14th COLOSS Conference

Full Proceedings

Ghent, Belgium, 16-17 September 2018
@ Ghent University, Belgium (prior to EurBee 8)

14th COLOSS Conference

TOPICS

- International meeting of COLOSS to provide an update on the network's achievements and future directions, including meetings for COLOSS Core Projects and Task Forces.
- Annual General Assembly Meeting
- Focus on two new invasive species in Europe – small hive beetles, *Aethina tumida* and Asian hornets, *Vespa velutina*

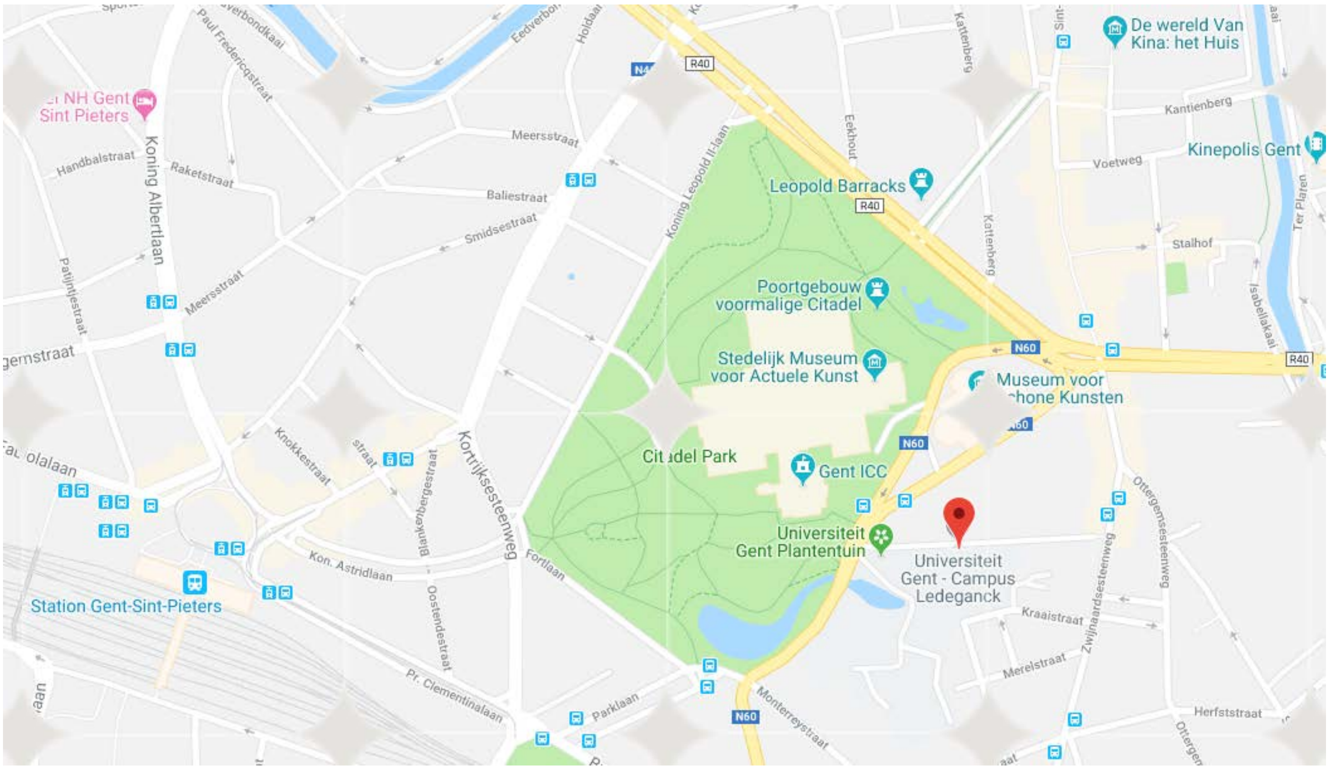
WHEN

15 September Executive Committee Meeting in the evening (open to EC members only)

16-17 September COLOSS General Assembly and discussions (open to all COLOSS members); see detailed schedule below.

WHERE

Ghent University – campus Ledeganck
Karel Lodewijk Ledeganckstraat 35
9000 Gent, Belgium



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REGISTRATION

- A registration fee of **40 Euros** covers entry, coffee breaks, lunches, and the social dinner. Please bring exact change.
- Due to limited financial support, participants will NOT be reimbursement for travel and accommodation.

POSTER SESSION

- **All poster abstracts have been accepted**
- All participants submitting abstracts for posters are expected to present their posters during the evening apéro on 16 September (see schedule for details).
- Poster dimensions: no larger than A0 (84.1x118.9 cm)
- If the first author is a student, please sign your poster as “Student poster”. The best poster by a student will receive the prestigious COLOSS award.
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TRAVEL & ACCOMMODATION

- **Please refer to information provided by EURBEE (http://www.eurbee2018.org/)**

Dear colleagues,

On behalf of the local organizing team, I would like to welcome you to the 14th COLOSS conference in Gent, Belgium. I was truly delighted that so many people will participate this time.

I would like to sincerely thank all the people, who made this meeting possible. In particular, it would have been impossible without the tireless efforts of Dirk de Graaf and his local team.

Appreciation is also addressed to all contributors for submitting their abstracts, which I hope will stimulate rewarding discussions.

Please be so kind and take in advance into consideration to plan our activity until the next COLOSS conference.

Financial support is kindly granted by the Eva Crane Trust, the Ricola Foundation *Nature and Culture*, Veto Pharma and the Vinetum Foundation.

