In partnership with

Varroa Control Task Force Workshop

Proceedings

Volcani Center of Agricultural Research Organization
Rishon LeZion, Israel,
20th to 22nd 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 Sharona – a restored German Templers' colony established in 1871
- Walk along Rothschild 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 night life located about 15km away from the Volcani Institute. We arranged a special price in BY14 TLV hotel located near the sea (545nis 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

Saturday 19th of January

20:30	Informal meeting in the BY14 hotel lobby

Sunday 20th of January

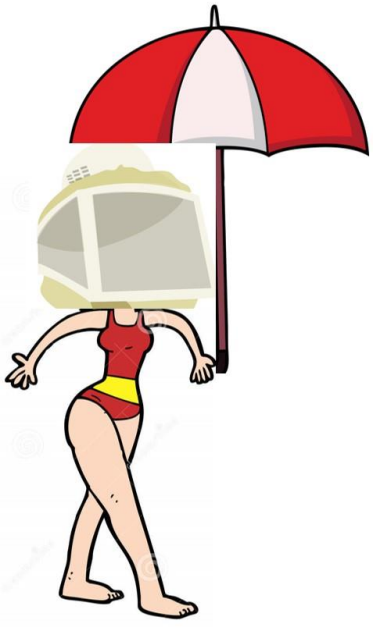
08:15	Ride from BY14 hotel to the Volcani Center (Haris hall)
09:00-09:30	**Registration**
09:30-9:45	Welcome by Zeev Meidan the Head of The Israeli Honey Board and Boaz Kanot the head of beekeepers association
09:45-10:00	General presentation of the TF by Giovanni Formato
10:00-11:00	Guest lecture: How to make the best tutorial (Avinoam Danin)
10:30-11:00	**Coffee break**
	11:00-12:30 Oral presentations
11:00-11:30	Current Varroa situation in Israel (Afik and Zarhin)
11:30- 11:50	Mechanical methods for Varroa Control (Asis)
11:50- 12:10	Varroa integrated control in autumn: trapping comb technique in association with oxalic acid (Formato)
12:10-12:30	BeeProTech: A revolutionary device for precise delivery of and compounds within hives for efficient and sustainable Varroa control (Ben Shimon and Korkidi)
12:30-13:30	**Lunch break**
13:30-14:30	Walking Tour in Volcani Center
14:30-15:30	Group discussions: **WG1** Infestation assessments: the joint paper (Petropaoli, via skype) **WG2** Brood interruption (Buchler) **WG3** Citizen Scientists (CSI Varroa) (Hatjina, Filipi and Kezic)
15:30-16:00	**Coffee break**
16:00-17:30	**WG4** Formic acid: the joint paper (Dainat) **WG5** Assessment of new control methods: Queen caging and trapping comb techniques in association with oxalic acid treatment to control Varroa destructor: efficacy and impact on honey bee and viruses population (Presern) Results of the Varromed® field trials: in Italy (Formato) **WG6** Communication (Soroker and Vejsnaes) **WG7** Varroa rearing in vitro (Formato)
17:30	Ride back to Tel-Aviv
19:00	Walking to the old train station followed by informal dinner at local restaurant

Monday 21st of January

08:15	Ride from BY14 hotel to Volcani apiary at Tzriffin
09:00-11:00	Visit to Volcani apiary at Tzriffin**.** Methods of Varroa monitoring protocol by SmartBees-Alexander Uzonov Local Varroa monitoring by Paz Kahanov, Shlomi Zarhin and Ohad Afik. To Be^2 invention demonstration
	Coffee break
11:00-11:30	Ride to Volcani
11:30-12:30	Poster session and group discussions
12:30-14:00	**Lunch break**
14:00-15:30	Discussion open slot
15:30-16:00	**Coffee break**
16:00-17:30	Closing discussion outcome of the workshop, future workshop
17:30	Ride back to Tel-Aviv
19:00	Optional walk to Jaffa old city

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



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

Avi Ben Shimon and Ron Korkidi	**BeeProTech: A revolutionary device for precise delivery of and compounds within hives for efficient and sustainable Varroa control**
Ohad Afik and Shlomi Zarhin	**Current Varroa situation in Israel**
Sharon Asis	**Mechanical methods for Varroa Control**
Giovanni Formato	**Varroa integrated control in autumn: trapping comb technique in association with oxalic acid**

Posters

Nurit Eliash	**Varroa chemosensing as a target for new management tools**
Dariusz Gerula	**Efficacy of Varroa mite treatment using strips containing amitraz in bee colonies with high Varroa infestation level**

Efficacy of Varroa mite treatment using strips containing amitraz in bee colonies with high Varroa infestation level

Dariusz Gerula, Wegrzynowicz, Beata Panasiuk, Malgorzata Bienkowska

Research Institute of Horticulture Pulawy

In June 2017, two apiaries were created in 10 km distant from each other: apiary with Cariolan (N = 14) and apiary with Caucasian (N = 12) queens. Bee colonies were prepared in hives with movable bottom board and beewax comb foundation populated with c.a. 15,000 worker bees and fumigated with tablet containing 12.5 mg of amitraz. Then no other Varroa control treatment was applied during the whole season.

