AVESPA
ASOCIACIÓN DE VETERINARIOS ESPECIALISTAS EN SANIDAD Y PRODUCCIÓN APÍCOLA

BEE HEALTH SYMPOSIUM

Honeybee welfare in a healthy world

Abstract book

BeeHealth '24 Spain
HoneyBee Welfare

June 15th - 16th 2024
MADRID

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2024, 15th – 16th May

Faculty of Veterinary Sciences

Complutense University of Madrid

Edited by Sergio Gil-Lebrero, 2024.

On behalf of AVESPA, the Association of Veterinarians Specialists in Bee Health and Production, we welcome you to the Bee Health APIMONDIA Symposium.

The celebration of this international Symposium has been an enormous challenge for AVESPA, a modest Association, which has faced its organization with great effort and enthusiasm, driven by the conviction of the need to hold a Symposium of this type in Spain. And, despite the beekeeping importance of our country and the fact that it has the largest census of hives in the European Union, an event like this has never been held before.

The Symposium is titled “Honeybee Welfare in a healthy world”, since we consider that international beekeeping, and Spanish beekeeping in particular, faces important challenges: health, environmental, climate change, etc. that can affect the well-being of our bees.

Given this scenario, we believe that this international Symposium, through the conferences of the invited speakers and the communications presented, represents an excellent opportunity to promote knowledge and research, as well as share experiences and new practices in beekeeping that are developed worldwide.

These days, Madrid is going to become a meeting point for researchers, scientists, consultants, veterinarians, beekeeping technicians and beekeepers, both Spanish and from other countries in the world, all of them fundamental links in the great beekeeping chain, who must work closely and together to safeguard the health of bees.

We must thank the Complutense University of Madrid for their support, and especially the Faculty of Veterinary Medicine, as well as all the sponsors who have made the celebration of this Symposium possible.

We appreciate your attendance and encourage you to actively participate in this event that we hope meets everyone's expectations, also allowing you to create ties and fraternize with colleagues from Spain and many other countries.

Mª Dolores Sánchez Escudero

President of the Organizing Committee

En nombre de AVESPA, la Asociación de Veterinarios Especialistas en Sanidad y Producción Apícola, os damos la bienvenida al Symposium Bee Health APIMONDIA.

La celebración de este Symposium internacional ha supuesto un enorme reto para AVESPA, una modesta Asociación, que ha afrontado con mucho esfuerzo e ilusión su organización, impulsada por el convencimiento de la necesidad de celebrar un Symposium de este tipo en España. Y es que, a pesar de la importancia apícola de nuestro país y de que cuenta con el mayor censo de colmenas de la Unión Europea, nunca antes se había llevado a cabo un evento así.

El Symposium lleva por título "Honeybee Welfare in a healthy world" (El bienestar de la abeja de la miel en un mundo saludable), ya que consideramos que la apicultura internacional, y la apicultura española en particular, se enfrenta a importantes retos: sanitarios, medio ambientales, el cambio climático, etc. que pueden afectar al bienestar de nuestras abejas.

Ante este escenario, creemos que este Symposium internacional a través de las conferencias de los ponentes invitados y las comunicaciones presentadas, supone una excelente oportunidad para impulsar el conocimiento y la investigación, así como compartir experiencias y nuevas prácticas en apicultura que se desarrollan a nivel mundial.

Madrid se va a convertir en estos días en punto de encuentro de investigadores, científicos, consultores, veterinarios, técnicos apícolas y apicultores, tanto españoles como de otros países del mundo, todos ellos eslabones fundamentales de la gran cadena apícola, que deben trabajar estrecha y conjuntamente para salvaguardar la salud de las abejas.

Debemos agradecer el apoyo a la Universidad Complutense de Madrid, y en especial a la Facultad de Veterinaria, así como a todos los patrocinadores que han hecho posible la celebración de este Symposium.

Agradecemos vuestra asistencia y os animamos a participar activamente en este evento que esperamos cumpla con las expectativas de todos, permitiendo además crear lazos y confraternizar con compañeros de España y de otros muchos países.

Mª Dolores Sánchez Escudero

Presidenta del Comité Organizador

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PROGRAM

Saturday - June 15th

8:15	**Opening poster session 1**
8:30	**Opening session** *Apimondia, AVESPA and UCM* *Honor Committee*
9:00	**Plenary session – Animal welfare concepts applied to honeybees: Is our planet a healthy world?** *Chairs: Aránzazu Meana & Jeff Pettis* Honeybee Welfare: from Five Freedoms to Five Provisions. *Page 11.* *Jesús de la Fuente* Challenges to ensure sustainability of beekeeping under modern agriculture and climate change. *Page 12.* *Fani Hatjina* INSIGNIA, an environmental biomonitoring study with honey bee colonies; an overview of the results. *Page 13.* *Sjef van der Steen*
10:30	**Coffee break** sponsored by Dalan Animal Health
11:00	**Session 1 – Provision 1: Related to provide food and water quality and availability.** *Chairs: Jesús de la Fuente & Carlos Marín* Short lecture from a chair. *Page 21.* Four oral presentations. *Page 21.*
12:15	**Sponsors Session** Apinevada, Calier & Véto-pharma
13:15	**Lunch break** sponsored by AVESPA
14:30	**Individual Sponsors Session** (per invitation)
15:00	**Session 2 – Provision 2: Related to provide an appropriate environment of honeybee.** *Chairs: Aránzazu Meana & Peter Kozmus* Short lecture from a chair. *Page 27.* Four oral presentations. *Page 28.*
16:15	**Coffee break** sponsored by AVESPA
16:45	**Session 3 – Provision 3: Related to prevention or rapid diagnosis and treatment.** *Chairs: Juan Molina & Jeff Pettis* Short lecture from a chair. *Page 35.* Four oral presentations. *Page 35.*
18:00	**End poster session 1**

Sunday - June 16th

8:15	**Opening poster session 2**
8:30	**Plenary session – Animal welfare concepts applied to honeybees: Can colonies be healthy and sustainable?** *Chairs: Aránzazu Meana & Fani Hatjina* Honey bee health in a world of pathogens and pesticides: measurement and interpretation of large data sets. *Page 14.* *Marie-Pierre Chauzet* Paving the way to marker-assisted selection in beekeeping targeting varroosis. *Page 15.* *Dirk de Graaf* Bee welfare evaluation as a tool to assess bee management. *P. 16.* *Giovanni Formato* Bee-Extend, to clarify the deficiencies and need of advisory services for sustainable beekeeping. *Page 18.* *Lotta Fabricius*
10:15	**Coffee break** sponsored by AVESPA
10:45	**Session 4 – Provision 4: Related to provide proper facilities and handling.** *Chairs: Sergio Gil & Miguel Alonso* Short lecture from a chair. *Page 49.* Four oral presentations. *Page 50.*
12:00	**Session 5 – Provision 5: Related to ensure conditions and treatment which avoid suffering of honeybee colonies.** *Chairs: Cristina Ruiz & Xesús Feás* Short lecture from a chair. *Page 55.* Four oral presentations. *Page 56.*
13:15	**End poster session 2**
13:45	**Conclusions**

PLENARY SESSIONS ABSTRACTS

HONEYBEE WELFARE: FROM FIVE FREEDOMS TO FIVE PROVISIONS

Jesús de la Fuente Vázquez.

Animal Production Dept. Faculty of Veterinary Medicine, Complutense University of Madrid, Spain.

Abstract: When we talk about animal welfare, we always think of hens in cages or pigs in intensive systems. However, few people consider that bees might have issues related to their welfare. This lack of consideration has meant that the development of issues regarding apicultural animal protection and welfare has never been taken into account, and it is only now that the need to consider them is being raised. When we consider the welfare of an animal, we always have the Five Freedoms in mind. One of the main objectives of the Five Freedoms is to understand, identify, and minimize negative welfare states. The main advantage of these Five Freedoms is that they identify the elements that determine the ideal state of welfare, but they are very general and difficult to quantify in real life, as they do not cover, in breadth or depth, the current knowledge of biological processes to understand animal welfare and guide its management.

In 2005, Webster presented the Five Provisions, which consist of management actions to facilitate the interpretation of each of the Five Freedoms. The aim of the Provisions is to provide a checklist to evaluate the strengths and weaknesses of production systems and ensure Freedoms understood within certain limits. At the same time, the Five Domains model, proposed by Mellor and Reid in 1994, was developed to address the difficulties of the Five Freedoms and to assess animal welfare. In 2015, this model was updated to incorporate ways to qualify welfare compromise (related to negative experiences) and welfare enhancement (related to positive experiences). With the domains, first, physical/functional alterations and imbalances, as well as restrictions in behavioral expression, are assessed individually, and then their impact on the fifth domain, the "mental domain," on the general welfare state of the animal is evaluated. Mind-body interactions are observed, with the assignment of affects. This way of considering animal welfare tries to align with the concept of "Quality of Life," which recognizes that animals can have both negative and positive

experiences, and that the net balance between the two types of experiences will vary over time, so the goal should be to achieve a net balance over time that favors positive experiences.

When we try to apply these freedoms, provisions, or domains in beekeeping, we encounter one of the first questions: should they be applied to each honeybee or to the superorganism, the colony? The honeybee colony as a superorganism shows a completely different life history than that of each of the individuals that constitute it. The colony can be considered permanent, whereas worker bees, drones, or the queen are not. The genetic integrity of the colony depends on the queen: when she dies, it represents the death of the colony, but the eggs she has left can allow another queen to emerge and perpetuate the genetic line of the colony, trying to keep the colony alive.

There are issues to consider regarding the application of the freedoms or domains in beekeeping, such as those related to management practices in apiaries: hive density, separation between them, adequacy of artificial feed supply, health problems, and pathogen transmission, and also those related to the environment, such as the use of pesticides and herbicides in agriculture and their impact on beekeeping flora and honeybees. All of these are of special importance when assessing the welfare of honeybees.

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CHALLENGES TO ENSURE SUSTAINABILITY OF BEEKEEPING UNDER MODERN AGRICULTURE AND CLIMATE CHANGE

Fani Hatjina.

Department of Apiculture, Inst. of Animal Production, Hellenic Agricultural Organization 'DIMITRA', Greece.

Abstract: Modern agriculture practices come along with intensification of farming, excessive use of pesticides, deforestation, urbanization, and all result in reducing bee foraging sources and accumulating toxic pollutants to food resources available for bees and wild pollinators. Beekeeping as a profession providing income, livelihoods and environmental services is undergoing a dramatic period. Inherent variables such as pests and diseases as well as pressure from changes in the climatic conditions are adding more stress to the bees and jeopardizing beekeeping. Beekeepers, scientists and

politicians need to develop urgent mitigation actions to ensure sustainability for the future generations. We need to go beyond Integrated Pest Management (IPM) and promote farther the organic farming practices to reduce the reliance on harmful chemicals. Policies limiting or banning the use of the most harmful pesticides are also crucial. The greening of the planet, the maintenance of the biodiversity and the protection of the natural habitats need to be reinforced. Plan be on saving the planet is already a history, we already move to plan C, whet ever this is. Breeding and selecting bee strains that are more resilient to changing climates is more essential than ever. Along this, adaptive management practices to new conditions are needed. Awareness campaigns for citizens about bees and their environmental services need to go hand to hand with support of the local and good quality bee products to improve the economic sustainability of beekeeping. To tackle all above challenges comprehensively we must reach optimal collaboration between farmers and beekeepers and involvement of both groups of producers, together with scientists in decision making and policy changes.

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INSIGNIA-EU. THE EU PREPARATORY ACTION FOR MONITORING OF ENVIRONMENTAL POLLUTION USING HONEYBEES

J. van der Steen[1], A. Quaresma[2], H. Baveco[3], R. Brodschneider[4], V. Brusbardis[5], B. Buddendorf[3], N. Carreck[6], L. Charistos[7], E. Danneels[8], A. Fernandez-Alba[9]. D. de Graaf[8], K. Gratzer[4], A. Gray[10], F. Hatjina[7], K. Kasiotis[11], O. Kilpinen[12], M. J. Martínez Bueno[9], M.A. Pinto[2], M. Pietropaoli[13], Maria Murcia[9], I. Roessink[3], E. Tzanetou[11] and F. Vejsnæs[12].

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Abstract: INSIGNIA-EU is the first pan-European action which has provided the baselines for the use of honey bees as environmental monitoring tools. In this citizen scientist beekeeper project, performed in 2023, honey bee

colonies were use to biomonitor environmental pollution in 315 apiaries in the 27 EU countries.

Non-polar pesticides were monitored with APIStrips every two weeks; 202 compounds were detected in the 5,524 APIStrips. Azoxystrobin, boscalid and acetamiprid were the most detected pesticides. The median number per APIStrip was four in agricultural-, two in urban- and two in natural areas. Honey was sampled at four-week intervals, giving 1,164 samples. Polar pesticides found in honey were glyphosate, AMPA, phosphonic acid or N-acetyl-glyphosate. Microplastics were sampled at four-week intervals; 52,099 synthetic polymer fibres and 7,244 synthetic polymer fragments and films were detected and analysed. Polyester, polypropylene, and polyacrylonite were the most detected microplastics. Metals were sampled at four-week intervals, and greater amounts of metals were found in southern Europe, due to natural soil sources. The analysis detected point emission sources. After four weeks of in-hive exposure for 1,216 silicone bands, all 20 target VOCs were detected. Isoprene was followed by hexane and benzene. Of 35 target PAH compounds, 34 were detected, the dominant compounds being naphthalene, methylnaphthalenes and pyrene. Significant exceedance of the average values indicated locally increased emissions. The 2,490 bee-collected pollen samples, showed 501 genera. Pollen of Trifolium, Plantago, Brassica, Rubus, and Castanea were most abundant. Pollen diversity was higher in urban and natural- than in agricultural areas. The Mediterranean area has the most differentiated bee-collected pollen in Europe. Pollen diversity and the distribution of environmental pollution in the European Union throughout the bee season are visualized in spatially explicit models. The study has already generated eight scientific publications. INSIGNIA-EU is an EU funded project (No 09.200200/2021.864096/SER/ENV.D.2.”.).

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HONEY BEE HEALTH IN A WORLD OF PATHOGENS AND PESTICIDES: MEASUREMENT AND INTERPRETATION OF LARGE DATA SETS

Marie Pierre Chauzet.

Agence Nationale de Sécurité Sanitaire de l'Alimentation, de l'Environnement et du Travail, France.

