18th COLOSS eConference

Presented via Zoom

Full Proceedings

In partnership with

DETAILED SCHEDULE

18th COLOSS eConference

Wednesday, 2 November 2022

Time (US CDT)	Time (CET)	Session Specifics
09:00	15:00	Introduction to the COLOSS eConference & Zoom & Protocols
09:05	15:05	COLOSS Presidential Keynote
09:10	15:10	Remembrance of Vice President Dr. Panuwan Chantawannakul
09:15	15:15	General Assembly 1 - EC Elections
09:20	15:20	**Core Projects** **Monitoring, BEEBOOK, B-RAP** State-of-the-Art & Update Presentations Questions & Answers
10:00	16:00	Break
10:15	16:15	**Task Forces** **Varroa, Apitox, Nutrition, World Bee Health** State-of-the-Art & Update Presentations Questions & Answers
11:15	17:15	Break
11:30	17:15	**2022 COLOSS Excellence Award Winner Presentations**
11:40	17:40	**Rapid Presentations Group 1** (Monitoring, Varroa, Apitox, Nutrition themes)
12:10	18:10	End of COLOSS eConference Day 1

Thursday, 3 November 2022

Time (US CDT)	Time (CET)	Session Name
09:00	15:00	Introduction to the COLOSS eConference Day 2 & Zoom & protocols
09:05	15:05	**Task Forces** **Breeding, Small Hive Beetle, Velutina**State-of-the-Art & Update PresentationsQuestions & Answers
09:50	15:50	Break
10:00	16:00	**Task Forces Survivors, Viruses** State-of-the-Art & Update PresentationsQuestions & Answers
10:30	16:30	General Assembly 2 (incl. EC election results)Break
11:30	17:30	**Rapid Presentations Group 2**
11:45	17:45	(Small Hive Beetle, Velutina, Survivors, Varroa, Viruses themes)
12:20	18:20	COLOSS eConference Closing Remarks
12:30	18:30	**Social Event** - Apiculture Pub Quiz (Trivia Night)End of
13:30	19:30	COLOSS e Conference Day 2

18th COLOSS eConference

TOPICS

- International online meeting of COLOSS to provide an update on the network's achievements and future directions, including online meetings for COLOSS Core Projects and Task Forces
- Annual General Assembly Meeting including COLOSS Executive Committee elections

WHEN

2 November
- Core Project & Task Force 'State-of-the-Art' presentations

3 November
- Core Project & Task Force 'Update' presentations
- General Assembly Meeting-Executive Committee Elections
- Rapid Presentations by conference participants
- Virtual mixer – Trivia Night

WHERE

Zoom – Links to specific sessions will be distributed to registered participants

Auburn University Panopto – web-links to view all Workshop 1 recordings and all submitted Rapid Presentations will be provided during the conference and will be available for viewing for 2 weeks after the conference.

ORGANIZER CONTACTS

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REGISTRATION

- Registration fee is 30 USD (~30,40 Euros equivalent), and can be paid to the Auburn University payment site

RAPID PRESENTATIONS

- All submitted Rapid Presentations must be accompanied by an abstracts.
- Rapid Presentations should be less < 3 min long and include one status slide.
- A submission should be submitted only once by the lead/presenting author.

TRAVEL & ACCOMMODATIONS

This is a virtual event. Please enjoy from the comforts of your home or office.

A note from the president

Dear colleagues,

On behalf of the organizing team, I would like to welcome you to the 18th COLOSS.

This is our 3rd e-conference, reflecting the need for online networking. Even though any online meeting cannot replace physical meetings, hybrid meetings offering both physical and online presence will be the way forward for our global networking. Indeed, if people cannot join physical meetings, online solutions will offer a feasible approach for each and every COLOSS member.

I am therefore delighted to say that we have again an all-time high of registered participants for this conference, thereby reflecting a general acceptance of such online events by our members.

I would like to sincerely thank all of the people who made this meeting possible. In particular, it would have again been impossible without the exceptionally organized efforts of Geoffrey Williams and the Auburn team.

Appreciation is also addressed to all contributors. Please be so kind and consider your active participation in our Core Projects and/or Task Forces. In particular, I would like to encourage all of you to consider joint experiments, joint fund raising and joint publications beyond our BEEBOOK.

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

I am looking forward to fruitful online discussions with all of you, and hope you will enjoy this conference. I am delighted to see many new faces from all over our COLOSS globe!

Yours sincerely,

Prof. Dr. Peter Neumann, President, COLOSS Association

Submitted Rapid Presentations

Note: Some Rapid Presentations associated with these abstracts will be played 'live' during the COLOSS Conference. All Rapid Presentations will be available on Auburn Panopto for two weeks after the event. The web-link will be distributed during the conference.

Authors (arranged by first name of first author)	Abstract title
*Alessandra Giacomelli, Vanni Floris, Massimiliano Gotti	Results of the UNAAPI Italian national loss and management survey third year (2020/2021)
*Alexander McMenamin, Ally Martin, Michael Simone-Finstrom, Vincent Ricigliano	Engineered microalgae as a novel pollen substitute and therapeutic delivery system
*Aura K. Palonen, Anna Papach, Erica Weinstein Teixeira, Geoffrey R. Williams, Giovanni Federico and Peter Neumann	Phenotypic traits in invasive populations of small hive beetles (*Aethina tumida*)
*Birgit Gessler, Lina Sprau, Melanie Liebsch, Kirsten Traynor, Peter Rosenkranz and Martin Hasselmann	A complementary approach combining breeding and genetic analysis to select for Varroa Sensitive Hygiene (VSH)
*Cayetano Herrera, Joana F. Ferragut, Mar Leza, Jose A. Jurado-Rivera	Invasion genetics of the yellow-legged hornet *Vespa velutina* in Mallorca (The Balearic Islands, Spain)
*Cresta Eleonora, Manganello Federico, Lazzari Filippo, Carbonari Fausto, Danieli Pier Paolo	A preliminary morphometric assessment of some *Apis mellifera siciliana* colonies in Sicily (Italy)
*Dalal M. Aljedani	Controlling Varroa mites infesting honey bees (*Apis mellifera* L.) using some essential oils and amitraz under colony conditions
*Damanjot Kaur, Harmanjot Kaur and Neloy Kumar Chakroborty	Sublethal concentrations of organophosphate and pyrethroid insecticides impair the perception and learning of sensory stimuli in the Western honeybee, *Apis mellifera*
*Dan Aurell, Selina Bruckner, Todd Steury, and Geoffrey Williams	Efficacy of natural Varroa mite control options in honey bee colonies established with queen cells
*Eliza Cauia	*Varroa destructor* - Insights into the sustainable control by capitalizing some natural behaviors
*Ewa Mazur, MichaL, Czopowicz, Izabella Dolka, Anna Gajda	Preliminary cage study of the influence of lithium chloride on the winter generation of the honey bee
*Ewa Mazur, Anna Gajda, Michal, Czopowicz	A four-year study of winter honey bee colony losses in Poland based on the COLOSS survey
*Hamidou Latrech, Ibrahim Belabdi, Nora Mimoun, Mouna Hamel, Roumissa Salma, Lakri Ait Gharbi, Malha Hammaz, Rachid Kaidi	Study of the reproductive performance of drones and queens bees of *Apis mellifera intermissa* in north of Algeria

Authors (arranged by first name of first author)	**Abstract title**
*Jean-Jacques De Clercq	Protecting beehives from other insects with computervision & deep learning
*J. Guerrero-Diago, A. Frias-Alvarez, P. Perez-Acosta, C. Armas-Moreno, A. Luzardo-Alvarez, A. Gracia	Evaluation of the toxicity of carvacrol in *Apis mellifera* honeybees and its efficacy as an anti-varroa treatment: In vitro study.
*Lazzari Filippo, Manganello Federico, Cresta Eleonora, Carbonari Fausto, Danieli Pier Paolo	Undesired trace element concentration in bee pollen collected in a suburban area
*Liudmyla Yazlovytska, Lesia Tymochko, Galyna Savchuk, Volodymyr Karavan, Diana Kachmaryk, Vasyl Kravchuk, Irina Panchuk	The effect of drug «apiplasma» on the adaptation potential of *Apis mellifera* L. under the combination of nutritional and temperature stresses
*Liudmyla Yazlovytska, Ostap Palamar, Oleksandr Cherevatov, Vasyl Kravchuk, Irina Panchuk	The influence of the drug "apiplasma" on the rate of *Apis mellifera* L. colonies development
*Lucia Caballero, Clara Armas, Pablo Perez, Maria Jose Caballero, Anselmo Gracia	Macroscopic and microscropic study of the testes, seminal vesicle and mucus gland of *Apis mellifera* drones from Gran Canaria hives.
*Mariia Fedoriak, Oleksandr Shkrobanets	Loss rates of honey bee colonies after the winter of 2021/22 during the war in Ukraine
*Rachid Sabbahi	Effects of climate change on insect pollinators and implications for food security - evidence and recommended actions
*Richard Odemer	Does it pay to remove drone brood for varroa control?
*Selina Bruckner, Jennifer Tsuruda, Robyn Underwood, Geoffrey Williams	Sugar coated bee-icide?
*Spyridon Vlogiannitis, Konstantinos Mavridis, Victoria Soroker, Fani Hatjina, Miguel Vilas-Boas, Janja Filipi, Noureddine Adjlane, Dalila Di Criscio, Delphine Panziera, Harmen Hendriksma, Beatrice T. Nganso, John Vontas	Monitoring phenotypic and molecular acaricide resistance in Varroa populations worldwide
*Tatjana Celic, Danijela Kojic, Srdana Dordievski, Elvira Vukasinovic, Ivan Pihler, Jelena Purac	Oral supplementation with spermidine increases acetylcholineesterase activity in honey bees (*Apis mellifera* L.)
*Valentine, A., Reilly, M., Smith, S., Browne, K.A., McCormack, G.P.	Outside the box - the evolution and adaptation of free-living Apis mellifera mellifera across the island of Ireland
*Zachary Huang, S. M. Saleem, M. Milbrath	Neonictinoid pesticides more toxic to honey bees at cooler temperatures
*Zheguang Lin, Ting Ji	Investigation of long non-coding and circular RNAs in *Varroa destructor* of varied reproductive states