I am looking forward to fruitful discussions with all of you, and hope you will enjoy this conference.

Yours sincerely,

Peter Neumann, President COLOSS Association

DETAILED SCHEDULE

14th COLOSS Conference, 2018

SCHEDULE – Saturday, September 15

Session 1 – COLOSS Executive Committee Meeting 1 (for Executive Committee members only)	
19:00-20:30	**Meeting of the COLOSS Executive Committee**

SCHEDULE – Sunday, September 16

Session 2 – COLOSS General Assembly Meeting 1	
07:45-08:30	**Sign-in & coffee**
08:30-08:35	Welcome by COLOSS President and Local Organizing Committee Chair
08:35-10:30	General Assembly Discussions
10:30-11:00	**Break**, with drinks & snacks
Session 3 – COLOSS Updates	
11:00-12:30	COLOSS Core Project & Task Force updates annual achievements (3 CPs & 8 TFs; 8 mins. ea.)
12:30-14:00	**Lunch (covered) & poster set-up**
Session 4 – Concurrent Discussion Groups 1	
14:00-16:00	1. Monitoring, 2. Survivors, 3. Vespa velutina
16:00-16:30	**Break**
Session 5 – Concurrent Discussion Groups 2	
16:30-18:30	1. CSI Pollen, 2. B-RAP, 3. Bee Breeding
Session 6 – Posters & Social Dinner	
18:30-20:00	**Poster session** with apéro
20:00-	**Social dinner**

SCHEDULE – Monday, September 17

Session 7 – Concurrent Discussion Groups 3	
08:30-10:30	1. Varroa control, 2. APITOX, 3. Small Hive Beetle
10:30-10:45	**Break**, with drinks & snacks
Session 8 – Concurrent Discussion Groups 4	
10:45-12:45	1. B-RAP, 2. Viruses, 3. Varroa Control
12:45-14:30	**Lunch**
Session 9 – Concurrent Discussion Groups 5	
14:30-16:30	1. APITOX, 2. Monitoring, 3. Bee Breeding
16:30-16:45	**Short break**
Session 9 – COLOSS General Assembly Meeting 2	
16:45-17:45	Updates from Core Projects & Task Force discussions
17:45-18:30	Final General Assembly discussions, plans & Farewell
Session 10 – Executive Committee Meeting 2 (for Executive Committee members only)	
20:00-21:00	Debrief meeting of the COLOSS Executive Committee

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NOTES

NOTES

1. **Diagnosis and molecular detection of Paenibacillus larvae, the causative agent of American foulbrood in indigenous honey bee of Saudi Arabia**

Mohammad Javed Ansari [1], Ahmad Al-Ghamdi[2]

[1]Department of Botany, Hindu College Moradabad-244001, [2]Bee Research Chair, King Saud University Riyadh, Saudi Arabia

Apis mellifera jemenitica, the only indigenous honey bee race of Saudi Arabia, is well adapted to the harsh local environmental conditions. A large-scale field survey was conducted to screen major Saudi Arabian beekeeping locations for infection by Paenibacillus larvae. P. larvae is one of the major bacterial pathogens of honey bee broods and is the causative agent of American foulbrood disease. Larvae from samples suspected of infection were collected from different apiaries and homogenized in phosphate-buffered saline. Bacteria were isolated on MYPGP agar medium. Two bacterial isolates, ksuPL3 and ksuPL5 (16S rRNA GenBank accession numbers, KR780760 and KR780761, respectively), were subjected to molecular identification using P. larvae-specifc primers. A BLAST sequence analysis revealed that the two isolates were P. larvae with more than 98% sequence identity. This detection of P. larvae in the indigenous honey bee is the first recorded incidence of this pathogen in Saudi Arabia. This study emphasizes the need for the relevant authorities to take immediate steps towards treating and limiting the spread of this disease throughout the country

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2. **Taskforce 'Survivors': Darwin's Black Bee Box put in action again**

Tjeerd Blacquiere

Wageningen University & Research

Having learned from three independent naturally developed Varroa resistant honey bee populations since 2007-2009 up to now, in the TF ‘Survivors’ meetings in Athens, Avignon and Bern (2016-18) we called for joining our Darwin Black Bee Box approach aiming to allow nature to build new survivor populations from own local bee stocks. This approach can be used in addition to looking for reported survivor populations, and may in a few years result in several well traceable and documented examples.

In our institute we have now set up three new populations of honey bee colonies from local origins: one in Burscheid (Germany), one in Almere (Netherlands) and lately one in Geel (Belgium). In all locations 2018 is the first year, in which we as much as possible mix the genes / alleles of the colonies per location by within population mating, and in which we perform the last varroa control. To that aim we did split the initial 20-25 colonies per location each into ~four nukes with each their own virgin queen, drones and mites. This has taken place in the summer of 2018. From now on no Varroa control will be performed anymore, except in a control / reference subpopulation (which mates separately and within the subpopulation).

At this moment we have young developing colonies which will grow to a strength that allows them to survive the next winter in good shape, and to propagate next spring / summer to constitute the next generation. There are 46 colonies in Almere, 42 in Burscheid and ~40 in Geel. Inside the black boxes and through exchange within the populations between colonies, the co-evolution between the honey bees, the varroa mites and the (micro-) biome can take its course. Let us see what comes out. This project will run for four years, financially and mentally supported by a number of companies and (anonymous) foundations and their and our unstoppable enthusiasm, but will probably and hopefully be sustained afterwards.