In spring 2018, the winter bee and mite fall was assessed. Then during Salix spp. flowering, when capped brood was in the colonies, the daily natural mites fall was on average 0.29 (0.0-3.75) mite per colony. The colonies' strength and general condition did not indicate high level of mites in that period. In June, the mites were already visible, the colonies clearly weakened and the wingless workers with Varroa mites on bodies crawled at hive entrances. At that time, the natural daily fall was 5.64 (0.16-33.0) of mite per colony and the bee infestation (powder sugar method) reached on average 3.05 (0.64-10.0) mite per 10g of bees. After main honey harvest (July 5), at least 1 month earlier than in other years, the regular Varroa mite control was performed applying two plastic strips containing 500 mg of amitraz.

During the 8 weeks of the strips exposure, an average of 3329.4 (647-6229) dead mites were counted. Based on the last week's result, reaching an average of 370.5 (47.0-1800) mites per colony, it was decided to prolong amitraz exposure period recommended by the producer. The treatment was extended for the following 21 days by caging queens to prevent laying eggs. At that period, an average of 594.2 (55-2786) mites per colony fell, of which 62% after the first week, then 26 and 12% after the 2 following weeks. During the broodless period, additional control treatments were applied: trickling bees with 3.6% oxalic acid solution followed by fumigation with a 12.5 mg amitraz. During these treatments, an average of 30.8 (3-272) dead mites per colony fell within the next three weeks. The effectiveness of treatment after an 8-week exposure of the strips was on average 84.7% (56.6-96.5). In Carniolan colonies the effectiveness was lower (80.6%), comparing to Caucasian (89.4%). Finally, the 11 weeks exposure of strips, combined with broodless period in bee colonies resulted in a satisfactory treatment effectiveness level of 99.2%.

High infestation of bee colonies at the end of 2018 an average of 3954.4 (906-7161) mites and especially the early spring occurrence of Varroa symptoms indicated a high level of mites in the colonies before previous winter. If the treatment was not taken early summer, most colonies would not survive until the end of the season. The above data indicate the mite re-infestation and the extremely high reproductive potential. On the other hand, alarming is also low efficacy of a formulation containing amitraz, and especially the need for prolonged exposure, and additional broodless period.

The mechanical methods for Varroa removal

Sharon Asis [1,2], Yoram Raih[2], Ido Bruno[3], Victoria Soroker[1]

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This study based on the understanding that mechanical means for parasite removal are common in the animal kingdom. We thus cheeked the possibility to take care of the Varroa problem via two mechanical means: brushing and powdering.

Studying the brushing possibilities, we compared the morphology of the brushing heir of *Apis ceranae* (the original host of the Varroa) with those of *Apis mellifera*. We have found some differences that can explain the differences in grooming efficacy between the two honeybee species. We have also conducted several attempts to design brushes for Varroa removal, but these did not prove successful.

Regarding the powders, we tested different particle sizes in the lab and in the hive. We have found that certain particle sizes are more effective than others in Varroa removal, affecting both Varroa attachment abilities and honeybee behavior.

Current Varroa situation in Israel

Ohad Afik and Shlomi Zarhin

The Extension Service, Ministry of Agriculture and Rural Development, Bet Dagan, Israel

Controlling Varroa mite populations pose a great challenge for commercial beekeepers worldwide and especially in Israel, where due to mild winter, hives contain brood combs year round. The lack of a season without a brood makes Varroa treatments less effective and hives are constantly infested with a certain level of mites. In addition, mite resistance to coumaphos and fluvalinate was recorded leaving amitraz as almost a sole treatment against Varroa. In order to find the best timing to apply treatments we keep on monitoring Varroa levels at various sites and seasons around the country. Varroa monitoring is also expected to provide indications for any development of resistant against amitraz and, on the other hand, to assist in making decisions concerning reintroduction of old acaricides.

During the last few years we also observe increasing levels of *Braula coeca* in Israel, most probably due to the withdrawal of coumaphos treatments. Though braula does not considered as a significant pest for beekeeping, many beekeepers misidentify it as Varroa mites and wrongly report about failure of treatments, adding a new challenge to Varroa monitoring.

