S.N.G.T.V. Honeybee Commission Newsletter

International Press Review

RECENT HONEYBEE SCIENTIFIC PUBLICATIONS

By the SNGTV* Honeybee Commission & other contributors

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Have collaborated on this issue :

Sébastien Hoffmann & Christophe Roy

Warning : this review does not claim to be exhaustive and only includes publications of interest in the eyes of members of the SNGTV Honeybee commission;
Thus, only 10 publications per issue are chosen.

* Société Nationale des Groupements Techniques Vétérinaires (National Society of the Veterinary Technical Groups)
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1- Experimental parameters affecting the outcomes of amitraz resistance testing in *Varroa destructor*

Rinkevich, Frank D. "Experimental Parameters Affecting the Outcomes of Amitraz Resistance Testing in *Varroa destructor*." Journal of Apicultural Research, 2024. https://doi.org/10.1080/00218839.2024.2314420.

Abstract: Honey bee colony health is impaired by a large variety of biotic and abiotic factors. The severe impacts of *Varroa destructor* and viruses associated with it on honey bees are undeniable and universal. Beekeepers often utilize miticides to mitigate *V. destructor* populations, but resistance to many widely used synthetic miticides such as amitraz has developed. The Apivar® resistance test has proven to be a valuable tool to monitor for amitraz resistance in *V. destructor*. However, a more thorough understanding of the effects that changes in testing parameters have on the outcome of the Apivar® resistance is critical for an accurate and comparable interpretation of the results. In this project, the effects of temperature, product age, product exposure surface area, and container reuse on the Apivar® resistance test were studied. High temperature significantly increased control mortality while low temperatures significantly increased Apivar® resistance. The increased Apivar® resistance at low temperature was due to reduced amitraz toxicity at low temperature. There was no association of Apivar® age or manufacturing batch on the outcome of the Apivar® resistance test. The maintenance of Apivar® efficacy with age is likely because the amitraz breakdown product N'-(2,4-dimethylphenyl)-N-methylformamidine (DPMF) is as toxic as amitraz. The rate and efficacy of the Apivar® resistance test were higher with a larger surface area of Apivar® strip. Reused testing containers or Apivar® strips from colony application yielded reduced efficacy and consistency. This research shows the standard conditions needed to produce comparable data from the Apivar® resistance test. Implications for amitraz resistance monitoring are discussed.

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2- Phylogenetic analysis of *Aethina tumida* Murray from Reunion Island

Cont, Aurélie Del, Georgios Koutsovoulos, Stéphanie Franco, and Véronique Duquesne. "Phylogenetic Analysis of *Aethina tumida* Murray (Coleoptera: Nitidulidae) from Reunion Island." Journal of Apicultural Research, 2024. https://www.tandfonline.com/doi/full/10.1080/00218839.2024.2314418.

Abstract: The small hive beetle (SHB), *Aethina tumida* Murray, native to sub-Saharan Africa, is a parasite of *Apis mellifera* causing significant damage to honey bee colonies. For the past decades, it has spread to many countries worldwide and once established, eradication is difficult or not feasible. In July 2022, an outbreak was reported for the first time in a French department in the Indian Ocean, Reunion Island. The origin and the pathway of the introduction were not identified. The molecular characterisation of SHB specimens collected in the southern part of the island, where the beetle has infested several apiaries, was investigated in order to provide elements on the invasive source. The sequencing of the partial Cytochrome oxidase I gene from two specimens showed that they belonged to the same new haplotype. Phylogenetic analysis suggests an introduction either from an unidentified African source or from the Asian continent since the haplotype is similar to those characterized from China and Philippines.

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3- Case report of massive honeybee colony losses in the USA

Lamas, Zachary S, Yanping Chen, and Jay D Evans. "Case Report: Emerging Losses of Managed Honey Bee Colonies." Biology 13, no. 2 (2024). https://doi.org/10.3390/biology13020117.