3. Investigating colony-level health traits in Canada's honey bee population

Renata S. Borba [1,2],Robert Currie[3], Pierre Giovenazzo[4], Marta Guarna[2], Shelley Hoover[5], Amro Zayed[6], Leonard J. Foster[1], Stephen F. Pernal[2]

[1]University of British Columbia, Center for High-Throughput Biology,[2]Agriculture and Agri-Food Canada, Beaverlodge Research Farm,[3]University of Manitoba, Entomology Department,[4]Universite Laval, Departement de Biologie,[5]Alberta Agriculture and Forestry,[6]York University, Biology Department

Overwintering mortality of honey bee colonies in Canada has been continuously greater than the acceptable range of 0% to 15% since the winter of 2006/2007. The main causes of colony death, as reported by Canadian beekeepers, include high pathogen/parasite infestation levels (e.g. Varroa mites, Nosema spp.), poor quality queens and severe weather conditions. Every year, Canadian beekeepers import hundreds of thousands of queens, mainly from the U.S.A. and New Zealand. The importation of foreign queens has the potential to introduce undesirable pathogens or genetics and supply bees that have not been selected to survive in northern temperate climates. The two main goals of our project is to: 1) develop genomic and proteomic markers for 12 economically-valuable traits (colony phenotypes), which will enable local queen producers to rapidly select and breed healthy and productive colonies that are well adapted to the Canadian climate; and 2) study the variation of each trait among colonies located in different landscapes and climates in Canada, as well as the correlation between phenotypes. In 2016, 1025 colonies across Canada (British Columbia, Alberta, Manitoba, Ontario and Quebec) were sampled and phenotypic data was collected for the following colony-level traits: 1) Varroa mite population growth 2) grooming behaviour; 3) hygienic behaviour; 4) defensive behaviour; 5) honey production; 6) sealed brood population; 7-9) pathogen abundance (viruses, Nosema spp., Trypanosomatids); 10) innate immunity factors; 11) gut microbiota; and 12) overwintering success. The identification of bio-markers for each trait, and the variation of each trait among colonies located in different landscapes and climates in Canada, as well as the correlation between phenotypes comprised the first step of this novel research. In the summer of 2017, 496 colonies were sampled and putative markers were validated against a test population, with the end goal of having this technology transferred to end-users, such as the National Bee Diagnostic Centre (Beaverlodge, AB), where it will be made available to beekeepers. This is the first large-scale study for marker assisted selection in honey bees using integrated genomics and proteomics tools. Our innovative research will promote a healthier honey bee population and support the sustainability of the Canadian beekeeping industry.

4. Honey bee dependence on wild flowers in an agricultural landscape

Nuno Capela, Artur Sarmento, Henrique Azevedo Pereira, Jose Paulo Sousa

University of Coimbra

In the last 50 years the area of pollinator dependent crops has increased by 70% in the developed countries. However, the pollination services can't keep up with this demand as wild bees are becoming extinct and honey bees' populations are declining in Europe and United States due to colony collapse disorder. This decline appears to result from the combination of multiple chemical, biological and environmental stressors. The last includes habitat fragmentation, monocultures and the lack of flower resources, all resulting from the current intensive agricultural practices. In order to fulfill their nutrient needs and provide pollination services, honey bees must rely on few semi-natural habitats (meadows, field margins”¦). To evaluate the dependence on these semi-natural habitats pollen was collected from 5 hives, every 15 days during sunflower blooming (from July to September) in Burgos, Spain. Pollen diet composition was evaluated and compared between hives for each sampling date, as well as the apiary diet throughout the season. Hive demography data (population size, closed and open brood, pollen and honey reserves) was also recorded every 15 days and related to pollen mass collection. Our results show that during sunflower blooming, and despite the huge pollen offer from sunflower crops, at least half of the honey bee diet depends on wild flowers. Also, after sunflower blooming peak there was a shortage in pollen collection, since the hives started to reduce their population. These results support the agricultural schemes that promote flower diversity in agricultural landscapes, as honey bees rely on these wild flowers to survive.

5. Genomic analyses reveal demographic history and temperate adaptation of the newly discovered honey bee subspecies Apis mellifera sinisxinyuan n. ssp.

Chao Chen[1], Wei Shi[2]

[1]Institute of Apicultural Research, [2]Chinese Academy of Agricultural Sciences

Studying the genetic signatures of climate-driven selection can produce insights into local adaptation and the potential impacts of climate change on populations. The honey bee (Apis mellifera) is an interesting species to study local adaptation because it originated in tropical/subtropical climatic regions and subsequently spread into temperate regions. However, little is known about the genetic basis of its adaptation to temperate climates. Here, we resequenced the whole genomes of 10 individual bees from a newly discovered population in temperate China and downloaded resequenced data from 35 individuals from other populations. We found that the new population is an undescribed subspecies in the M-lineage of Apis mellifera (Apis mellifera sinisxinyuan). Analyses of population history show that long-term global temperature has strongly influenced the demographic history of Apis mellifera sinisxinyuan and its divergence from other subspecies. Further analyses comparing temperate and tropical populations identified several candidate genes related to fat body and the Hippo signaling pathway that are potentially involved in adaptation to temperate climates. Our results provide insights into the demographic history of the newly discovered Apis mellifera sinisxinyuan, as well as the genetic basis of adaptation of A. mellifera to temperate climates at the genomic level. These findings will facilitate the selective breeding of A. mellifera to improve the survival of overwintering colonies.