BeeProTech: A revolutionary device for precise delivery of compounds within hives for efficient and sustainable Varroa control

Avi Ben Shimon and Ron Korkidi

To Bee^2, Influencing innovation, Israel

The active ingredient distribution of currently available anti-Varroa products is either temperature or bee dynamic dependent. Consequently the available products suffer from insufficient efficacy, inconsistent activity, use of excessive amount of miticides, long treatment times and the development of resistant mite strains.

BeeProTech is holistic bee healing and hive management device which provides highly controlled precise delivery of bee healing compounds within hives. The device allows fumigation based delivery of volatile as well as none volatile compounds. Using Tau-fluvalinate/Amitraz, BeeProTech achieves over 98% Varroa reduction using tenth of the miticides amounts and third of the treatment time with respect to control (6 weeks synthetic strips). Preliminary studies of temperature independent delivery of Thymol also provide very promising results.

Varroa chemosensing as a target for new management tools

Nurit Eliash [1,2], Starlin Thangarajan[1], Inna Goldenberg[1], Noa Sela[1], Yosi Kamer[1], Ada Rafaeli[1] & Victoria Soroker[1]

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The tight synchronization between the life cycles of the parasitic mite *Varroa destructor* and the honeybee is mediated by chemical stimuli from the brood and adult bees. These stimuli are mainly perceived by a pit organ located at the distal part of the mite's foreleg. Despite the significance of chemical cues in the parasite lifecycle, information on the molecular structure and function of chemosensing in Varroa is mostly lacking. Via transcriptomic and proteomic approaches, we looked for specific chemosensory proteins. Based on the presence of conserved domains, we identified in the Varroa foreleg transcripts of chemosensory related genes belonging to several groups. These included Niemann-Pick disease protein type 2 (NPC2), gustatory receptors (GRs), ionotropic receptors (IRs), sensory neuron membrane proteins (SNMPs) and odorant binding proteins (OBPs). However, no insect odorant receptors (ORs) and odorant co-receptors (ORcos) were found. In particular, we compared the expression profile of Varroa forelegs relative to its rear legs (as control) and mites' forelegs from the two main physiological stages, phoretic and reproductive, those differ in their host orientation behaviour. The analysis revealed transcripts and proteins up-regulated in the mite's foreleg, of which 14 were chemosensory related. Phylogenetic analysis shows that some of the Varroa chemosensory-proteins are conserved across Arthropods while others Arachnid-specific, with low similarity to insects. These Arachnid-specific chemosensory proteins are promising targets for development of new tools for Varroa management via specific disruption of Varroa chemosensing, without impairing the colony chemical communication.

Varroa integrated control in autumn: trapping comb technique in association with oxalic acid

Jorge Rivera-Gomis, Marco Pietropaoli, Giovanni Formato

"Apiculture, Honey Bee Productions and Diseases" Laboratory, Istituto Zooprofilattico Sperimentale del Lazio e della Toscana "M. Aleandri", Rome, Italy

The parasitic mite *Varroa destructor* is considered the most damaging pathogen of *Apis mellifera*. Control strategies range from biotechnical methods to treatments with acaricides. In the study here presented, we evaluated the acaricide efficacy given by the *V. destructor* integrated control given by the combination of the trapping comb technique with the oxalic acid treatment against.

In autumn 2016 in Rome municipality (Central Italy - temperate climate region), we conducted a field trial on 16 honeybee colonies (8 honey bee colonies treated + 8 honey bee colonies untreated/control) homogeneous in terms of strength and Varroa infestation levels, housed in standard 10 frame Dadant-Blatt hives. Queens were caged in the trapping comb named "Bigabbia Cassian" cage, which allow the queen to lay eggs in a single empty comb (same dimension of the combs that are used for the super). After a caging period of 20 days the trapping comb was removed and the queens transferred into a Var-control cage to prolong the caging period during the follow-up treatment. After removing the trapping comb, we applied an oxalic acid treatment by trickling. Mite fall was quantified for 14 days, and the follow-up treatment was applied using a double dosage of amitraz (Apivar).

The miticide efficacy of the trapping comb technique was 48,3%±15,7% + 16,4% of mites that remained trapped inside the capped brood of the removed trapping combs for a final acaricide efficacy of.64.7%±15,7%. Associating the oxalic acid treatment in absence of brood, we obtained the final 97,7%±2,8% average acaricide efficacy.

No queen mortality was observed during the integrated control tecnique and all queens (100%) were reaccepted after their release. Eggs were found in all colonies 1 day after the release.

These results reflect the usefulness of the trapping comb technique, above all when associated with the oxalic acid, increasing the final efficacy of both control methods. Further research should be carried out in order to compare different types of combs or the combination of the trapping comb with different acaricidal treatments.

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