Abstract: Honey bee health in a world of pathogens and pesticides: measurement and interpretation of large data sets Declines in insect

pollinators have been linked to a range of causative factors such as disease, loss of habitats, the quality and availability of food, and exposure to pesticides. According to the WOAH Terrestrial Code, animal welfare means 'the physical and mental state of an animal in relation to the conditions in which it lives and dies'. Reducing exposure to stressors would therefore increase honeybee welfare. Within the Poshbee framework (www.poshbee.eu), sentinel bees (*Apis mellifera*, *Bombus terrestris* and *Osmia bicornis*) were deployed in a network of 128 sites in eight European countries focusing on either oilseed rape fields or apple orchards during focal crop bloom. We measured the field exposure to 11 IPAs (6 RNA viruses, 2 bacteria, and 3 microsporidia). Pesticides were also screened in the three species, in pollen-nectar stores/beebread, in pollen collected with traps and directly on flowers and in regurgitated nectar. We describe differences among bee species in IPA profiles - richness, diversity, detection frequencies, loads and their change upon field exposure, and exposure risk- with no clear patterns related to the country or focal crop. We also report positive correlations of IPA loads supporting the potential IPA transmission among sentinels. We developed a new index to summarise key aspects of complex pesticide exposure data and to understand the links between pesticide exposures. We found that matrices collected from apple orchards generally contained a higher number of pesticides (7.6 pesticides per site) than matrices from sites collected from oilseed rape crops (3.5 pesticides), with fungicides being highly represented in apple crops. Our results show that for a complete assessment of pollinator exposure to stressors, it is necessary to consider several exposure routes and multiple species of bees across different agricultural systems.

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PAVING THE WAY TO MARKER-ASSISTED SELECTION IN BEEKEEPING TARGETING VARROOSIS

Dirk C. de Graaf.

Department of Biochemistry and Microbiology, Ghent University, Belgium.

Abstract: For 10 years now, Professor Dirk de Graaf has taken up the challenge to pave the way for marker-assisted selection against varroosis. This involved looking for changes in the genome sequence that could indicate an

innate predisposition to resistance to varroosis and using that as the basis for a breeding program. In 2019, an initial success was achieved with finding an 8-variants model that can predict with a high probability the predisposition of the protective trait 'suppressed mite reproduction' in drones. But the path to marker-assisted selection is full of obstacles and each one requires deep research. For example, the model was challenged in the cross-population study among Flemish beekeepers. It was also examined whether the model holds up for the same characteristic in workers and the allele frequency was screened in the different Member States of Europe with its diversity of bee subspecies. We are currently at the level of practical tests: is it possible to improve the genetic profile of bee colonies and what is its influence on the expression of the protective trait?

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BEE WELFARE EVALUATION AS TOOL TO ASSESS APIARY MANAGEMENT

Giovanni Formato.

Veterinary in charge of the Apiculture Unit at Istituto Zooprofilattico Sperimentale del Lazio e Toscana, Italy.

Abstract: Welfare is a multidisciplinary science that raised more and more interest over the past 50 years. Its relation to better productions, in term of quantity and quality became a point of interest for the science field. Popular attention to animal Welfare has increased too over the Years. Farmers are now interested in adapt their production and management in order to meet the quality demands, which includes Welfare of Animals. Currently animal related practices and medicine follows the One Health Approach, in the aim of Health and Protection of all, human, animals and environment. After Welfare arising, One Health Approach has been enriched with the One Welfare Concept, aiming to balance between human, animals and environment and operating in a broader framework.

There are several definitions of Animal Welfare, the WHOAH in the Terrestrial Animal Code define Animal Welfare as “The physical and mental state of an Animal concerning the conditions in which lives and dies”. In this case mental state is recognized to all animals through the sentience status which includes honey bees. Welfare status in animals is the resultant of multiple stressors coming from environment, defined by duration, intensity, frequency and

severity. The ability to respond to external stress is determined by the resilience of an animal, this means the ability to restore lost balance (mental, physical or medical) in relatively short time and without significant losses. This concept applies to honey bees especially considering the colony as the single animals, where lead all observations. Stressors in the One Welfare approach can be specie-specific or generic. Generical stressors such as Nutritional resources, Disease prevalence, Climate change impact, Pesticide intoxication, Soil erosion, Urbanization, Antimicrobic resistance and Overcrowding, can be found in any of the One Welfare Areas (human, environments, animals) and are also applicable to beekeeping sector. Welfare is observed directly on Animals, and in this case on the colony.

The honeybee resiliency is expressed as colony loss which is one of the most problematic challenges in modern beekeeping. Colony loss arises from multiple factors and its multifactoriality is the reason why it is a viable indicator of honey bee Welfare. Management can have a huge impact on colony loss, and Good Practices are always considered as one of the most effective way to ensure health and Welfare. Colony loss has multiple causes including Varroa, Climate Change, Pesticides, Equipment Hygiene and Poor Management (Winter management, General Management) in analogy to the generic stressors mentioned in the One Welfare approach. The attitude and the awareness of beekeepers in consideration of this factors appeared to be predictive of a higher probability of colony loss. Management can have an impact on colony loss especially for specific practices such as Winter, Queen, Brood and Apiary management, Keeping Register, Train workers and considering local resources. In order to achieve a better Welfare, institutions suggested the necessity of a Welfare Certification, for a standardized Welfare condition and an added value to beekeeping food chain. The certification opened the possibility of setting new way of observing Welfare.

The most reliable is acting through Risk Assessment Analysis, where are considered both the Environmental risk potentiality and the visible effect on Animals. In this context Italian Ministry of Health and the Welfare National Centre for Italy (at IZSLER-CRENBA) ideated the ClassyFarm System, that represents an integrated approach that melt information from different repository databases (Veterinary repository, Treatments repository, BDA and Laboratories) to produce a general score, considering in each farm its animal management, the biosecurity measures adopted, the existing structures and the final effect on the farmed animals. Furthermore, it provides interactive

dashboards of the controls and downloadable reports and manuals. The outcomes of the ClassyFarm system are positive for farmers as they can access easily to European funds, overcome official control greatly and soon also to obtain quality certifications. ClassyFarm is based on Risk Analysis where specific measures are validated by experts, considering their relevance. ClassyFarm adoption is on a voluntary base for farmers, and involve on-site inspections of Veterinary Officers through the adoption of specific check-lists of indicators affecting animal health. Currently Classyfarm is experimented and upload with the collaboration of IZSLT (Istituto Zooprofilattico Lazio e Toscana) for honeybees with the ClassyAlv Protocol.

For the management checklist the following aspects are considered relevant: the training of operators, number of hive inspections, colony balance, swarming management, winter management, water & feeding availability, bee killing, transport, hive entrance management, Quarantine apiary, Disease control and varroa protocols. For the checklist concerning the structure & equipment: hive maintenance, hive position and orientation are considered the most relevant for ensuring honey bee welfare. For the Biosecurity checklist, particular emphasis is given to traceability (including beekeeping register) and hygiene, artificial feeding, wintering, queen management, waste management and prevention and control of diseases. The system will be presented in details.

Future perspectives for ClassyAlv will include the integration of data, the creation of manuals, checklists, and the implementation of good beekeeping practices.

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BRIDGING RESEARCH AND PRACTICE - EXTENSION AND ADVISORY SERVICE FOR HEALTHY HONEY BEES AND SUSTAINABLE BEEKEEPING

Lotta Fabricius Kristiansen.

Swedish University of Agricultural Sciences, National Competence Center for Advisory Services, Department of People and Society, Alnarp, Sweden.

Abstract: A skilled and experienced beekeeper knows how to read the seasons' development and accordingly manage his/her honey bee colonies. A lot of practices are being done by routine but with a changing and

unpredictable climate, the demand for credible knowledge, innovation and support is called upon from both experienced and new beekeepers. Do these supporting structures exist, and do they keep up with the articulated demands of beekeepers?

Beekeepers are confronted with a large amount of information through various sources such as the internet, beekeeping literature and networks of co-beekeepers. It is hard for beekeepers to know who and what is credible and trustworthy, as information is often inconsistent and contradictory. Finding the “correct” information becomes even more complex when the problems are multi-scalar, and solutions need to be based on local conditions.

Local adaptation and sharing of context-specific research results and practical experience are generally facilitated through beekeeping extension activities and advisory services. This adapted knowledge needs to be accessible to beekeepers in a user-friendly form – ideally through a network of various supporting structures focusing on different aspects of beekeeping.

COLOSS, the international honey bee research association, has the main mission to improve the well-being of honey bees. COLOSS has 12 organized groups working on different topics related to honey bee health. One of the groups, B-RAP (Bridging Research and Practice), has the specific intention of connecting science and beekeeping through the work of beekeeping advisory services. As an initiative to support and professionalize the extension and advisory services within beekeeping, the B-THENET Horizon network explores the development of internationally certified training of advisors in beekeeping.

SESSION 1 ABSTRACTS

Provision 1: Related to provide food and water quality and availability

CHAIR'S SHORT LECTURE:

BEEKEEPING FEEDING; MORE QUESTIONS THAN ANSWERS

Carlos Marín.

Veterinarian and president of FAPI, the Federation of Beekeepers Associations of Asturias, Spain.

Abstract: By evaluating the general zootechnical development of the beekeeping sector we can realize its serious deficiencies, even more so when we make comparisons with other farms. Regarding bee nutrition and artificial feeding (as in many other fields), we have many questions to answer with a wide horizon to investigate. Is artificial feeding necessary in beekeeping? How do we know when we need to feed? Do we know what and how we should feed? How is the availability of food in the countryside modified by climatic alterations, changes in habitats due to human consequences or new predators and non-native pests? Are we becoming more dependent on artificial feeding of our bees? Unfortunately, we do not know many of these answers, a consequence of a lack of applied studies in nutrition. The beekeeper must have technical tools if we want to maintain a profitable beekeeping activity in these times of commercial difficulty.

ORAL COMUNICATIONS:

PROBLEMS IN THE EXECUTION OF EFFECTIVENESS STUDIES OF PROTEIN SUPPLEMENTATION ON *APIS MELLIFERA IBERIENSIS*

Marta Pitarch-Bielsa[1], Antonio Gómez-Pajuelo[1], María Fernanda López-Climent[2] and Fina Gonell Galindo[1].

(1) Pajuelo Consultores Apícolas, Spain; (2) Universitat Jaume I, Spain.

Abstract: Honey bees play an important role in agriculture, through the pollination of crops and also natural ecosystems. In recent decades, the beekeeping sector worldwide is threatened by different factors, such as

parasites and pathogens, exposure to pesticides or a reduction in food availability, associated with changes in land use and climate change. The decrease in natural sources of nectar and pollen, essential to meet nutritional needs, has a negative impact on the health of the colonies, reducing their productivity or even their viability. Therefore, in times of scarcity, nutritional supplementation can prevent malnutrition and its consequences.

To evaluate the effectiveness of protein supplements on *Apis mellifera iberiensis*, simple markers are needed for beekeepers, in order to predict their effect on the colony. The strength of the colonies would be one of them, but when we provide protein feeding, the result is not reflected instantly, but is observed in long term. Therefore, in the present work, the analysis of proteins and body fats of nurse bees is proposed as a quick and simple measure to evaluate the nutritional status of the bees. In parallel, analysis of the gene expression of genes related to nutrition and the immune system, such as vitellogenin (vg) and defensin (defensin), has also been carried out. This analysis is presented as a great tool to evaluate the influence of feeding on the physiology of bees, but its higher economic cost must be considered. Evaluating the effect of protein supplementation by carrying out field trials is difficult; sometimes the apiary site environment can mask the results, without being able to establish a direct relationship between the impact of the feeding and the results obtained. Therefore, is essential to increase data and control tools to plan feeding strategies and evaluate the need for them.

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BODY WATER LOSS AS BEE ADAPTABILITY TO CLIMATE CHANGE

Soledad Sagastume[1], Giovanni Cilia[2], Banan Al-Shagour[3], Asmaa Anwer Eissa[4], Fernando Doblado[1], Nizar Haddad[3], Antonio Nanetti[2], Mariano Higes[1] and Raquel Martín-Hernández[1].

(1) IRIAF- Instituto Regional de Investigación y Desarrollo Agroalimentario y Forestal de Castilla-La Mancha, Centro de Investigación apícola y agroambiental (CIAPA), Marchamalo (Spain); (2) Institution name 2 CREA-Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Bologna (Italy); (3) NARC-National Agricultural Research Center, Baqa' 19381 (Jordan); (4) ARC- Agricultural Research Center, Bee Research department, Giza (Egypt).

Abstract: Climate change is a powerful source of stress, being the temperature one of the most important abiotic pressures. However, changes in precipitation patterns are also key, not only because of water availability

per se but also because of fluctuations in relative humidity (RH). Both variables are closely related and, when get combined, act as new independent stressor; for example, in bees, low RH levels combined with high temperature can exacerbate heat stress, whereas high humidity can reduce its severity. Because of it, the bees are able to regulate both temperature and humidity inside of the hive evaporating nectar water and regurgitating liquid droplets to restore the favourable conditions. One way to study this dehydration ability is calculating the body water loss (BWL) per bee before and after the exposure to a specific combination of temperature and humidity. Within MEDIBEES project, BWL assays were performed testing 9 different conditions which combined 35, 40 and 45°C of temperature with 10, 25 and 50% of RH. Using standard protocols, the same experiment has been carried out at different laboratories of Spain, Italy and Jordan with their corresponding subspecies. The results showed the protective effect of high RH under high temperature conditions. On the other hand, differences in the dehydration ability have been found between subspecies which point to a different adaptability to hot environments.

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ADAPTATION OF BEEKEEPING TO CLIMATE CHANGE: MODELLING THE ECOLOGICAL NICHE OF HABITATS OF BEEKEEPING INTEREST IN THE SIERRA DEL RINCÓN (MADRID, SPAIN)

Jorge J. Ortega Marcos[1], Jorge Chicote Carreras[1], José Ángel Sánchez Agudo[2], David Rodríguez[2] and Ana Moreno de la Fuente[1].

(1) Instituto Madrileño de Investigación y Desarrollo Rural, Agrario y Alimentario (IMIDRA), Spain; (2) Universidad de Salamanca, Spain.

Abstract: Adaptation to climate change represents a pivotal challenge for the resilience of agricultural systems. Beekeeping is particularly susceptible to the effects of climate change, given its high degree of dependence on local conditions and the state of the vegetation. Ecological niche modelling provides an understanding of the suitability of habitats to support certain species under environmental conditions such as climate. The objective of the study was to analyze the melliferous value of the vegetation in order to model the ecological niche of apicultural habitats and to predict the impact of climate change. The study area was the Sierra del Rincón, a territory situated

in the north of the Community of Madrid with a long tradition of beekeeping. In 2005, the “Sierra del Rincón” was designated a Biosphere Reserve in recognition of its cultural heritage, biological diversity and the sustainability of agricultural practices. A total of 12 apiaries were selected for analysis of the melliferous value of the vegetation. A 2 km radius buffer zone was created around each apiary in order to identify and characterize the habitats of interest to beekeepers using geographic information systems (GIS). Furthermore, botanical inventories were conducted at 20 representative sampling points. The estimation of beekeeping value of the different vegetation formations was calculated on the basis of the abundance and melliferous value (pollen and nectar) of each plant species. In addition, honey from selected apiaries was analyzed. The results indicated a preponderance of honeydew (from *Quercus pyrenaica* Willd.) with a comparatively minor presence of monofloral honeys, including *Erica australis* L. In order to predict how the honey value and the suitability of beekeeping activity could change in a scenario of climate change, an ecological niche model of the most representative species in this area (*Quercus pyrenaica* Willd.; *Erica australis* L. and *Adenocarpus complicatus* (L.) J.Gay) was carried out. It is expected that, in the near future (2040), the melliferous values in the area will not change significantly, thanks to the support of honeydew. Nevertheless, the feeding of hives may be compromised by the increased vulnerability of herbaceous species such as *Echium plantagineum* or *Adenocarpus complicatus*.