6. Protecting Beehives from other insects with computer vision & deep learning

Siegfried Dhont, Dirk Van den Poel, Jean-Jacques De Clercq, David Gooskens

Ghent Unviversity, Faculty of Economics, RESEARCH CLUSTER Big Data ANALYTICS

There are 2 possible methods for avoiding parasites and enemy intrusion: Actual Method : up to now worldwide attempts have been made to protect bees from parasites with biochemical products (AFTER-THE-FACT or just-to-late approach). Indeed, once the beehive gets infected the fight against parasites is often lost. Disadvantage : most parasites become often immune against those products within the year and still more frightening is that we don't always know the adverse effects of these products on the health of bees, honey and people. Time has come to change completely our way of thinking and look for more ecological and less detrimental solutions! New Method (this project) : a highres camera detects what kind of insect enters the beehive with Computervision and Deep Learning techniques. All non-bee insects and infected bees are kept out by capturing them in one of the 32 available entrance channels with electronic valves in front and back. This project is preventing that anything unwanted gets into the beehive (PREVENTIVE or just-in-time approach). Eventually an email can be sent to the beekeeper to warn him from the intruder.

7. Enhancement of chronic bee paralysis virus levels in honeybees acute exposed to imidacloprid: A Chinese case study

Qingyun Diao[1], Beibei Li[1], Hongxia Zhao[2], Yanyan Wu[1], Rui Guo[3], Pingli Dai[1], Dafu Chen[3], Qiang Wang[1], Chunsheng Hou[1]

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Though honeybee populations have not yet been reported to be largely lost in China, many stressors that affect the health of honeybees have been confirmed. Honeybees inevitably come into contact with environmental stressors that are not intended to target honeybees, such as pesticides. Although large-scale losses of honeybee colonies are thought to be associated with viruses, these viruses usually lead to covert infections and to not cause acute damage if the bees do not encounter outside stressors. To reveal the potential relationship between acute pesticides and viruses, we applied different doses of imidacloprid to adult bees that were primarily infected with low levels (4.3x105 genome copies) of chronic bee paralysis virus (CBPV) to observe whether the acute oral toxicity of imidacloprid was able to elevate the level of CBPV. Here, we found that the titer of CBPV was significantly elevated in adult bees after 96 h of acute treatment with imidacloprid at 66.9 ng/bee compared with other treatments and controls. Our study provides clear evidence that exposure to acute high doses of imidacloprid in honeybees persistently infected by CBPV can exert a remarkably negative effect on honeybee survival. These results imply that acute environmental stressors might be one of the major accelerators causing rapid viral replication, which may progress to cause mass proliferation and dissemination and lead to colony decline. The present study will be useful for better understanding the harm caused by this pesticide, especially regarding how honeybee tolerance to the viral infection might be altered by acute pesticide exposure.

8. San Michele all'Adige Declaration, Appeal for biodiversity protection of native honey bee subspecies of Apis mellifera Linnaeus, 1758 in Italy

Paolo Fontana, Valeria Malagnini, Gino Angeli, Livia Zanotelli

Edmund Mach Foundation, San Michele all’Adige (Trento, Italy), Protection of agroforestry plants and beekeeping Unit

On 12 June 2018, a consensus paper, written by the Italian scientific community involved in research on bees and beekeeping, was presented at San Michele all'Adige, at the headquarters of the Edmund Mach Foundation. This document, the San Michele all’Adige Declaration, can be downloaded at this link: https://eventi.fmach.it/Carta-di-San-Michele-all-Adige/La-Carta-di-San-Michele-all-Adige. This document, drawn up and signed by exponents of authoritative research institutions and by key figures in the beekeeping and environmental fields, wishes to make political administrations aware of the urgency of granting adequate protection to the honey bee (Apis mellifera Linnaeus, 1758) and in particular to its indigenous subspecies. Despite being managed by beekeepers for many years, the honey bee cannot be considered as a domestic animal, and plays a key role in biodiversity conservation as a pollinator, with a high impact on agricultural production. The honey bee was originally distributed throughout most of Europe, Africa (including Madagascar), the Middle East, part of the Arabian Peninsula and some parts of Central Asia. From Europe, the honey bee was introduced to America, Asia and Oceania. Like all wild species, due to the evolutionary pathway and biology of this insect, adaptation to the environment is essential for the honey bee. This adaptation to a range of environmental conditions, together with geological and climatic changes in past eras, has resulted in subdivision of the Apis mellifera species into 31 subspecies. Due to the wide variety of environments, the Mediterranean area has the greatest intraspecific diversity. In the last 150 years, technological advances in beekeeping have caused a devastating genetic impoverishment, with an impact on honey bee production and pathologies, endangering conservation of the native subspecies of Apis mellifera in Europe. Evaluation of the impact of this phenomenon on the ecological equilibrium is still ongoing, while the negative effects that this problem is having on beekeeping are known and evident. This document sets forth the scientific arguments in support of this vision, on the basis of which we can proceed with concrete actions aimed to protect the honey bee, also as a biological entity, according to various operating methods. This document does not intend to oppose the actions of the beekeeping sector, but rather to contribute to a more global vision of the very serious problem of honey bee decline.