Abstract Title
Results of the UNAAPI Italian national loss and management survey third year (2020/2021)

Abstract Authors
Alessandra Giacomelli, Vanni Floris, Massimiliano Gotti

Authors Affiliations
Italian National Union Beekeeper Association- Unaapi

Abstract Text
The Italian National Union Beekeeper Association (UNAAPI) during the third year of the national loss and management survey has monitored a total of 33,819 colonies located in 11 Italian regions. The study focused on the presence of *Vespa velutina* and *Vespa orientalis* feeding on honey bees and on the supplemental nutrition implemented on colonies during the period 1rst April 2020- 31 March 2021. *Vespa velutina* was observed in 140 apiaries in Tuscany, 45 apiaries were found positives in Liguria, 2 apiaries in Lombardy and Campania and one apiary in Molise region. In Sicily, two apiaries reported issues from *Vespa orientalis* (loss of 10% of the total amount of families). Focusing on honey bee nutrition in the monitored year, we found that 84,9% of the beekeepers provided supplemental nutrition to their colonies. Candy patty was the most widely administered food and was used by 70% of the beekeepers. 89.1% was the total percentage of colonies fed with candy patties, and an average of 3.2kg was used per colony. Beekeepers principally fed their colonies with patties in January (26,9%) and February (26,2%) and the main reason for this feeding was to provide emergency food in times when environmental food resources were scarce (43,1%). Sugar syrup was administered by 25.4% of beekeepers and 91.1% was the total percentage of colonies fed. About 6l (6.3l) of syrup were used per colony. August (69.7%) and September (51.5%) were the months where families were mostly fed with syrup and the reason given were to provide emergency food (69.7%), and to prepare families to breed winter bees, for wintering (63.6%). Colonies were also fed with hive products to provide emergency food: honeycombs were given by 2.3% of beekeepers in April, to 22.5% of the total amount of colonies. Pollen was similarly administered (2.3% of beekeepers) in December and January. Early support feeding to prepare colonies for a high stress period was carried out by 46.4% of beekeepers using different supplemental food, for an average period of 2.9 weeks (range: 1-8 weeks of feeding). Regarding the environmental conditions, the months in which the families suffered most from the lack of nectar were August (49%) and July (22.2%) and pollen deficiency was identified in August (29.4%) and April (13.7%). The survey has found that 27.4% of the beekeepers used pollen traps to check the abundance and diversity of the environmental sources. Scales located under the hives to estimate the incoming nectar flow have been used by 20.3% of the beekeepers. The average cost per colony for the supplementary carbs and protein feeding was 7.7 euros (range 0.9-30.8 euros). Regarding the supplementary prebiotic and probiotic feeding administered, the average expense was 0.61 euros per colony (range 0.3-6.7 euros).

Abstract Title
Engineered microalgae as a novel pollen substitute and therapeutic delivery system

Abstract Authors
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Abstract Text
With a rapidly growing human population and a changing climate, it is more important than ever to devise sustainable agricultural solutions. Intensifying land-use conversion has resulted in extirpations of native pollinator species and a gross reduction in insect biomass, which has increased our reliance on honey bees (*Apis mellifera* subsp.) to pollinate crops. However, the beekeeping industry is threatened by unsustainable colony losses due to a variety of biotic and abiotic factors including pests (e.g., *Varroa destructor*), pathogens (e.g., viruses) and inadequate nutrition. Therefore, we must develop interventions to reduce the disease load in colonies while, ideally, supplying necessary nutrients. To that end, a microalga was engineered express immune-stimulating biomolecules against deformed wing virus (DWV) - a major threat to colony health. Bees fed this engineered algae survive longer and have reduced DWV genome equivalents when injected with DWV relative to various controls. Additionally, larvae reared in vitro on royal jelly supplemented with engineered microalgae were challenged with 106 DWV genome copies at pupation and scored for deformities (none, mild, moderate or severe) at eclosion. Individuals reared on engineered algae showed significantly lower rates of deformity than individuals reared on control jelly. Together these data demonstrate that microalgae are a promising nutritional supplement and a scalable therapeutic delivery system for apiculturists.

Abstract Title
Phenotypic traits in invasive populations of small hive beetles (*Aethina tumida*)

Abstract Authors
Aura K. Palonen(1), Anna Papach(1), Erica Weinstein Teixeira(2), Geoffrey R. Williams(3), Giovanni Federico(4) and Peter Neumann(5)

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Abstract Text
Understanding how natural selection may shape the impact of biological invasions seems to be a key for their successful mitigation. Indeed, novel selection pressures may lead to adaptive shifts in certain traits, which may increase invasion impact. For example, increased body size in response to higher food availability in invasive ranges is often connected to a higher fecundity. However, data comparing phenotypic traits between multiple invasive populations remain scarce and are lacking for small hive beetles (SHB). Here, we compared for the first time body length, width and weight of adult SHB between a well-established invasive population in the USA and recent ones in Brazil and Italy. The data

show that females are longer than males in all three locations, confirming previous reports. As in many other species, this size dimorphism between sexes is probably adaptive due to oviposition by females. Furthermore, the data show that SHB in Brazil are shorter and narrower than their US and Italian counterparts. This may be due to more limited access to food in association with colonies of Africanized honey bees in Brazil compared to European (-derived) ones in the USA and Italy. Indeed, Africanized honey bees show more frequent aggression towards SHB by workers and provide less opportunities for SHB mass reproduction. Future analyses of additional invasive and native populations will shed light on the generality of our findings, thereby enhancing our understanding of SHB invasions.

Abstract Title

A complementary approach combining breeding and genetic analysis to select for Varroa Sensitive Hygiene (VSH)

Abstract Authors

Birgit Gessler (1), Lina Sprau(1), Melanie Liebsch(1), Kirsten Traynor(2), Peter Rosenkranz(2) and Martin Hasselmann(1)

Authors Affiliations

(1) University of Hohenheim, Institute of Animal Science - Department of Livestock Population Genomics, Stuttgart, Germany
(2) University of Hohenheim, Apicultural State Institute, Stuttgart, Germany

Abstract Text

The honey bee ectoparasite *Varroa destructor* is the main cause of honey bee colony losses worldwide. In the collaborative SETBie project in Baden-Wuerttemberg (Germany) we seek to establish honey bee colonies with high levels of the varroa-sensitive hygiene trait (VSH). VSH is a trait, where adult honey bees remove Varroa infested brood. This arrests the reproductive cycle of the female mites, leading to a reduction of the Varroa population within the bee colony. The underlying molecular mechanisms of VSH are still unclear and so we applied a comprehensive approach of colony phenotyping and high-throughput sequence analysis to detect stable inherited molecular markers for VSH.
1,411 queens of the subspecies *Apis mellifera* carnica, *A.m. mellifera* and Buckfast were instrumentally inseminated with single or multiple drones and colonies headed by these queens were established annually between 2019 and 2022. We infected 764 of these colonies with 180 mites each to determine the level of non-reproduction and thus calculate the suppressed mite reproduction (SMR) rate. We selected 131 low and high SMR performing colonies of the different subspecies and performed a subsequent analysis for VSH by artificially introducing 30 mites into single brood cells and comparing them to manipulated control cells. Each year, colonies with a removal rate above 50% of the infested brood cells were successfully identified. Colonies with high VSH values were used to generate our selectedVSHstock.
For the complementary genome analysis DNA and RNA of age-standardized adult worker bees were extracted for transcriptome, genome and bisulfite sequencing of the same species. Our preliminary analyses of single nucleotide polymorphisms (SNPs) data indicate a high number of differentiating SNPs between high and low-performing VSH colonies. Interestingly, remarkable differences exist between distinct subspecies of *A. m. carnica*, *A.m. mellifera* and Buckfast lineages. Several SNPs are enriched with genes that are associated with gene ontology terms such as regulation of olfactory learning and the nervous system. Combining additional sequence datasets from other studies will broaden our understanding of the underlying molecular network for VSH. Furthermore, this project contributes to the identification of stable-inherited molecular markers for VSH that will then be tested and evaluated for their suitability in broader scale breeding programs.
Supported by the European Agricultural Fund for Rural Development (EAFRD).