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A HOLISTIC APPROACH TO HONEY BEE WELFARE

Claudia Garrido[1] and Antonio Nanetti[2].

(1) BeeSafe; (2) CREA-Consiglio per la ricerca in agricoltura e l’analisi dell’economia agraria, Bologna (Italy).

Abstract: As social insects, honey bees form colonies with complex behaviour. Their intricate sociality categorizes honey bee colonies as superorganisms, which are capable to buffer stressors. Despite this, management and novel stressors like climate change, challenge the beekeeping industry globally. Applying the "five freedoms" to honey bee welfare presents difficulties, which lie in the elusive nature of insects and the nested superorganism complexity. At least two levels have to be addressed: the individual bee in all

its developmental stages and the colony as a whole. For sustainable beekeeping, colony welfare will play an essential role, benefiting both productivity and food safety. Focusing on key areas like colony biology, nutrition, disease management, and environmental impact present a first step for a holistic approach to beekeeping. We address the mentioned complexity with a new concept and formula generalizing the importance of good practices over stressors. This will facilitate continuous improvement in beekeeping practices and honey bee welfare.

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SESSION 2 ABSTRACTS

Provision 2: Related to provide an appropriate environment of honeybee

CHAIR'S SHORT LECTURE:

HOW TO ADAPT GOOD BEEKEEPING PRACTICE TO GLOBAL CLIMATE CHANGE?

Peter Kozmus.

Slovenian Beekeepers´ Association.

Abstract: The beekeeping industry faces significant challenges due to the impacts of global climate change, which affects bee health, productivity, and ecosystem stability. Adapting Good Beekeeping Practices (GBP) to these changing conditions is crucial for sustaining honeybee populations and the pollination services they provide. Presentation explores strategies for modifying GBP in response to climate variability, emphasizing the need for an integrated approach that encompasses environmental, biological, and socio-economic factors. Key adaptation measures include enhancing habitat diversity to ensure year-round forage availability, implementing precise monitoring and management of hive conditions to mitigate stressors, and selecting resilient bee breeds that are better suited to fluctuating climates. Additionally, beekeepers must adopt practices that reduce their carbon footprint, such as optimizing transportation logistics and minimizing the use of synthetic chemicals. The presentation highlights the importance of leveraging technology, such as remote sensing and data analytics, to provide real-time insights into environmental changes and bee health. Collaboration among researchers, beekeepers, and policymakers is essential to develop and disseminate region-specific guidelines that address local climate challenges. Training and education programs are also vital to equip beekeepers with the knowledge and skills needed to implement adaptive strategies effectively. Furthermore, fostering community-based approaches can enhance resilience by sharing resources and best practices. Overall, adapting GBP to climate change involves a proactive and dynamic approach that integrates traditional knowledge with scientific advancements. By promoting sustainable

beekeeping practices, we can safeguard honeybee populations, ensure the continuity of pollination services, and contribute to global food security in the face of an increasingly unpredictable climate. This presentation serves as a call to action for the beekeeping community to embrace innovation and collaboration in their efforts to combat the challenges posed by climate change.

ORAL COMUNICATIONS:

NEW PERSPECTIVES FOR THE ASSESSMENT OF HONEYBEES' EXPOSURE TO AGROCHEMICALS

Audrey Dewar and Pedro A. Segura.

Université de Sherbrooke, Sherbrooke, QC, Canada.

Abstract: The health of honeybees (*Apis mellifera*) is declining globally, due to various factors, such as parasites, pathogens, and climate change. Pesticides have come under intense scrutiny because they are suspected of compromising bee health. This sensitivity to pesticides is mainly due to the honeybees' deficiency in detoxification enzymes.

Current analytical methods face challenges in establishing a direct link between pesticide exposure and bee mortality, detecting only trace or no amounts of pesticides. These targeted analyses, while specific, overlook potential exposure to other agrochemicals of concern (e.g. adjuvants) or transformation products, thus limiting our understanding of the full spectrum of toxic compounds to which bees are exposed.

This presentation will discuss the potential of nontargeted analysis, which indiscriminately records signals from a wide range of compounds in each sample, for assessing honeybees' exposure to a wide range of agrochemicals. Examples of approaches of interest, such as spectral accuracy, molecular networks and clusters, and suspect screening will be presented.

Honeybee samples were extracted using a modified QuEChERS method and analyzed by liquid chromatography- quadrupole-time-of-flight mass spectrometry. The presence of compounds in samples was determined using a suspect screening list of more than 600 compounds in MZMine software, which included mass criteria for peak identification. A broad spectrum of compounds, varying widely in polarity, was extracted, with logP values

ranging from -0.1 to 5.2. Regarding extraction efficiencies, 85% of all compounds fell within the 70–100% range. Matrix effects were within the -20 – 20% range for 77% of the compounds tested. Subsequent acquisition of tandem mass spectra for several compounds aligned with theoretical spectra unambiguously confirmed their presence in the samples.

Our methodology demonstrates the feasibility of detecting these compounds using a nontargeted approach, thus enhancing our ability to comprehensively analyze agrochemical residues of concern in honeybee samples. The proposed method also allows the preservation of sample data digitally for future retrospective analysis. When combined with quantitative targeted methods, nontargeted analysis workflows like the one described here are powerful tools for enhancing our understanding of the role of exposure to agrochemicals in bee decline.

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INSTALLING BEEHIVES IN SOLAR PARKS TO ENHANCE LOCAL BIODIVERSITY

Nuria Rubio Saura, Maria Campo, Joana Ruiz and Paola Vecino.

El Rincón de la Abeja (Spain).

Abstract: Renewable energies have been proposed for some years as a solution to the ecological crisis caused by traditional fuels. The installation of solar parks for electricity production is therefore necessary for a transition to cleaner energy.

Additionally, spaces occupied by solar parks can be ideal places for biodiversity promotion consisting in controlled areas allowing free transit of numerous animal species in absence of phytosanitary products or other substances commonly used in rural areas.

The main objective of this project is increasing local biodiversity. Secondary objectives include the installation of beehives with *Apis mellifera iberiensis* swarms (native honeybee species), the monitoring and periodic evaluation of the state of health and demographic progression of these swarms and study of biodiversity increase in these areas, mainly due to the presence of *A. mellifera iberiensis*.

Prior to bee-hives installation, a preliminary study of the area is carried out to quantify floral load, biocenosis and geo-climatological characteristics of the area of study for determining the optimal number of hives for the benefit of the local ecosystem.

Once beehives set up, the bee-swarms health status is monitored and evaluated quarterly using monitoring systems. Parameters studies are weight, humidity inside the hive, external and internal temperature, and sound inside the hive.

Furthermore, a biodiversity study of the area was conducted by direct observation and quantification of species (S) in the area of bee-foraging (1 km around the beehives).

A great diversity of species has been detected in the area of study. Therefore, the population of Apis mellifera iberiensis is not displacing other pollinators in the area, on the contrary, results show that it is contributing to the pollination of the different plant species enhancing wild bees' biodiversity.

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HONEY BEES AND LARVAE AS INDICATORS OF ENVIRONMENTAL BURDEN WITH TOXIC MACRO- AND TRACE ELEMENTS IN EASTERN SLOVAKIA

Imrich Szabó[1], Rastislav Sabo[1], Konstantinos M Kasiotis[2], Effrosyni Zafeiraki[2], Lucia Sabova[1] and Kyriaki Machera[2].

(1) University of Veterinary Medicine and Pharmacy in Košice, Slovakia; (2) Laboratory of Pesticides' Toxicology, Department of Pesticides Control and Phytopharmacy, Benaki Phytopathological Institute, Greece.

Abstract: In the present study, 27 macro- and trace elements were measured in matrices, such as honey bees and larvae, in different regions of eastern Slovakia with an industry sector. The toxicity of heavy metals is an ecological problem in regions affected by processes such as mining, industry, and agriculture. Honey bees directly interact with air, soil, water, and plant nutrients during flight and foraging and are directly exposed to various environmental pollutants such as microplastics, heavy metals, and fine particles that directly affect the health of bees. As a consequence, their products and the bees themselves can provide valuable information on

potential pollution and can be considered indicators of environmental pollution.

GC-MS/MS and ICP-MS methods were used to quantify macro and trace elements. Heavy (toxic) elements such as As, Hg, Pb, and Cd were detected in higher amounts in the matrix of adult bees than in larvae in our case. The highest value of As was found in the bee matrix at 54 µg/kg, whereas the only positive sample in the larvae matrix had a value of 24 µg/kg. The Hg concentrations detected in the bees appeared to be twice the concentrations detected in the larvae. Pb was, in some cases, many times higher in bee samples compared to larvae. Cd was detected in higher amounts in bee samples, namely 161 and 131 µg/kg, compared to 15 µg/kg in larvae. Other macro- and trace elements of interest to us, such as Sb, Sn, Ag, Cu, Fe, Mn, Zn, Ni, Mo, and Co, were also recorded at higher levels in the matrix of adult bees compared to larvae. These elements are of analytical importance to us because of their presence in fertilizers and pesticides. Therefore, metal pollution at trace levels is a major threat to pollinators.

Funding: This research was supported by the Slovak Grant Agency APVV-21-0185 and GP MŠVVaŠ SR VEGA 1/0161/23.

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EFFECTS OF HONEYBEE HIVES DENSITY ON WILD POLLINATORS' COMUNITIES

Jorge Chicote Carreras, Jorge J. Ortega Marcos and Ana Moreno-Delafuente.

Instituto Madrileño de Investigación y Desarrollo Rural, Agrario y Alimentario (IMIDRA), Spain.

Abstract: The honeybee (*Apis mellifera* Linnaeus, 1758) is recognised as one of the most important pollinator species. Beekeeping activities create synergies between food production (honey, pollen) and pollination of natural and agricultural plant communities. Therefore, the honeybee not only plays a key ecological role in ecosystems, but also in the cultural and traditional values associated with this human activity. However, recent scientific evidence shows that inadequate management of honeybee hives, such as high hive densities, can affect pollen and nectar availability at the local scale (affecting food availability for wildlife species as well as for the domestic bees) and may increase the pathogens impact in the bee hives. In this study, we

analysed the de effect of honeybee density on wild pollinators in the Sierra del Rincón Biosphere Reserve (Madrid, Spain). Richness, abundance and functional diversity of wild bees and hoverflies (syrphids) at different distances from the apiaries and at areas without beehives within a radius of 2 km were analysed and compared. Sampling of wild pollinators in the field, was performed placing coloured pantraps traps in the filed during 24 hours. The sampling was carried out in October 2022 and June 2023. The proximity to apiaries was found to have different effects on the biodiversity of wild bees and syrphids. A negative relationship was observed between the proximity to apiaries and the abundance, richness and diversity of wild bees. This effect was also affected by the sociability and nesting behaviour of the wild bee species. In contrast, syrphid species respond differently to the presence of hives. Our observations suggest that the presence of hives might be beneficial for these flies. These results show the need to adjust the honeybee hive density in apiaries in order to ensure an ecological balance with other wild pollinators and to favour a sustainable use of natural resources.

POSTER COMUNICATIONS:

POSTER 01: THE USE OF AGROCHEMICALS AND CONSERVATION OF BEE SPECIES IN THE CERRADO BIOME IN MINAS GERAIS, BRAZIL

Bruno Otávio Teodoro[1], Miguel Pinto da Silva[2] and Anete Pedro Lourenço[1].

(1) Universidade Federal Dos Vales do Jequitinhonha e Mucuri (Brasil); (2) Instituto Mineiro de Agropecuária (Brasil).

Abstract: The decline in populations of pollinator insects has emphasized the urgency of implementing conservation strategies for these crucial species. Brazil´s Cerrado Biome harbors diverse bee species but faces significant biodiversity loss due to habitat fragmentation and the extensive use of agrochemicals. Conservation Units (UCs) have been established as a key strategy for biome conservation. Here, we analyzed bee species in Cerrado UCs in Minas Gerais State and the pesticides used in the UC municipalities to speculate on their potential effects on bees. For the apifauna in the UCs we conducted searches in Web of Science, Scielo, and Google Scholar. The aim was to identify species mentioned in the articles that function as pollinators or floral visitors to the crops surrounding the UCs. Subsequently, using data from the Instituto Mineiro de Agropecuária (IMA), the most commonly sold

active ingredients used in Minas Gerais agriculture over the past three years were determined. Cross-referencing the data revealed that out of the 91 bee species mentioned in the analyzed articles, 69 are pollinators or floral visitors of the principal crops cultivated in the municipalities neighboring the UCs. *Apis mellifera* was the most cited species in the analyzed studies and pollinates all related crops. Furthermore, insights from the commercialization of active ingredients highlighted a significant use of the following agrochemicals: mancozeb, acephate, atrazine, chlorpyrifos, chlorothalonil, and imidacloprid. It is noteworthy that some of these agrochemicals have already been banned by the European Union for their detrimental effects on bees. Glyphosate and 2,4-D are the top two most commercially traded herbicides by a wide margin. The findings suggest that while UCs serve as havens for pollinator species crucial to the surrounding crops, which depend on pollination as a vital ecosystem service, there is a pervasive use of harmful active ingredients within these areas. This highlights the necessity for international cooperation strategies to conserve pollinators, especially considering that a substantial portion of pollination- dependent products from Brazil are destined for the European market, where paradoxically, the active ingredients are both produced and prohibited.

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POSTER 02: SEASONALITY IS IMPERATIVE FOR PESTICIDE RISK ASSESSMENT ON HONEYBEES

Annelise Rosa-Fontana[1], María Benito Murcia[1], Raquel Martín-Hernández[2], Mariano Higes[2], Alice Pinto[3], Dora Henriques[3], Simone Tosi[4] and Juan Miguel Rodríguez Gomez[1].

(1) Complutense University of Madrid, Spain; (2) Centre for Beekeeping and Agri-environmental Research, Spain; (3) Polytechnic Institute of Bragança, Portugal; (4) University of Turin, Italy.

