COLOSS

Research Network of Sustainable Bee Breeding

Spring 2017 Workshop

Kraków, Poland, 2-3 March 2017

COLOSS Research Network of Sustainable Bee Breeding Spring 2017

Workshop

Meeting Schedule

1st of March, 2017 – arrival and informal meeting at a hotel

2nd of March, 2017

Time	
7:40 !	Meeting by Mikołaj/Wit Stwosz hotels and walk (10-15mins) to the bus. Bus transportation from Kraków to Łysoń company
9:00 -10:30	Welcome and visit to Łysoń company in Klecza Dolna
10:30 - 10:45	Transportation to the discussion place in Inwałd
10:45 – 11:15	Registration and organization, administrative issues
	SESSION 1
11:30 - 13:30	VSH - SMR experiment - results presentation, discussion, problematic issues
	Relevance of recapping for SMR and Varroa resistance- Ralph Buchler
	VSH/SMR trait evaluation in Romania- Eliza Căuia
	Expession of SMR/VSH traits and comparison between cecropia and macedonica colonies- Fani Hatjina
13:30 - 14:15	Lunch
	SESSION 2
14:15 - 16:00	Further discussion on VSH - SMR experiment, publications planning
	Hygienic behavior in locally bred honeybees and its impact on Varroa infestation - Victoria Soroker
	Honey Bee Breeding Program for increasing disease resistance and productivity - Pierre Giovenazzo
16:00 - 16:30	Coffee break
	SESSION 3
16:30 - 17:45	Further discussion on VSH - SMR experiment, journal paper writing
17:45	Transportation to Wadowice- town of pope John Paul II birth
18:00 ….	Dinner- at Miodowa restaurant in Wadowice

3rd of March, 2017 – at Wit Stwosz Hotel

Time	SESSION 4
9:00 - 11:00	Popular Bee Book project: “Sustainable bee breeding: why and how”
11:00 - 11:30	Coffee break
11:30 - 13:00	Popular Bee Book project: “Sustainable bee breeding: why and how”
13:00 - 14:00	Lunch
	SESSION 5
14:00 - 16:00	New ideas, propositions and plans for further cooperation
16:00-	Final synopsis of the meeting Walk in Kraków – with guide…
19:30 …	Dinner…

List of contents:

Honey bee diversity in Denmark

Per Kryger

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The Danish queen breeders have used mating stations on several of the smaller islands, since approximately 30 years. Different breeder have favoured either bees labelled as Yellow bees (Apis mellifera ligustica), Carnica bees (A. m. carnica), or most frequently Buckfast bees. The breeders have rather similar goals: to produce bees that are gentle, that don't swarm, and produce a lot of honey. In Denmark there is a strong focus on disease tolerance, with regular test for hygienic behaviour and a complete absence of Nosema spores in a sample of 60 bees taken at the end of winter, is mandatory for all potential breeder colonies.

The typical beekeeper may buy queens from one of these breeders, but not every year. However, the neighbouring beekeepers often got bees of another subspecies. There lacks a local consensus on the best bee.

The islands with their mating stations have thus allowed the breeders to maintain their bees purebred, of three different subspecies in peaceful co-existence. However, the haphazard acquisitions of queens by the Danish beekeepers, is bound to result in a very complex honey bee population, with a multitude of hybrids bees. These hybrid bees make up the majority of the population, with only a few purebred bees, which are mostly situated at the breeders apiaries. Previous results indicate that traces of the original A. m. mellifera bees are also still present. This is surprising considering an absence of beekeepers wanting to maintain these bees in most of Denmark.

The current approach towards improvement of the Buckfast bees results in the introduction of additional genetic variation, sometimes of rather exotic origin. Still the relative low numbers of very foreign queens being imported for new Buckfast crossings, means that hybrids with these subspecies are of limited relevance for the population.

Therefore, the majority of hybridisation occurs between the three main breds, through queen trade. It seems that the hybrid bees maintain the gentleness of the purebred bees. However, the productivity of these hybrid bees and their health status is not known. A new project aims to evaluate if indeed the current co-existence of three different populations in Denmark is a fortunate situation for bees and beekeepers.