Abstract Title
Invasion genetics of the yellow-legged hornet *Vespa velutina* in Mallorca (The Balearic Islands, Spain)

Abstract Authors
Cayetano Herrera (1), Joana F. Ferragut (2), Mar Leza (1), Jose A. Jurado-Rivera (2)

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Abstract Text
The yellow-legged hornet (*Vespa velutina*) is a social Hymenoptera native from Asia and an invasive species in Europe where was first detected in France in 2004, and have spread across the continent reaching peninsular Spain in 2010 and Mallorca Island in 2015. Its predatory habits on a broad diversity of pollinators including *Apis mellifera* are known to have a negative impact on ecosystems. Here we investigate both the origin and phylogenetic relationships of *V. velutina* in Mallorca Island based on the analysis of DNA sequences from the gene encoding the mitochondrial cytochrome c oxidase subunit 1 (cox1) and 15 nuclear STR (microsatellite) markers. Our results retrieved the Mallorcan *V. velutina* population nested in a genetic cluster including other European populations and specimens sampled in Jiangsu and Zhejiang (China). In addition, we provide evidence for two independent incursions in Mallorca, which suffered a genetic bottleneck. Both incursion of *V. velutina* populations derived from the spreading southward of the yellow-legged hornets initially established in France, which have successfully spread an established in much of Europe. This study provides further insights into the invasion genetics of *V. velutina* in Europe, highlining the necessity of biosecurity strategies.

Abstract Title
A preliminary morphometric assessment of some *Apis mellifera siciliana* colonies in Sicily (Italy)

Abstract Authors
Cresta Eleonora, Manganello Federico, Lazzari Filippo, Carbonari Fausto, Danieli Pier Paolo

Authors Affiliations
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Abstract Text
The Sicilian honey bee, subspecies *Apis mellifera siciliana* Dalla Torre (AMS), occurs exclusively on the island of Sicily. Its behavioural and ecological differences from A. m. ligustica Spin. (AML) and the other Mediterranean subspecies make it prone to be conserved. Its ability to reduce brood rearing during the summer months, also controls infestations of the parasitic Varroa mite, making it the preferred subspecies in Sicily. Anyway, the genetic integrity of colonies belonging to the subspecies AMS is considered to be at high risk due to hybridization with other honey bee subspecies, imported in Sicily for productive purposes. The introduction of AML from mainland Italy, to improve the docility and honey-storing behaviour of native AMS colonies, has generally been the main cause of genetic modifications of the native subspecies. In order to preserve on-site the genetic resources of AMS, in the current study, as part of the Plant-B, an European Project funded by PRIMA Foundation (Grant n. 1812), 21 different bee colonies provided by two beekeepers located in Sicily were analysed, through a morphometry characterization, to the identification of strains with the characteristics of the pure

subspecies. The morphometric analysis was carried out with the determination of 16 biometric traits on the front wings, hind legs and tergites according to the standard for AMS set up by the Italian Council for Agricultural Research and Economics. The wings were mounted on anti-newton slides, then scanned at a resolution of 9600 dpi. Through the use of the DrawWing software, the coordinates of the junction points of the forewing ribs on each pair of wings were determined. With the aid of a stereo microscope at 10a—, the two rear legs of the samples were photographed and the following measurements were then determined: length of the femur, tibia, and length and width of the metatarsus. To identify the colour and profile of the pigmented bands of the T2 and T3 tergites, the Goetze scale was taken as a reference. Statistical belonging of each honey bee sample was defined in terms of membership degree to the subspecies AMS of each colony the sample was taken out. The results show a global membership of 34.2% (± 13.2%), with minimum and maximum values of 18.8% and 68.8%, respectively. Only in 19.0% of colonies a membership of at least 50% emerged, and of these a single colony had a value that exceeds 60.0%. Likewise, the results obtained from a concomitant study carried out to verify the belonging to the AML subspecies of 41 different bee colonies located in Central and Southern Italy, show an average membership of 40.5% (± 12.9%), with values ranging from 16.7% to 77.8%. These preliminary outcomes confirm that the genetic heritage of this honey bee subspecies in Sicily is extremely compromised and that more research efforts over time are essential for future crossbreeding experiments aimed at producing and propagating high membership AMS colonies in Sicily.

Abstract Title

Controlling Varroa mites infesting honey bees (*Apis mellifera* L.) using some essential oils and amitraz under colony conditions

Abstract Authors

Dalal M. Aljedani

Authors Affiliations

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Abstract Text

Varroa mite (*Varroa destructor*) is the major challenge for beekeeping worldwide, this pest is caused damage in the terms of honey yield and mortality of adult honey bees. Therefore, this study tested some essential oils and chemicals (amitraz), for the control integrated on Varroa destructor and effected of *Apis mellifera* L. Five essential oils (garlic oil, Peppermint oil, Cinnamon oil, thyme oil, Lavender oil) of plant natural products, and chemical pesticide (amitraz) were evaluated against varroa mite infested in the honeybee colonies, and the fallen mites were monitored through the sticky card placed at the bottom of the hive. Data was recorded after 1,3, 7, 15, 22 days of treatment, under colony conditions. The natural approaches employed in the control and spread of bee illnesses have been demonstrated to be effective. Garlic oil and thyme oil were found to be particularly efficient against Varroa Mites and honey bees (*Apis mellifera* L.), Garlic oil outperformed all other treatments in terms of reducing the number of varroa mites after treatment, with a significant difference of (Mean± Std. Error) (9.330± 2.392) throughout the study, with increased Varroa mortality in all treatments compared to natural Varroa mortality during the pretreatment period. Also, the daily dead bees were counted during the study period, it is clear that there were insignificant differences between honey bee colonies with different treatments in the daily dead worker bees treated with certain oils and chemicals. In addition, all the treatments were safe for worker bees at the applied dose. The natural approaches employed in the control and spread of bee illnesses have been demonstrated to be effective, and that essential oils can improve the health of bee families.

Abstract Title
Sublethal concentrations of organophosphate and pyrethroid insecticides impair the perception and learning of sensory stimuli in the Western honeybee, *Apis mellifera*

Abstract Authors
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Abstract Text
Malathion and lambda-cyhalothrin, respectively an organophosphate and a pyrethroid insecticide, are widely used in agricultural fields and other landscaping in India. We assessed the toxicity of these insecticides in the Western honeybee species, *Apis mellifera* (brought from Italy), domesticated in India. The acute oral median lethal dose values (LD50) after 24 h of administrations were estimated to be 0.39 µg/bee and 0.074 µg/bee respectively for malathion and lambda-cyhalothrin in *A. mellifera*. This shows that lambda-cyhalothrin is more toxic than malathion in this species of honeybee. We used half the acute LD50 doses of these two insecticides to understand their possible adverse effects on the behavior of *A. mellifera* and found that lambda-cyhalothrin reduced the water responsiveness of the foragers compared to the control bees after 24 h. Oral administration of lambda-cyhalothrin also significantly lowered the responses of the foragers to the 0.1%, 0.3%, 0.8%, and 1.0% sucrose solutions but not to the higher sucrose concentrations (5%, 10%, 20%, 35%, and 50%) compared to the controls after 24 h. Malathion, on the other hand, has been found to significantly disrupt olfactory learning and 24 h memory of the foragers. Our results confirm that lambda-cyhalothrin significantly compromises the detection thresholds of gustatory stimuli, which are extremely important for food foraging, in *A. mellifera*. In addition, exposures to malathion and possibly also lambda-cyhalothrin (study is undergoing) substantially deteriorate olfactory learning ability and retentions of odor memories in *A. mellifera*, which also contribute to the waning of foraging success.

Abstract Title
Efficacy of natural Varroa mite control options in honey bee colonies established with queen cells

Abstract Authors
Dan Aurell (1), Selina Bruckner (1), Todd Steury (1), and Geoffrey Williams (1)

Authors Affiliations
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Abstract Text
Varroa destructor mites are considered the leading cause of *Apis mellifera* honey bee colony losses in the U.S. and Canada. Varroa management currently relies heavily on chemical miticides, especially synthetics. However, a core tenet of Integrated Pest Management (IPM) is that physical, cultural, and biological controls should be used alongside chemical control. We investigated the effects of natural Varroa treatments (i.e., miticides based on naturally occurring compounds), combined with a widely used cultural control method (i.e., starting new colonies with queen cells), on Varroa mites. We started 177 new experimental colonies using queen cells - immature queens (cultural control). Experimental

colonies either served as untreated controls or received one of several treatments (chemical control). We measured the Varroa infestation of adult bees on the day of establishment and post-treatment, 75 days later. Samples from untreated control colonies had 5.1 times as many Varroa post-treatment as when the colonies were established. Varroa infestations in treated colonies either rose modestly, remained similar, or were reduced. We estimated the following treatment efficacies: Apivar(R) (85%); Amitraz E.C. (86%); Oxalic Acid Dribble (72%); Oxalic Acid Vapor (60%); Repeated Oxalic Acid Dribble (78%); and HopGuard 3 (91%). These results suggest that natural treatments based on oxalic acid and hops acids can rival the efficacy of amitraz-based (synthetic) treatments when strategically applied after installing queen cells in new colonies. This combination of cultural and chemical control provides an opportunity to rotate with natural miticides, reduce Varroa damage, and reduce colony losses from Varroa.