Abstract: The European Food Safety Authority (EFSA) recently devised an integrated framework focused on developing a holistic approach to the risk assessment (RA) of multiple stressors in bees. Considering that pesticides are key stressors, and that seasonality may alter the sensitivity of the bees, we investigated if the toxicity varies across season. We have chosen an acaricide (tau-fluvalinate, TAU) and an insecticide (flupyradifurone, FPF) to compare the mortality of bees from brood combs sampled in spring, summer, and

autumn. We have chosen an oral mean sublethal concentration for TAU, and a high field concentration for FPF. *Apis mellifera* is recognized by the Organisation for Economic Co-operation and Development (OECD) as a model organism for RA studies. Newly emerged bees from A. m. iberiensis were subjected to a unique concentration of each pesticide (232ppm: TAU; 36ppm: FPF). The control groups consisted of pure syrup (negative control, NC), and 1% of acetone added to the syrup (solvent control, SC). Each one was offered to three replicates containing 10 bees. The laboratory trials for the 3 seasons were carried out under equal conditions, and in accordance with the OECD (Nº 245). All experimental groups showed the highest mortality in the summer trials, and the lowest one in the spring. Herein a critical point warrants attention: we observed that the results exhibited substantial variance among replicates attributed to a high standard deviation. On the other hand, in autumn, we obtained results consistent with expectations within the parameters established by the OECD: mortality exhibiting low variability among replicates. Our findings indicated that bees emerging from brood combs sampled during autumn exhibited the most favourable responses for RA studies. We are currently investigating bees sampled from these same bioassays, with the aim of identifying molecular parameters that may be associated with seasonality. We have brought the seasonality as a new approach that until now, has been overlooked in RA studies. Our findings provide essential insights for further research into this topic.

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SESSION 3 ABSTRACTS

Provision 3: Related to prevention or rapid diagnosis and treatment

CHAIR'S SHORT LECTURE:

CAN WE SLOW THE SPREAD OF EXOTIC PESTS LIKE SMALL HIVE BEETLES AND TROPILAELAPS MITES?

Jeff Pettis.

Apimondia President.

Abstract: Worldwide trade continues to increase and thus the spread of exotic pests to new areas may seem inevitable. The movement of Asian hornets to France in trade goods and the continued spread of these hornets across Europe is just one example. Small hive beetles have spread widely across the globe from and were introduced into Italy in 2014 but have yet to spread within Europe. This is likely due to regulation and the raising of awareness among beekeepers and the public at large. Beekeepers are our best eyes on the ground to detect new pests but this requires education about new threats. *Tropilaelaps spp.* continues to spread from SE Asia and is on the doorstep of Europe. We must continue to work with guidance from the World Organization for Animal Health (WOAH) for the safe movement of bees and bee products and continue our efforts locally to educate beekeepers and the general public about exotic threats to bees and how they can serve as the watchdogs to safeguard local bee populations.

ORAL COMUNICATIONS:

EFFICIENCY OF A NEW TYPE OF OXALIC STRIPS IN VARROA CONTROL

Hussein Jradi.

Lebanon.

Abstract: A new product based on oxalic acid was evaluated for use in Varroa control under climatic conditions in South Lebanon. The formulation consists of new type of strips made of wooden core, covered by cellulose tissue,

impregnated with a solution based on oxalic acid. 25 beehives were used to assess the product efficacy. Each trial had respective control groups, a group treated with ordinary cellulose strips impregnated with the same solution of oxalic acid and another group remained without any treatment. At the beginning of the experiment, five strips of the formulation were applied to the colonies belonging to the treated group. Falling mites were counted after 7, 14, 21, 28 days. After the last count, the strips were removed and colonies received two dripping amitraz doses during 14 days. Falling mites were counted throughout this period. The results showed that the application of new type of strips seems to be more practical and efficient, leading to a successful Varroa control even in seasons with brood presence.

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DETECTING AND COMPARING THE ABUNDANCE OF *Vairimorpha (Nosema)* spp. IN DIFFERENT BEE HABITAT TYPES

Beáta Sabolová, Petra Kandráčová, Imrich Szabó, Monika Sučik and Alexandra Valenčáková.

University of Veterinary Medicine and Pharmacy in Košice, Slovakia.

Abstract: Nosematosis, caused by the microsporidial species *Vairimorpha apis* and *Vairimorpha ceranae*, represents a growing problem contributing to the decline of bee colonies worldwide. Previous research indicates that the species *Vairimorpha ceranae* is gradually replacing *Vairimorpha apis*, and in recent years, it is the only species repeatedly found in samples from Slovakia. The aim of this study was to detect the occurrence of *Vairimorpha spp.* and identify the species of this parasite in bee colonies kept in different environments, as well as to compare the impact of colony site location on its occurrence.

The methods included sampling winter dead bee corpses, microscopic examination of the contents of bee abdomens, and subsequent molecular analysis using duplex PCR. A total of 82 samples were examined, which were divided into four categories according to the location of the bee colonies: urban bees (22 samples), rural bees located within the built-up area (27 samples), rural bees located outside the built-up area (22 samples), and bees located in a forest habitat (11 samples).

After examining urban bees, 18 (82%) samples were positive and 4 (18%) were negative. Among rural bees located within the built-up area, 20 (74%) samples were positive and 7 (26%) were negative, while in rural areas, 4 (18%) were positive and 18 (82%) were negative. All 11 samples of bees located in a forest habitat showed no presence of *Vairimorpha spp.* The results of the microscopic method correlated with the results of molecular diagnostics. Using Duplex PCR, we identified the species *Vairimorpha ceranae* in all positive samples.

Our results indicated an increased occurrence of this parasite in colonies located in urban areas and colonies located within the built-up area of the municipality, which may be due to transportation as an abiotic stress factor. Abiotic factors, including transportation and associated vibrations, may play a role in the spread of *Vairimorpha spp.*. Research and monitoring of this issue are therefore essential for the protection of bee colonies and the maintenance of ecological balance.

This paper was created with the support of grant projects GP MŠVVaŠ SR VEGA no. 1/0161/23 and APVV-21-0185.

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THE USE OF NATURAL SUBSTANCES TO INCREASE THE IMMUNITY OF HONEY BEE COLONIES

Dagmar Mudroňová, Juraj Toporčák, Marek Ratvaj, Lenka Kollár Moskáľová, Rastislav Sabo, Tomáš Majchrák, Katarína Kuzyšinová and Ivana Cingeľová Maruščáková.

University of Veterinary Medicine and Pharmacy in Košice, Komenského 73, Košice, Slovakia.

Abstract: The immunity of the bee colony is negatively affected by a number of factors, which include environmental and climate changes, pesticides, improper beekeeping practices and many others. Bees with weakened immunity are more susceptible to infections and have reduced production capabilities. We tested the influence of autochthonous probiotic bacteria, pollen, and their combination on the immune response of bees and their clinical status. We achieved the best results in bee colonies, where we applied probiotic bee lactic acid bacteria (LAB) together with pollen in the form of a "live" suspension. Increased expression of genes for antimicrobial peptides in

the intestine and a positive effect on the intestinal microbiota were recorded in treated bees. In bee colonies where *Paenibacillus larvae* were detected in the digestive tract of bees without clinical manifestation of AFB, the pathogen was eliminated within 2 weeks. In weakened bee colonies, the fitness of the bee colonies and their grooming activity increased significantly, which was accompanied by a reduced drop of Varroa mites. No deaths were recorded in bee colonies treated before winter. Similarly, we recorded the elimination of *Mellissococcus plutonius* from the digestive tracts of bees within 2-3 weeks after the first application of the probiotic. When applied in the honey collecting season, honey quality was not negatively affected. In pilot experiments, we studied the influence of humic substances (HS) on the immunity of bees raised in laboratory conditions. We confirmed an increase in the detoxification abilities of bees when HS increased gene expression for antioxidant enzymes that play a key role in removing reactive oxygen radicals from the insect's body. In healthy bees, gene expression for AMP was reduced, what is probably connected with positive effect on gut microbiota composition. The tested natural substances represent a promising option for modulating the defense mechanisms of beehives. Further testing, especially of HS, is necessary, including the impact on the quality of bee products.

The work was supported by the project VEGA 1/0454/22 and funded by the European Union under the project 101059812 – B-THENET. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the EU or the European Research Executive Agency (granting authority). Neither the EU nor the granting authority can be held responsible for them.

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THE IMPACT OF DISINFECTANTS ON THE BACTERIUM PAENIBACILLUS LARVAE IN LABORATORY SETTINGS

Ivana Tlak Gajger[1], Zlatko Tomljanović[2], Franco Mutinelli[3], Anna Granato[3] and Josipa Vlainić[4].

(1) Faculty of Veterinary Medicine University of Zagreb, Croatia; (2) Ministry of Agriculture, Croatia; (3) Istituto Zooprofilattico Sperimentale delle Venezie, Italy; (4) Institute Ruđer Bošković, Croatia.

Abstract: American foulbrood is a highly infectious disease that poses a severe threat to honeybee brood and beekeeping. The causative agent of this

disease is the bacterium *Paenibacillus larvae*, which produces spores that are highly resistant to disinfection and can remain viable for decades. Eradication measures and effective final disinfection of equipment and tools are essential in cases where the disease is clinically visible. A comprehensive study was conducted to evaluate the efficacy of ten commercially available disinfectants commonly used in beekeeping, as well as those with proven efficacy in medicinal and veterinary medicine, against different strains of *P. larvae* bacterium. The objective of this study was to evaluate the efficacy of selected disinfectants against certified strains of *P. larvae* under controlled laboratory conditions. The examined disinfectant products were subjected to four different tests: agar diffusion test, suspension test for viable bacteria, surface disinfectant test, and sporicidal effect in the suspension test. It is noteworthy that the findings of this study indicate that Incidin OxyFoam S and Sekusept Aktiv can be considered effective options for disinfection due to sporicidal impact on a different *P. larvae* genotypes. On the other hand, while Despadac and Despadac Secure can provide bactericidal benefits, they may not be suitable for addressing the sporicidal aspect of *P. larvae* infections as effectively as Genox. It has been noted that Genoll, Ecocide S at 1%, Bee Protect H Forte, Bee Protect F, and EM® Probiotic for Bees have been found to have insufficient sporicidal or bactericidal effects. However, the implementation of proper control measures, final disinfection and early detection can help in reducing the reoccurrence of visible clinical signs of disease.

POSTER COMUNICATIONS:

POSTER 03: AN AI-BASED APPROACH FOR AUTOMATIC DETECTION OF VARROA MITE FROM SMARTPHONE-CAPTURED IMAGES

José Divasón[1], Ana Romero[1], Francisco Javier Martínez de Pisón[1], Matías Casalongue[2], Miguel A. Silvestre[3], Pilar Santolaria[2] and Jesús Yániz[2].

(1) Universidad de la Rioja (Spain); (2) Universidad de Zaragoza (Spain); (3) Universidad de Valencia (Spain).

Abstract: Varroa mites (*Varroa destructor*) pose a severe threat to beekeeping, causing highly destructive diseases in honey bee populations, weakening their immune systems, shortening lifespans, and even leading to colony collapse. A traditional method of assessing mite infestation involves

counting mites on sticky boards placed at the colony's bottom, but this is typically a time-consuming manual process. We present an ongoing work to automatically locate and count Varroa mites using artificial intelligence techniques applied to smartphone-captured images from such sticky boards. Specifically, we use deep learning models and some approaches focused on small object detection tasks. To train the neural networks, 64 images of sticky boards with Varroa mite were captured using smartphones with good-resolution cameras (48MP). These images were captured in real conditions without any king of preprocessing, being the number of Varroa mites highly variable in each image (ranging from 1 to 60). Data augmentation were applied (rotations, contrast modification, brightness, etc.) to enlarge this dataset. To further improve the results, each image was divided into small tiles of 224 x 224 pixels on which super-resolution techniques were applied and the inference of each tile was performed individually, followed by several reconstruction and refinement steps. So far, we have achieved good-accuracy models (mAP 0.9073) that are able to automatically detect and locate Varroa mites even in images that include numerous artefacts (such as dust, soil and so on) and blurred parts, but requiring substantial computational resources (a computer with GPU). We also present the advances we are working on to achieve more efficient models based on the state-of-the-art Yolo8 Nano model, with the ultimate goal of developing a mobile app that can perform the inference directly on the smartphone itself without the need for internet connection.

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POSTER 04: BACTERIAL LOADS OF DRONE HONEY BEE SEMEN IS INFLUENCED BY THE COLLECTION TECHNIQUE, THE APIARY AND THE COLONY

Jesús Yániz[1], Marion Toquet[2], Pilar Santolaria[1], Miguel Ángel Silvestre[3], Raquel Toledo-Perona[2] and Ángel Gómez Martín[2].

(1) Universidad de Zaragoza, Spain; (2) Universidad Cardenal Herrera-CEU; (3) Universidad de Valencia, Spain.

Abstract: Bacterial contamination of semen reduces sperm viability and increases the risk of infection transmission to the queen after natural mating or instrumental insemination in the honey bees. The aims of this study were

to characterize drone semen bacterial contamination by culture-dependent and independent methods and to describe its variation depending on the method of semen collection, colony and apiary.

Two experiments were performed. The first experiment was designed to study the bacterial contamination of semen using culture-dependent methods and two methods of semen collection. A total of 42 pooled samples of mature drones were prepared after collection from the seminal vesicles or from the ejaculates. From the 42 semen samples analyzed, 28 (66.7%) were positive for bacteria, which represented 100% of the samples obtained from the seminal vesicles (21 of 21), and 33.3 % of those obtained from the ejaculates (7 of 21). In contaminated samples, the degree of bacterial contamination was much higher for the vesicular samples than for the ejaculates.

In the second experiment, next-generation sequencing techniques were used to describe the microbiome of ejaculated drone semen. Pooled semen samples collected in duplicate from drones of 25 hives in 5 different apiaries were analyzed through amplification and sequencing of V3/V4 variable regions of the 16S ribosomal RNA gene.

Results showed that the apiary had a significant effect on the community structure composition and abundance of the seminal microbiota. Significant differences were also observed in the richness of the microbiota between apiaries and colonies. At the phylum level, the most abundant bacterial phyla were Proteobacteria, Firmicutes, Bacteroidota and Actinobacteriota. These four phyla represent more than 93% of the bacterial composition. Lactobacillus, Staphylococcus, Prevotella, Alloprevotella and Streptococcus were the most abundant genera. Lactobacillus comprised 5.4 % of the taxonomic composition, although this genus was absent in the semen collected from two colonies. The presence of *Listeria spp.* is reported for the first time in honey bees.

This work is supported by MCIN/AEI (grant PID2020-112673RB-I00) and the DGA-FSE (grant A07_23R).

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POSTER 05: FLUORESCENT MARKER AS A TOOL TO EVALUATE THE SPREAD OF SUBSTANCES IN THE BEEHIVE DEPENDING ON THEIR APPLICATION METHOD

Eduardo José García-Vicente[1], María Benito-Murcia[1], Ana Pérez[1], María Martín[1], Salomé Martínez[2], Juan Manuel Alonso[3], Laura Morales[1] and David Risco[2].