Honey Bee Breeding Program for increasing disease resistance and productivity

Pierre Giovenazzo

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Martin Georges

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Our main objective is to establish a permanent honey bee breeding program based on stock performance assessments and controlled crosses of selected lines to improve desirable traits. Breeding colonies are selected on the basis of multiple criteria and independent rejections using a performance rank and a character priority level. Our main criterion is spring colony strength of overwintered colonies. Other criteria are, in order of priority, population build up from May to July, hygienic behavior, honey production, Varroa tolerance, aggressive behavior and wintering weight loss.

The initial F0 genetic selection pool (2010) comprised 135 Apis mellifera colonies (14 lines) with queens obtained from local breeders and 5 inbred Buckfast lines from Denmark (Keld Branstrup, Buckfast breeder). Selective crosses are accomplished by rearing queens and drones from top ranking colonies. Young queens are open mated in isolated apiaries with drone flooding or fertilized using instrumental insemination. Between 10 and 14 lines are produced each year.

After 5 years, selected colonies have improved results in the most important performance criteria: 7% reduction in winter colony mortality, 20% increase of sping population build up, 33% increase in hygienic behaviour, 30% increase of honey production, and colonies are gental and easy to work.

Improved honeybee stock is distributed every year to participating queen breeders who perform a second evaluation and commercial distribution of young queens to beekeepers.

VSH/SMR trait evaluation in Romania

Eliza Căuia

Adrian Siceanu, Gabriela Oana Vișan, Dumitru Căuia (eliza.cauia@yahoo.com)

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The international researches regarding the VSH/SMR show that the low reproduction rate of varroa could be an important genetic trait of bees which to be used for selection activity. The firsts evaluations on Romanian bee (A.m. carpatica) show a relatively high variability of this trait. In the evaluation procedure we used an improved protocol in the frame of RNSBB network and Smartbees project. Additionally, in 2016 evaluations we used an artificial decapping method in order to evaluate the impact of this action on reproduction rate of varroa. The results of the evaluations in the last 2 years of experiment (2015-2016) will be presented and analyzed in the frame of the meeting.

Expession of SMR/VSH traits and comparison between cecropia and macedonica colonies

Fani Hatjina

Division of Apiculture, Inst. of Animal Science, Hellenic Agricultural Organizaton 'DEMETER'

Nea Moudania, 63 200 Greece (Fhatjina@gmail.com)

The SMR and VSH traits of honey bee ccolonies belonging to subspecies, A.m. cscropia and A.m. macedonica were evaluated in Autumn 2016. Ten brood frames with pupa of the corect age, each one from a different colony and for both populatons, were collected in August or September 2016 and placed in a deep freezer for later examinaton. From the population of A.m. macedonica, a second sampling occoured 12 days later but only from 6 out of the 10 initial colonies. For the SMR, a number of brood dells were opened , the percentage of single infected and multiple infected cells were recorded and the varroa offsprings in each single infected cell were noted. From these, the percentage of total infected cells and the percentage of non reproductive cells were calculated. For the VSH trait, all cappings of the cells opened were observed and the ones regarded opendd and recapped were noted. The percentage of cells recapped was then calculated. The percentage of infected cells was on average 10.4% and 6.8% for cecropia and macedonica colonies while the rate of non reproductive varroa of the single infected cells was 11.4% and 10.7% respectively. Cecropia colonies showed that they opened and recap the cells in a rate of 9.9% while macedonica colonies showed this trait in a rate of 6.8%. The repetition of the examination on macedonica colonies gave a slight different picture, with infestation rate, non reproductive rate and recap rate being 9.4%, 14.8% and 11% respectively. The differences among the colonies in both populations were very high and we might need higher number of total cells in order to have a more clear idea of the traits in both populations.

Sustainable Bee Breeding Book: chapter “Honey bees and genotype - environment interactions”

Cecilia Costa*, Fani Hatjina, Marina Meixner, Maja Drazic, Beata Panasiuk, Aleksandar Uzunov

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In this chapter of the planned book on sustainable bee breeding we aim to describe genotype – environment interactions and their implications on honey bee breeding and vitality.