Abstract Title
Varroa destructor - Insights into the sustainable control by capitalizing some natural behaviors

Abstract Authors
Eliza Cauia

Authors Affiliations
Institute for Beekeeping Research and Development

Abstract Text
It is well known that honey bees are currently facing numerous health and nutritional problems. An important contribution to the permanent degradation of their health is the *Varroa destructor* mite. The reproduction of the mite is strictly dependent on the presence of the brood, but its dispersion within the honey bee colony, between colonies as well as between apiaries is dependent on the adult bee. We are talking here about the reproductive phase and the phoretic phase of the mite. The reproductive phase involves the existence of the larval brood just before capping when the infestation with the founders females takes place. Mite reproduction and the growth of the new generation of mites takes place in the brood, where most part of the mites are found in the active season. The bees cap the brood just before the larva weaves its cocoon. The cap serves to prevent the larvae from falling out of the cells during the circular movements of the cocoon-weaving. Although it has an extremely important functional role for bees, the cap represents a barrier that also protects the mite population in various stages of development from the action of most of the antivarroa treatments. Through the accumulation and concentration of parasites towards the end of the active season, together with the decrease of the brood surface in the same time with the rearing of winter honey bee generations, the risks of depopulation and mortality during the inactive season also increase. As a result, it is necessary to drastically reduce the level of infestation, at various key times, before the winter honey bee is reared. This implies the application of organic treatments, including the treatment of the brood, where most of the parasites are located. This is the reason why we developped new working procedures aimed to treat the capped brood with volatile organic acids such as formic acid in optimized formulas, treatments that have 100% effectiveness. These treatments capitalize on the property of the caps to absorb and transfer volatile substances into the cells, but also the resistance capacity of the brood in the pupal stage to the treatment substances. A series of technical details as well as the results obtained have been published recently in several scientific papers. The results show the high effectiveness of formic acid when used in different concentrations (40%-85%). When used in lower concentrations (40%) the treated brood can be introduced immediately after treatment into the origin colonies without posing risks for adult bees or queens.

Abstract Title
Preliminary cage study of the influence of lithium chloride on the winter generation of the honey bee

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Abstract Text
Varroa destructor is a dangerous parasite of the honey bee (*Apis mellifera*). Together with viral infections it is the cause of major honey bee colony losses. Therefore, developing novel and effective drugs is still required. Lithium chloride (LiCl) is a promising active substance for the control of V. destructor. Its high efficacy has been evidenced in both laboratory and field studies. LiCl does not remain in beeswax and is quickly eliminated from honey and winter food. Studies, however, have shown negative effects of LiCl on brood, both open and capped. So far there is no evidence of LiCl toxicity on workers.
We conducted a preliminary experiment on the effect of LiCl on adult bees after direct contact. Adult bees were collected from colonies with diagnosed nosemosis type C in October. The infection level was 1mln spores per bee. Three groups of 150 insects each were formed. Group A received a 25mM LiCl in sugar syrup daily for 26 days. Group B received syrup once with a concentration of 25mM LiCl and then received sugar syrup, while the control group received sugar syrup each day. All groups received water ad libitum. The bees were kept in cages at a constant temperature 33°C and 60% humidity. During the experiment, one alive bee was collected from each cup twice a week for histopathology. Tissue samples (midgut) were fixed in buffered 10% formalin. Daily mortality as well as syrup and water consumption were recorded. Statistical analysis was performed in TIBCO Statistica 13.3.0. During the second week, following the observation of altered bee behaviour in groups A and B, filming was added to the experimental protocol.
The most prominent changes in the intestinum were found in the bees infected with Nosema spp. The intracellular presence of Nosema spores was noted in all groups. There were no histopathological differences between group A and group B. Differences were observed between groups A and B compared to the control, i.e. the increased number as well as disintegration and destruction of the peritrophic membranes were noted in the examined groups.
There was a significant difference between group A and group B as well as between group A and control group in the overall survival rate, and in the cumulative mortality. However, there were no significant differences between group B and control. Syrup intake (ml/bee) decreased significantly in group A, while it remained constant in group B and control group. Water consumption did not change significantly in time in any of the groups. In group A numerous apathetic and moribund bees were noticed. Group B also showed behavioural changes such as shivering, hyperactivity, lack of motor coordination.
This experiment will be repeated on the larger sample size, as its results suggest that LiCl affects the nervous system of the honey bee. Our results correspond to the other studies and, they indicate that LiCl may negatively affects the intestinal epithelium.

Abstract Title
A four-year study of winter honey bee colony losses in Poland based on the COLOSS survey

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Abstract Text
The Colony Loss Monitoring Group is a core project of COLOSS Association. Its main objective is to study the causes of colony losses worldwide based on an annual survey of beekeepers. A standardized questionnaire is distributed to beekeepers by national coordinators after the winter. Respondents are asked about the number of bee colonies before and after winter and the suspected reason for the colonies loss. They also answer questions about basic beekeeping practices. The results are published in beekeeping press and scientific journals. In Poland, a survey of bee colony losses has been conducted since 2008 and almost every year the overall colony losses exceeded an acceptable level of 10%. The winter colony losses from 2017 to 2021 in Poland were analyzed and linked with 5 variables that could influence the loss rate. In total data from 1671 respondents regarding 61 416 overwintering colonies were collected. The overall colony loss rate changed significantly between 2017 and 2021 (p25% queens, varroa monitoring and treatment) were significantly and independently linked with the lower colony loss rates. After adding a geographical region as a random effect, all variables remained significantly and independently associated with the lower colony loss rates and the result was stronger. These results suggest that beekeeping practices such as queen replacement, monitoring and treatment of colonies against *Varroa destructor* affect colony mortality. Possessing more than one apiary and migrating colonies are most likely associated with beekeeping knowledge and experience. The study indicates that reasonable modification of these factors may decrease winter colony losses in Poland.

Abstract Title
Study of the reproductive performance of drones and queens bees of *Apis mellifera intermissa* in north of Algeria

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Abstract Text
Our studies were carried out in the region of Metidja, in the north of Algeria, from January 2016 to August 2019; the first part of the study consists in examining the production and the quality of the sperm of the drones from certain numbers parameters including age, weight and the season of rearing.
The second part of the study was reserved for the grafting and the quality of the queens, the average weight of the queens at emergence and after mating, were evaluated, as well as the Spermatheca diameter and the number of spermatozoa in the queen's spermatheca, ovaries weight and ovariols number.

The morphological and biometric characters of queens and the correlations that may exist between these characters were also studied.
The results show that 34.45% of the drones examined released sperm by endophallus after manual eversion; the number of spermatozoa produced by drones is 5.750.000 and 3.380.000 spermatozoa in seminal vesical for Drones who do not produce semen during eversion. The spermatozoa number produce increases with weight, age and season of rearing.
The acceptance rate of larva grafted into queen right colonies was 75%, with 334 mg royal jolly produced by cup.
The average weight of the queens at emergence and after mating were evaluated, as well as the number of spermatozoa in the queen's spermatheca. The results obtained show a high mortality rate of nymphs before hatching (26.66%), an average weight of virgin queens at emergence (0.160±0.011gr), and after mating is (0.176±0.017gr), a rate variable mating from 52.5% to 78.57% depending on the season, Semen analysis shows an average of 5,411,111 ± 1915,361 spermatozoa in the queen's spermatheca after mating.
Concerning the study of the morphological and biometric characters of the queen, the results show that there is same Morphometrics correlations :Tomentum-Pilosity, Tomentum - Coloration, Tongue length-Cubital index. And same biometrics correlation: Queen weight-Spermateca diametere, Queen weight- ovaries weight.
These studies underline the need to know more about the local bee (Apis mellifera intermissa), and about the quality of drones and queens, in order to characterize the local bees and to have a continuous improvement of production.

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Abstract Text
Varroa destructor is an ectoparasite distributed worldwide and it has become the main threat against beekeeping. Traditionally, synthetic ascaricides with a hitgh risk of developing varroa resistance have been used to treat the disease. In recent years, resistances have been detected in this type of drugs. Among other harmful side effects, such as the presence of residues in the hives and their products. Alternative treatments have emerged in response to this problem. Some of this alternative are organic acids, being essential oils the most promising of this group. Some essential acids are already used in beekeeping, like thymol or formic acid. Others are being investigated, such as carvacrol, which is a component extracted from *Origanum vulgare* essential oil. In this study, we evaluated the mortality rates associated to the application of this essential oil in adult honeybees and its effectiveness against Varroa destructor. This evaluation was carried out for two different application methods under laboratory conditions: carvacrol-loaded microcapsules (inhalation route) and essential oil supplemented in the diet (intraoral route). The evaluation of mortality rates of carvacrol was evaluated by counting the dead bees every 24 hours in the micro hives. It started 24 hours after the administration, and it finished 96h after the treatment. Every 24 hours honey were fed with sugar syrup. In honeybees treated with carvacrol-loaded microcapsules, increased survival was observed at doses of 2.4/100 bees and 9.6 mg/100 bees. In bees treated with carvacrol (intraoral route), an increase in survival was observed at low doses (2.4 mg/100 bees), while survival worsened at high doses (9.6 mg/100 bees). In addition, anti-varroa efficacy was observed with this method of

aplication at doses of 2.4 mg/100 bees and 9.6 mg/100 bees.
This work was supported by to “Grupos Operativos Supraautonomicos; Varroaform”; Ministerio de Agricultura, Pesca y Alimentacion.

