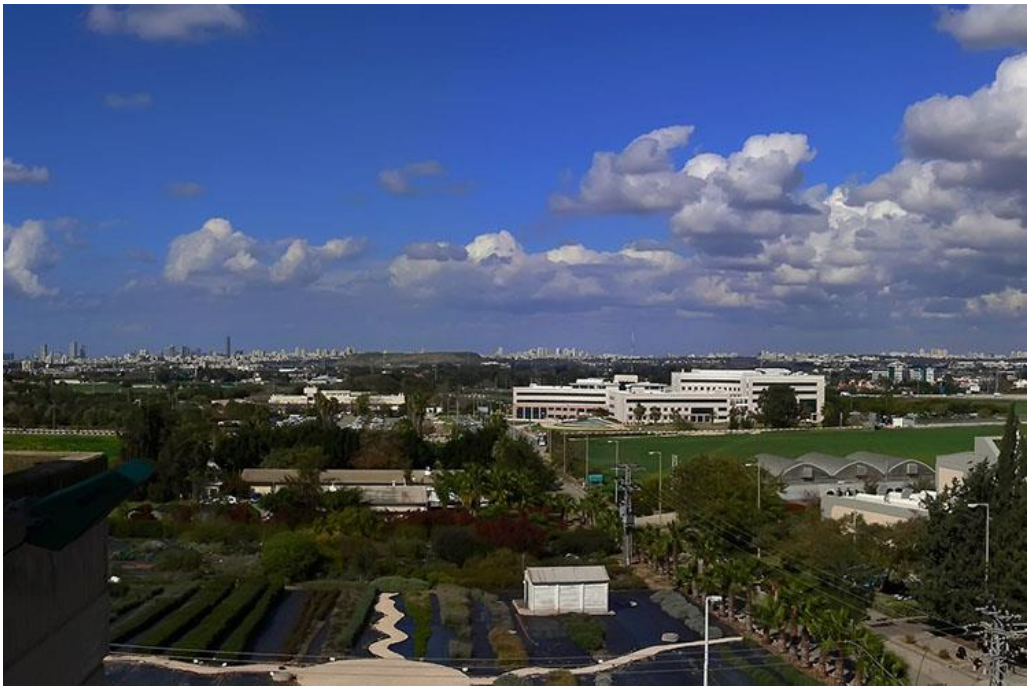
In partnership with

Bee Breeding Task Force Workshop

Proceedings



Volcani Center of Agricultural Research Organization
Rishon LeZion, Israel,
22nd to 24th January 2019

Arrival from / to the airport

- **The airport is remote from the city.**
- You can get to the hotel either by taxi, or by train and a bus.
- Taxis are located outside to the left of exit 2 (about 150 NIS).
- Train to Tel Aviv: from Ben Gurion Airport to Tel Aviv HaHagana station (about 13.5 NIS).
- In Tel Aviv you can take a bus or a taxi
  - Buses numbers (to the hotel BY14): 104 / 204 (6 NIS) or taxi (around 40 NIS)

  Check for train schedule here: https://www.rail.co.il/en

  Check for route planning here: https://moovitapp.com
  - **Please note, there is NO public transport from Friday evening to Saturday evening.**

Tel Aviv info:

Tel Aviv is one of the most vibrant cities in the world. It is a 24 hour city with a unique pulse, combining yellow sandy Mediterranean beaches with a world-class nightlife, a buzzing cultural scene, nice food, Bauhaus UNESCO recognized architecture and an international outlook.

Recommended places to visit at free time:

- Walk along the beach
- Visit old Jaffa town
- Visit Sarona - a restored German Templers' colony established in 1871
- Walk along Rotshild street: the first street of Tel-Aviv where Declaration of Israel by David Ben-Gurion took place. Look for Bauhous style buildings.
- Enjoy Tel-Aviv rich nightlife with hundreds of pubs and restaurants.