Firstly we describe genotype – environment interactions (GEI) as the phenomenon by which environment differentially influences genotype. If a species is present across a wide range of environments, some subpopulations consistently experience different environments compared to others and natural selection will favour genotypes which confer the highest fitness in each environment, causing subpopulations to differentiate, each adapting to its own environment. Thus, GEI are an indicator for local adaptation and fitness. GEI also have implications for breeding, because a strain selected in one environment may not realize its potential in a different environment. In honey bees several studies have shown the presence of GEI, when considering traits related to colony development, showing the presence of populations with local adaptations.

The second part of the chapter summarizes the most important results of an experiment carried out across Europe with between July 2009 and March 2012, in which 621 bee colonies, involving 16 different genetic origins of European honey bees, were tested in 21 locations spread in 11 countries. The genetic strains belonged to the subspecies A. m. carnica, A. m. ligustica, A. m. macedonica, A. m. mellifera, and A. m. siciliana. At each location, the local strain of bees was tested together with at least two “foreign” origins. Survival, behaviour, development and diseases were the traits that were observed as a measure of colony vitality and adaptation. The most striking result of the experiment was that colonies of local origin survived longer than the non-local ones. Trends of adaptation were noticed also when observing the behavioural and development traits.

We conclude the chapter by stating that overall these results suggest that the best bee does not exist, but that the best breeding strategy is to start from local bees: this can be a way to improve honey bee health and to conserve honey bee diversity.

Hygienic behavior in locally bred honeybees and its impact on Varroa infestation

Rya Zelzer, Paz Kahanov, Shlomki Franklin, Yosef Kamer, Ilia Zaidman, Malgorzata Bienkowska, Abraham Hefetz and **Victoria Soroker**

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Institute of Horticulture, Apiculture Division, 24-100 Pulawy, Poland

The aim of our research is to breed locally reared honey bees for lower Varroa infestation. Bees bred in our apiary are basically *Apis mellifera ligustica*, but other honey bee strains were sporadically introduced in the past to improve honey productivity. We focus on selection for higher frequency of hygienic behavior and lately in VSH.

We have started this research about four years ago by screening colonies with freely mated queens for hygienic behavior using the "pin test". In parallel we assessed the tested colonies for colony strength, health and honey production. After the first year we selected colonies that represented two extremes: most hygienic and least hygienic, and screened the second generation using for the above traits. For two generations we also tested seasonal changes in Varroa infestation in freely mated colonies. Significant negative correlation was found between Varroa infestation and the level of hygienic behavior. In the last year we made crosses between hygienic and none hygienic colonies via artificial insemination. The results show that while artificial insemination between hygienic colonies produce very hygienic daughter colonies and the cross between non-hygienic colonies produces extremely non-hygienic daughter colonies their naturally mated sister colonies lost much of their hygienic trait in one generation similarly to artificial inseminations between hygienic mother and none hygienic fathers. These results suggest not only heritability of hygienic behavior in local populations but also high importance of father's contribution to the trait. We continue our selection efforts now evaluating VSH characteristics in hygienic and none hygienic colonies, by testing Varroa breeding abilities and cell recapping.

Analysis of biodiversity of honey bee populations bred in Poland

Dariusz Gerula[1], Bogumiła Badek[2], Małgorzata Bieńkowska[1], Beata Panasiuk[1], Paweł Węgrzynowicz[1]

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Originally, the Central European bee covered the majority of Poland territory, and only in south-eastern areas of Poland Carniolan honeybee occurred. At the moment, the native bee has been greatly replaced by other geographical races, creating higher but factitious diversity. Depending on the period, the popularity of individual races differed, and currently the Carniolan bee is most widely kept. Geographical conditions and population density and consequently number of bee colonies on any area prevented to organize natural mating stations, that is why instrumental insemination of bee queens became popular in Poland (over 100 thousand of instrumentally inseminated queens per year). At the end of the 20th century several, mainly state, leading honeybee breeding centers existed, that supplied other breeders in the breeding material. Widely used insemination was a toll to achieve breeding progress relatively quickly, unfortunately some mating design resulted a change of diversity.

Bee breeders, mostly private companies, are currently supervised by the state institution, which carries breeding registry. The selection and distribution of Carnica, Caucasica, Central European and Italian bees is permitted in Poland. Beekeepers that buy such queens can use the EU fundings, that indirectly favors the races. Beekeepers buy also from abroad other races bees, for example, Buckfast. However, later distribution of these bees may not be official in Poland.