Abstract Title
Protecting beehives from other insects with computervision & deep learning

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Abstract Text
Where actual methods for protecting bees from all kind of enemies use biochemical products (AFTER-THE-FACT or just-to-late approach) we have opted for a mechanical solution (PREVENTIVE or just-in-time) by using the most modern techniques available like Computer Vision and Deep Learning to protect the beehive and obtaining at the same time a BIO-label for the honey collection. Time has come to change completely our way of thinking and look for more ecological and less detrimental solutions like we are using nowadays with biochemical products (misuse or overuse of formic-oxalic acid, amitraz, coumaphos and derivatives creating drug resistance). Our method is based on a 16 channel 8x8mm acrylic passageway with an highres camera on top that detects the difference between bees and all other unwanted insects (wild bees, hornets, beetles, varroa mites etc.) and captures the non-bees in the channel they are in by closing the front/back of the channel with electronic shutters used in digital cameras. At the same time the beekeeper is warned with an SMS-message of the channel# the unwanted insect is in. Trapped insects are freed by inverting the polarity manually of the camera shutters. The camera is connected to a RaspberryPy3B+, fed with a battery and solar panel, who works with a trained mobilenet program that detects bees and non-bees. The training happened on a DELL cluster with 8 servers running on mesosphere using 12.000+ images and resulting after 83 training/validation runs (horizontal ï¬‚ipping & random rotation) into an hitrate of 94%. We used a pretrained model from Google who visually differentiates between cats & dogs, then we adapted the model with transfer learning & Early Stopping to bees/non-bees so it would become futureproof for all other upcoming enemies. Two software pre-filters were used for insect length and color of the yellow bee rings. Labeling the photos for supervised learning resulted in a lot of human labor done by students. Software used: Tensorflow (Google), Keras framework (Google), Mobilenet V2 (Google) + Intel Neural Computing Stick with OpenVino library connected to the RPI3B+ for performance reasons. Finally, Tesseract OCR-software was used to detect the printed channel entrance numbers 1-16. Accuracy and Cross Entropy graphs show that both Training and Validation curves nearly overlap eachother. Accuracy is close to 95% and Cross Entropy hits the 0.2 border.
This monitoring system can do all additional monitoring tasks by just adding software to the RPI3B.

Abstract Title
Undesired trace element concentration in bee pollen collected in a suburban area

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Abstract Text
The pollen is a basic feed for good growth and development of honey bees (HB). It is also a food that is increasingly receiving interest from human consumption. However, it can be expected that locally environmental conditions can play a role on the nutrition of HB colonies through the diversity pollen, at the same time, environmental conditions could lead to an accumulation of toxic in pollen. The aim of this study carried out within the frame o PRIMA PLANT-B (grant Number 1812/PLANT-B, a program supported by the European Union) was to analyze the content of some trace elements in pollen samples collected monthly in the suburban area of Viterbo, Central Italy. From March to August 2021 pollen was collected monthly from the PLANT-B apiary located in the Experimental Educational Farm "Nello Lupori" (Tuscia University, Viterbo, Italy). The pollen was harvested for 24 hs from HB colonies by means of commercial pollen traps. After each harvest, the pollen samples were packed and stored frozen, and then dried before analysis. Two pollen subsample samples for each sampling month of collection were analyzed by the help of an Atomic Absorption Spectrometer (AAS) Shimadzu AA 7000 equipped with graphite furnace (GFA), for the following trace elements: lead (Pb, calibration R2 =0.9995), cadmium (Cd, R2 =0.9985), and chromium (Cr, R2 0.9982). To verify the accuracy of the analyses, the percentage recoveries were calculated on the basis of certified values of a the NIST Standard Reference Material N. 1549 (75% for Pb, 126% for Cd, 107% for Cr). The results obtained showed that the sampled pollen had a mean concentration of 0.062 ± 0.026 mg/kg for Pb 0.009 ± 0.002 mg/kg for Cd, 0.007 ± 0.003 mg/kg for Cr and, in line or lower with respect to the values obtained from literature research (0.29 ± 0.24 mg/kg with a range of 0.014-0.68 mg/kg for Pb, 0.02 ± 0.03 mg/kg with a range of 0.0012-0.0925 mg/kg for Cd, mg/kg and 0.17 ± 0.20 with a range of 0.003-4.8 mg/kg for Cr). As many works found in literature considered the pollen as a bioindicator to assess the state of industrialized or contaminated areas, the values in the literature were higher than the ones observed in this study. Looking at the differences among sampling months, the concentrations of Pb did not vary, Cr showed a downward trend from March to August, even if it is not statistically significant. On the other hand, the Cd concentration exhibited a decrease in concentration (though not statistically significant) until May, and then rose again in the following months. This preliminary work makes it possible to ascertain that the sampled pollen can be considered safe, both for the HB and human consumption, under the standpoint of the accumulation of Pb, Cd and Cr. It is also planned to extend the analysis to other trace elements (i.e., mercury and arsenic) in the pollen in order to get insights about a more exhaustive mineral profile of the pollen gathered by the HB in the same apiary.

Abstract Title
The effect of drug «apiplasma» on the adaptation potential of *apis mellifera* l. under the combination of nutritional and temperature stresses

Abstract Authors
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Abstract Text
An adequate nutrition of bees is important for the resistance to numerous factors threating health of insects. The search for biologically active food supplement with a protective effect on the bees,

especially during wintering, is relevant. The drug «Apiplasma» (APL) (made in Ukraine, Private enterprise Kravchuk V.I.) is a mixture of macro- and microelements, with a high content of magnesium ions.
Oxidative stress markers (TBARS and proteins carbonyl (CO) groups levels), histological structure of the midgut and fat body mass of bees, maintained on different carbohydrate diets with adding of APL, were investigated under temperature stress.
1-2-days-old bees were transferred from the combs to the cages (about 300 bees each) and kept during 3 days at +28°C on a water solution with 25% glucose +25% fructose. After that, the bees were transferred for 5 days to different diets: 1) 25% glucose+25% fructose (control), 2) 50% fructose, 3) 25% glucose+25% fructose+APL, 4) 50% fructose+APL. We added 60 Î¼l of APL per 100 ml. Then half of the bees were exposed to low-temperature (+ 14°C) for 7 days. After that all the bees were processed depending on the specifc method employed.
An increase in the TBARS levels was established in the heads of bees, that were kept on diets with the APL compared to those without APL at +28°C. The highest level of TBARS was found in the head of fructose+APL-fed bees kept. Thus, APL increased nutritional stress. This indicates inhibition of the reactions of the antioxidant defense system of the bees. The CO groups levels did not differ between different diets at +28°C. The APL reduced the stressful effect on bees of control group at +14°C compared to +28°C. The decrease of TBARS in the head of bees confirms it. Low-temperature stress on fructose diet caused a decrease in the level of both TBARS and CO groups in the head of bees, regardless of the presence of APL. Thus, APL increases the viability of bees to the action of the studied stress factors.
The structure of the midgut in bees under the combined effects nutrition and temperature stress differ in the following features: more intense secretion and vacuolization of the cytoplasm of epitheliocytes, a more pronounced in rhabdom, and a more developed microflora in the gut lumen. The addition of the APL to the fructose diet causes an increase in the secretory activity of cells and the development of microflora in the lumen of the midgut. These indicate an increase in metabolic processes.
The fat body mass of fructose-fed bees kept increased compared to the control group at +28°C. Fat body mass significantly reduced on both carbohydrate diets without APL at +14°C. This testifies about intensities the use of fat body reserves under low-temperature stress. However, the addition of the APL to the fructose diet prevents a rapid decline in the fat body mass at +14°C.
Thus, our results indicate the expediency of using the APL drug in the beekeeping in Ukraine and the world.