Abstract: United States commercial beekeepers prepare honey bee colonies for almond pollination in California each year in late January to early February. This represents the largest managed pollination event in the world and involves more than half of all U.S. honey bee colonies. In winter 2023, numerous colonies in Florida, which were graded as suitable for almonds (larger than ten frames of bees), dwindled suddenly or altogether died within several weeks, just prior to movement for almonds. The timing of these losses and the resulting morbidity caused severe economic harm to affected operations. This study reports interviews with affected stakeholders, their economic harm, and analyses of pathogens and parasites found in their colonies.

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4- *Aspergillus* strains present in hives are specific to bee bread

Bush, Daniel S, Bernarda Calla, and May R Berenbaum. "An *Aspergillus flavus* Strain from Bee Bread of the Western Honey Bee (*Apis mellifera*) Displays Adaptations to Distinctive Features of the Hive Environment." Ecology and Evolution 14, no. 2 (2024). https://doi.org/10.1002/ece3.10918.

Abstract: *Aspergillus* fungi are ubiquitous inhabitants of colonies of the western honey bee (*Apis mellifera*), where they interact with bees in associations ranging from parasitism to possible mutualism. *Aspergillus Flavi* fungi are frequently found in bee bread (pollen processed for longterm storage) and are thought to contribute to food preparation, processing, preservation, and digestion. Conditions in the hive are challenging for fungi due, in part, to xeric and acidic properties of bee bread and the omnipresence of propolis, an antimicrobial product manufactured by bees from plant resins. We used quantitative and qualitative assays to determine whether *A. flavus* isolated from bee bread demonstrates tolerance for hive environmental conditions in terms of temperature, pH, osmotic pressure, and propolis exposure. Comparisons made use of three strains of *A. flavus*: a fungal biocontrol product not known from beehives (AF36), a strain isolated from bee bread (AFBB) in hives from central Illinois, and a pathogenic strain from a honey bee colony displaying symptoms of stonebrood (AFPA). Strain AFBB displayed higher tolerance of acidic conditions, low matric potential (simulating xeric substrate), and propolis exposure than did other strains. A genomic comparison between this new strain and the reference NRRL-3357 showed that AFBB, like AF36, might be blocked from carrying out aflatoxin biosynthesis. Sequence comparisons also revealed several missense variants in genes that encode proteins regulating osmotolerance and osmotic pressure in *Aspergillus* spp., including SakA, SskB, GfdA, and TcsB/Sln1. Collectively, results of our laboratory assays and genetic analyses are consistent with the suggestion that the strain isolated from bee bread is adapted to the bee bread environment and may have persisted due to a coevolutionary relationship between *Aspergillus* and *A. mellifera*. This finding bolsters recent concerns about the effects of fungicide use near bee colonies and broadens the ecological importance of highly adaptable fungal strains.

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5- Advances and knowledge gaps on climate change impacts on honey bees and beekeeping

Zapata-Hernández, Germán, Martina Gajardo-Rojas, Matías Calderón-Seguel, Ariel A Muñoz, Karen P Yáñez, Fabrice Requier, Francisco E Fontúrbel, Pablo I Ormeño-Arriagada, and Héctor Arrieta. "Advances and Knowledge Gaps on Climate Change Impacts on Honey Bees and Beekeeping: A Systematic Review." Global Change Biology 30, no. 3 (2024). https://doi.org/10.1111/gcb.17219.

Abstract: The Western honey bee *Apis mellifera* is a managed species that provides diverse hive products and contributing to wild plant pollination, as well as being a critical component of crop pollination systems worldwide. High mortality rates have been reported in different continents attributed to different factors, including pesticides, pests, diseases, and lack of floral resources. Furthermore, climate change has been identified as a potential driver negatively impacting pollinators, but it is still unclear how it could affect honey bee populations. In this context, we carried out a systematic review to synthesize the effects of climate change on honey bees and beekeeping activities. A total of 90 articles were identified, providing insight into potential impacts (negative, neutral, and positive) on honey bees and beekeeping. Interest in climate change's impact on honey bees has increased in the last decade, with studies mainly focusing on honey bee individuals, using empirical and experimental approaches, and performed at short-spatial (<10 km) and temporal (<5 years) scales. Moreover, environmental analyses were mainly based on short-term data (weather) and concentrated on only a few countries. Environmental variables such as temperature, precipitation, and wind were widely studied and had generalized negative effects on different biological and ecological aspects of honey bees. Food reserves, plant-pollinator networks, mortality, gene expression, and metabolism were negatively impacted. Knowledge gaps included a lack of studies at the apiary and beekeeper level, a limited number of predictive and perception studies, poor representation of large-spatial and mid-term scales, a lack of climate analysis, and a poor understanding of the potential impacts of pests and diseases. Finally, climate change's impacts on global beekeeping are still an emergent issue. This is mainly due to their diverse effects on honey bees and the potential necessity of implementing adaptation measures to sustain this activity under complex environmental scenarios.