Accommodation

We recommend staying in Tel-Aviv, a modern touristic city with rich nightlife located about 15km away from the Volcani Institute. We arranged a special price in BY14 TLV hotel located near the sea (545 nis per double and 490nis per single room including breakfast, 149107 reservation number), but each participant can choose his place of stay.

Registration and fee

A workshop fee of 50 euro per person will be paid at place.

Lunches, Social dinner, coffee break, transportation to the Institute from Tel-Aviv and a trip to Jerusalem will be covered by COLOSS funding and a workshop fee.

Travel and accommodation costs will be paid by the participants.

Schedule

Tuesday 22nd of January

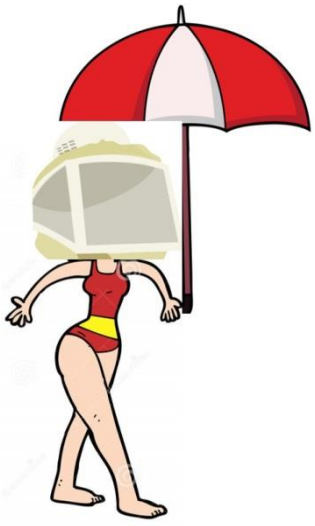
6:30-18:00	Tour to Jerusalem and a Bee Keeper in Judea Mountains + lunch in Abu Gosh.
20:00	Social Dinner

Wednesday 23d of January

8:15	**Ride from BY14 hotel to Volcani center (Haris hall)**
9:00 - 9:15	**Registration**
9:15 - 9:30	Welcome and organization matters
9:30 - 10:30	Oral presentations on Breeding and Varroa resistance traits (Mondet, Zeltzer and Maucourt)
10:30 - 11:00	**Coffee break**
11:00 - 12:30	Oral presentations on Breeding technology and Conservation strategies (Costa, Dahle, Kandemir and Rousseau)
12:30 - 13:30	**Lunch break**
13:30 - 14:30	Walking Tour in Volcani Center, visiting some bee colonies. Presentation of local methods of colony assessment and discussion
	Project Discussions 14:45 - 18:00
14:45 - 15:00	Overview of **EurBest** progress (Büchler)
15:00 - 16-30	Case study reports from 5 European countries (Büchler, Mondet, Costa, Hatjina and Panasiuk)
16:30 - 17:00	**Coffee break**
17:00 - 18:00	Proposed methodology for assessing Varroa resistance and economic traits (Uzunov and Dimitrov)
18:00	**Ride back to Tel Aviv**

Thursday 24th of January

8:15	**Ride from BY14 hotel to Volcani**
9:00 - 9:20	Methods to collect data across different environments: online database (Uzunov and Andonov)
9:20 - 9:40	Interview with some commercial beekeepers (Uzunov and Dimitrov)
9:40 - 10:10	Coordination of queen exchange between case studies (all case study coordinators)
10:10 - 10:30	Supplemental studies by CREA, INRA and LLH (Costa, Mondet and Büchler)
10:30-11:00	**Coffee break**
11:00 - 12:00	Parallel program: (A) Apiary visit or (B) EurBest discussions
	A) Visit to research apiary apiary (participants not needed in EurBest session)
	B) EurBest Discussions (mandatory for key partners). Preliminary planning for the final conference in Brussels, April 2021 (Wirtz, Büchler and all partners)
12:00 - 12:30	Administrative issues and next steps (Wirtz and Büchler)
12:30 -13:30	**Lunch Break and Poster Session**
13:30-14:00	Update on Popular Breeding Book (Carreck)
14:00-14:30	Update on SMR manuscript (Mondet and Andonov)
14:30-15:30	Update on ongoing and concluded projects by RNSBB members (eg. SmartBees Conservation outcome, Meixner et al.)
15:30-16:00	Coffee break
16:00-17:00	Open discussion on strategies for future cooperation and common experiments, future meetings and events
17:00	**Ride back to Tel-Aviv**
19:00	Optional walk to Sarona



We recommend bringing:

1. Beekeepers' veil and hat.
2. A swimming suit (especially if you plan to join the trip to the Dead Sea).
3. Umbrella, as this winter is very rainy.