9. Monitoring of "Preclinic indicators" as innovative good beekeeping practice in modern apiculture

Jorge Rivera-Gomis[1], Antonella Cersini[1], Magali Chabert[2], Marie-Pierre Chauzat[2], Roberto Eggenhoeffner[3], Serkan Erat[4], Ales Gregorc[5], Walter Haefeker[6], Mariano Higes[7], Riccardo Jannoni Sebastianini[6], Charlotte Lietaer[8], Philip McCabe[6], Rudolf Moosbeckhofer[9], Dilek Muz[4], Mustafa Necati Muz[4], Nurullah Ozdemir[4], Marco Pietropaoli[1], Licia Ravarotto[10], Alexandra Ribarits[9], Marie-Pierre Riviere[2], Maja Ivana Smodis Skerl[11], Giovanni Formato[1]

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Good Beekeeping Practices (GBPs) can be defined as those activities that beekeepers apply for on-apiary production to attain optimal health for humans, honey bees and environment. The application of the GBPs, therefore, has a positive effect on colonies' health, on society in general and at the same time guarantees high production standards. With a final result to ensure more sustainability and resilience of the whole beekeeping sector.
Honeybee diseases and their global spread represent an important threat to the beekeeping sector, affecting its viability and productivity. Monitoring of "Preclinic indicators" is a GBP that beekeepers should practice to detect the presence of a pathogen in the hives before that the symptoms of the disease can be observed in the hive. In this way honey bee health and prevention of economic losses can be guaranteed. "Preclinic indicators" can be considered as an essential part of GBPs that should be kept in mind by modern beekeepers.

10. Activities in 2018 of the COLOSS core project on monitoring colony losses

Alison Gray[1], Robert Brodschneider[2]

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The annual workshop of the COLOSS monitoring group was held in Nitra, Slovakia, in February 2018, back to back with the COLOSS B-rap workshop, and a majority of participants attended both as there are common interests. Monitoring group members were able to contribute experience of surveys and questionnaires to the discussions at B-rap. Some new participants at the 2-day monitoring workshop itself included representatives from England, Belgium, Slovenia and Macedonia.
A large part of the discussion and presentation time addressed the use of LimeSurvey, as a software tool for an online survey. While some countries host their own independent online surveys, and the standardised COLOSS questionnaire is finalised at the annual workshop, this platform allows for a common survey in a standardised data collection form allowing some inbuilt data checking to enhance data quality. This option was taken up by numerous countries this year.
In this 10th year of the COLOSS monitoring, 36 countries returned data from their 2018 survey for common analysis of colony loss rates, compared to 30 countries in 2017 and 29 in 2016, including for the first time Greece and Bulgaria. The Netherlands was able to contribute again after a break last year. There was an exceptional response from England, which has been noticeably unrepresented in the COLOSS data returns of recent years. Hungary returned after several years of absence. Portugal was also able to send data, after beginning monitoring in summer 2017.
The series of short journal articles summarising winter loss rates begun in 2016 is now established, and the second of these appeared in the Journal of Apicultural Research in May 2018, after a publication delay. We expect this year’s paper to be submitted in the next few weeks. As well as comparative loss rates, these papers have been examining the effect of one or more risk factors for loss. A significant association of the risk of winter loss with operation size has been established, in that larger operations are at lower risk, which confirms effects reported by other researchers. While migration had an effect in certain countries singly, for the countries represented in the data as a whole it has not been found to be a significant factor. The current work is examining the role of certain forage crops, building up a picture of risk factors related to management and the environment in the vicinity of the apiary. These complement previous publications of the monitoring group which also use a modelling approach.

11. Bee Scanning

Bjoern Lagerman

University of Orebro

An App has been developed by the Swedish company Fribi Holding AB with European funding to scan a beehive for varroa mite infestation, deformed wing virus (DWV) and presence of queen. The technology uses artificial intelligence to analyse images. It enables anyone with a smartphone to diagnose the need for treatment. Beescanning is building the worlds lagest database of images of bees on the comb. Now 10 000 images and manually labeled regions. Purpose besides helping the beekeeper is to find healthy and resistant bee populations. Coming features include detection of decapped brood, all visible diseases including american foul brood and instant queen spotting. Database for analysing video sequences is under way.

12. The LIFE STOPVESPA project: progress and achievements

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The LIFE STOPVESPA project (LIFE14 NAT/IT/001128 STOPVESPA - Spatial containment of Vespa velutina in Italy and establishment of an Early Warning and Rapid Response System) aims to contain the spread of Vespa velutina, an invasive species that causes serious damage to beekeeping and biodiversity, in Italy. It is coordinated by the University of Turin-Department of Agricultural, Forest and Food Science in collaboration with the Polytechnic University of Turin-Department of Electronics and Telecommunications, the Beekeeping Association of Piedmont ASPROMIELE Piemonte, and the Abbazia dei Padri Benedettini Santa Maria Finalpia in Liguria. The project started in August 2015 and will finish in July 2019.
From the beginnings, the project aimed to rise consciousness of V. velutina impact in decision makers, beekeepers, farmers, students, other research centers, and the general public, in order to gather information on the spread of this hornet in Italy by developing a citizen science scheme through the project internet site (www.vespavelutina.eu). By the end of 2017, V. velutina has colonized the westernmost part of Liguria (the whole Imperia district and part of Savona district) up to 750 m above the sea level; the species was also present in an small area of south-western Piedmont, however with a rather insignificant population. Outside these areas, a single nest had been identified in Bergantino (Veneto) in 2016 and a repeated presence of workers was observed in La Spezia (eastern Liguria region) and in Pietrasanta (Tuscany) in 2017, thus suggesting the presence of at least one nest in each locality. Moreover, single adults were reported from other few localities of Piedmont and Liguria. Within the project, a harmonic radar prototype has been developed for tracking hornets to their nests. The radar is capable to cover 360Â° in the horizontal plane and a large field of view in the vertical plane (20Â°) and allows to follow the tracks of the hornets tagged with a 12.3 mm wire antenna and a diode (12.1 mg) up to 500 m. This prototype is fully operational from October 2017 and has already allowed the identification of three nests in Liguria in 2017; it is actively employed since the beginning of the summer of 2018.
The identified nests are destroyed mainly by trained teams within the project activities or, to a smaller extent, by firefighters, civil defense or other volunteers. On a whole, 233 nests were destroyed in 2015, 487 in 2016, and 419 in 2017.
Part of the nests have been collected and analyzed to acquire indications on V. velutina biology. The project is also evaluating the effectiveness of the capture of V. velutina gynes in spring and the impact this hornet on beekeeping, wild bees, and native wasp communities.