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6- Pollinators in Africa and Europe will be hardest hit by global warming

Rahimi, Ehsan, and Chuleui Jung. "Global Trends in Climate Suitability of Bees: Ups and Downs in a Warming World." Insects 15, no. 2 (2024). https://doi.org/10.3390/insects15020127.

Abstract: Bees represent vital natural assets contributing significantly to global food production and the maintenance of ecosystems. While studies on climate change effects impacting major pollinators like honeybees and bumblebees raise concerns about global diversity and crop productivity, comprehensive global-scale analyses remain limited. This study explores the repercussions of global warming on 1365 bees across seven families of bees worldwide. To compile a robust global bee occurrence dataset, we utilized the innovative 'BeeBDC' R package that amalgamated over 18.3 million bee occurrence records sourced from various repositories. Through species distribution models under the SSP585 scenario in the year 2070, we assessed how climate change influences the climate suitability of bees on a global scale, examining the impacts across continents. Our findings suggested that approximately 65% of bees are likely to witness a decrease in their distribution, with reductions averaging between 28% in Australia and 56% in Europe. Moreover, our analysis indicated that climate change's impact on bees is projected to be more severe in Africa and Europe, while North America is expected to witness a higher number (336) of bees expanding their distribution. Climate change's anticipated effects on bee distributions could potentially disrupt existing pollinator–plant networks, posing ecological challenges that emphasize the importance of pollinator diversity, synchrony between plants and bees, and the necessity for focused conservation efforts.

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7- Seasonal trends of the ABPV, KBV, and IAPV complex in Italian managed honeybee colonies

Cilia, Giovanni, Elena Tafi, Laura Zavatta, Amanda Dettori, Laura Bortolotti, and Antonio Nanetti. "Seasonal Trends of the ABPV, KBV, and IAPV Complex in Italian Managed Honey Bee (*Apis mellifera* L.) Colonies." Archives of Virology 169, no. 3 (2024): 1–9. https://doi.org/10.1007/s00705-024-05967-y.

Abstract: Acute bee paralysis virus (ABPV), Kashmir bee virus (KBV), and Israeli acute paralysis virus (IAPV) usually persist as covert infections in honey bee colonies. They can cause rapid bee mortality in cases of severe infection, often associated with high *Varroa destructor* infestation, by which they are transmitted. In various countries, these viruses have been associated with colony collapse. Despite their potential danger, these viruses are often disregarded, and little information is available on their occurrence in many countries, including Italy. In 2021, 370 apiaries representing all of the Italian regions were investigated in four different months (June, September, November, and March) for the presence of ABPV, KBV, and IAPV. IAPV was not found in any of the apiaries investigated, whereas 16.45% and 0.67% of the samples tested positive for ABPV and KBV, respectively. Most ABPV cases occurred in late summer-autumn in both northern and southern regions. We observed a scattered pattern of KBV-positive colonies that did not allow any seasonal or regional trends to be discerned. Differences observed among regions and months were potentially related to the dynamics of *Varroa* infestation, viral genetic variations, and different climatic conditions resulting in variations in bee behaviour. This study improves our understanding of the circulation of bee viruses and will contribute to better disease prevention and preservation of bee health.