Looking forward to host you in ARO and in Israel!!

The organizers

Oral presentations

Fanny Mondet	**Environmental parameters that influence the expression of Varroa resistance, and the link between VSH and SMR**
Segolene Maucourt, Claude Robert, Pierre Giovenazzo	**Genetic selection of the honeybee (*Apis mellifera* L.) in a northern climate**
Rya Zeltzer, Yosef Kamer, Ilia Zaidman, Paz Kahanov, Malgorzata Bienkowska, Abraham Hefetz, and Victoria Soroker	**Hygienic behavior in the honeybee (*Apis mellifera*): what is the paternal contribution?**
Andree Rousseau, Pierre Giovenazzo, Emile Houle, Noemie Lampron	**Deleterious effects of shipping honey bee queens**
Irfan Kandemir & Ahmet Inci	**Honey bee conservation issues and autumn colony losses in Turkey**
Cecilia Costa′, Bjorn Dahle, Dylan Elen, Raffaele Dall'Olio, Egoitz Galartza, Maja Drazic	**The International Honey Bee Breeding Network: a new association to connect breeders and achieve improvement and conservation of honey bees**

Posters

Malgorzata Bienkowska, Beata Panasiuk, Dariusz Gerula, Pawel Wegrzynowicz	**Assessment of SMR and VSH traits and comparison between *A.m.carnica* and *A.m.caucasica***
Malgorzata Bienkowska, Jerzy Wilde, Beata Panasiuk, Dariusz Gerula, Pawel Wegrzynowicz	**Bee Breeding activity in Poland**

Abstracts

Deleterious effects of shipping honey bee queens

Andree Rousseau[1], Pierre Giovenazzo[2], Emile Houle[1], Noemie Lampron[2]

[1]Research Center Science Animal De Deschambault, [2]Laval University

Canadian honey bee industry relies on queens and honeybee packages importations to face winter mortality averaging 29% since 2010. In 2016, 200 000 queens and 60 000 packages were imported mainly from California, Chile and New Zealand. Recent studies have documented adverse conditions in Canadian and USA honeybee queen shipments. The first objective of this project was to measure environmental conditions experienced by queens shipped from USA and within Canada. A total of 38 commercial queen shipments were followed. Results show minimum / maximum temperature of 12°C / 34°C and minimum / maximum relative humidity of 27% / 68%. Shipments took an average of 31 hours to reach their destination (maximum distance of 4 800 km; range 16 - 69 hours).

The second objective of this project was to test different queen shipping methods (cage models and presence of attendant worker bees within the cages) on the internal cage temperature, queen survival and sperm viability of the queens. We compared four shipping treatments (see Figure 1): 1) Jz-Bz plastic battery shipping boxes with 4 attendant worker bees inside individual queen cage, 2) Mini Riteway cardboard shipping boxes with 4 attendant worker bees inside individual queen cage, 3) Jz-Bz plastic battery shipping boxes with 4 attendant worker bees inside individual queen cage + 250 loose bees inside each box and 4) Mini Riteway cardboard shipping boxes with 4 attendant worker bees inside individual queen cage + 500 loose bees inside each box. Shipping methods were exposed to 6°C, 26°C and 40°C for 2 hours. A total of 72 queens were randomly distributed in one of the four shipping treatments. Survival of queens and sperm viability were measured at the end of the experiment. Results show that the addition of loose bees inside queen shipments regulates temperature within shipping boxes when exposed to low temperature; loose attendant bees were able to keep the inside temperature above 25°C while temperature decreased down to 15°C without them (Figure 2). Exposition to 6°C and 40°C for two hours resulted in an average decrease of sperm viability of 12% (± 8,6%) compared to the control group exposed to 26°C.