Abstract Title
The influence of the drug "apiplasma" on the rate of *Apis mellifera* l. colonies development

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Abstract Text
Natural and/or anthropogenic stress factors (agrochemicals and pesticides, feed shortages, seasonal changes, pathogens, etc.) cause the loss of colonies of the European honey bee *A. mellifera*. Nutritional inferiority is considered critical to both individual bee health and the health of whole colonies. It is

known that mineral deficiency leads to structural, physiological, biochemical and even behavioral changes in honey bees. Therefore, the search for substances that can increase the viability of honey bee colonies is quite relevant. The rate of spring development of honey bee colonies is critical for the rapid growing the strength of the colony for the purpose of its preparing for the main honey collection. We investigate the effect of the drug "Apiplasma" (made in Ukraine, Private enterprise Kravchuk Vasyl Ivanovych), which consists of macro- and microelements of natural origin with a high content of magnesium ions, on the rates of spring development of honey bee colonies over the course of 3 years. The 5 apiaries from different physiographic of zones of western Ukraine were taken for the experiment. The each of control group and experimental groups included 20 colonies with the same strength without clinical signs of diseases. Bee colonies were fed for 2 days after 7 days from the end of March to the beginning of May depending on weather conditions. The feeding mixtures consist of 50 % sugar solution to which various concentrations of (0.3, 0.6, 1.2, 1.8 ml/l) of the drug "Apiplasma" were added. The 250-300 ml solution for one feeding for each colony was used. Revision of the colonies regarding the area of brood and the strength of families was done before the start of the experiment and on the 12th, 24th, 36th, 48th and 60th day of the experiment.
It was found that feeding bee colonies with sugar syrup with the addition of "Apiplasma" led to increasing of the intensity of egg laying by the queen. Thus, on the 48th day of the experiment, the queen laid eggs, and the nurse bees fed on average 40% more brood in the colonies that consumed the drug "Apiplasma" in a concentration of 0.6 ml/l of syrup, than in the colonies that did not receive the study drug. It was found that after 2 springs add feedings of the colonies with the "Apiplasma" (0.6 ml/l of syrup) from the 12th day to the end of the experiment the area of the sealed brood was increased compared to the colonies that did not receive the drug. Starting from the 24th day of the experiment the strength of colonies which consumed the polymineral drug "Apiplasma" was higher, than in control group. Our research shows that the drug "Apiplasma" has a positive effect on the rate of spring development of honey bees colonies of various subspecies such as A.m.macedonica, A.m.carnica and their hybrids, regardless of the location of the apiary (mountain/plain area). Our data indicate that the use of the drug "Apiplasma" as a spring feeding has great prospects for practical use by beekeepers.

Abstract Title
Macroscopic and microscropic study of the testes, seminal vesicle and mucus gland of *Apis mellifera* drones from Gran Canaria hives.

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Abstract Text
The anatomy and physiology of the drone reproductive system has been studied for several years. However, only the normal evolution of the testes through the sexual maturation, from the larval stage to the adult stage, has been documented both macroscopically and microscopically. In this study we propose to examine several samples of testes, seminal vesicles and mucus glands from random drones of the Gran Canaria Island caught during May and June 2022 to establish a relationship between macroscopic measurements and histological changes. The results of the macroscopic study allowed us to classify them in adult or young drones based on the size of the testes. Seminal vesicles and mucus glands do not show macroscopic differences between both stages. The histology study allowed to differentiate between the 4 stages of reproductive status (I, II, III, IV). Stages I and II characterised mainly by progressive development changes, and III and IV by atrophic changes. Individuals labelled

macroscopically as young drones corresponded histologically to stages I and II. Individuals labelled macroscopically as adult drones corresponded histologically to stages III and IV. The combination of both studies have helped to catalogue for the first time the reproductive status of *Apis mellifera* drones from Gran Canaria hives.

Abstract Title
Loss rates of honey bee colonies after the winter of 2021/22 during the war in Ukraine

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Abstract Text
Despite the beginning of the Russian invasion of Ukraine, military operations, missile attacks and air alarms, we managed to conduct monitoring. Of course, this affected the number of surveyed beekeepers. We interviewed more than 550 beekeepers from all regions of Ukraine, which is 1.5 times less than last year. The largest number of respondents is traditionally covered from the western regions of Ukraine.
The 551 Ukrainian beekeepers, managing 34,212 colonies before winter reported 3.72 % (95% CI 3.13 % - 4.42 %) colonies as dead/empty after winter, 3.07 % (95% CI 2.67 % - 3.52 %) colonies lost due to unresolvable queen problems and 2.08 % (95% CI 1.64 % - 2.64 %) colonies lost due to natural disaster, giving an overall loss rate of 8.87 % (95% CI 8 % - 9.81 %), which is 1.7 times lower than last year overall loss rate (15.18 %). As in previous years, dead/empty colonies accounted for the largest share of total losses.
Overall loss rate varied between operation size, from the smallest (to 50 colonies) to medium operations (51-150 colonies) and largest-size operations (over 150 colonies). The vast majority of our respondents (61.9 %) keep small operations, 31.4 % of beekeepers keep medium operations and only 6.7 % of beekeepers keep large operations. The loss rates in each group were 13.79 % (95% CI 12.06 % - 15.73 %), 8.58 % (95% CI 7.27 % - 10.11 %) and 6.35% (95% CI 4.8 % - 8.35 %) for the smallest to largest-size operations. Loss rates on small operations statistically significantly higher than losses on medium and large operations. These results are repeated annually and it is clear overall that smaller operations have higher losses.
The number of Ukrainian beekeepers who treat their colonies against the *V. destructor* mite has remained quite high for several years. So, 96.2% of the surveyed beekeepers treated bee colonies against the *V. destructor* mite in the period from April 2021 to April 2022. At the same time, 79.9% of the interviewed beekeepers conducted monitoring for presence of the V. destructor mite during the specified period.
This year we added a question to the survey regarding the destruction of the apiary or the lack of access to it due to military operations. Thus, beekeepers of Chernihiv and Donetsk regions noted the destructions of the apiary due to military operations, while beekeepers of 7 regions of Ukraine did not have access to the apiary due to military operations.
For the first time in 8 years of COLOSS monitoring in Ukraine, we received results from the annexed Crimea. Unfortunately, only 1 respondent. However, we believe that this is an important result, because beekeepers know about us and show a desire to participate in the survey, despite the obstacles caused by the aggressors. Therefore, in the future, we will establish relations with beekeepers of previously occupied territories.

Abstract Title
Effects of Climate Change on Insect Pollinators and Implications for Food Security - Evidence and Recommended Actions

Abstract Authors
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Abstract Text
Pollinators are crucial to biodiversity conservation, ecosystem protection, agriculture, and climate change adaptation. Crop pollination has a global annual value of US$235-577 billion. In Morocco, insect pollinators contributed USD$1,235.06 M to main crop production, accounting for 8.52% of total agricultural GDP. In response to climate change, geographical range and phenology of insect pollinators shift, their interactions with plants and other taxa are altered, and in some cases, pollination services are reduced. As a result, a decrease in pollination activity clearly compromises adequate crop production for a growing human population. Consequently, other plant species that rely on insect pollinators for outcrossing may also face extinction, putting human health and crop production at risk. The effects of elevated temperature on flowering plants and insect pollinators may have an impact on pollinator floral resources and plant pollination success, respectively. Plant reactions to global warming, irregular rainfall, and other environmental conditions may include altered blooming, nectar, and pollen production, as well as changes in floral resource availability, distribution, visitation quality, pollinator reproductive output, and threat from insect pests and diseases. Pollinator responses, such as changes in foraging spatial scale, body size, and lifetime, may also influence pollen flow patterns and pollination efficiency. Climate change must be considered because it has the potential to have a substantial influence on pollinator populations, resulting in lower productivity and imperiling food security. Efforts should therefore be directed toward the preservation of pollinators. One solution for improving agriculture in Morocco and rising its resilience to climate change is to take an integrated agroecological and socioeconomic approach to pollinator conservation. Thus, monitoring the status and trends of insect pollinators and assessing pollination functions and services are needed to address the potential effects of climate change and inform adaptive management of ecosystems, that could help ensure food security and agricultural sustainability. Recommended actions include as well doing more research to fill knowledge gaps, expanding studies to cover a wider range of pollinators, and promoting coordinated follow-up work at the local, regional, and national levels.

Abstract Title
Does it pay to remove drone brood for varroa control?

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Abstract Text
Varroa mites are strongly attracted to drone brood of *Apis mellifera* as it increases the chances of successful reproduction. Therefore, drone brood removal (DBR) with trap frames is common practice among beekeepers in Europe and part of integrated varroa control management. However, it is considered labor intensive and there are doubts about the effectiveness of this measure. Currently, it

is largely unknown how many mites a drone frame can carry at different times of the season and how many mites can be removed on average if this measure is performed frequently. Therefore, we sampled a total of 262 drone frames from 63 different hives. Mites were washed out from brood collected from mid-April to mid-July using a standard method to obtain comparable results. We found that one drone frame carried a median of 71.5 mites, and with the removal of four trap frames, about 286 mites can be removed per colony per season. In addition, mite counts were significantly higher in June and July than in April and May (Tukey-HSD, $P < 0.05$). Our results suggest that DBR is effective in reducing *Varroa destructor* numbers in colonies, confirming the results of previous studies on the efficacy of DBR. Although mite numbers varied, we believe that increasing sample sizes across seasons and locations could elucidate infestation patterns in drone brood and ultimately improve DBR as an integrated pest management tool for a wider audience of beekeepers.

Abstract Title
Sugar coated bee-icide?