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8- Distribution of infectious and parasitic agents among three sentinel bee species across European agricultural landscapes

Babin, Aurélie, Frank Schurr, Sabine Delannoy, Patrick Fach, Minh Huyen Ton Nu Nguyet, Stéphanie Bougeard, Joachim R de Miranda, et al. "Distribution of Infectious and Parasitic Agents among Three Sentinel Bee Species across European Agricultural Landscapes." Scientific Reports 14, no. 1 (2024): 1–20. https://doi.org/10.1038/s41598-024-53357-w.

Abstract: Infectious and parasitic agents (IPAs) and their associated diseases are major environmental stressors that jeopardize bee health, both alone and in interaction with other stressors. Their impact on pollinator communities can be assessed by studying multiple sentinel bee species. Here, we analysed the field exposure of three sentinel managed bee species (*Apis mellifera*, *Bombus terrestris* and *Osmia bicornis*) to 11 IPAs (six RNA viruses, two bacteria, three microsporidia). The sentinel bees were deployed at 128 sites in eight European countries adjacent to either oilseed rape fields or apple orchards during crop bloom. Adult bees of each species were sampled before their placement and after crop bloom. The IPAs were detected and quantified using a harmonised, high-throughput and semi-automatized qPCR workflow. 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. Our results suggest that the most frequent IPAs in adult bees are more appropriate for assessing the bees' IPA exposure risk. We also report positive correlations of IPA loads supporting the potential IPA transmission among sentinels, suggesting careful consideration should be taken when introducing managed pollinators in ecologically sensitive environments.

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9- Is biodynamic beekeeping right to ban queen excluders?

Bundschuh, Jana, Herbert Rappel, Andreas Bock, Ute Balleisen, Markus Daiser, Günter Friedmann, Werner König, et al. "Effects of Queen Excluders on the Colony Dynamics of Honeybees (*Apis mellifera* L.) under Biodynamic Management." Apidologie 55, no. 1 (2024): 1–22. https://doi.org/10.1007/s13592-023-01041-9.

Abstract: The evaluation of beekeeping management practices (BMPs) is important for beekeepers worldwide because their choice affects health and survival of managed honeybee (*A. mellifera* L.) colonies and touches ethical and economic questions. This study focusses on queen excluders, a common hive addition in contemporary beekeeping. Its impacts are controversially discussed but have not been studied scientifically yet. Within a 4-year participatory on-farm experiment, we assessed the effects on colony dynamics in 64 hives in 8 apiaries during one season in Germany using the Liebefeld estimation method. We found no significant deviation for parameters of colony dynamics between hives managed with and without queen excluders. A qualitative decision-making tool (Pugh decision matrix) facilitated concept selection only for specific beekeepers.

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10- Glyphosate researched… and found in Italian honey

Rampazzo, Giulia, Elisa Zironi, Giacomo Depau, Giampiero Pagliuca, and Teresa Gazzotti. "Preliminary Data on Glyphosate, Glufosinate, and Metabolite Contamination in Italian Honey Samples." Italian Journal of Food Safety 13, no. 1 (2024). https://doi.org/10.4081/ijfs.2024.11996.

Abstract: Glyphosate and glufosinate are among the most widely used pesticides in agriculture worldwide. Their extensive use leads to the presence of their residues on crops and in the surrounding environment. Beehives, bees, and apiculture products can represent potential sources for the accumulation of these substances and their metabolites, and the consequences for bee health, as well as the level of risk to human health from consuming contaminated food, are still unclear. Furthermore, information on the contamination levels of honey and other beehive products by these compounds remains poorly documented. This study is part of a broader research effort aimed at developing specific analytical methods for monitoring the level of these contaminants in bee products. The methodology employed enabled the acquisition of preliminary information concerning the levels of glyphosate and glufosinate contamination in honey samples obtained from various retailers in Italy to assess compliance with the limits established by Regulation 293/2013. The liquid chromatography tandem mass spectrometry analysis of the 30 honey samples revealed quantifiable levels of glyphosate in eight samples, with contamination ranging from 5.4 to 138.5 ng/g. Notably, one sample of the wildflower type showed residue levels nearly three times the maximum residue limit. Additionally, trace levels of glyphosate contamination were detected in another ten samples. It is noteworthy that glufosinate and its metabolites were not detected in any of the analyzed samples within the established method's detection ranges.

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