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Abstract: *Varroa destructor* is a parasitic mite of honeybees (*Apis mellifera*) and it supposes one of the main risks for beekeeping. Due to the decrease of the effectiveness of the conventional treatments, alternative natural products are been investigated to fight the mite. However, many of them are in developing in field conditions yet. The aim of this study is to evaluate different application methods for these compounds and how they spread in the inside of the beehive.

Three groups of beehives were established for the study. Cellulose strips were used for the first one, following the protocol of the commercial product of oxalic acid Aluén Cap®, but replacing the active ingredient for a pink fluorescent marker. The same protocol was used for the second group, but changing cellulose strips for paperboard strips. The last group was treated with a solution of sucrose and water 1:1 added with fluorescent powder in spite of the oxalic acid (Oxybee® protocol), and applied by dripping. A sample of 20 bees was collected from each inter-frame space with activity in each beehive of the study in four monitoring: days 1, 3, 7 and 14 post-treatment. The bees were homogenized and each sample was placed in an ultraviolet light plate to take a picture of them. The fluorescence signal was measured with image analyzer software.

The results obtained showed that cellulose strips were the best application method, with a high fluorescent signal in the samples than the others at days 1, 3 and 7, and the great difference was at day 1 when cellulose strips showed a mean intensity of fluorescence of 2.37, while for paperboard was 0.36 and for dripping was 0.2. Moreover, the fluorescence was undetectable in last monitoring at day 14 for all groups. This method needs to be tested with a higher number of beehives to obtain more robust results, and need to

consider some features of each specific product, but it could be an interesting approach to know how different application methods affects to the dispersion of the products in the beehives.

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POSTER 06: FREQUENT PARASITISM OF *Apis mellifera* BY TRYPANOSOMATIDS IN GEOGRAPHICALLY ISOLATED AREAS WITH RESTRICTED BEEKEEPING MOVEMENTS

Daniel Aguado López[1], Carolina Bartolomé[2], Ana Rita Lopes[3], Dora Henriques[3], Sara Kafafi Segura[4], Xulio Maside[2], Alice Pinto[3], Mariano Higes[1] and Raquel Martín Hernández[1].

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Abstract: Trypanosomatidae are a group of parasitic protozoa that can infect a wide range of organisms, from plants to vertebrates and insects, including honey bees. *Lotmaria passim* is the most frequently trypanosomatid species found in bee populations worldwide, however, our knowledge of its ecology in isolated environments remains limited. Due to their geographical isolation and the presence of honeybee populations that are not exposed to two of their main threats, *Varroa destructor* and *Nosema ceranae*, the Portuguese archipelagos of Madeira and Azores provide a fascinating setting to study the ecology and dynamics of invasive pathogen colonisation, such as trypanosomatids. Using various molecular techniques, 661 bee colonies from Madeira and the Azores were studied and showed a high prevalence of trypanosomatids despite the isolation of the islands. *Lotmaria passim* was the most prevalent species, being found in most colonies, even on islands where *V. destructor* and/or *N. ceranae* were not detected. However, although no significant correlation was found between the presence of *N. ceranae* and trypanosomatids, a higher prevalence of *L. passim* was observed on islands with *V. destructor*. In addition, *Crithidia bombi* was identified on Madeira and three Azores islands (Flores, Faial and São Miguel), mainly associated with *L. passim*, while no samples of *Crithidia mellificae* were found. The use of the High-Throughput Sequencing technique revealed that two main haplotypes

of *L. passim*, representing 98% of the total number of sequences. The remaining 2% of sequences were found at a very low frequency and appeared to be variants from the majority haplotypes with single nucleotide changes. These results suggest that, despite geographical isolation, trypanosomatids frequently infect colonies in Madeira and the Azores, even when there are restrictions on honey bee movements to mite-free islands. The detection of *L. passim* and *C. bombi* in areas where *V. destructor* and *N. ceranae* are not present suggests that they have been associated with *A. mellifera* for much longer than originally thought.

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POSTER 07: DEVELOPMENT OF A FAST AND NON-INVASIVE METHOD FOR DETECTION OF TRYPANOSOMATID PARASITES OF BEES USING RPA-CRISPR-CAS12A

Jennifer Solano Parada[1], Pedro García Olmedo[1], Jessica Carreira De Paula[1], Juan Rosel[1], Carlos Fernández Gutiérrez[1], Tamara Gómez Moracho[1], Francisco Orantes Bermejo[2] and Luis Miguel de Pablos Torró[1].

(1) Universidad de Granada, Spain; (2) Apinevada SL, Spain.

Abstract: Bees are essential pollinators with a key role in sustainability of all terrestrial ecosystems. Currently the bees are suffering a decline in their numbers due to multiple factors among which are multiple types of pathogens. Trypanosomatid parasites are a family of protozoa that are widely distributed in insects Hymenoptera. To date, up to four different species of trypanosomatids have been described in honey bees, being *Lotmaria passim* the most prevalent. Thus far there are methods molecular tests for their detection, however, all of them involve the sacrifice of the analyzed individuals and the use of specialized equipment.

To facilitate and speed up the diagnosis of parasites trypanosomatids in bees, a non-invasive method has been developed and easy implementation. This detection method combines an isothermal amplification, using a mixture of recombinases and polymerases (RPA) and a detection of the endonuclease activity of the Cas12a enzyme activated in the presence of the amplicons obtained by RPA, by immunochromatography or fluorescence under UV light. For this one study, feces as non-invasive samples and digestive tract of bees

were analyzed hive workers located in different parts of the province of Granada (Spain). Each of the samples were incubated in a buffer that contained a non-ionic detergent, from which the direct amplification of a conserved fragment of the α-tubulin gene of trypanosomatids. This method allowed us to detect the presence of parasites in less than 4 hours from sample collection. The sensitivity and specificity of the samples were compared parallel by conventional qPCR. Our results showed that the RPA-CRISPR-Cas12a-based methodology is sensitive and can be useful in field studies and/or experimental infections allowing the quick detection of trypanosomatids in bees. Currently, the lab is working in the application of the method to the detection of other gastrointestinal pathogens of bees.

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POSTER 08: OWN EXPERIENCES WITH ACARICIDES AND THE DEATH OF THE HIVES

Carlos Pardo Navarro and Julio Pardo Navarro.

Miel SierraFlor, Spain.

Abstract: I'm Carlos Pardo Navarro, and along with my brother Javier, we manage 800 Layens hives in transhumance. We are first-generation beekeepers; we've learned everything ourselves. It's evident that if a field in bloom with thousands of bees working is sprayed with insecticide, the bees die, but not the hives. Analysis of our honey shows that we never have pesticides even when bees are killed by spraying.

Regarding climate change, bees are highly adaptable, resilient animals to temperature and humidity changes, but they need assistance. We keep the hives in the south during winter and in the north in high mountains during summer. We have brood almost all year round, except in August. We've managed to control varroa only with oxalic acid and some good techniques, based on the knowledge we've acquired, especially understanding how the varroa mite lives. If mites prefer drone brood, we provide it all year round and remove them every 3 weeks. We can proudly say that in our country, there are transhumant beekeepers who can control varroa without using chemical products or synthetic acaricides, and not a single hive is dying.

Our experience related honeybee losses all over our country indicates that one out of every 5 hives die due to drone brood, another 2 due to varroa, and the rest due to the chemicals applied to them. Many beekeepers acknowledge that some of the chemicals applied directly kill bees because they are highly toxic, or because they've used excessive doses when they see live mites. Other times, bees have diarrhea and become weak, and there are hives that don't die but have so few bees that they are not productive.

Nowadays, the Ministry requires treatment once a year. There are many synthetic acaricides available in the market, and some Health Defense Associations select the products, excluding any ecological ones like oxalic acid or thymol.

*****

POSTER 09: EPIDEMIOLOGY OF TRIPANOSOMATID PARASYTE INFECTION IN HONEY BEES LOCATED IN ANDALUSIA

Pedro García Olmedo[1], Francisco José Orantes Bermejo[2] and Luis Miguel de Pablos Torró[1].

(1) Universidad de Granada, Spain; (2) Apinevada SL, Spain.

In recent years, honey bees have been subjected to different factors, both biotic and abiotic, which contribute to the decline of honey bee colonies. Among the factors causing this mortality are parasite infections. Monoxenous trypanosomatid parasites such as *Lotmaria passim* and *Crithidia mellificae* develop by colonising the digestive tract of hymenopterans such as bees. Different studies show *Lotmaria passim* as the most widespread trypanosomatid of bees worldwide. The aim of this work has been the detection of these trypanosomatids in the intestines of bees from hives located in different parts of Andalusia, using standardised PCR for the amplification of α-tubulin and cytochrome b genes of these parasites. The results show the presence of up to 51.61% for *Lotmaria passim* and 0% for *Crithidia mellificae*. To check the parasitosis dinamics, we analysed the parasite loads of individual bees from infected hives by quantitative PCR. This study represents a contribution to the understanding of the range of this type of parasitosis in honey bees.

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POSTER 10: EFFECT OF ESSENTIAL OILS AS NATURAL TREATMENT AGAINST *Varroa destructor* IN VITRO CONDITIONS

Ana Pérez[1], Eduardo J. García-Vicente[1], María Benito-Murcia[1], María Martín[1], María González[1], Zaira Canet[2], Alfredo García[3], Juan Manuel Alonso[4], Laura Morales[1] and David Risco[2].

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Abstract: Honey bees play an important role in agriculture, through the pollination of crops and also natural ecosystems. In recent decades, the beekeeping sector worldwide, causing high levels of mortality. The treatments used are creating resistances in the population, so it is necessary to find other natural alternatives that do not generate resistances or residues. Essential oils have been studied and they can be a good option due to their characteristics. Therefore, the aim of this study is to know the effects of the different essential oils against *V. destructor*. Three oils have been tested: *Cymbopogon citratus*, *Thymus vulgaris* and *Origanum vulgare*, and a control group (acetone). Capped brood frames have been brought from beehives with varroa infestation upper than 10%. In laboratory, the brood is opened, and it was removing the larvae trying to recollect all adult females *V. destructor* until get all necessary mites. Essential oils have been diluted in acetone and impregnated 5 mL in filter paper, with a concentration of 0.5 mg/mL. For each Petri dish, 20 mites were introduced and were incubated at 34 ºC during six hours. After that, the mite viability was examinate and that was classified in three categories: “2” (alive), “1” (damaged) or “0” (dead). This experiment was carried out three times for each essential oil and only were validated if control group did not have more than 20% of mortality. The results were: the mean viability of control group was 1.44, mean viability of Thymus was 0.64, in the same way Origanum was 0 and finally mean viability of Cymbopogon was 0.67. Significant differences were detected between each essential oil with control group, as well as among Origanum with the rest of groups. In conclusion, Origanum oil would be a good alternative to the treatment against varroa. In futures studies essential oils might try in field conditions and the toxicity of these products about honeybees must be study.

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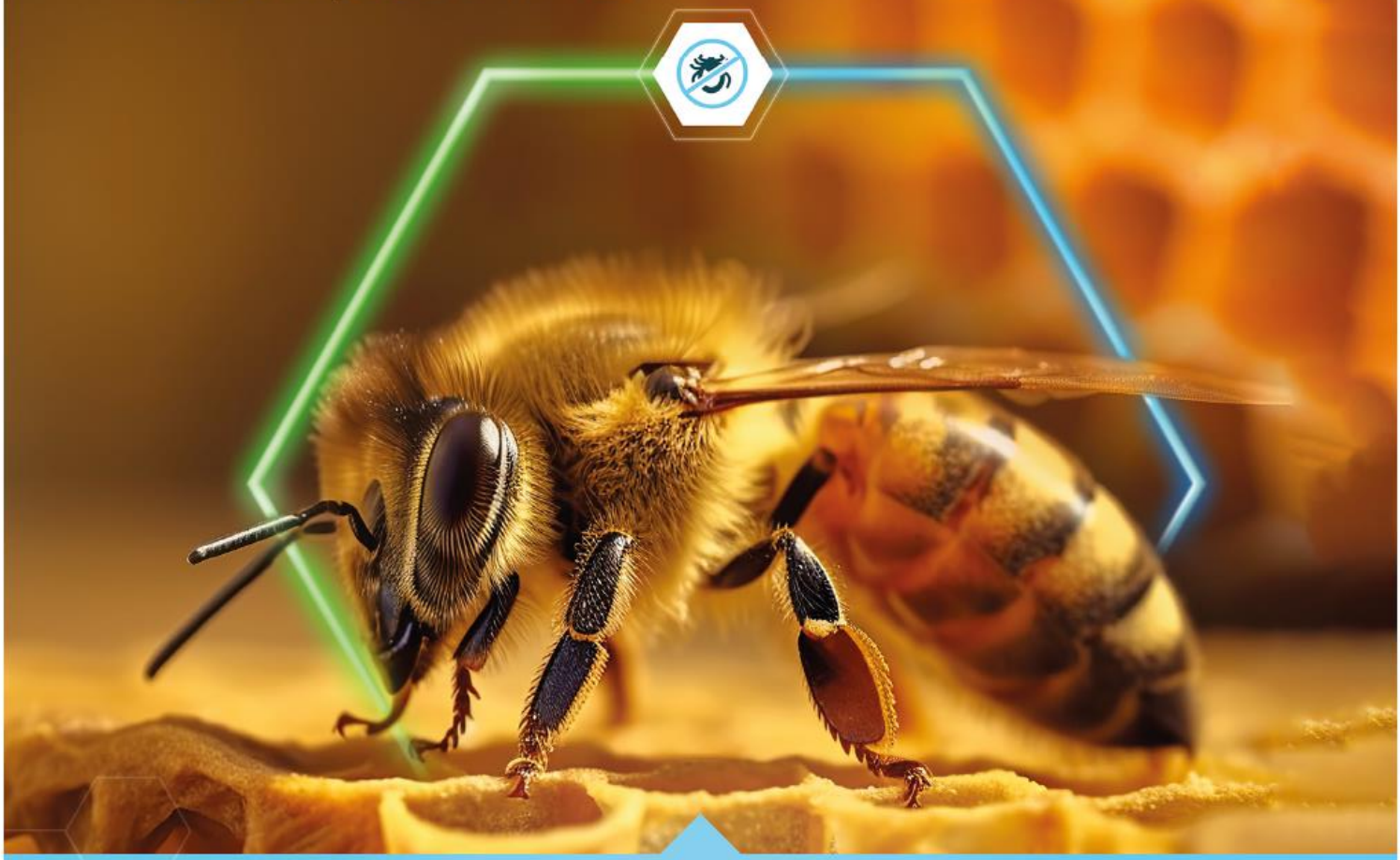

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SESSION 4 ABSTRACTS

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CHAIR'S SHORT LECTURE:

BIOTECHNICAL CONTROL IN ECOLOGICAL BEEKEEPING

Miguel Alonso.