13. Monitoring Sensitivity to Amitraz Helps Maintain our Arsenal of Anti-Varroa Weapons

Raphaele Massard

CEO Veto-pharma

Amitraz is one of the most-used active ingredients in the treatment of honey bee colonies against Varroa destructor in the majority of countries worldwide. This heavy use raises some concerns regarding the potential emergence of resistance to Amitraz. If Varroa mites develop resistance to Amitraz, it would prove catastrophic for many beekeepers who have limited options for mite control. Many independent global organizations conduct regular efficacy studies to monitor mites' resistance to Amitraz. Studies conducted in Lithuania, Spain, Italy and France during 2016 and 2017 show efficacy levels of at least 97.0 percent. For example, the Spanish study, conducted by one of Europe's largest beekeeper cooperatives, examined seven colonies in the autumn of 2017. Fifty days after treatment, the study indicated average efficacy of 97.98 percent. The same study conducted the previous year showed average efficacy of 99.67 percent after 70 days of treatment. Annual monitoring in Italy's Piedmonte region shows average efficacy of 98.0 percent in 20 colonies since 2008. A French trial on 15 colonies recorded average efficacy of 99.0 percent after 10 weeks of treatment. A smaller-scale Lithuanian efficacy test conducted in 2016 showed average efficacy of 87.8 percent at a low infestation level. This monitoring activity should be increased to include not only Layens and Dadant hives, but also Langstroth hives, and monitoring should be conducted in more regions and countries. Only by monitoring the efficacy of registered products on a global level will beekeepers will have a clear understanding of the resistance situation. In addition to expanded monitoring, beekeepers should also use quick, ready-made resistance tests in their apiaries, and consider Varroa management as part of their integrated pest management program.

References: Testapi 2017 GLP Study 302-2017 / Ensayo de efficacia Apivar (campana 2017), Pinofranquedo, del 6 noviembre de 2017 al 29 enero de 2018. / Short and long-term efficacy of Apivar and residues analysis of honey and wax in Piemonte, Italy / Mandelli, Umberto. 2009. “Valutazione dell’efficacia di Apivar in periodo invernale”. L’Apis: No. 6 Agosto/Settembre 2009. / Fissore, Andrea; Barbero, Roberto. 2014. “Efficacia di Apibioxal e Apivar nello scorso inverno”. L’Apis: No. 9 Dicembre 2014. / Allais, Luca. 2015. “Apivar: Efficacia e residui”. L’Apis: No. 2 Febbraio 2015. / Lithuania: Apivar efficacy test 2016

14. Parasitic mites, Varroa destructor, are present on drone honey bees, Apis mellifera, at aerial mating sites

Ashley N. Mortensen[1,2], Cameron J. Jack[1], James D. Ellis[1]

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Drifting behavior in worker honey bees (Apis mellifera L.) is one of the mechanisms by which the parasitic mite Varroa destructor moves between host honey bee colonies. Drone honey bees also can drift to another colony, especially during daily mating flights to/from drone congregation areas (DCAs). Varroa have been observed to infest drone brood at higher rates than they do worker brood, but there have been no investigations of the potential for Varroa to be present on adult drones during mating flights. We conducted a survey of drones present at five DCAs in central Florida, USA to determine if drones carry Varroa when flying outside of their hive. Varroa were recovered from drones at each DCA. Furthermore, drones from DCAs 0.25 km from managed apiaries had lower Varroa/100 drones than did drones collected >2.8 km from managed apiaries. This study is the first to confirm that drones present at DCAs do carry Varroa, thus suggesting that drone honey bees also may play a role in inter-colonial Varroa dispersal.

15. Artificially-reared honey bee larvae express a normal behavioural repertoire as adults

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Cooperative behaviours observed in social insects are often regarded as simple instinctual responses to positive and negative feedback. However, learning and cognition have been demonstrated in some behaviours within eusocial colonies. We have utilized the dramatic differences in environment between natural and artificial rearing systems of honey bee, Apis mellifera L., larvae to explore the extent to which developmental environment may affect adult honey bee behaviour. During natural development in a hive, honey bee larvae interact extensively with nurse bees, whereas social interactions are almost eliminated when honey bee larvae are reared artificially in the laboratory. Naturally- and artificially-reared adult honey bees were introduced into an observation hive and observed twice daily for 28 days. Artificially-reared bees engaged in every behaviour in which naturally-reared bees engaged including: attending the queen, ventilation, guarding, attending a waggle dance, performing a waggle dance, and foraging. These observations highlight that artificially-reared bees are capable of preforming a myriad of honey bee behaviours. Additionally, there was not a detectable effect of rearing environment on the mean age at which bees were observed conducting specific age related behaviours, suggesting that artificially reared bees are responding appropriately to colony level cues that coordinate task allocation within age-related polyethism. However, we did observe a statistically detectable reduction in lifespan of bees that were reared artificially compared to bees that had been reared naturally. Our results indicate that rearing environment may not have pronounced impact on the likelihood that adult bees will perform a task. However, we only detected execution of each task and did not assess the quality of that task execution. Furthermore, these data do not address questions regarding collective behaviours that emerge at the colony level such as brood and/or honey production, swarming, or nest construction.