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Abstract Text
Varroa destructor is the most important biological threat to honey bees as it not only feeds on tissue related to honey bee's immune system but also transmits detrimental viruses. When mite populations exceed a certain threshold, honey bee colonies will collapse due to their impact. Therefore, it is crucial for beekeepers to monitor for *V. destructor* regularly and make informed management decisions. A common method used to assess Varroa levels in a colony, is the alcohol wash. While it is considered most accurate, this method requires sacrificing ~300 adult bees by submerging them in alcohol. To avoid this, beekeepers may favor the sugar shake, a method considered harmless to bees. Although beekeepers and educators alike state that the sugar shake is not lethal to subjected adult bees, studies to verify this statement are lacking. To address this, we employed a mark-recapture experiment to assess mortality levels of the sugar shake method. We identified five pre-established queenright colonies that each contributed workers to three treatment groups: 1) Sugar Shake, 2) Sugar Coat and 3) Control. Experimental bees were obtained from brood frames to mirror general *V. destructor* mite sampling by beekeepers. For each treatment group, 300 adult bees were marked with a different oil-based marker after being immobilized on ice for 10 minutes. Once marked, bees belonging to the Sugar Shake group were added to a glass jar with a mesh lid, coated with powdered sugar and vigorously shaken for one minute as per typical beekeeper practice. The Sugar Coat bees were subjected to the same procedure except the shaking, while the Control bees were added to a jar without additional handling. Then, marked bees were re-introduced into their respective colonies. Five days later, the experimental colonies were revisited to take photos of equipment occupied by bees (e.g., frames and walls of boxes) to subsequently count remaining marked bees (i.e., recapture). We would expect to recover a similar number of bees belonging to the Control and Sugar Coat treatment groups, as powdered sugar dusting is considered harmless to adult bees. In contrast, we anticipate recovering less bees belonging to the Sugar Shake treatment group relative to the others, as they were subjected to vigorous shaking against a metal mesh. Results will be discussed in this presentation.

Abstract Title
Monitoring phenotypic and molecular acaricide resistance in Varroa populations worldwide

Abstract Authors
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Abstract Text
Beekeeping plays an important role in providing nutritional, economic and ecological security globally but is threatened by several stressors which sometimes are causing the phenomenon known as colony collapse disorder (CCD), which occurs when the majority of worker bees in a colony disappear. The level of *Varroa destructor* infestation is considered as a major stressor and inflicts higher damage and economic costs than all other known apicultural diseases combined. Most beekeepers use synthetic acaricides extensively for treatment of Varroosis. However, mites have developed resistance to synthetic acaricides, as reports from nearly all parts of the world show. In an effort to restrain this phenomenon, we managed to delineate the resistance mechanism that the Varroa mite has developed against the major organophosphate pro-insecticide Coumaphos (Vlogiannitis et al, 2021, PNAS). Additionally, we have developed and applied molecular diagnostic tools for the detection of Varroa resistance mechanisms, such as target site mutations which have been associated with Varroa resistance to Flumethrin and Amitraz acaricides. The aim of this study was to utilize both classical bioassays and molecular techniques, to comprehensively monitor the insecticide resistance of Varroa, in several countries globally, namely Croatia, Greece, Cyprus, Portugal, Israel, Kenya (analysis already completed) and Algeria, The Netherlands, Nigeria, Spain, Chile (analysis ongoing). Up to now, our results shown that phenotypic resistance is detected for Amitraz in Israel and Algeria, for Coumaphos in Israel and for Flumethrin in Israel, Algeria and Greece. At the molecular level no significant downregulation of CYP4EP4 that has been shown to contribute to Coumaphos resistance (metabolic resistance) or the presence of target site mutations N87S and Y215H in the β-adrenergic-like octopamine receptor associated with Amitraz resistance were detected in the samples analyzed so far. In the contrary, we detected kdr-type mutations L925V and L925I related to Flumethrin resistance in Greece (64.3% L925I and 7.1% L925V in Flumethrin survivors), Cyprus (53.2% L925I in unexposed populations), and Israel (28.6% L925V in the unexposed Volcani and 13.6% L925V in the Modiin populations). Interestingly, we were able to detect incipient Flumethrin resistance at the molecular

level, not captured by bioassays, at very low frequencies in Portugal (5.0% L925V) and Croatia (3.8% L925V). Our findings provide important insights in the management of acaricide resistance in Varroa populations worldwide.

Abstract Title
Oral supplementation with spermidine increases acetylcholineesterase activity in honey bees (*Apis mellifera* L.)

Abstract Authors
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Abstract Text
In the last few decades, the weakening of honey bee (*Apis mellifera* L.) populations in Europe and worldwide has been occurring, due to the presence of pathogens, poor nutrition and increased levels of environmental xenobiotics. For this reason, research on nutritional supplements which could improve honey bee health are coming into focus. In that regard, spermidine appears as a potential candidate, as supplementation with spermidine prolongs the lifespan and increases resistance to stress in several model organisms and humans. According to our knowledge, spermidine effects on honey bees was not investigated so far. Spermidine is a naturally occurring polyamine compound with various metabolic functions and the mechanism behind its action is not fully understood. The aim of this study was to investigate the effect of spermidine supplementation on acetylcholinesterase (AChE) activity in honey bees. Bees of the same age were fed in controlled conditions for 17 days. In addition to the sucrose-fed control group, the diet of honey bees was supplemented with 0.1 mM and 1 mM spermidine. AChE enzymatic activity was measured in homogenates of whole body of honey bee workers, as well as in the head and abdomen homogenates, using the Ellman method, optimized for microplate assay. Results showed that supplementation with 0.1 mM spermidine increased AChE activity in both head and abdomen of honey bees, while higher concentration, 1 mM spermidine, only increased AChE activity in the head. AChE hydrolyzes acetylcholine, a main neurotransmitter associated with learning in the insect brain. The enzyme inactivation, which could be induced by different inhibitors, causes acetylcholine accumulation, hyperstimulation of its receptors, and neurotransmission disruption. Hence, measurement of AChE inhibition has been used as a biomarker of neurotoxicity in honey bees. Our results are suggesting that spermidine supplementation could be beneficial for maintenance of AChE activity, and consequently neural functions, in the presence of neurotoxic compounds. Further studies are necessary to determine exact mechanisms of spermidine action on this enzyme.
Acknowledgement: This study was supported by the Science Fund of the Republic of Serbia, Program IDEAS, Grant No 7721972, Implication of dietary and endogenous polyamines for the health and longevity of honey bees (B- HEALTH).

Abstract Title
Outside the box - the evolution and adaptation of free-living *Apis mellifera mellifera* across the island of Ireland

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Abstract Text
With the discovery of a free-living pure population of *Apis mellifera mellifera* (Amm) across Ireland in 2018, little else is known about this important cohort. My PhD project aims to dramatically increase the amount of knowledge on these surviving honeybees with particular focus on their distribution, population structure (including introgression) and fitness in comparison to the managed beekeeping cohort, including habitat use and impact of habitat on colony traits. Infrared thermography (IRT) will also be used to depict the size of free-living colonies in a variety of habitat spaces in 3D form, and used along with investigations of disease and phenotypic and genotypic approaches, to study adaptation locally and in the wild. Museum specimens will be included to identify the impact of commercial beekeeping and natural selection on the genotypes and phenotypes of modern free-living and managed specimens.
To date approx. 130 honeybee colonies have been sampled to include both managed and free-living representatives and from a range of habitat types (trees, roof cavities; rural and urban settings). All samples come with a set of specific metadata that includes information on habitat, location, survival, and aggression. Honeybee samples come from three main areas in Ireland, (NW Donegal, West Galway, and SE Wexford) and include comparative sets of data for disease screening (new colonies, established colonies, managed colonies). Sampled bees are chilled on collection, frozen and freeze dried prior to DNA extraction. Bees are photographed for colour & size assessment and wings removed for geometric morphometrics. Colony-level genomes are generated by Novogene via a pool-seq approach using 30 individual workers.
Evidence of introgression is apparent in all areas examined and in both free-living and managed cohorts but is still very low showing the impact of importations but consistent with the healthy state of Amm here in Ireland. These preliminary results will be presented along with patterns of habitat and survival.
While at the early stages as yet, my project will provide deep insights into mechanisms of survival of free-living Amm in Ireland in the presence of varroa providing information for beekeepers on how to manage bees in the local environment without the heavy reliance on chemical treatments to control disease. This work will also shed light on patterns of geneflow and reproductive strategies of locally adapted Amm, and the relative fitness of imported and hybridised bees on the Island of Ireland.

Abstract Title
Neonictinoid pesticides more toxic to honey bees at cooler temperatures

Abstract Authors
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Abstract Text
Pesticide exposure has been identified as one of the many stressors causing high mortality in honey bee colonies. Effects of various pesticides have been measured for multiple responses such as learning, memory performance, feeding activity, and thermoregulation. These studies were conducted at many different temperatures (11-35°C); however, few studies compared toxicity of the same pesticide to bees at different temperatures. It is possible that the same pesticide might show different toxicity to honey bees at different temperatures. To reveal such potential interactions, we administered low doses of two neonicotinoid insecticides (imidacloprid and thiamethoxam) at three different temperature scenarios (35°C, 24°C, and a varying temperature) and determined the effects

on honey bee survivorship. We discovered that honey bees are much more sensitive to the neonicotinoid pesticides imidacloprid and thiamethoxam at a constant 24°C or at a varying temperature (night at 13°C and day at 24°C) compared to bees at 35°C. These results suggest that honey bee colonies during winter time will be more sensitive to pesticides. Doses of neonicotinoids that are safe to colonies during summer might kill them during the winter time.