During summer 2018, we measured the impact of various shipment temperatures (6, 26 and 40 °C) on sperm viability within the queen's spermatheca. Additionally, a sample of these queens was introduced in colonies to evaluate colony performance and survival (N=35 colonies). Survival and performance of these queens and their colony will be recorded until spring 2019. Knowledge obtained from his study will help improve queen shipping conditions to maximize sperm viability, queen acceptance and colony performance.

Assessment of SMR and VSH traits and comparison between *A. m. carnica* and *A. m. caucasica*

Malgorzata Bienkowska, Beata Panasiuk, Dariusz Gerula, Pawel Wegrzynowicz

Research Institute of Horticulture Pulawy

Late July 2018, studies of the suppressed V. destructor mite reproduction (SMR) were carried out by inspecting combs with brood at the pupae stage aged 9-10 days. The combs were taken from bee colonies where queens were evaluated for the trait just before applying any Varroa treatment. For the SMR, a number of brood cells were opened, the percentage of single infected and multiple infected cells were recorded and Varroa offsprings in each cell were noted. From these, the percentage of total infected cells and the percentage of non-reproductive cells were calculated. Additionally, all opened capping was observed and the percentage of recapped cells single infected and multiple infected cells were recorded and Varroa offsprings in each cell were noted.

In total, in both studied bee populations, 4,630 cells were examined, of which an average of 13.7% (from 1.8% to 22.0%) were infested by the mite. It was found that 36.4% were infested by non-reproductive females, among which 17.6% were females without offspring, 6.6% females without any male and 12.4% cells with females that reproduced late. In *A.m.caucasica* bees, significantly more females started laying eggs late (15.8%), while in *A.m.carnica*, significantly more females had no offspring or no offspring male (19.1% and 9.2% respectively). It was shown that the bees of both subspecies uncapped and recapped on average 8.4% of all examined cells, with significantly higher result in *A.m.caucasica* bees (10.7%). Among them were cells without Varroa destructor female, but also infested cells, which accounted for an average of 43.7% of all recapped (*A.m.carnica* 48.3% and *A.m.caucasica* 39.7%). In both bee subspecies, Varroa females with offspring were found among uncapped and recapped cells on average 66.3%. In *A.m.caucasica* bees, significantly more (33.4%) females with delayed egg laying were found, while in *A.m.carnica*, more females without offspring - 35.8%. Preliminary results suggest that *A.m.caucasica* bees characterize a better instinct for hygienic behavior: detecting and uncapping brood cells infested with mite and recapping them, that may influence SMR.

Bee Breeding activity in Poland

Malgorzata Bienkowska[1], Jerzy Wilde[2] ,Beata Panasiuk[1], Dariusz Gerula[1], Pawel Wegrzynowicz[1]

[1]Research Institute of Horticulture Pulawy; [2]University of Warmia and Mazury in Olsztyn

Honey bee breeding in Poland has been regulated by governmental law for four honey bee sub-species: *A. m. mellifera* (commonly called the "national", "local" or "black" bee*); A. m. carnica*, *A. m. caucasica* and *A.m ligustica* over 40 years ago. The territory of Poland is a natural habitat for A. m. mellifera bees. Polish beekeepers, during the last century, started to import Caucasian queens from the former USSR countries and Carniolan queens, mainly from Danubian countries and Austria. Uncontrolled importation caused hybridization of local bee stocks. The imported sub-species of bees, especially the Carniolan bees, began to dominate.

Three types of breeding programs exist in Poland: genetic improvement of the bee sub-species; cross-breeding programs where the breeders work mostly on breeding productive hybrids from two sub-species or from different breeding lines within a sub-species and the national Black Bee Genetic Resources Conservation Program. The last one covers four lines of *Apis mellifera mellifera* lines: Asta, Pólnocna (North Bee), Kampinoska and Augustowska. The selection of breeding material is conducted in breeding apiaries, that realize breeding programs on double recording system: stationary recording in breeding apiaries and field recording of various cross breeds in selected commercial apiaries. Except of production traits, like honey yield and spring development, there are also biological traits evaluated: swarming, wintering, gentleness, hygienic behavior, Varroa infestation and in some apiaries SMR, that directly influence the production and make the apiary management easier.