16. COLOSS welcome - the future is in our power

Peter Neumann

University of Bern

COLOSS emerged in 2008 as a COST Action and has now developed into a global, non-profit scientist association. COLOSS is dedicated to improving the well-being of honey bees by: 1) development of standard research methods; 2) coordinating and conducting large-scale honey bee monitoring and research projects; 3) disseminating knowledge and providing training related to the needs of bees and; 4) advocating for honey bees, and their conservation, especially to government legislators and administrators. This brief talk will provide strategic suggestions for the future of our association to be discussed in the GA.

17. 2018 - First Greek Colony Winter Loss Survey

Solenn Patalano, Nick Panagidis, Maria Bouga, Laetitia Papoutsis, Vaia Vouk, Fani Hatjina

Agricultural University of Athens

A survey based on the International COLOSS questionnaire was performed in Greece for first time. A number of 301 beekeepers, including 69 professionals (with more than 150 beehives) answered the questions about the health and the development of their colonies. The estimated 2017-2018 winter losses have an average of 22.3%, amongst which one third is due to worker bees' disappearance. Although beekeepers reported a renewal of above half of their queens, the hive performances don't seem to be impacted compared with those with older queens. Greek beekeepers have a long tradition on migratory beekeeping in order to find specific habitats to produce their honey. Indeed, professional beekeepers reported up to 9 moves (2.7 times on average) with an average of 115.7 km travelled. Pine, heather and thyme are amongst the most reported destinations for honey production. Finally, 93% of the Greek beekeepers performed several Varroa treatments all along the year. In conclusion, this first report represents only a small proportion of the beekeepers community, but it is a blueprint for a greater communication and understanding between the scientists and beekeepers communities in order to reduce the bee losses.

18. Accumulation of toxic elements in honey bees following a Nosema ceranae infection

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Toxic elements show a lethal effect on living organisms even at low concentrations. Superabundance of Cd, Hg, Pb, and As can damage the nervous system. Moreover, Hg degrades proteins, reduces enzyme activity and causes damages of cell membranes. Furthermore, Pb affects reproductive abilities and disturbs metabolism of indispensable bioelements, such as: Fe, Cu, and Zn. The toxic elements' content was analysed in summer worker bees (foragers) which had been captured at the beginning of July 2015, and in winter bees captured at the end of March 2016, after their winter-cleansing flight. The worker bees originated from colonies which were Nosema-free and N. ceranae infected. Element compositions in each of the 10 worker-bee body pooled samples were determined using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES, iCAP Series 6500, Thermo Scientific, USA). The mineralization of the 10-worker-bee pooled sample was conducted in a Microwave Digestion System (Bergh of Speedwave, Eningen, Germany) using optical, temperature and pressure monitoring of each sample during acid digestion in Teflon vials (type DAP 100). In the summer, concentrations of Cd, Hg, Pb, and As in N. ceranae infected foragers were higher than in the Nosema-free ones. This might be connected with the increased foraging activity infracting with the N. ceranae infection. This increased the accumulation of toxic elements in the bodies of the N. ceranae infected bees, which in turn may cause harmful side effects and hence higher mortality of infected foragers. Cd and Pb were more highly concentrated in bees during their overwintering than during the summer. Higher amounts were observed in winter samples, both in N. ceranae infected and in Nosema-free bees. Surprisingly, Hg and As content was much lower in winter samplings. Probably, there are some physiological mechanisms in bees, which aid to balance the proper amount of Hg and As preventing their accumulation to toxic levels.

19. A novel protocol to get high quality data on hive health and development

Artur Sarmento , Nuno Capela, Henrique Azevedo-Pereira, Jose Paulo Sousa

University of Coimbra

Pollination is a vital ecosystem service that enables the functioning and sustainability of terrestrial environments, including many important crops. The failure of this service, provided by several pollinators - mainly insects - is being seen as an important threat to the long-term survival of plants. There is a huge concern about this topic due to the reported global decline of pollinators, like honeybees (Apis mellifera L.), that are the most commonly managed bees in the world, being a critical resource for world agricultural and food security. The reasons for this decline have been studied in the past years, focusing on several biotic and abiotic stressors. However, it has been difficult to understand how these stressors affect hive fitness, especially when acting in several combinations. In order to tackle this, an approach that has gained supporters among those who study this phenomenon is the use of landscape modelling. EFSA has already proposed risk assessment models for honey bee colonies (e.g. ApisRAM, MUST-B Project) but these models require high quality data for their development and validation.

Nowadays, there is a huge variety of methods to assess hive fitness; such techniques are described in guides such as the “COLOSS BEEBOOK” and the EFSA’s “HEALTHY-B” document. However, there is no standardized protocol which defines a group of methods that tackles the full range of variables required for this type of models. After a thorough analysis of the several techniques developed and published by other research teams, and by testing them along with ground-breaking software, we propose a feasible protocol that can allow one to obtain high quality data on hive fitness. Our measurements are made at the colony level - accounting for hive demography (adult population, brood and mortality), reserves, activity, diseases and pests, pollen diet and pesticide presence (on reserves and bees) - as well as at landscape level - landscape composition, resources' availability, agricultural practices and climate. We divide the variables into 3 categories according to the period of time between measurements: fortnight, monthly and continuous. The methodology for each parameter will be described in this poster (along with the reference of the study/document where it was based on).