Professional beekeeper. Veterinarian of the Leonesa Beekeepers Association, Spain.

Abstract: Work is the basis of biotechnical control in beekeeping. The succession of visits to the apiaries is laborious, but with repeated sampling of *Varroa destructor*, we will guarantee the objective of having the levels under control.

From personal experience, repeating sampling over several years often results in the same patterns, and identifying them means being able to proceed in time, either with treatments based on ecologically based products or through management techniques. To do this, the different techniques that we will use will be the removal of drone brood, caging the queen, partitions or simply the renewal of the queen. Knowing the botany of the area and matching it to management is essential. If the hive has a good nectar intake, the use of combs to direct them to drone breeding will be the choice. The constant review is laborious, since the risk of this drone being born and with them, *Varroa destructor*, grows exponentially. Each time of year has its advantages and disadvantages, and replacing the queen in the final part of the campaign is risky but effective. We find second- or third-year queens already in full decline. Removing them and replacing them with a new one opens a stop-laying window, which we must take advantage of to carry out the treatment, since this is usually the time when the levels of *Varroa destructor* are usually highest. We will also have a young queen, which will promote a good start to the season so that the hive can replenish itself and can survive the winter adequately.

In conclusion, the continued sampling and the different management techniques carried out increase the number of visits made to the apiary, but

this monitoring will give us very valuable information on the health of our hives, and that will be the fundamental tool in adequate control of the levels of *Varroa destructor*. Work will make you free!

ORAL COMUNICATIONS:

GALICIAN BLACK BEE PROJET - PANEGA

Xosé Manuel Durán Orús[1], Marcos Varela Lorenzo[1], Ester Ordóñez[2], Maruxa Blanco[3], Manuel Ferreira[4] and Román Cid[5].

(1) Asociación Galega MENA, Spain; (2) Agrupación Apícola de Galicia, Spain; (3) Asociación Galega de Apicultura, Spain; (4) Asociación Casa do Mel, Spain; (5) Asociación Apícola Abellas Nais, Spain.

Abstract: The PANEGA Galician black bee program was created to develop the genetic improvement of our traditional bee through a conservation, breeding and selection program aimed at obtaining resilient colonies capable of maintaining productivity within the framework of the difficulties they currently face. Through periodic evaluations, queens are selected with improving characteristics (honey production, defense against varroa, hygienic behavior...) which are then disseminated among the beekeepers who collaborate and are trained with the program. PANEGA was born from the initiative and involvement of the main Galician beekeeping associations: Asociación Abellas Nais, Agrupación Apícola de Galicia, Asociación Casa do Mel, Asociación Galega de Apicultura and Asociación Galega MENA. In addition, there are entities that participate as external collaborators carrying out scientific advisory work and dissemination of results: Vasque Cauntry University, Zaragoza University, IXP Mel de Galicia and CFEA Sergude.

Objectives: The general objective of the program is to promote the genetic improvement of Galicia's own bee through the collaboration and permanent training of beekeepers in selective techniques and, in addition, to disseminate the improvement obtained.

Methodology: The Improvement Program began in 2023 by establishing an open base population of forty black bee colonies selected from those belonging to the program's collaborators. In 2024, from that initial series of forty pre-selected strains, twenty were chosen to breed the first colonies on which to begin the evaluations, thus constituting series 1 and 2 of the PANEGA with ten strains each. In successive years, a single series of ten

breeders is formed for each season. These ten strains in each series must pass a rotating standard over two full years (evaluation, selection, reproduction, mating, dissemination and formation of new colonies) that is repeated in alternating biennial mode in order to be able to work continuously with twenty strains per season, organized in two series of ten. Fertilizations are controlled by partially directed non-panmitic matings based on saturating mating areas with males of improving genetics. In this way, the base population of the PANEGA is formed with three hundred and twenty queens/colonies distributed throughout the Galician geography.

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THE RELATIONSHIP BETWEEN BEEKEEPING MANAGEMENT AND THE INFESTATION OF *Varroa destructor* IN BEEHIVES OF SIERRA DEL RINCÓN (MADRID, SPAIN)

Ana Moreno de la Fuente, Jorge Chicote Carreras and Jorge J. Ortega Marcos.

Instituto Madrileño de Investigación y Desarrollo Rural, Agrario y Alimentario (IMIDRA), Spain.

Abstract: Spain is characterised by the coexistence of diverse beekeeping models. The majority of beekeepers are non-professionals, with small-scale apiaries. Professional beekeepers, comprising approximately 18% of the total, many of whom are transhumant. According to the Spanish Ministry of Agriculture, Fisheries and Food, the number of bee colonies has increased by 47% since 2010. However, the sector is experiencing a gradual decline in productivity and increased hive mortality due to the spread of pathogens such as *Varroa destructor* Anderson and Trueman (Parasitiformes: Varroidae). The objective of this study was to analyse the correlation between different beehive managements and the degree of infestation by the mite *V. destructor*. The study area was Sierra del Rincón Biosphere Reserve, a territory located in the north of the Community of Madrid with a high landscape value and a long beekeeping tradition. Three beekeeping management types were observed: conventional, organic and non-certified organic. Thirteen apiaries with more than 150 hives were sampled each year (2022 and 2023), prior to and following mite control treatment (summer and autumn, respectively). Mite numbers were quantified using Varroa EasyCheck (Véto-pharma, France), which involves bees and mites being anaesthetised

with CO2. The amount of *V. destructor* were counted in 300 bees from the brood frames. Thus, infestation percentage was obtained in adult bees to quantify the degree of *V. destructor* infestation. The infestation was found to be moderate in this region, with the greatest issues observed in amateur apiaries. In some cases, the infestation increased in 2023, which may be attributed to a lack of bee cycle disruption due to relatively mild winter temperatures. The lowest infestation rates were observed in certified organic professional apiaries, and in some of the non-professional appiaries that combines ecological and conventional treatments. Within the apiaries themselves, different levels of infestation were also observed. It can be concluded that the ineffectiveness of certain treatments may have led to the emergence of resistance to certain products. Furthermore, a lack of knowledge regarding the optimal timing and most suitable products for use by beekeepers in the study area may also be a contributing factor.

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HOW TO CONTROL VARROA WITH OXALIC AND MUCH MORE

Carlos Pardo Navarro and Julio Pardo Navarro.

Miel SierraFlor, Spain.

Abstract: I am Carlos Pardo Navarro and together with my brother Javier we manage 800 Layens hives in transhumance, all with a sanitary floor. We package and market our products: honey, pollen, propolis, bee bread and others. We are first generation beekeepers; we have learned everything by ourselves.

In recent years we have not lost any hives to varroa or aggressive chemical treatments. We use only legal products with oxalic acid (APIBIOXAL) as acaricides and we always apply it without any breeding. In January we have the hives in warm areas and begin the first treatment, removing any brood or caging the queen. At the end of the month, we introduce drone combs that we let out to mate virgin queens. Starting in March there are always two combs to remove the drone brood every 20 days until July (or weekly if many varroas fall in a tray). In the sanitary fund we sometimes put thymol, if the temperature is not going to rise to 18ºC. We move the hives looking for blooms until we have them in the high mountains in summer. In August nothing because the queen does not lay eggs and in September in the middle

of the month, we apply oxalic acid again frame by frame so that not a single mite remains. Then we move them to warm areas and continue removing baby drones every 20 days and adding thymol depending on the temperature. At the end of December, we transfer brood combs from one apiary to another and cage the queens of the hives before applying the oxalic

Data: 1) in just 3 and a half hours we removed sealed drone brood between two people from 80 hives, 2) we never apply the sublimated oxalic more than 5 times at intervals of 3 days as it kills less varroa and affects the bees (irritations in the respiratory tract and intestines), 4) oxalic acid does not leave residues and there are no resistant populations, 5) it reduces the burden of Nosema, and 6) Amitraz residues have disappeared.

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GENETIC LINES OF *Apis mellifera iberiensis* WITH HIGHER SURVIVAL AND VARROA-RESISTANCE (ECOAPI PROJECT)

Melanie Parejo[1], Valentina Florea[1], Xose Manuel Durans[2], Anne Zubieta[1], Luis Javier Chueca[1], Egoitz Galartza[1,3] and Iratxe Zarraonaindia[1,4].

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Abstract: In the ECOAPI project (2022 - 2024), funded by the Ministry of Science and Innovation and the State Research Agency, we are looking for a long-term sustainable solution against varroosis based on the selection of varroa-resistant lines in order to avoid or minimize the sector's dependence on chemical treatments. The aim of the project is to study factors (environment, genome, microbiome) and mechanisms (social immunity; management) that contribute to varroa resistance and survival. One of the populations studied within ECOAPI consists of Apis mellifera iberiensis colonies not treated since 2015 and managed by the beekeeping association MENA under the MENA program. In 2023, we set up an experiment with a total of 75 colonies to evaluate the MENA hive type and three genetic lines (2 MENA; 1 commercial) in three apiaries with different environmental conditions. Varroa levels were monitored using bottom boards and adult mite infestation was measured with powdered sugar. Additional performance data

was collected (colony strength, pin test, …). Moreover, samples were taken for the study of the colonies' microbiomes and genomes. Due to queen problems, 15 colonies were lost at the beginning of the experiment. We report a remarkably high winter mortality (66%) due to high Varroa infestation and due to an increased *Vespa velutina* pressure in one apiary this year. Despite the high mortality, MENA genetic lines had a higher survival and lower varroa loads compared to the commercial line. Both MENA genetic lines showed also a higher hygienic behaviour as measured by the pin test. The MENA hive type, in contrast, influenced the outcome to a lesser degree and dependent on the apiary. Thus, although the type of management may influence and MENA management may help bees become more resistant to Varroa, the main reason for this resistance is likely the bees' own genetics.

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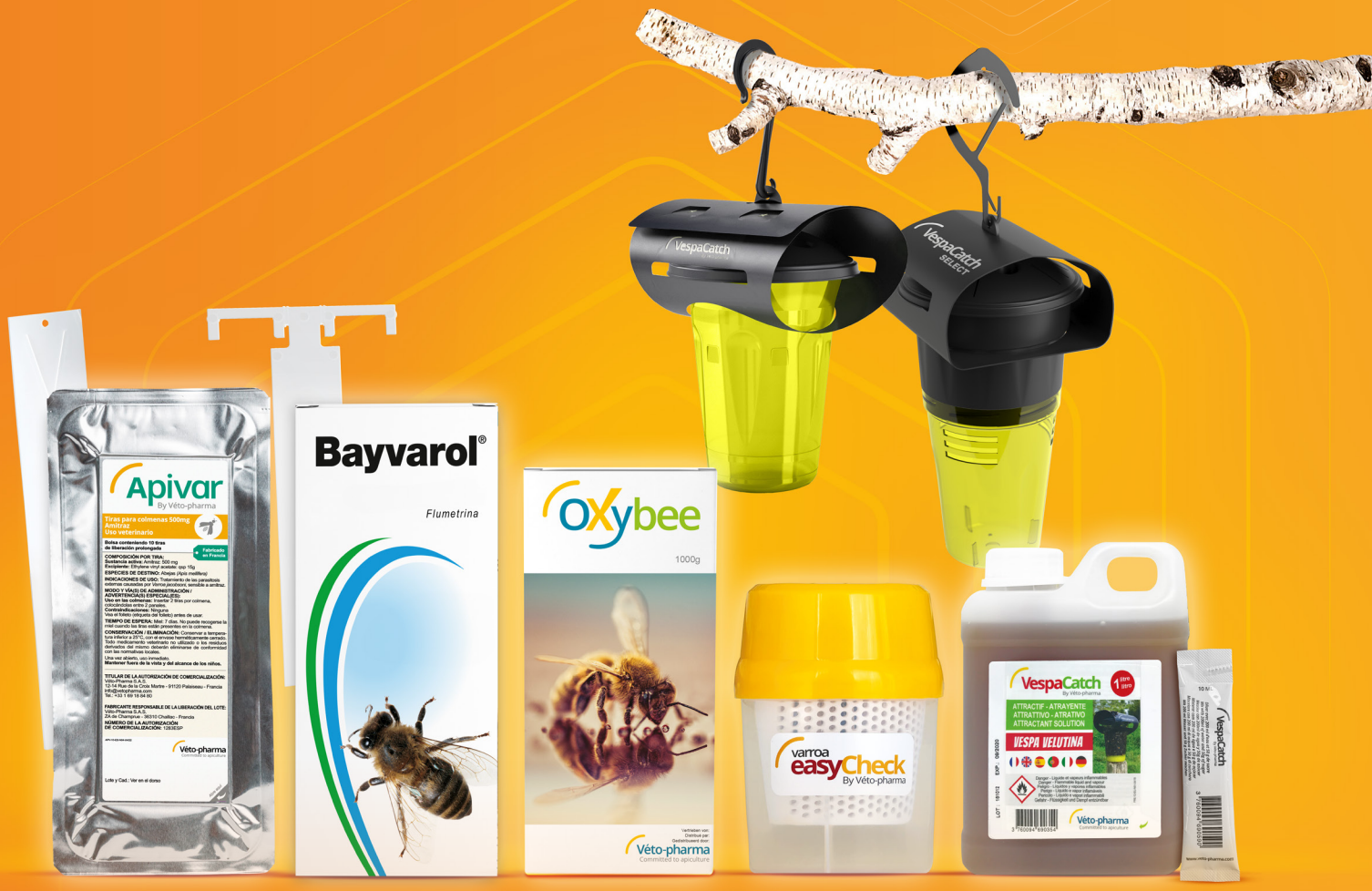

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BAYVAROL® 3,6 mg tiras para colmenas –Indicaciones de uso: Para el diagnóstico y control de Varroa destructor sensible a flumetrina en abejas. **Contraindicaciones:** Ninguna. **Precauciones** específicas que debe tomar la persona que administre el medicamento veterinario a los animales: Lávese las manos después de manipular las tiras, antes de las comidas y después del trabajo. No coma, beba ni fume durante el uso. No abra las bolsas hasta el momento inmediato a su utilización. Evite el contacto de las tiras con la miel que vaya a ser destinada a consumo humano. **Tiempo de espera:** No se requiere tiempo de espera para la miel sea cual sea el momento del año en que se utilice Bayvarol. O tros productos de las abejas no se deberán destinar a consumo humano hasta la primavera siguiente al tratamiento. **Titular de la autorización de comercialización:** Elanco Animal Health GmbH. **Representante:** Véto-Pharma S.A.S. **Nº de registro:** 1713 ESP. vES0223-gp. **Medicamento sujeto a prescripción veterinaria.**
Por favor, consulte a su veterinario, farmacéutico u organización sanitaria. En caso de persistencia de los síntomas, consulte con su veterinario. Uso Veterinario.