The new project is planned to examine the biodiversity of the honey bee populations that are officially controlled, including populations of native Central European bees and Carnica bees. In bee diversity studies the molecular techniques (SSR-PCR) and geometric morphometry analysis (wing venation) are used. So far 12 from 48 of bees populations registered in Poland have been examined. Preliminary studies indicate high or average differentation of bee colonies within each population (FST = 0,027-0,117), and the moderate genetic variation between breeding lines.

Aknowledgements: This work was performed in the frame of multiannual programme (2015-2020) “Actions to improve the competitiveness and innovation in the horticultural sector with regard to quality and food safety and environmental protection”, financed by the Polish Ministry of Agriculture and Rural Development.

Breeding Study Against Varroa in Mugla Honey Bee (*Apis mellifera anatoliaca*) Population

Rahşan İvgin Tunca[1], **Taylan Doğaroğlu**[1], Devrim Oskay[2], Servet Arslan[3], Kemal Karabağ[3], Umut Özer[4]

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Recent studies have shown that one of the most important factors that lead to mass mortality in honey bee populations all around the world is the parasitic mite Varroa destructor. For this reason, efforts to obtain Varroa resistant lines have gained importance worldwide. This project is being carried out at Breed Center in Fethiye, İncirköy. 100 colonies, which has not received queenbee from outside of Mugla, were obtained from different beekeepers who has not been practicing migratory bee-keeping for the last 10 years. Powdered sugar methods were applied to determine the number of Varroa mites on the adult bees and brood cells were opened to determine the number of mites. Additionally, number of Varroa fallen from nest to bottom board were counted and recorded. Scoring has been performed by also considering the number of frames loaded with bees and brood. In selection of breeding colonies, this trait was used as criteria and a selection index was created. The colonies with the highest selection index scores were selected for parental generations. Instrumental insemination techniques were using for mating control. The first stage of the breeding program was completed and the results belonging to the measurements of November 2016 were recorded. The measurements of the spring period for the second year will be carried out.

This Project (TAGEM-15/ARGE/19) is supported by TAGEM (Republic of Turkey Ministry of Food, Agriculture and Livestock) and Mugla Beekeeping Association.

STUDY THE UNIFLORAL CHARACTER OF CRUDE HONEY

Nitin Gaikwad

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The floral character of honey is determined by the Palynological tools. The word melissopalynology plays an important role in the honey industries and also research it deals with the study of pollen grains from the honey. There are 20,000 species of honeybees are known all over the globe which shows diversity in between them. The present work completed on the study of unifloral nature of crude honey by analysis of pollen grains present in the honey. Generally the bees collect pollen grains through their pollen basket bag and used for feeding their young larva. The bees collects both pollen and nectar from the medicinal plants having more medicinal value from the ancient times. Due to different types of flower visit the honey contains different pollen grains. We studied the crude honey by staining method and observed the pollen grains of Eucalyptus. That is the honey shows unifloral in nature and due to the presence of pollen grains of Eucalyptus its having high medicinal value.

LIST OF PARTICIPANTS

1.	Benjamin Basso	France
2.	Małgorzata Bieńkowska	Poland
3.	Maria Bouga	Greece
4.	Ralph Büchler	Germany
5.	Andrzej Bober	Poland
6.	Norman Carreck	United Kingdom
7.	Eliza Cauia	Romania
8.	Leonidas Charistos	Greece
9.	Yves Le Conte	France
10.	Cecilia Costa	Itlay
11.	Bjørn Dahle	Norway
12.	Taylan Doğaroğlu	Turkey
13.	Andone Estonba	Spain
14.	Janja Filipi	Croatia
15.	Nitin Gaikwad	India
16.	Anna Gajda	Poland
17.	Dariusz Gerula	Poland
18.	Pierre Giovenazzo	Canada
19.	Fani Hatjina	Greece
20.	Irfan Kandemir	Turkey
21.	Nikola Kezic	Croatia
22.	Marin Kovačić	Croatia
23.	Per Kryger	Denmark
24.	Marina Meixner	Germany
25.	Ana Marta Muñoz-Colmenero	Spain
26.	Andrzej Oleksa	Poland
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33.	Adrian Siceanu	Romania
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35.	Adam Tofilski	Poland
36.	Aleksandar Uzunov	Germany
37.	Paweł Węgrzynowicz	Poland
38.	Jerzy Wilde	Poland
39.	Monika Leleń	Poland
40.	Przemysław Szeliga	Poland
41.	Tomasz Łysoń	Poland
42.	Michał Kolasa	Poland

Presentations and discussion on the trait Suppression of Mite Reproduction (some discussion on terminology: we state that what we have been measuring according to the RNSBB protocol is not Varroa Sensitive Hygiene, but only the Suppression of Mite Reproduction).

