood removal, summer treatment with formic acid, winter treatment with oxalic acid).

Starting in July 2021, two apiaries were set up with 8+8 colonies each. Colonies were evenly distributed to the groups based on colony strength and mite infestation. Population dynamics and parasitization were recorded over the course of the years.

The results show a significant effect of treatment groups on mean infestation levels during drone rearing (mite infestation of bee samples [% ± s.e.m] in calendar week 19: IN = 2.3% ± 0.5; CO = 0.2 ± 0.1; $p \leq 0.001$, one-sided ANOVA). Yield in 2022 (harvest [kg ± s.e.m]: IN: spring = 26.1 ± 2.7, summer = 13.8 ± 4.3; CO: spring = 23.8 ± 1.9; summer = 25.7 ± 2.2) was significantly higher in CO in summer ($p = 0.002$) but not in spring and total yield (n.s.). The innovative approach led to a higher colony strength before winter (number of bees before winter ± s.e.m: IN = 8845 ± 719; CO = 7243 ± 465; $p = 0.06$) as well as to a higher overwintering index (2022-23; IN: 0.99 ± 0.04; CO: 0.87 ± 0.04; $p = 0.04$).

These encouraging results will be followed up by further investigations in the laboratory and in the field, focusing on the mating success of drones. The potential of the innovative approach in terms of supporting natural selection will thus be further investigated.

The road to self-sufficiency in bee colonies in Canada

Pierre Giovenazzo

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Abstract

The beekeeping industry in Canada relies on imported stock bees to replace mortalities and increase the number of active colonies. These imports carry various risks (e.g., new pathogens and undesirable or unsuitable bee genetics) and undermine the efforts of local breeding programs. Sustainability and self-sufficiency are major concerns of the Canadian beekeeping industry and various measures are being studied to reduce our dependence on the importation of bees. First, our research group has set up a selection program using quantitative genetics (BLUP model) offering a pedigree data since 2010; second, we are developing a new method to overwinter many young, mated queens from September to April (queen bank). These banked queens are released in the spring and reduce the need for imports. These actions will contribute significantly to maintaining the local stock of selected bees, improving colony performance, colony resistance to pathogens, and overall increasing the sustainability and self-sufficiency of our industry.

Varroa non-reproduction and recapping in Carniolan honey bee population

Marin Kovačić, Zlatko Puškadija

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Abstract

Despite the great effort in breeding varroa resistant bees, progress in improving certain traits is slower than expected. An important role in this is played by proper assessment of traits throughout the season, selection of the best individuals based on breeding values, and controlled mating of the next generation. The population of Carniolan honey bees in north-east Croatia is under selection for varroa resistance traits (SMR, recapping and hygienic behaviour) for last 4 generations. In addition to selection for varroa resistance traits, great emphasis is put on traditional beekeeping traits such as reduced swarming behaviour and increased honey production. Results of our efforts showed very slow increase in proportion of non-reproducing mites, but high increase in recapping of brood cells infested with Varroa mite. Further, significant negative correlation is found for hygienic behaviour with brood infestation (r=-0,305) while highest positive correlation was found between recapping of all cells and recapping of infested cells (r=0,711). There was no difference in fecundity and fertility of mites between recapped and untouched brood cells.

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09.03.2023. Group picture of RNSBB workshop participants