OXYBEE polvo y solución de 39,4 mg / ml de dispersión para colmenas. Indicaciones para su uso: Tratamiento de varroasis (Varroa destructor) de las abejas melíferas (Apis mellifera) en colonias sin cría. **Contraindicaciones:** ninguna. **Tiempo de espera: Miel:** cero días. No usar cuando haya cuadros con miel. Lea cuidadosamente las instrucciones de la etiqueta del producto antes de usar. **Precauciones específicas que debe tomar la persona que administre el medicamento veterinario:** Este medicamento veterinario es muy ácido y puede tener efectos irritantes y corrosivos en la piel, los ojos y las membranas mucosas. Evite la exposición oral, incluido el contacto de mano a boca. Evite el contacto directo con la piel y los ojos, así como el contacto mano a ojo. Se debe usar un equipo de protección personal consistente en ropa de protección, guantes a prueba de ácidos y gafas de seguridad. Lávese las manos y la piel expuesta inmediatamente con jabón y agua abundante. No coma, beba ni fume mientras manipule y aplique el medicamento veterinario. Quítese la ropa contaminada inmediatamente. Los dispositivos de medición usados y los envases vacíos deben desecharse inmediatamente de manera adecuada. En caso de ingestión accidental, lave la boca con agua y beba agua o leche, pero no induzca el vómito. En caso de contacto con los ojos, enjuáguelos inmediatamente con agua (primero quite las lentes de contacto). Busque atención médica inmediatamente y muestre el prospecto o la etiqueta. **Por favor, consulte a su veterinario, farmacéutico u organización sanitaria. En caso de persistencia de los síntomas, consulte con su veterinario. Uso Veterinario. Titular de la Autorización de Comercialización:** Dany Bienenwohl GmbH, Geyerspergerstr.27, 80689 München, Deutschland

VTP-124-ES-N01-05/24

SESSION 5 ABSTRACTS

Provision 5: Related to ensure conditions and treatment which avoid suffering of honeybee colonies

CHAIR'S SHORT LECTURE:

INVASIVE HORNETS ON THE HORIZON: A CALL TO ACTION FOR ECOSYSTEM HEALTH

Xesús Feás.

Academy of Veterinary Sciences of Galicia, Spain.

Abstract: During a three-year period (2010-2013), three allochthonous species of hornets were detected in Spain: the yellow-legged Asian hornet (*Vespa velutina*) in Navarra, the oriental hornet (*Vespa orientalis*) in Valencia, and the black shield hornet (*Vespa bicolor*) in Málaga. In the entry areas, the species have maintained stable populations but differ in their propagation capacity, with *Vespa velutina* standing out as a highly invasive exotic species with impacts on human health, environmental health, and various agricultural and livestock activities. Particularly affected have been apiculture, viticulture, fruit growing, and forestry. Currently, *Vespa bicolor* and *Vespa orientalis* are established and expanding in Andalusia, already causing damage to apiculture. Historically, beekeepers have been the "eyes and ears" in the early detection of *Vespa velutina*, given that the diet of these hornet colonies is based on bees and other insects. The species has become a major threat to beekeeping and pollination. In Northern Spain, the annual cost of lost production is estimated at over 4.5 million euros. *Vespa velutina* could be responsible for the loss of 65% of bee colonies in infested areas. Additionally, *Vespa velutina* directly affects human health. Due to its habits, abundance, and wider distribution, the risk it poses to human health is incomparable to other native hymenopteran species. Beekeeping in Europe must be prepared to face these invasive species. Measures and control protocols are necessary to prevent their spread, based on scientific evidence. A rapid, coordinated, and effective response from various administrations is essential against these invasive species. Economic measures and proposals for training, coordination, detection, prevention, and combat are needed

from a One Health perspective, an indispensable multidisciplinary approach where beekeepers play a central role. Being scientifically literate makes us more capable and less susceptible to manipulation. Invasive hornets are a controversial topic at a social and political level. But controversy, if it is not sterile, is necessary for progress. It's important to note that *Vespa velutina* is expanding throughout Europe and has also been detected in the USA, South Korea and Japan. Additionally, other species such as *Vespa mandarinia* have been detected in North America, and *Vespa orientalis* in South America. Information provided about invasive hornets must be: accurate, relevant, accessible, effective, and evidence-based. Society needs scientists who go down to the streets, explaining, surprising, and enthusing people.

ORAL COMUNICATIONS:

HAS TROPILAELAPS MITE PASSED THROUGH THE BORDERS OF IRAN? AND COULD IT BE THE CAUSE OF THE SEVERE HONEY BEE LOSSES OF IRAN OVER THE PAST 2 YEARS?

Pegah Valizadeh.

Animal Science Research Institute of Iran.

Abstract: Over the past two years, there has been a very severe honey bee loss in apiaries all across Iran, the cause of which is still unidentified. The damage is through killing brood, and therefore causing an interruption of population growth, ending in either colony collapsing or absconding. In several cases, result has been up to 100% colony destruction. The symptoms are somehow similar to European foulbrood (EFB), or American foulbrood (AFB). However, the microbiological tests show that the condition seems to be independent of the presence, or absence, of the two bacterial diseases. Since announcing this health problem at the Apimondia Congress in Chile in September 2023, through public discussions the hypothesis of Tropilaelaps being involved has been formed. So far, there is no official report of the mite Tropilaelaps being detected in Iran. The symptoms such as dead brood, perforated capping, scattered brood pattern, colony population decline and absconding are apparently common between the unidentified health defect of honey bees of Iran and Tropilaelaps mite infestation. Over the past 7 months, there has been a strong effort to convince the decisionmakers of Iran to conduct a countrywide surveillance for Tropilaelaps mite. In the

meanwhile, in Fall 2023 leading from discussions with some beekeepers across Iran, who over the past 2 years have noticed in their apiaries the presence of some “fast small mites”, a number of dead mites suspicious of being Tropilaelaps were collected. However, the dead collected mites have not been tested thus far. More recently, the country has officially agreed to start Tropilaelaps surveillance. Through this monitoring, it will be assessed whether or not Tropilaelaps has entered the boarders of Iran. In addition, the result will be a start in analyzing if Tropilaelaps is the cause of the severe honey bee loss in Iran. By the time of the Bee Health Symposium of AVESPA in June 2024, there will be an update for the Tropilaelaps surveillance of Iran.

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SURVIVAL RATE WITHIN *Apis mellifera* SUBSPECIES FROM MEDITERRANEAN BASIN

Soledad Sagastume[1], Giovanni Cilia[2], Banan Al_Shagour[3], Mustafa Necati Muz[4], Dilek Muz[4], Nizar Haddad[3], Antonio Nanetti[2], Mariano Higes[1] and Raquel Martín-Hernández[1].

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Abstract: The adverse effects of heat stress on bees include multiple aspects such affecting their growth, development, task-related physiology, immunocompetence, foraging activity, and reproduction. Hence, it is expected that the new and increasingly hot environments coming from climate change affect to the life expectancy of the different subspecies of honeybees. On the other hand, humidity as single possible stressor seems to have lowest impact on bees, but it acts synergist when both variables get combined. In order to understand the influence of these new hotter and drier environments, six different conditions have been studied: 35ºC, 40ºC and 45ºC at 75% of relative humidity (RH), and 35ºC combining 15, 30 and 50% of RH to determine the survival rate of *Apis mellifera* subspecies. Different groups of bees were maintained feed ad libitum under each condition and the survival mean (in days) was noted. These assays were carried out as a part of the MEDIBEES Project with *Apis mellifera iberiensis*, *Apis mellifera*

ligustica, *Apis mellifera anatoliaca* and *Apis mellifera syriaca*. Our results showed important differences according to the subspecies and a clear negative influence of heat on the survival rate of the bees, as in all cases the bees survived less than half of the days at 40ºC versus 35ºC, and in no case were they able to survive 24 hours at 45ºC. Regarding to humidity, the effect was no relevant along each subspecies. It is interesting to note that *A.m. iberiensis* was the subspecies showing the higher life expectancy.

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ASSESSING THE ADAPTATION OF *Apis mellifera* SUBSPECIES TO MEDITERRANEAN ENVIRONMENTS

Antonio Nanetti[1], Giovanni Cilia[1], Marion Zammit-Mangion[2], Thomas Galea[3], Sergio Sapienza[4], Azzurra Vella[5], Soledad Sagastume[6], Mariano Higes[6] and Raquel Martín-Hernández[6].

(1) CREA-AA, Research Centre Agriculture and Environment, Bologna (Italy); (2) Department of Physiology and Biochemistry, University of Malta, Msida (Malta); (3) Breeds of Origin Conservancy, Żebbuġ (Malta); (4) Associazione Allevatori Apis mellifera siciliana, Palermo (Italy); (5) Department of Agricultural, Food and Forest Sciences (SAAF), University of Palermo, Palermo (Italy); (6) IRIAF - Instituto Regional de Investigación y Desarrollo Agroalimentario y Forestal de Castilla-La Mancha, Centro de Investigación apícola y agroambiental (CIAPA), Marchamalo (Spain).

Abstract: The adaptation of *Apis mellifera* subspecies to their specific environment is vital for honey bee colony welfare and productivity. The MEDIBEES project, spanning several Mediterranean countries, aims to promote the utilisation of native *A. mellifera* subspecies, that are naturally suited to their local conditions. Within this project, a comprehensive assessment of intersubspecific behavioural, reproductive, and productive traits at the colony level is underway. This involves comparisons between native subspecies and *A. m. ligustica*, which is often imported into Mediterranean countries outside its natural range of distribution. In the first year of the MEDIBEES field survey, remarkable cases of environmental maladaptation of *A. m. ligustica* colonies were observed, which manifested differently across the involved countries compared to local subspecies. Here we present some remarkable cases where the traits exhibited by the foreign subspecies appeared less fitting at the reproductive, productive, or population dynamics level. It is known that *A. m. ligustica* exhibits reduced defensive behaviour compared to other subspecies, which prompts its

widespread importation from Italy by Mediterranean beekeepers. However, this behaviour comes at a cost, potentially impacting colony welfare, increasing mortality rates, susceptibility to diseases, and costs of management. Preserving the biodiversity of native subspecies is imperative, as these result from a unique evolutive adaptation process. Nonetheless, the beekeepers may improve local subspecies genetically, both to keep adaptation traits and reduce the aspects that make them complicated to manage. Although preliminary, these findings from the MEDIBEES project highlight the importance of rearing honey bee subspecies that are tailored to specific environments. Sustainable beekeeping in the Mediterranean region requires the protection of the heritage represented by the native *A. mellifera* populations. These results are under the project 2011-MEDIBEES, which is part of the PRIMA programme supported by the European Union.

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HEAT AND COLD TOLERANCE OF *Apis mellifera iberiensis* AND *Apis mellifera syriaca*

Soledad Sagastume[1], Banan Al_Shagour[2], Nizar Haddad[2], Mariano Higes[1] and Raquel Martín-Hernández[1].

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Abstract: Thermotolerance is defined as the temperature range between the coldest temperature (critical thermal minimum, CTmin) and the warmest temperature (critical thermal maximum, CTmax) at which an organism can maintain muscle control. Both of these characteristics appear to be different among honey bee subspecies, which today are trying to adapt to new and increasingly extreme climatic environments brought about by climate change. In bees, both thermal tolerance and the degree of plasticity play key roles in determining the geographical distribution of species. Within the MEDIBEES project, thermal tolerance assays have been carried out comparing honey bee subspecies in the Mediterranean area. In this work we present the results of *Apis mellifera iberiensis* from Spain and *A.m. syriaca* from Jordan workers and drones of different ages and exposed to two different temperature ramps: from 30 to 70ºC (heat study), and from 35 to

0ºC (cold study). Our results showed differences in both heat and cold tolerance between subspecies, as well as sex and age-related differences within both of them. In heat assay, the Iberian bees showed signs of thermal stress up to 40ºC, and both *A.m. iberiensis* and *A.m. syriaca* individuals showed hyperthermia up to 45ºC, where mortality was detected in some ages or castes. Regarding cold-tolerance, both subspecies showed different effects: while no signs of cold stress or hypothermia were detected in *A.m. syriaca*, all of them appeared in *A.m. iberiensis*. In the latest, mortality occurred in foragers below 6ºC. Further experiments are actually carried out within MEDIBEES to property understand the molecular bases of the differences founded.

POSTER COMUNICATIONS:

POSTER 11: EFFECT OF 4 PRODUCTS AGAINST NOSEMA CERANAE IN HONEY BEES: FUMAGILLIN, SULFAMETHOXAZOLE, THYMOL & EXTRACT OF CHAMOMILE

Hussein Jradi.

Lebanon.

Abstract: *Nosema ceranae* is an obligate microsporidian intracellular parasite infectious to honey bees; it can cause bee mortality and have been correlated with colony losses. *Nosema ceranae* is also associated with morbid physiological impairments including immune function, foraging behavior and pheromone production. The only registered product for its control is the antibiotic Fumagillin. Researches show that Fumagillin poses a toxic threat, and its efficacy against *Nosema ceranae* is uncertain. Sulfamethoxazole is a bacteriostatic sulfonamide antibiotic that interferes with folic acid synthesis in susceptible bacteria. It is generally given in combination with trimethoprim and suggested by certain groups of beekeepers to treat *Nosema ceranae*. Thymol is a natural essential-oil ingredient derived from Thymus vulgaris. Chamomile extract is a mixture of the many natural oils and other substances produced in chamomile flowers. Chamomile has a long history of use in herbal medicine and is still thought to have a range of beneficial properties including anti-inflammatory and anti-oxidant. The aim of this study was to investigate the effect of the four mentioned products on the spore loads in bees infected with the *Nosema ceranae* as well as parameters of oxidative

stress and bee survival. The results reveal mostly positive effects of thymol and Chamomile extract by decreasing Nosema spore loads, while Fumagillin and Sulfamethoxazole gave discouraging results when applied to *Nosema ceranae* infected bees.

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POSTER 12: NATURAL SELECTION AS A TOOL AGAINST VARROA INFESTATION

Antonio Pérez Pérez, Mariano Higes Pascual, Raquel Martín Hernández and Aránzazu Meana Mañes.

(1) Centro de Investigación Apícola y Agroambiental (CIAPA) Marchamalo, Spain; (2) Departamento de Parasitología; Facultad de Veterinaria de la Universidad Complutense de Madrid, Spain.

Abstract: One of the most relevant health issues in modern apiculture is the infestation of beehives by the *Varroa destructor* mite. Confirmation of natural selection in *Apis mellifera* regarding mite infestation has shown that there are hives capable of resisting Varroa infestations without any control over them. This has been verified by wild hives and hives that have not been treated with chemicals, demonstrating that natural selection has a positive effect. The major problem is ensuring that a significant portion of the initial population survives the first infestation. It has also been confirmed that in hives, where some chemical treatment has already been used, such as European or North American ones, this effect is not as noticeable. These animals face an issue related to the mating behaviour of bees, which causes genes of resistance among neighboring populations to spread at a faster rate than they take to stabilize within the population itself. This significantly reduces the effect of natural selection. However, if the apiaries are sufficiently isolated at the time of mating, this dispersion can be reduced.