Over 95% of breeding apiaries in Poland use instrumental insemination to produce breeding queens and also queens for commercial colonies. Instrumental insemination with semen of selected breeds and isolated drones guarantees pure mating and selection. In Poland instrumental insemination of bee queens is used not only for breeding purpose but also on large scale for commercial beekeepers, and scores about 30,000 bee queens yearly (from 20,000 to 80,000 depending the year).

Totally in Poland, beekeepers produce 282,256 queens, but registered breeders produce only 68% of queens (190,575). Unregistered producers sell 37,130 Buckfast and 54,551 *A.m carnica* queens, that is about 32%.

Genetic selection of the honeybee (*Apis mellifera* L.) in a northern climate
Segolene Maucourt, Claude Robert, Pierre Giovenazzo
Laval University
Animal breeding, in combination with developments in agricultural technology, has made remarkable progress in increasing production of many domestic species. However, these important tools are poorly exploited in the honeybee (*Apis mellifera* L.) industry because of the complex genetic and reproductive features of the bee. In recent years, new mathematical approaches have allowed the application of statistical models in honey bee breeding programs and the use of breeding values to improve genetic selection. The aim of our project is to adapt statistical models currently used for breeding in the Dairy and Pig Industry in Quebec Canada for the genetic evaluation and performance monitoring of the honey bee. This project will: 1) identify honey bee performance traits with high heritability within the colonies of the Centre de recherche en sciences animales de Deschambault (Canada, QC) honey bee breeding program; 2) develop a breeding plan to improve the genetic potential and produce superior breeding stock and 3) measure the impact male selection on the breeding values of honey bee colonies. This novel approach will improve honey bee performance of traits relating to yield stability and sustainability of our northern climate beekeeping industry.

Honey bee conservation issues and autumn colony losses in Turkey

Irfan Kandemir[1] and Ahmet Inci[2]

[1]Department of Biology, Faculty of Science, Ankara University, Ankara-Turkey

[2]Beekeeping Consultant, ANG Foundation, Istanbul-Turkey

Two subspecies namely *Apis mellifera anatoliaca* and *A. m. caucasica* and several ecotypes of these subspecies are under protection in conservation apiaries in different parts of Turkey. The question raised in this preliminary research is whether the conservation apiaries are still keeping their original status or not? Also *A. m. caucasica* in Camili-Artvin is used to establish a replica conservation apiary outside the original conservation site , thus the second question asked is whether this replica conservation apiary represents the original population or not? After five years, we sampled honey bee samples from Ankara (*A. m. anatoliaca*), Camili, Hatila, and Posof (*A. m. caucasica*) for morphometric analysis in order to answer the questions previously rose. A total of 26 characters belonging to fore wings, hind wings, legs, and color of tergites were used in multivariate analysis. The results showed that the original populations from conservation apiaries were keeping their original values and also the replica conservation apiary was overlapped with the original conservation site meaning that the new replica represents the original population.

In year 2018 after honey harvest, much news on different media (written, visual and even in social) appeared about unexpected high colony losses. In order to verify these honey bee colony losses, we communicated with 142 beekeepers through phone from six different regions (Mediterranean, Aegean, South and Southeast Anatolia, Central Anatolia, Black Sea, and Marmara), and carried out a quick survey about their colony number and the total death outs after the harvest. The size of the apiaries changed from a few colonies to a thousand. We saw that there are beekeepers that did not lose any; on the contrary, there are beekeepers that lost all their colonies. The highest loss was found the quick survey seen in Black Sea region and the lowest loss in Marmara region. The overall colony losses in Turkey were calculated as 27% just before entering winter. We will repeat the survey with enlarging the questionnaire during spring in order to get a better idea about the colony losses and the reasons.