Presentations are made by R. Buechler, V. Soroker, P. Giovenazzo, M. Kovacic, Y. Poquet, E. Cauia.

SMR analysis protocol to be updated by end of June by: Yannick, Fanny M., Ralph, Marin, Cecilia

Popular Bee Book status

Chapter 1 "Bee evolution" by Marina Meixner, Maria Bouga, ~~Roy Francis~~, Melanie Parejo, Victoria Soroker and Iratxe Montes Asperilla. (Roy Francis will be substituted by Per Kryger.) Writing is 70% complete, including a long subchapter on evolution of beekeeping by V. Soroker.

Chapter 2 "Current situation and history in Europe" Yves Le Conte, Irfan Kandemir, Maja Drazic and Janja Filipi. Y. Le Conte describes the synopsis of the chapter written by J. Filipi and him. The chapter would include a description for each subspecies. P. Kryger comments that a box on the Smart Bees biodiversity questionnaire would be suited in this chapter. R. Buechler suggests that the evolution should follow the breeding tools described in the book: morphometry, performance testing, genetic markers, possibly with examples for each one.

Various new titles for the chapter are suggested:

History and current situation of bee breeding in Europe.

The main trends of beekeeping in the last century

From beekeeping to bee breeding

Bee breeding in Europe: past present and future

Chapter 3 "Honey bees and genotype – environment interactions". Writing is 80% complete. Suggestions are made concerning the honey production data: show that the selected stock had higher production to incentivate breeding initiatives. Suggestions to make the graphs more understandable for a general audience: for example, on the survival graph place vertical and horizontal lines showing the proportion of surving colonies on a certain date. Suggestion to dedicate care in explaining why the results happened and the concept of regional variation of diseases.

Chapter 4 "Breeders viewpoints and considerations". This will be organized in box format and will include short biography of Brother Adam and Prof. F. Ruttner. N. Carreck suggests including Beowolf Cooper, very active in the British Isles on black bee conservation. Suggestion by V. Soroker to include pros and cons of bee transport and exportation, what is gained but at what price. There is not full agreement on this point. Another suggestion is to show the agricultural importance of sustainable breeding in providing food via pollination for a growing world (so not to focus on conservation merely from a biological and apicultural point of view). Completion of Chapter 4 awaits the highlights from the other chapters in order to choose considerations and viewpoints which will be in line and complementary.

Chapter 5: "Conservation efforts across Europe" by Per Kryger, Maria Bouga, Raffaele Dall'Olio, Irfan Kandemir, Melanie Parejo and Cecilia Costa. This chapter is almost finished. Content on CITES, IUCN will be transferred to box format.

Chapter 6 "Selection and propagation of honey bees" by Ralph Buechler and multiple coauthors. Two subchapter are finished and will be sent out as example of simple and effective writing.

In the subchapter on health of queens suggestion is to stress the risk acaricides pose to queens, as well as agricultural pesticides. A few lines on Small hive beetle will be added by N. Carreck.

Future plans:

- Completion of the book "Sustainable Bee Breeding: why and how"
- Completion of article on joint SMR experiment
- **Next RNSBB meeting** will be held as usual during the COLOSS conference in connection with Apimondia in Istanbul. COLOSS conference will be held just before Apimondia, on the 27 & 28 September 2017
  Volunteers for hosting **RNSBB spring meeting 2018**:
  - M. Bouga, Athens, Greece
  - A. Uzunov, Ohrid, Macedonia
  - P. Kryger, Flakkebjerg, Denmark
  - other suggestions may be made during the next meeting or via email!
  -
- **Survivors Working Group**: suggestion to ask them to join for next workshops, as the topic is also of interest within RNSBB. Suggestion is that participating RNSBB members broach this issue within the Survivors workshop which will be held in Avignon, France, on 5-6 April.