This protocol is already being applied with success in a fieldsite in Burgos (Spain), framed within an INTERREG-SUDOE project (Poll-Ole-GI SUDOE, SOE1/P5/E0129). A total of 8 hives - 5 for general measurements, 1 observation hive and 2 control hives - are being used in this study. The control hives will allow us to determinate the impact of the selected techniques on the development and production of the hives.

The proposed protocol is valuable not only for its ability to tackle almost every driver related to colony loss and to acquire accurate data for research purposes, but also because the techniques selected reduce the observer bias and the level of specialization needed.

20. What tools do we need to tackle SHB in different stages of invasion?

Marc O. Schaefer

Friedrich-Loeffler-Institut

The small hive beetle, endemic to Africa, south of the Sahara, is nowadays an invasive species in many countries worldwide, causing problems in apiculture. Successful eradication seems only possible if early detection is guaranteed and if a ready concept exists that can be implemented quickly and consistently. In the talk procedures will be described that should help the authorities to implement eradiction or containment of the small hive beetle.

21. Image Analysis Approaches for Parasite Detection on Honeybees

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Rapid growth of parasites like Varroa destructor is one of the main reasons for elevated mortality of bee colonies. Beekeepers have to perform time consuming manual sampling to enable treatment and avoid colony losses. Most existing sampling plans only produce rough estimates and can be invasive and costly. This can be a significant stress factor, when considering an average sample size of 300 bees per apiary, to get a significant test result. This yields the question, if it would be possible to automatically monitor the infestation status of a beehive, using a non-invasive method. This works provides a first step towards answering this question. Therefore a camera system capable of creating continuous recordings of the entrance of an apiary is designed with whom more than 7TB of video data is recorded. From the conducted video material, a ground truth dataset is created with more than 13,000 manually labeled images of infected and healthy bees. The dataset is used to train and evaluate a deep learning approach for Parasite detection.

22. Revisiting standard protocols to measure carbohydrate consumption in honey bees: A new approach based on a new conditioning chamber.

Michel B.C. Sokolowsk

University of Picardie Jules Verne

To measure carbohydrate consumption in honey bees, Williams et al.(2012) suggest to propose free food and to record the weight of the feeder. Because only one point is obtained, we suggest this kind of protocol to be completely inadequate to know how carbohydrates are important for bees. Based on a behavioral economic approach, we propose to vary the "price" of carbohydrate to know the work honey bees are ready to perform to get syrup more and more difficult to gather. To do such experiment, we used cages equipped with new computer controlled artificial flowers. When the "price" of syrup is increased, honey bee consumption is decreased, and we show inelastic demand for carbohydrates.

We examine the implications of such results to study carbohydrate consumption and pesticide effects.

23. Synergistic Effects of Pyriproxyfen, Boscalid and American Foulbrood on Cuticular Compound Profiles of Honey Bees

Bryce Williamson, Dominique Fortini, Carole Vauzelle, Pierrick Aupinel, Freddie-Jeanne Richard

University of Poitiers, [2]INRA Le Magneraud

Pesticides and disease have been implicated in the decline of honey bees and other pollinators. In particular, the interactions between various factors have been of greater interest in recent years, since no one factor has proven to be the most significant. In this study, the interactive effects of sub-lethal doses of the insecticide pyriproxyfen, the fungicide boscalid, and the disease American foulbrood caused by Paenibacillus larvae spores were investigated. Effects on cuticular compound profiles, which regulate social interactions, were shown for nearly all combinations of the stressors on honey bee larvae and adults. Furthermore, additive effects were shown for all three stressors. These results imply that pyriproxyfen, boscalid and P. larvae spores have the potential to cause nestmate rejection and larval neglect in honey bee colonies. The interactive effects of these widespread stressors could be of great importance in the decline of certain honey bee colonies.

24. Constrution and rescue of infection clone of Israeli acute paralysis virus

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Honeybee is fundamental to supply the pollination servicefor increasing the agricultural production and biodiversity. Recently in America and European countries, however, honeybee colony went through a large number of losses that has been linked with a RNA virus, Israeli acute paralysis virus (IAPV).Current knowledge about honey bee virus is limited, especially on virulence and athogenicity of IAPV due to the lack of honey bee virus cell. Thus, it is crucial to construct a reverse genetic system to understand clearly the infection and develop effective drug to control IAPV. For this purpose, we constructed a full-length genomic cDNA clone of IAPV and identified the on healthy adult worker bees. To further study the effect of natural product on inhibition of IAPV replication, we injected the healthy adult bees with constructed infectious IAPVand investigated the effect of Q application on their survival.Our results indicated that we not only constructed infectious clone of IAPV with virulence but also found one agent based on natural product to control the IAPV infection. Thus, we provided a power tool to study the molecular mechanisms involved in viral genome replication and virus pathogenesis, and found a potent antiviral agent that can be used widely in field. These results pave the way for further study the infection mechanism of honey bee virus as well as for antiviral treatment of bee viruses infected hives in practice. To our knowledge, our study provides the first infectious clone and antiviral agent based on the natural product and established a general model platform for studying the genetic characterization and gene functions of honey bee viruses.

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