Abstract Title
Investigation of long non-coding and circular RNAs in *Varroa destructor* of varied reproductive states

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Abstract Text
Long non-coding RNAs (lncRNAs) and circular RNAs (circRNAs) are two large class of non-protein coding transcripts and emerge as critical regulators across a diverse spectrum of biological processes in living organisms. To date however, few studies regarding these novel non-coding RNAs have investigated the role in the biology of invertebrate parasites. Here, we collected adult female Varroa destructor, the devastating ectoparasitic mite of honey bees, from *Apis mellifera* (AmV) and *Apis c*erana (AcV) capped brood cells, kept them on the adult A. mellifera worker bees to mimic the life phase of phoretic dispersal, and experimentally infested the freshly capped A. mellifera worker brood. Mites in three different life stages, i.e., phoretic dispersal phase, oogenesis phase (2d after capping), and reproductive phase (7d after capping) with fertility and infertility, were sampled to perform the genome-wide identifications of lncRNAs and circRNAs, as well as mRNAs, via high-throughput sequencing technology. Intriguingly, the transcriptomic catalogues of lncRNA and mRNA were demonstrated to be consistent that differentially expressed genes of oogenesis and fertile AmV showed a similar landscape, and of oogenesis AcV (potentially infertile) and infertile and phoretic dispersive AmV clustered, indicating the inability of reproduction may have been created before oogenesis although the pregnancy can be observed. However, the oogenesis AcV and AmV mites were clustered, separating from others, in the circRNA profile, implying a life-staged distribution. GO term and KEGG pathway enrichment analyses of the lncRNA target genes and of the parental genes of the identified circRNAs suggested that these predicted non-coding RNAs may be potentially responsible for the regulatory functions of protein processing, signal transduction, and various metabolism processes in the reproductive phase of V. destructor. These results revealed the prevalence of lncRNAs and circRNAs in V. destructor and provides biological insights for future genetic studies on this ubiquitous parasitic mite.

Abstract Title
Trickling oxalic acid in summer to combat varroa mites - a comparative field study in spain

Abstract Authors
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Abstract Text

Organic or “soft” varroa treatments, based on oxalic acid or other organic acids, have become one of the key instruments of modern Integrated Pest Management (IPM) plans in beekeeping in recent years. One of the big advantages of oxalic acid as an active substance is that - contrary to thymol and formic acid - it represents a treatment option that is largely independent of ambient temperature. In regions with hot climates, and considering global warming due to climate change, beekeepers are interested in effective and tolerable varroa management solutions fitting these conditions.
We tested three authorized oxalic-acid-based varroa treatments in summer in the South of Spain, recording efficacy, worker bee mortality, and the number of brood frames as well as the honeybee population before and after treatment. The products Oxybee® and Api-bioxal® were applied once in each colony after the queen had been caged for 25 days. The product VarroMed® was applied three times per colony without caging the queens. All tested treatments were applied in compliance with the SPC.
While Oxybee® and Api-bioxal® both achieved high treatment efficacy after queen caging, three applications of VarroMed® per colony without queen caging were not sufficient to control varroa effectively in this study. Although not statistically significant due to a small sample size, Oxybee®-treated hives demonstrated the lowest worker bee mortality in absolute numbers out of all three treatment groups. Treatment with both Api-bioxal® and VarroMed® resulted in a reduced number of frames containing brood and frames covered with bees later in the season compared with the Oxybee® group.
These results confirm that oxalic acid treatments can be highly efficient in summer after brood-interruption, making them a valuable instrument within an IPM plan for varroa management, even under high ambient temperatures. On the other hand, repeated oxalic acid treatments during the season with brood present in the colonies may not provide sufficient varroa control. It is therefore essential to prepare colonies with a brood interruption before treating them with oxalic-acid based formulations during the season.

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Afik	Ohad	Israel
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Aljedani	Dr. Dalal M.	Saudi Arabia
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Anwer	Asmaa	Egypt
Arab	Alireza	Iran
Arjun	Rajini	India
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Bava	Roberto	Italy
Beach	Nathan	United States
Beaurepaire	Alexis	Switzerland
Ben Salem	Hassen	Tunisia
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Brodschneider	Robert	Austria
Bruckner	Selina	United States
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Brusbardis	Valters	Latvia
Buechler	Ralph	Germany
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Cabirol	Amelie	Switzerland
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Costa	Cristina	Portugal
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Dahle	Bjorn	Norway
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De Clercq	Jean Jacques	Belgium
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Di Ruggiero	Camilla	Italy
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Douarre	Vincent	France
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Molasy	Bartlomiej	Poland
Mooney	Helen	Ireland
Morawetz	Linde	Austria
Morin	Marie-Lou	Canada
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Mumoki	Fiona	South Africa
Mustafa	Sandra	Germany
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Naree	Sanchai	Thailand
Nasr	Medhat	Canada
Nave	Anabela	Portugal
Nedic	Nebojsa	Serbia
Neumann	Peter	Switzerland
Nganso	Beatrice	Israel
Odemer	Richard	Germany
Opitz	Michael	Austria
Ota	Takahiro	Japan
Owen	Robert	Australia
Ozkirim	Asli	Turkey
Pade	Remi	France
Paillard	Marilene	Canada
Palgrave	Chris	United Kingdom
Palonen	Aura	Switzerland
Panziera	Delphine	Netherlands

Papach	Anna	Switzerland
Papas	Evangelos	Greece
Patalano	Solenn	Greece
Pavlov	Borce	Macedonia
Pietropaoli	Marco	Italy
Puskadija	Zlatko	Croatia
Quesada	David	Spain
Reichart	Andreas	Luxembourg
Retschnig	Gina	Switzerland
Rogenstein	Steve	Germany
Rojas Nossa	Sandra	Spain
Rollin	Orianne	Belgium
Rousseau	Andree	Canada
Rowe	William	United States
Rueppell	Olav	Canada
Sabbahi	Rachid	Morocco
Salvatore	Giovanna	Italy
Santrac	Violeta	Bosnia and Herzegovina
Schaefer	Marc	Germany
Schiesser	Aygun	Turkey
Schoeffmann	Martina	Austria
Schoonman	Marten	Netherlands
Senchyk	Tanya	Ukraine
Sgolastra	Fabio	Italy
Shabel	Allyson	United States
Sharaf El-Din	Hatem	Egypt
Sheridan	Audrey	United States
Shkrobanets	Oleksandr	Ukraine
Shpigler	Hagai	Israel
Simon Delso	Noa	Belgium
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Smodis Skerl	Maja Ivana	Slovenia
Soroker	Victoria	Israel
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Steeger	Thomas	United States
Stevanovic	Jevrosima	Serbia
Stief	Karsten	Germany
Stine	Donna	United States
Suwannapong	Guntima	Thailand
Thai	Pham	Viet Nam
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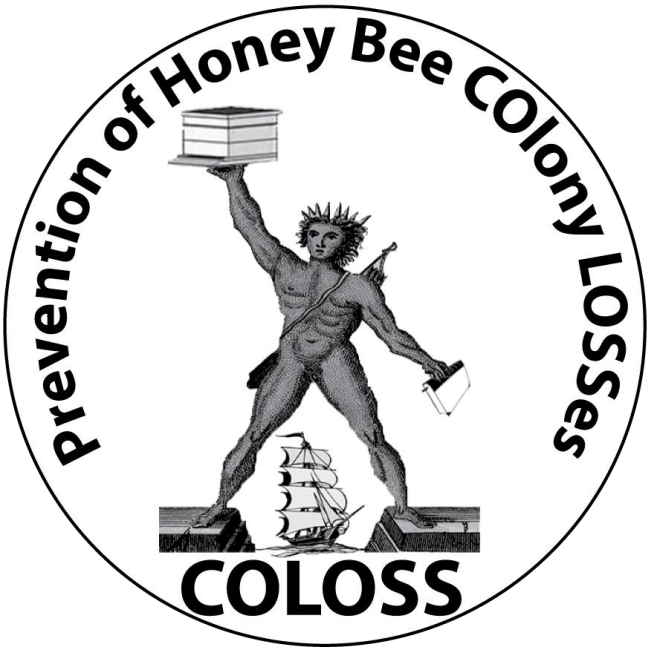
Tlak Gajger	Ivana	Croatia
Tosi	Simone	Italy
Traynor	Kirsten	Germany
Tsagkarakis	Antonios	Greece
Tymochko	Lesya	Ukraine
Underwood	Robyn	United States
Uzunov	Aleksandar	Macedonia
Valentine	Alexandra	Ireland

van Gent-Pelzer	Marga	Netherlands
Vejsnaes	Flemming	Denmark
Vignoli	Vania	Italy
Visick	Oliver	United Kingdom
Vlogiannitis	Spyridon	Greece
von Knoblauch	Tammo	Germany
Vranic□ar Novak	Anita	Slovenia
Vu	Amy	United States
Wagoner	Kaira	United States
Webster	Thomas	United States
Wilde	Jurek	Poland
Williams	Anthony	United Kingdom
Williams	Geoff	United States
Y N	Venkatesh	India
Yanez	Orlando	Switzerland
Yazlovytska	Liudmyla	Ukraine
Zending	Sean	Netherlands
Zhang	Zhaonan	France
Zheng	Huoqing	China
Zvokelj	Lucija	Slovenia



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