Among the most efficient mechanisms used by bees against mites are the removal of phoretic mites between individuals, hygienic behaviour, and the cleaning of infected cells. Genes that promote these behaviours are the ones most enhanced by natural selection. In the EU, resistant hives have already been obtained in seven countries, and breeding programs for these genetic lines have been established. The aim of this work is to present the protocols developed in the Darwinian Black Box Selection project, to attempt to obtain

resistant populations in Spain and assess their efficiency in our country. During the study, molecular data will be collected to assess the possible reduction of resistance genes present in Varroa due to the treatments used, as there is no selection pressure exerted by these treatments on the mite.

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POSTER 13: BOMBUSPATH: STUDYING THE PATHOGENESIS AND EPIDEMIOLOGY OF BUMBLEBEE PATHOGENS TO ENSURE THE WELFARE OF BEES

Raquel de Evan, Raquel Martín-Hernández, Mariano Higes and Cristina Botías.

(1) Universidad de Alcalá, Madrid (Spain); (2) Instituto Regional de Investigación y Desarrollo Agroalimentario y Forestal (IRIAF), Laboratorio de Patología Apícola, Centro de Investigación Apícola y Agroambiental (CIAPA), Marchamalo, Spain.

Abstract: Cropland has increased by 25% in the past half century, particularly involving crops that depend to some extent on pollinators. Among them, bumblebees are essential pollinators of many wild-flowering plants and provide valuable services for agricultural crops. Indeed, the contribution to crop yield and quality by commercial bumblebees alone has been estimated to be €12 billion per year while individual species of wild bumblebees can contribute over $5000 per hectare.

Bumblebees' welfare is being compromised. This is evidenced by the decline of many bumblebee species at local and regional scales, raising concern about reduced agricultural productivity and sustainability in natural ecosystems. Although there is no single factor identified as the origin of bee declines, there is evidence suggesting that it could be a multi-causal phenomenon, with pathogens playing a key role in this problem together with exposure to pesticides, habitat loss, introduction of non-native bees, and climate change. These elements interfere with the maintenance of welfare in bumblebee colonies and hinder the achievement of the Five Freedoms included within the concept of animal welfare, with particular emphasis on the first one (i.e. freedom from hunger and thirst) due to habitat loss, and the third one (freedom from pain, injury or disease) due to presence of pathogens which can produce disease in bumblebees that may contribute to their decline, and that could be transmitted to other bee species. We will

present the project BOMBUSPATH, providing an overview of the main stressors affecting bee health and the preliminary results we are currently obtaining.

Bumblebees are host to numerous pathogens that can have severe impacts on their health, but there are several knowledge gaps that need to be disentangled if we are to mitigate the detrimental effects caused by these pathogenic agents. Our aim is to increase the knowledge of the impact of the main bumblebee stressors in order to ensure the survival of our natural resources, guarantee the well-being of bumblebees and consequently achieve a sustainable bioeconomy.

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POSTER 14: THE EFFECTS OF TEBUCONAZOLE EXPOSURE ON REDOX HOMEOSTASIS AND FATTY ACID PROFILE OF HONEYBEE BRAIN

Máté Mackei[1], Júlia Vöröházi[1], Patrik Tráj[1], Hedvig Fébel[2], Zsuzsanna Neogrády[1] and Gábor Mátis[1].

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Abstract: Among the various causes of pollinator decline, plant protection products are considered potentially one of the major factors playing a role in the development of problems like colony collapse disorder (CCD). Recent studies indicate that pesticides such as azole fungicides can negatively affect bee behavior, foraging effectiveness, learning, as well as the maintenance of normal colony functions. However, the detailed effects on metabolism, which may underlie these consequences, remain unclear. Our research aimed to investigate oxidative stress and its related consequences caused by acute triazole exposure in the central nervous system of honeybees.

In our study, we focused on tebuconazole, commonly and widely used in agriculture. After collecting honeybees, tebuconazole was administered in acute sublethal doses (per os 8,505; 4,253 and 2,123 µg/bee/day) over a 48-hour period. Tissue samples of the central nervous system were homogenized, and the following redox parameters were measured: total antioxidant capacity (TAC), the ratio of reduced and oxidized glutathione (GSH-GSSG ratio), glucose-6-phosphate dehydrogenase (G6PDH) activity,

superoxide dismutase (SOD) activity, xanthine oxidase (XO) activity, and malondialdehyde (MDA) concentration. Furthermore, analysis of the fatty acid profile using gas chromatography mass spectrometry (GC-MS) has been also conducted.

The results indicate that tebuconazole significantly disrupted the redox homeostasis of the samples in a negative manner. Parameters such as TAC and the GSH-GSSG ratio were consistently decreased as a result of each applied tebuconazole treatment. A similar pattern was observed for G6PDH, SOD, and XO enzyme activities, while MDA concentration increased only in response to the highest tebuconazole treatment. Azole exposure impacted the fatty acid profiles as well, leading to increased concentrations of total fatty acids, saturated and polyunsaturated fatty acids, as well as lauric acid (C12:0), myristic acid (C14:0), pentadecanoic acid (C15:0), palmitic acid (16:0), alpha-linolenic acid (C18:3; n-3), and oleic acid (C18:1; n-9).

The findings confirm the occurrence of oxidative stress caused by exposure to fungicide tebuconazole. Our study highlights the impact of tebuconazole on honeybees and contributes to the understanding of potential consequences related to azole exposure on the health of pollinator insects, which may also correlate with further issues such as the occurrence of CCD.

RESÚMENES EN CASTELLANO

BIENESTAR DE LAS ABEJAS: DE LAS CINCO LIBERTADES A LAS CINCO DISPOSICIONES

Jesús de la Fuente Vázquez.

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Resumen: Cuando hablamos de bienestar animal, siempre se nos viene a la mente las gallinas en jaulas o los cerdos en sistemas intensivos. Sin embargo, pocas personas consideran que las abejas pudieran tener problemas relacionados con su bienestar. Está falta de consideración ha hecho que el desarrollo de las cuestiones de protección y bienestar animal apícola nunca se hayan tenido en cuenta y solamente en la actualidad se esté planteando la necesidad considerarlas. Cuando planteamos el bienestar de un animal siempre tenemos en mente las Cinco Libertades. Uno de los principales objetivos de las Cinco Libertades es comprender, identificar y minimizar los estados de bienestar negativos. La principal ventaja que presentan estas Cinco Libertades es que identifican los elementos que determinan el estado de bienestar ideal, pero son muy generalistas y difíciles de cuantificar en la vida real, ya que no recoge ni en la amplitud y ni en profundidad el conocimiento actual de los procesos biológicos, para comprender el bienestar animal y orientar su manejo. En 2005, Webster presentó las Cinco Disposiciones, que consisten en acciones de manejo, para facilitar la interpretación de cada una de las Cinco Libertades. Lo que se pretende con las Disposiciones es proporcionar una lista de verificación para evaluar las fortalezas y debilidades de los sistemas de producción y asegurar las Libertades entendidas dentro de unos límites.

Al mismo tiempo se desarrolló el modelo de los Cinco Dominios, propuesto por Mellor y Reid en 1994, para abordar las dificultades que tenían las Cinco Libertades y para poder valorar el bienestar animal. En 2015 se ha actualizado este modelo incorporando formas para calificar el compromiso del bienestar (relacionado con experiencias negativas) y la mejora del bienestar (relacionado con experiencias positivas).

Con los dominios primero se evalúa a nivel particular las alteraciones y desequilibrios físicos/ funcionales, así como las restricciones en la expresión

del comportamiento, y seguidamente su impacto en el quinto dominio "dominio mental" en el estado de bienestar general de animal. Se observan interacciones mente-cuerpo, con asignación de los afectos. Esta forma de tener en cuenta el bienestar de los animales intenta alinearse con el concepto de “Calidad de Vida”. En el cual se reconoce que los animales pueden tener experiencias tanto negativas como positivas, y que el balance neto entre los dos tipos de experiencias variará con el tiempo, por lo que el objetivo debería ser lograr un saldo neto en el tiempo que favorezca las experiencias positivas.

Cuando estas libertades, disposiciones o dominios intentamos aplicarlos en apicultura encontramos con una de las primeras cuestiones, ¿se deben aplicar a cada abeja o se debe aplicar al superorganismo, colonia? La colonia de abejas como superorganismo muestra una historia de vida completamente diferente a la que tienen cada uno de los individuos que la constituyen. La colonia se puede considerar como permanente, sin embargo, las abejas obreras, los zánganos o la reina no lo son. La integridad genética de la colonia depende de la reina: cuando ella muere, lo que representa es la muerte de la colonia, pero los huevos que ella ha dejado pueden permitir que otra reina pueda surgir y perpetuar la línea genética de la colonia, intentando mantener la colonia con vida.

Existen cuestiones a considerar en cuanto a la aplicación de las libertades o los dominios en apicultura, como las relacionadas con las prácticas de manejo en los colmenares: densidad de colmenas, separación entre las mismas, idoneidad de suministro de alimento artificial, problemas de salud y transmisión de patógenos, y también las relacionadas con el medio ambiente como son el empleo de pesticidas y herbicidas en agricultura y su repercusión en la flora apícola y en las abejas. Todas ellas son de especial importancia a la hora de valorar el bienestar de las abejas.

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ALIMENTACION APÍCOLA; MÁS PREGUNTAS QUE RESPUESTAS

Carlos Marín.

Veterinario y presidente de FAPI, Federación de Asociaciones de Apicultores de Asturias, España.

Resumen: Evaluando el desarrollo zootécnico general del sector apícola podemos percatarnos de sus graves carencias, más aún cuando hacemos

comparaciones con otras ganaderías. En lo referente a la nutrición apícola y a la alimentación artificial (como en otros muchos campos), tenemos muchas preguntas que contestar con un amplio horizonte para investigar.

¿Es necesaria la alimentación artificial en apicultura? ¿Cómo saber cuándo precisamos alimentar? ¿Sabemos con qué y cómo debemos alimentar? ¿Cómo se modifica la disponibilidad de los alimentos en el campo con las alteraciones climáticas, los cambios de hábitats por consecuencia humana o los nuevos depredadores y plagas alóctonas? ¿Estamos extremando la dependencia de la alimentación artificial de nuestras abejas? Desgraciadamente desconocemos muchas de estas respuestas, consecuencia de una falta de estudios aplicados en nutrición.

El apicultor debe disponer de herramientas técnicas si queremos mantener una actividad apícola rentable en estos tiempos de dificultad comercial.

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CONTROL BIOTECNICO EN APICULTURA ECOLOGICA

Miguel Alonso.

Apicultor profesional. Médico Veterinario de la Asociación Leonesa de Apicultores, España.

Resumen: El trabajo es la base del control biotécnico en apicultura. La sucesión de visitas a la explotación da trabajo, pero con el muestreo de Varroa destructor de manera repetida, nos garantizaremos el objetivo de tener los niveles bajo control. Por experiencia personal, repitiendo los muestreos durante varios años, suelen repetirse los mismos patrones e identificarlos significa poder proceder a tiempo, bien sea con tratamientos a base de productos de base ecológica o mediante técnicas de manejo. Para ello, las diferentes técnicas que usaremos serán la retirada de cría de zánganos, enjaulado de la reina, particiones o simplemente el cambio de reina.

Conocer la botánica de la zona y acompasarlo al manejo, es esencial. Si la colmena tiene buena entrada de néctar, la utilización de cuadros para dirigirlos a cría de zánganos será de elección. La revisión constante da trabajo, puesto que el riesgo de que ese zángano nazca y con ellos, Varroa destructor crezca de manera exponencial.

Cada época del año tiene sus ventajas y sus inconvenientes, y la sustitución de la reina en la parte final de la campaña es arriesgada pero efectiva. Nos encontramos con reinas de segundo o tercer año ya en pleno declive. La eliminación de las mismas y la sustitución por otra nueva nos abre una ventana de parada de puesta, que debemos aprovechar para realizar el tratamiento, puesto que suele ser la época en la que los niveles de Varroa destructor suelen ser más altos. Además tendremos una reina joven que nos dará un buen arranque para que la colmena se reponga y pueda pasar el invierno de una manera adecuada. En conclusión, el muestreo continuado y las distintas técnicas de manejo realizadas aumentan el número de visitas realizadas al colmenar, pero ese monitoreo nos dará una información muy valiosa de la salud de nuestras colmenas, y esa será la herramienta fundamental en un control adecuado de los niveles de Varroa destructor.

¡El trabajo os hará libres!

*****

CÓMO CONTROLAR VARROA CON OXÁLICO Y MUCHO MÁS

Carlos Pardo Navarro y Julio Pardo Navarro.

Miel SierraFlor, España.

Resumen: Soy Carlos Pardo Navarro y junto con mi hermano Javier manejamos en trashumancia 800 colmenas Layens, todas con fondo sanitario. Envasamos y comercializamos nuestros productos mieles, polen, propóleos, pan de abejas y otros. Somos apicultores de primera generación, todo lo hemos aprendido por nosotros mismos.

En los últimos años no hemos perdido ninguna colmena por varroa o por tratamientos químicos agresivos. Utilizamos como acaricidas sólo productos legales con ácido oxálico (APIBIOXAL) y lo aplicamos siempre sin nada de cría. En enero tenemos las colmenas en zonas cálidas y comenzamos el primer tratamiento, retirando la cría que haya o enjaulando a la reina. A finales de mes, introducimos panales zanganeros que dejamos salir para aparear reinas vírgenes. A partir de marzo siempre hay dos panales para retirar la cría de zángano cada 20 días hasta julio (o semanal si caen muchas varroas en bandeja). En el fondo sanitario a veces ponemos timol, si no va a subir la

temperatura de 18ºC. Movemos las colmenas buscando floraciones hasta tenerla en verano en alta montaña.

En agosto nada pues la reina no pone huevos y en septiembre a mediados de mes volvemos a aplicar ácido oxálico cuadro por cuadro para que no quede ni un ácaro. Luego las vamos moviendo hasta zonas cálida y seguimos retirando cría de zángano cada 20 días y poniendo timol según la temperatura. A finales de diciembre, trasegamos panales de cría de unos colmenares a otro y enjaular las reinas de las colmenas antes de poner el oxálico

Datos: 1) solo en 3 horas y media retiramos cría sellada de zángano entre dos personas 80 colmenas, 2) nunca aplicamos el oxálico sublimado 5 veces seguidas a intervalos de 3 días pues mata menos varroa y afecta a las abejas (irritaciones en el tracto respiratorio y en los intestinos), 4) el oxálico no deja residuos y no hay poblaciones resistentes 5) reduce la carga de Nosema, y 6) nos han desaparecido los residuos de Amitraz.

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