Environmental parameters that influence the expression of Varroa resistance, and the link between VSH and SMR

Fanny Mondet [1,2], Lea Tison [1,2], André Kretzschmar [3], Alban Maisonnasse [2,4], Yves Le Conte [1,2]

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Varroa resistance can be defined as the ability of honey bee colonies to survive the parasite for several years in the absence of any treatment against the mite. It has been associated with the development of active behavioural defences by bees, most importantly with the expression of two related traits. Resistant colonies are able to detect the presence of Varroa through the cap of developing brood and to remove parasitised brood, a behaviour known as VSH (Varroa sensitive hygiene). Female mites located in surviving colonies also frequently fail to efficiently reproduce. This failure of mite reproduction is known as SMR (suppressed mite reproduction). VSH and SMR currently represent major traits for the selective breeding of mite resistant honey bee colonies.

It is known that task allocation in the colony, e.g. VSH behaviour expression, largely depends on the population dynamics of the colony as well as the food supply available. The level of infestation of the colony may also influence the extent of expression of the VSH and SMR traits.

We tested the influence of the environmental context on the ability of colonies to perform VSH behaviour or express the SMR trait by studying population dynamics, task allocation, parasitisation burden and food supply in honey bee colonies.

Our result help get a better knowledge of the mechanisms that enable bees to survive mite infestation and environmental conditions that can influence this ability. This study can also provide practical recommendations to beekeepers for the testing of Varroa resistance potential of honey bee colonies.

Hygienic behavior in the honeybee (*Apis mellifera*): what is the paternal contribution?

Rya Zeltzer[1,2], Yosef Kamer[1], Ilia Zaidman[1], Paz Kahanov[1,3] Malgorzata Bienkowska[4], Abraham Hefetz[2], and Victoria Soroker[1]

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Using colonies headed by naturaly mated and artificialy mated queens we compared drones' and queens' genetic contribution to colony hygienic behaviour. Hygienic behaviour was assessed using pin test after 24 hours. Even though it is clear that both parents contributed to the trait, drones contribution appeared stronger and constant to the performance of following generations. Furthermore, we found increased hygienic behavior in lines that arose from selected drones, also in colonies of naturally mated daughter queens. Based on the hygienic performances of artificially inseminated and naturally mated queens a logistic model was calculated to predict probability the hygienic performance of the progeny in both mating systems.

The International Honey Bee Breeding Network: a new association to connect breeders and achieve improvement and conservation of honey bees

Cecilia Costa [1,], Bjorn Dahle [2, 3], Dylan Elen [4], Raffaele Dall'Olio [5,], Egoitz Galartza [6], Maja Drazic [7]

[1]CREA - AA, Bologna , Italy ; [2]Norwegian Beekeepers Association (NBA); [3]Norwegian University of Life Sciences (UMB); [4] Bangor University (Wales); [5] BeeSources, Bologna, Italy; [6] Erbel, Iberian Bee (Erle Beltza) Breeding Association, Spain; [7] Hrvatska poljoprivredna agencija, Zagreb, Croatia

A new organization "International Honey Bee Breeding Network" (IHBBN) was founded on October 19th in Hohen Neuendorf, Berlin, where the regional coordinators of SMARTBEES breeding activities and other colleagues involved in the breeding and conservation convened. The agenda of the meeting was to establish an organization that could support the continuation of SMARTBEES work for improvement of local populations and conservation of honeybee subspecies. After agreeing on the statutes the participants, several of which representing breeders and honey bee conservation associations from across Europe, elected a management and advisory board, each with 6 members.

The aim of the organization is to aid to the genetic improvement of local honey bee stocks and the conservation of the different subspecies of the honey bee within their native range. This shall be achieved by coordinating honey bee breeding and conservation activities; collaborating with local networks; facilitating the trust and interaction among the breeders; improving the genetics in terms of Varroa resistance and other desirable traits; assisting in administrative issues.

We imagine that in the future IHBBN can conduct and/or participate in scientific research as well as execute educational as well as promotional activities.

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